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BEFORE THE ARIZONA CORPORATION COMMISSION

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IN THE MATTER OF THE APPLICATION OF ARIZONA PUBLIC SERVICE COMPANY FOR A HEARING TO DETERMINE THE FAIR VALUE OF THE UTILITY PROPERTY OF THE COMPANY FOR RATEMAKING PURPOSES, TO FIX A JUST AND REASONABLE RATE OF RETURN THEREON, TO APPROVE RATE SCHEDULES DESIGNED TO DEVELOP SUCH RETURN.	DOCKET # E-01345A-16-0036 **INTERVENOR WARREN WOODWARD'S DIRECT TESTIMONY IN OPPOSITION TO THE SETTLEMENT AGREEMENT**
IN THE MATTER OF FUEL AND PURCHASED POWER PROCUREMENT AUDITS FOR ARIZONA PUBLIC SERVICE COMPANY	DOCKET # E-01345A-16-0123

Warren Woodward, Intervenor in the above proceeding, hereby submits his Direct Testimony in Opposition to the Settlement Agreement.

Table of Contents

Page

EXHIBITS

Page

EXHIBITS

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME, ADDRESS, AND OCCUPATION.

A. Warren Woodward, 200 Sierra Road, Sedona, Arizona 86336. I am retired.

Q. WHAT IS YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUND?

A. I dropped out of Duke University in my junior year when in two subjects, economics and my major, political science, I found myself teaching the teachers rather than vice-versa. I have spent the last 6 years researching all aspects of the "smart" meter issue, including buying and familiarizing myself with scientific measuring equipment suitable for measuring Arizona Public Service ("APS") "smart" meters. My working life involved many different jobs and various small businesses.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING?

A. In accordance with Arizona Corporation Commission ("ACC") Decision # 75047 which was the result of appeals by Intervenor Pat Ferre and I, I discuss aspects of APS's "smart" meters that relate to the Settlement Agreement, and I discuss residential rates proposed in the Settlement Agreement.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE COMMISSION?

A. Yes. I have testified at a number of Commission Open Meetings and Workshops, specifically involving Dockets # E-00000C-11-0328, # RU-00000A-14-0014, and # E-

01345A-13-0069.

II. SUMMARY OF DIRECT TESTIMONY

Q. PLEASE SUMMARIZE YOUR DIRECT TESTIMONY.

A. APS's "smart"meters do not pencil out for anyone except APS and its cheerleaders at the Arizona Investment Council ("AIC"). The Settlement Agreement would require unjust and unreasonable fees from APS customers who have seen through the lies APS has told repeatedly about "smart" meters. The fees are discriminatory, and they are extortion as well as in violation of ACC Decision # 69736. Any such fees are not "just and reasonable" per A.R.S. § 40-361.A. It appears that APS's installed "smart" meters in order to have a never-ending expansion of its rate base and thereby get the rate increase for which the Settlement Agreement provides. Promised operational savings from "smart" meters were a pipe dream, a fraction of the overall costs of the "smart" meter system. As such, Customers who refuse "smart" meters should actually get a refund for unwillingly subsidizing the financially unsustainable "smart" meters (and the related system) that those customers never asked for and do not want. Additionally, the provision in the Settlement Agreement that requires new customers to be on a TOU rate for three months is discriminatory and neither just nor reasonable. It's not surprising that the Settlement Agreement is so flawed. It is the result of a very flawed process.

III. DIRECT TESTIMONY

III.A DISCRIMINATION IN THE SETTLEMENT AGREEMENT

Q. IS DISCRIMINATION BY A STATE REGULATED PUBLIC UTILITY ILLEGAL?

A. Yes. Here is the statute:

> **A.R.S. § 40-334.A & B –** Discrimination between persons, localities or classes of service as to rates, charges, service or facilities prohibited
> A. A public service corporation shall not, as to rates, charges, service, facilities or in any other respect, make or grant any preference or advantage to any person or subject any person to any prejudice or disadvantage.
> B. No public service corporation shall establish or maintain any unreasonable difference as to rates, charges, service, facilities or in any other respect, either between localities or between classes of service.

Q. ARE THE SETTLEMENT AGREEMENT PROPOSALS REGARDING CUSTOMERS WHO REFUSE "SMART" METERS DISCRIMINATORY?

A. Yes, and in many ways.

According to APS' Responses to Woodward at 2.10, APS has to manually read the meters of some 3,684 customers (1,840 residential and 1,844 commercial) because "smart" meters do not work at those customers' premises since the meters are unable to communicate due to being in remote geographical locations, or due to "building configuration, type of building materials, and other topographical or mechanical limitations." The Settlement Agreement would pose no extra charges to manually read the meters of those 3,684 customers, while at the same time the Settlement Agreement *would pose* extra charges to manually read the meters of other customers who refuse "smart" meters. APS has rationalized the discrimination inherent in the Settlement Agreement thus:

> Customers who specifically choose to opt out of APS's standard metering when they otherwise could be successfully served via standard metering are causing additional costs for the utility that it would otherwise not have. It is therefore appropriate for those customers who make that choice to bear those costs.
> (Response to Woodward at 2.10.d)

But discrimination is still discrimination – *and illegal*. No exceptions are listed in the statute, so obviously the Settlement Agreement provision is illegal. Actually it is APS that made a poor business decision to waste money on a "smart" metering system that was not mandated by regulation, that is unreliable and does not work uniformly, and that people did not ask for and do not want. As such, customers who must have their meter read manually *for whatever reason* owe APS nothing. Any such costs belong to APS shareholders.

APS's rationalization also fails in the following way. In its Response to Woodward at 2.11, APS stated:

> The cost of providing meter reading service (including personnel, vehicles, computer systems, etc.) are virtually the same whether a meter reader reads a meter once a month or once every other month. Those costs are not dependent on the frequency of meter reads; they must be borne regardless.

So, if APS must have "personnel, vehicles, computer systems, etc." already in place for one subset of customers (for whom a fee would not be charged according to the Settlement Agreement), it does not make logical sense for other customers using that existing and necessary system to be scapegoated as "cost-causers" and charged extra fees. In APS's own words, the costs "must be borne regardless." In APS's own words, the

costs "are not dependent on the frequency of reads."

The Settlement Agreement is also discriminatory in that it selectively targets one customer group as "cost-causers" but not others. For example, under the Settlement Agreement APS is allowed to offer free and subsidized services and accommodations to some select customers – services and accommodations that do *not* benefit all customers – while at the same time the Settlement Agreement would impose fees from customers who refuse a "smart" meter, including even those customers with doctor's notes recommending that they be accommodated by not being exposed to "smart" meter radiation.

According to the Arizona State Constitution at § 2, "The official language of the state of Arizona is English." Additionally, there are no ACC regulations that require APS to provide multi-language services. Yet APS, of its own volition, has accommodated Spanish speaking customers for years by providing services and marketing in Spanish. Those are accommodations that all customers pay for, despite not all customers being served or benefited by those accommodations, and despite those accommodations not being required by law. In the Test Year of 2015, APS spent $149,466.68 on Spanish language marketing (see APS Pre-Filed data at 1.38), and APS spent $499,080.55 on translation services and bi-lingual pay differential. In its Response to Woodward at 2:32, APS stated that: "APS has had bilingual employees for many years to assist non-English speaking customers." So it is safe to say that over the years APS has spent many, many

millions of dollars accommodating this particular subset of customers at the expense of all other customers. That said, money spent is not the only issue here. In the case of customer service, there are language preferences. In the case of meters, where "smart" meters negatively impact customers, there are meter preferences. It is simply unfair – discriminatory – to charge for one preference and not the other. If providing a choice with regard to language in the case of customer service is good business practice then so should be providing meter choice.

Another example of APS accommodating some customers at the expense of all other customers is APS's "Home Energy Checkup." At its website, APS advertises that "for just $99 (a $400 value) … specially trained contractors can diagnose your home and identify energy saving upgrades." APS goes on to say this service, which not all customers use, "is funded by APS customers." (See Exhibit A.) Not everyone needs or wants a "Home Energy Checkup," yet all are subsidizing it even though it may not yield any benefits such as lower energy consumption.

In response to Woodward's data request 2.24.a, APS admitted that

> ... customers prefer varying levels of interaction with their utility and have preferences on how to receive information. The development of each communication avenue and the varied use of each avenue continues to develop and each has a different cost. For example, sending direct mail information has a different cost than a message on the bill.

APS has no problem making special accommodations to select customers at no added fee when that accommodation suits its business plan. In the above example, APS

admitted that "customers prefer varying levels of interaction with their utility and have preferences on how to receive information," and APS admitted that each of those preferences "has a different cost." Yet APS does not seek extra money from those customers whose preferences cost more than others. Customers' meter preferences should be no different. Instead, because customers who refuse "smart" meters do not fit APS's business plan, APS wants to punish them with a punitive fee instead of accommodating them as APS does with customers that suit its business plan.

Supporting the Settlement Agreement means supporting APS's vindictive discrimination toward customers who refuse a "smart" meter which is found in the Settlement Agreement at Service Schedule I, 8.5. The conditions APS wants to apply *only* to customers who refuse a "smart" meter are insulting in their implication that customers who refuse "smart" meters are criminal types who need special rules. Conditions of service such as these must either apply to *all* customers or they should not apply to any. To single out customers who refuse "smart" meters in this way is absolutely reprehensible – and highly discriminatory.

> **8.5 Discontinuation of Non-Standard Metering** - The Company may replace a non-standard meter with a standard meter, without notifying the customer prior to replacement, under any of the following conditions:
> **(A)** Company employees observe or have evidence of a safety hazard to employees, customers, or Company or customer property.

> **(B)** Company employees observe or have evidence of meter tampering, energy diversion, or fraud.
> **(C)** Company has evidence of unauthorized resale of electricity.
> **(D)** Company employees have received verbal or physical threats, including, but not limited to, verbal threats while installing meters or performing maintenance to Company equipment, and physical threats such as weapons or dogs.
> **(E)** All terms and conditions in Section 7, regarding termination of service, will also apply

Supporting the Settlement Agreement means supporting APS's discrimination against residential solar customers by forcing "smart" meters on residential solar customers under the guise that the meters are necessary to integrate distributed energy to the grid. Indeed, APS has told that lie repeatedly in previous appearances before the Commission as well as in Docket filings. In actual fact, "smart" meters are *not* needed to integrate distributed energy to an electrical grid.

In a January 17, 2014 filing before the Massachusetts Department of Public Utilities, Northeast Utilities stated:

> *An Advance Metering System is not a "basic technology platform" for grid modernization and is not needed to realize "all of the benefits of grid modernization."* The Department identified four objectives for grid modernization, all of which can be achieved without the implementation of an advanced metering system. Meters do not reduce the number of outages; metering systems are not the only option for optimizing demand or reducing system and customer costs; and metering systems are not necessary to integrate distributed resources or to improve workforce and asset

management. Therefore, it is not correct that advanced metering functionality is a "basic technology platform" that must be in place before all of the benefits of grid modernization can be fully realized, as the Department suggests. Id. at 12.

In fact, there are non-metering technologies that the Companies have implemented, or can implement in the future within a grid-modernization plan, that would tangibly advance the grid-modernization objectives set by the Department. For example, utilizing SCADA-enabled smart switches will both reduce outages and mitigate the effects that outages have on customers. Substation monitoring, remote controls and microprocessor relays can mitigate the impact of widespread outages; manage load constraints; and help to optimize the use of assets in real time. As a means to optimize demand, the installation of automated capacitor banks increases system efficiency and reduces costs. Direct control of load or generation can be employed to manage system peaks. In order to allow for the integration of distributed resources, sensors and systems for advanced load flow models that allow for more distributed resources on a circuit can be installed. As for improving workforce and asset management, next generation mapping and outage management systems increase the efficiency of response to outages, while communications, sensors and systems provide system level situational awareness and enhanced safety. Therefore, it is clear that the Companies would be able to identify and implement a suite of non-meter technologies and processes, in addition to those already implemented, in order to advance the Department's grid-modernization objectives *without* the implementation of an advanced metering system.

There is also an important dynamic involved in relation to the integration of widespread distributed energy resources to the electric power grid. Industry study conducted by entities such as the Electric Power Research Institute shows that the electric distribution grid will require substantial investment to be positioned for the integration of distributed energy resources. Therefore, grid-modernization efforts have to be closely coordinated with policies that are encouraging the growth of distributed energy resources. Finite capital resources available for grid modernization should be aimed at this integration effort before any additional monies are expended on metering capabilities that provide limited and/or speculative incremental benefits over current metering technology (following many years of investment in those systems). Moreover, the growth of distributed

> generation and current subsidies results in the bypass of the electric distribution system by potential electric customers leaving fewer and fewer customers to pay for it. This creates a pricing crisis in practical terms for both residential and business customers remaining on the system. Huge additional investments to the distribution system will only have the effect of exacerbating the issue for customers.
>
> Accordingly, not only is there a flaw in the Department's premise that an advanced metering system is a "basic technology platform" for grid modernization, but also the implementation of a costly, advanced metering system is at odds with policies designed to promote the growth of distributed energy resources.
> (Exhibit B, pp. 4 – 6, italics in original)

A recent document from the National Association of Regulatory Utility Commissioners ("NARUC") agrees with Northeast Utilities. The *NARUC Manual on Distributed Energy Resources Rate Design and Compensation, A Manual Prepared by the NARUC Staff Subcommittee on Rate Design, November 2016*, states:

> If the utility has installed AMI on its customers' load **or** has supervisory control and data acquisition (SCADA) systems across its distribution grid, it may be able to gather better data to understand the impacts of DER [Distributed Energy Resources] on certain locations.
> (p. 69, emphasis added. The entire 180 page *Manual* is here: http://pubs.naruc.org/pub/19FDF48B-AA57-5160-DBA1-BE2E9C2F7EA0)

The key word in the above NARUC statement is of course, "or." In order to integrate distributed energy into an electrical grid, AMI ("smart" meters) are *not* necessary.

Furthermore, other utilities such as Florida Power & Light and San Diego Gas & Electric – and currently APS! – allow solar customers to refuse "smart" meters. (See Exhibit C) So APS's argument fails miserably.

As discussed in Part III.B.7 INACCURACY of this testimony, a recent study published by the Institute of Electrical and Electronics Engineers stated that "... in several cases [smart] electricity meters registered only a part of the energy factually fed into the public supply network from a PV inverter." Perhaps that is the real reason APS does not want solar customers to be able to refuse "smart" meters.

Supporting the Settlement Agreement means also supporting APS's discrimination against commercial customers by not allowing commercial customers to refuse a "smart" meter. In his direct testimony at page 9, APS's Scott Bordenkircher stated:

> Non-residential customers may not opt-out of having a standard meter because they are larger customers with more complex billing structures, including demand rates based on 15 minute intervals for certain commercial customers, that require the sophistication of an AMI meter.

That is totally untrue nonsense. Not all commercial customers are "larger customers with more complex billing structures," and indeed, in APS's Response to Staff at 8.12.e, APS admits that as of 9/30/2016 – just six months ago – it has 2,338 commercial customers without "the sophistication of an AMI meter." As well, APS admitted at Woodward 2.10 that it has 1,844 commercial customers who, due to their remote location, cannot have a "smart" meter even if they wanted one. If those customers can be served without a "smart" meter then so can others. APS also admitted at Woodward 2.10 that it has 1,840 residential customers who, due to their remote location, cannot have a "smart" meter even if they wanted one. Does that mean those customers cannot then have solar? So APS's proposition that solar and commercial customers cannot refuse a

"smart" meter is discriminatory nonsense, and so, therefore, is the Settlement Agreement.

One of the more conspicuously bad examples of APS discrimination which is proposed in the Settlement Agreement is the preposterous AZ Sun II program whereby all customers are forced to pay a fixed charge so that a select very few customers can have APS-owned solar on their roofs *plus* get a bill credit of $10-50 per month on their APS bill. Ten to fifteen million dollars per year of other customers' money will be wasted on that discriminatory massive cross subsidy.

III.B EXTORTION IN THE SETTLEMENT AGREEMENT

Q. WHAT IS EXTORTION?

A. Payment to avoid harm or the threat of harm defines extortion.

Q. WHAT IS THE HARM OR THREAT OF HARM POSED BY APS "SMART" METERS THAT WOULD MAKE THE "SMART" METER REFUSAL FEE PROPOSED IN THE SETTLEMENT AGREEMENT EXTORTION?

A. APS "smart" meters harm or threaten harm in numerous ways. In broad terms, the harm can be categorized as privacy violations, cybersecurity risks, fire risks, damage to and interference with household appliances and equipment, trespass and theft, and health risks.

III.B.1 Privacy Violation

Q. **EXPLAIN HOW "SMART" METERS POSE A PRIVACY VIOLATION.**

A. Over the years, APS has lied repeatedly regarding the surveillance capabilities of its "smart" meters. Here is an example of APS's lying, taken from its "Myth vs Fact" sheet (Exhibit D) that APS used to send customers and had posted at its website:

> **Myth:** APS will use automated meters to monitor the actions of its customers.
>
> **Fact:** Automated meters do not have this capability. Like the old mechanical meters, automated meters measure how much energy customers use, not how they use energy.
> The automated meter does not store or transmit any personal identification information. The automated meters give APS no indication of who our customers are, what they are doing, nor can they determine what appliances customers are using.

APS's claims are at odds with those of the Congressional Research Service, NARUC, "smart" meter cheerleaders at the Smart Grid News, "smart" meter manufacturer Elster, and even APS's own response to ACC Staff's data request 9.17.p.

The 2012 Congressional Research Service report, "Smart Meter Data: Privacy and Cybersecurity" (Exhibit E) states:

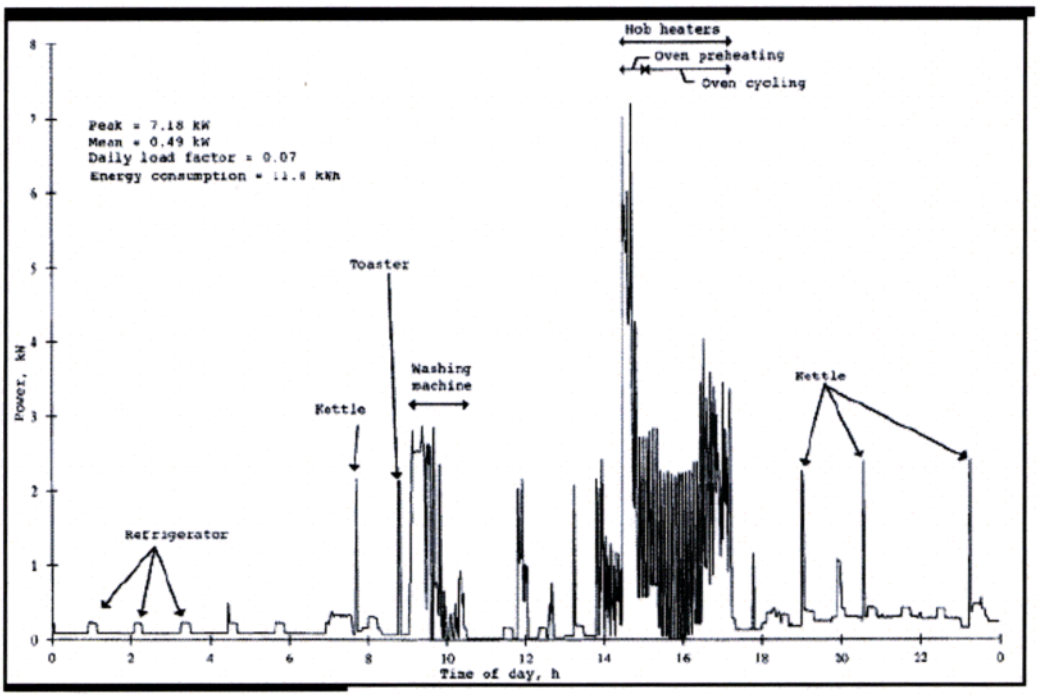
> **Detailed Information on Household Activities**
>
> Smart meters offer a significantly more detailed illustration of a consumer's energy usage than regular meters. Traditional meters display data on a consumer's total electricity usage and are typically read manually once per month. In contrast, smart meters can provide near real-time usage data by measuring usage electronically at a much greater frequency, such as once every 15 minutes. Current smart meter technology allows utilities to measure usage as frequently as once every minute. By examining smart meter data, it is possible to identify which appliances a consumer is using and at what times of the day, because each type of appliance generates a unique electric load "signature." NIST [National Institute of Standards and Technology] wrote in 2010 that "research shows that analyzing 15-minute

interval aggregate household energy consumption data can by itself pinpoint the use of most major home appliances." A report for the Colorado Public Utilities Commission discussed an Italian study that used "artificial neural networks" to identify individual "heavy-load appliance uses" with 90% accuracy using 15-minute interval data from a smart meter. Similarly, software-based algorithms would likely allow a person to extract the unique signatures of individual appliances from meter data that has been collected less frequently and is therefore less detailed.

By combining appliance usage patterns, an observer could discern the behavior of occupants in a home over a period of time. For example, the data could show whether a residence is occupied, how many people live in it, and whether it is "occupied by more people than usual." According to the Department of Energy, smart meters may be able to reveal occupants' "daily schedules (including times when they are at or away from home or asleep), whether their homes are equipped with alarm systems, whether they own expensive electronic equipment such as plasma TVs, and whether they use certain types of medical equipment." **Figure 1,** which appears in NIST's report on smart grid cybersecurity, shows how smart meter data could be used to decipher the activities of a home's occupants by matching data on their electricity usage with known appliance load signatures.

Figure 1. Identification of Household Activities from Electricity Usage Data

Unique Electric Load Signatures of Common Household Appliances



Smart meter data that reveals which appliances a consumer is using has potential value for third parties, including the government. In the past, law enforcement agents have examined monthly electricity usage data from traditional meters in investigations of people they suspected of illegally growing marijuana. For example, in United States v. Kyllo, a federal agent subpoenaed the suspect's electricity usage records from the utility and "compared the records to a spreadsheet for estimating average electrical use and concluded that Kyllo's electrical usage was abnormally high, indicating a possible indoor marijuana grow operation." If law enforcement officers obtained near-real time data on a consumer's electricity usage from the utility company, their ability to monitor household activities would be amplified significantly. For example, by observing when occupants use the most electricity, it may be possible to discern their daily schedules.

As smart meter technology develops and usage data grows more detailed, it could also become more valuable to private third parties outside of the grid. Data that reveals which appliances a person is using could permit health insurance companies to determine whether a household uses certain medical devices, and appliance manufacturers to establish whether a warranty has been violated. Marketers could use it to make targeted advertisements. Criminals could use it to time a burglary and figure out which appliances they would like to steal. If a consumer owned a plug-in electric vehicle,

> data about where the vehicle has been charged could permit someone to identify a person's location and travel history.
>
> Even privacy safeguards, such as "anonymizing" data so that it does not reflect identity, are not foolproof. By comparing anonymous data with information available in the public domain, it is sometimes possible to identify an individual—or, in the context of smart meter data, a particular household. Moreover, a smart grid will collect more than just electricity usage data. It will also store data on the account holder's name, service address, billing information, networked appliances in the home, and meter IP address, among other information. Many smart meters will also provide transactional records as they send data to the grid, which would show the time that the meter transmitted the data and the location or identity of the transmitter.
> (Exhibit E, pp. 3 - 6)

Commenting on this privacy violating information generated from "smart" meters, Miles Keogh, director of grants and research at NARUC, was quoted in a 2015 Politico article (Exhibit F) as saying, "I think the data is going to be worth a lot more than the commodity that's being consumed to generate the data."

The Politico article also stated:

> All sorts of inferences about people's private lives are potentially available from detailed energy consumption data. The number of people inside a house. Daily routines. Degree of religious observance. Household appliance usage. Even, according to two German hackers, what's on the television, given a fast enough meter refresh rate.
>
> "Very sensitive information can be revealed about homes, and homes are the most sacred privacy environment," said Nancy King, an Oregon State University business law and ethics academic who's studying smart meter deployments.
>
> Access and control of that energy usage data will be key, she added. "Most consumers are just unaware about how their data feeds into the Big Data machine and are powerless to do much about it."

Smart Grid News, "smart" meter promoters supported by such industry names as Telvent, Silver Spring Networks and Lockheed Martin, wrote an article in 2014 entitled, "Now utilities can tell customers how much energy each appliance uses (just from the smart meter data)." (Exhibit G) In case the title does not speak for itself, here is a salient quote:

> Soon, the idea of using smart meters to simply tell us how much electricity is being used at any given time will seem similarly archaic. One of the next areas of value comes from taking smart meter data and 'disaggregating' it to tell us exactly how customers are using electricity.

In a 2013 article, "Securing the Smart Meter Supply Chain" (Exhibit H), that appeared at Energy Central, an online electric power industry information clearing house, Michael John, Solution Manager at Elster, a company that makes "smart" meters used by APS, stated:

> Other potential security threats include tampering with meter data in order to manipulate the outcome of billing, or the leakage of personal information and utility-related data that could provide attackers with insight into a householder's behavior. Known as a `consumption signature', this type of information can be used to work out the times of day the householder is absent from a property, as well as the types of electronic appliances they own.

Michael John also stated:

> Finally, at end-of-life, the smart meter must be decommissioned to ensure remaining sensitive data such as security credentials and personal information is disposed of securely.

In APS's response to ACC Staff's data request 9.17.p, APS stated:

> Due to data privacy and security concerns, the Company's electronics salvage vendor disassembles the meter and destroys the chips, then recycles the various remaining parts.

But APS said in their Myth vs Fact sheet that "The automated meter does not store or transmit any personal identification information. The automated meters give APS no indication of who our customers are, what they are doing, nor can they determine what appliances customers are using." If that was true, then why would APS bother destroying chips due to "data privacy" concerns?

The foregoing information from the Congressional Research Service, Smart Grid News, NARUC and Politico, "smart" meter manufacturer Elster, and even APS itself proves that "smart" meters are surveillance devices.

The extra fee that the Settlement Agreement would impose on customers who refuse a "smart" meter to avoid the harm of unwarranted surveillance is extortion.

III.B.2 Cybersecurity

Q. EXPLAIN HOW "SMART" METERS POSE A CYBERSECURITY RISK.

A. Regarding the security of the data collected on customers by APS's "smart" meters, the aforementioned Congressional Research Service report says:

> ...consumer data moving through a smart grid becomes stored in many locations both within the grid and within the physical world. Thus, because it is widely dispersed, it becomes more vulnerable to interception by unauthorized parties and to accidental breach. The movement of data also increases the potential for it to be stolen by unauthorized third parties while it is in transit, particularly when it travels over a wireless network.... (Exhibit E, p. 7)

Even without the wide dispersal mentioned above, data security is a pipe dream. As the Microsoft Corporation succinctly puts it at the Windows help forum on their website,"There is no way to guarantee complete security on a wireless network." (https://answers.microsoft.com/en-us/windows/forum/windows8_1-networking/are-others-using-my-internet-connection/6c26417d-40d9-443d-835f-0c93869844ba)

Northeast Utilities, in its previously mentioned filing before the Massachusetts Department of Public Utilities, is in concordance, stating at page 9 of its filing, "AMI introduces a brand new portal into the Companies' information systems, significantly increasing the cyber-security risk."

In addition to the cybersecurity risk to customers' personal and private information, customers face an additional risk related to cybersecurity, the hacking of the "smart" meter's remote disconnect switch. From "Smart Metering: The First Security Challenge" in the reference book, *Smart Grid Security: An End-to-End View of Security in the New Electrical Grid*, by Gilbert N. Sorebo, Michael C. Echols:

> What if ["smart"] meters are told to disconnect by a worm or virus? Among all the services AMI [Advanced Metering Infrastructure] offers, the disconnect function is the most controversial in information security circles as it is the only one that directly controls the flow of power to the home or business. While DR [Demand Response] and ALC [Automatic Load Control] involve sending a signal to a meter that could result in switching off an appliance, the consumer is usually able to easily override such action. However, absent some rewiring, there is no equivalent override for the disconnect switch. In fact, one of the purposes of the disconnect switch is to ensure that customers who do not pay their bills are denied electricity until they do so.

> The greatest concern is that a successful attack could allow someone to gain control of customers all at once. In addition to causing widespread blackouts, repeatedly switching the power off and on could create frequency imbalances and surges in the grid that could damage loads and destabilize the entire grid, potentially causing damage to generators, transformers, and other equipment in the path [including the "smart" meters themselves and major appliances in homes and other buildings]. Such a consequence would be much more severe than a simple power outage, resulting in damage to expensive equipment with replacement times of more than a year in some cases. Effectively taking temporary control of a meter network could lead to widespread power outages lasting weeks or perhaps longer.
>
> When the Internet started, there really were no viruses. They were being written and they were infecting machines, but there was no real impact. It was not until people realized that their identities were being stolen, as a result of these viruses, that anti-virus became a must. … Once worms started taking down e-mail servers and business services, patches became extremely important and now businesses are more vigilant than ever in this regard. … Today we are still fighting that battle, and at the same time a new battlefield is emerging.
>
> Cyber security as related to the utility field is currently a place where 'information can now be used to control physics,' as Joe Weiss of Applied Control Solutions puts it. The manipulation of data can be used to turn off electricity or to steal energy. There will be multiple impacts that can be realized as a result of cyber security risks and smart metering. But the paradigm change is that the hackers can actually harm human life.

The extra payment to APS that the Settlement Agreement proposes for refusing a "smart" meter to avoid the threat of harm of cyber-insecurity is extortion.

III.B.3 Fires

Q. DETAIL THE FIRE RISKS ASSOCIATED WITH "SMART" METERS AND THE EVIDENCE THAT SUPPORTS THE CLAIM.

A. "Smart" meter related fires are of great concern to customers, especially given the

number of "smart" meter related fires that have occurred across the U.S. and Canada, resulting in at least 2 deaths. Hundreds of thousands of "smart" meters have been recalled (See Exhibit I).

At my instigation, based on inside information that I received and shared with the ACC in September of 2014 (Exhibit J), APS admitted to the ACC (Exhibit K) that there have been "some" "smart" meter related fires in their service territory. It should be noted here that "some" is APS's vague term, and "'smart' meter related" is my characterization of the fires.

Via the discovery process of this rate case, I was able to finally get APS to quantify how many "some" is. At Woodward 2.14.a, APS said "twelve fires have been alleged to have been caused by APS installed Elster AMI meters." At Woodward 2.15.a, APS stated that, in a fire related lawsuit, APS has been dropped as a defendant by the homeowner's insurance company but that "The meter manufacturer remains a defendant in the matter."

According to A.R.S. § 40-361.B, a utility's equipment is supposed to "promote the safety … of its patrons." The clear and present danger of losing one's house and all that's in it, not to mention losing one's life, should be enough to shut down the entire "smart" meter program. Certainly to charge people a fee to avoid this possible harm – or even to avoid the constant anxiety caused by its specter – is extortion.

III.B.4 Damage to and Interference with household appliances and electronics

Q. DETAIL YOUR ASSERTION THAT "SMART" METERS POSE RISKS OF DAMAGE TO AND INTERFERENCE WITH HOUSEHOLD APPLIANCES AND ELECTRONICS

A. "Smart" meter damage to household appliances and electronics has been well documented in ACC "smart" meter dockets E-00000C-11-0328 and E-01345A-13-0069, both by news reports and anecdotes from Arizonans who have had the displeasure and expense of "smart" meters messing with and ruining their electrically powered things.

With my own eyes, and using a microwave analyzer to pick up the "smart" meter microwave transmissions that correlated perfectly with the lights, I have seen "smart" meters turn motion sensing lights on again and again with each "smart" meter microwave transmission.

When computers or major appliances are ruined, or burglar alarms triggered, it is more than annoying; it is costly. Here's an excerpt from a typical complaint on this subject on file at the ACC:

> APS's "smart meter" does not work correctly in every home. … We have spent endless hours discussing this with APS, Bonds alarm, electricians, all at our expense. In addition to the monetary expense, we have suffered hearing trauma from lengthy blaring of our home alarm (at times in excess of an hour.) Finally, a few months ago, APS agreed to reinstall the old meter. Since then, the blaring alarm problem has not reoccurred and we have been able to live in peace."
> (Exhibit L)

The Settlement Agreement proposes a fee to avoid the harm described above. Paying a fee of any amount to avoid this sort of harm in order to "live in peace" is

extortion. The Settlement Agreement is an attempt to legalize extortion.

III.B.5 Trespass & Theft

Q. EXPLAIN HOW "SMART" METERS IMPOSE A RISK FOR TRESPASS AND THEFT.

A. The actual metering of electricity is but a fraction of the overall functions of a so-called wireless "smart" meter. Not just measuring devices, "smart" meters are also computers, radio transceivers and relay antennas. The I.R.S. actually classifies "smart" meters *not* as meters but as computers (see Exhibit M). From Big Four accounting firm PwC:

> The IRS ... determined that the meter is a computer under asset class 00.12 of Rev. Proc. 87-56 because it shares common features with computers such as a central processing unit with storage and other logic functions. In addition, it is programmable, electronically activated, and is capable of detecting energy tampering or service quality issues.
> (Exhibit M)

Calling these devices "meters" distracts from the fact that they are utility company communications and computing equipment designed to not just gather and transmit a single customer's data but also to move the data of others. APS has easement for a meter, but APS has quite simply gamed its easement and stolen ratepayers' property in order to establish APS's own private communications and computer network to move other people's data and to implement APS's business plan. Not even a telecommunications company can do that on a customer's property, but thus far APS has gotten away with it.

Placement of a computer, radio transceiver and relay antenna (of any size) on

anyone's private property without permission or compensation is trespass and theft. The fees proposed in the Settlement Agreement for customers trying to avoid this theft, this trespass, by refusing a "smart" meter is extortion.

It is worth noting that all the other violations and abuses caused by "smart" meters start with this initial property violation. In other words, once one has lost property rights, one has lost all others as well. This is why someone's home is supposed to be their castle.

III.B.6 Health

Q. EXPLAIN HOW "SMART" METERS POSE A RISK TO APS CUSTOMERS' HEALTH.

A. The Arizona Department of Health Services' ("ADHS") "smart" meter health study, heavily flawed as it was, did *not* conclude that "smart" meters are safe. The ADHS study concluded "smart" meters are "not likely to harm." "Not likely to harm" does not equal safe. APS is thereby in violation of A.R.S. § 40-361.B which states:

> Every public service corporation shall furnish and maintain such service, equipment and facilities as will promote the safety, health, comfort and convenience of its patrons, employees and the public, and as will be in all respects adequate, efficient and reasonable.

"Not likely to harm" means that health harm *is in fact a possibility* with a "smart" meter. Requiring customers to pay a fee, as proposed in the Settlement Agreement, to refuse a "smart" meter in order to avoid health harm or the possibility of health harm, is extortion.

It is important to note here that, in his direct testimony at page 7, APS's Scott Bordenkircher called APS's "smart" meters "safe, encrypted, FCC-compliant metering technology."

We know from the ADHS that APS's "smart" meters are *not* in fact safe. Whether or not the meter data is encrypted is irrelevant. 1) Any encryption can be hacked. 2) Personal, private data, once taken, is a privacy violation whether encrypted afterward or not. As for the metering technology being FCC-compliant, that is another irrelevancy. The FCC has established guidelines for protection against the thermal effects of radio frequency exposure. Those guidelines are *not* safety standards. That is acknowledged in an FCC document entitled, *Consumer Guide, Wireless Devices and Health Concerns*, the very first line of which states that "... there is no federally developed national standard for safe levels of exposure to radiofrequency (RF) energy..." (Exhibit N).

In addition, the Office of Air and Radiation at the U.S. Environmental Protection Agency is on record as saying:

> The FCC's current exposure guidelines, as well as those of the Institute of Electrical and Electronics Engineers (IEEE), and the International Commission on Non-Ionizing Radiation Protection, are thermally based, and do not apply to chronic, non-thermal exposure situations. They are believed to protect against injury that may be caused by acute exposures that result in tissue heating or electric shock and burn.
> (Exhibit O, p. 2)

"Chronic, non-thermal exposure situations" are precisely that to which APS "smart" meters expose people. Regarding APS "smart" meter microwave radiation, no one has

complained of "acute exposures that result in tissue heating or electric shock and burn." Those thermal effects are not the issue.

As well, the Office of Environmental Policy and Compliance at the U.S. Department of the Interior is on record as stating that the FCC's guidelines are 30 years out of date.

> … the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today. This is primarily due to the lower levels of radiation output from microwave-powered communication devices such as cellular telephones and other sources of point-to-point communications; levels typically lower than from microwave ovens.
> (Exhibit P, at ¶ 3 of Enclosure A)

Earlier this year, the obsolescence of the FCC guidelines decried by the U.S. Department of the Interior was borne out by the U.S. Department of Health and Human Services' National Toxicology Project ("NTP"). On May 26, 2016, the NTP released partial findings from their $25 million study of the cancer risk from cell phone radiation, the same type of non-ionizing radiation emitted from APS "smart" meters. (See Exhibit Q. For the full 74 page *Report of Partial Findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposures)*, see http://biorxiv.org/content/biorxiv/early/2016/05/26/055699.full.pdf) The released findings prove that chronic exposure to such radiation can cause cancer without heating tissue. The NTP thought those findings important enough that the findings were

announced prior to the release of the full study which should occur sometime in 2017.

The Institute of Electrical and Electronics Engineers, in writing about the NTP study, stated that "... an NTP study is the gold standard for animal cancer assays." (http://spectrum.ieee.org/the-human-os/biomedical/ethics/cellphone-radiation-causes-cancer-in-rats) And according to the Microwave News:

> Both the American Cancer Society (ACS) and Consumers Reports immediately shelved their long-held, wait-and-see positions. In a statement issued soon after the NTP's press conference, Otis Brawley, ACS' chief medical officer, said the NTP results mark a "paradigm shift in our understanding of radiation and cancer risk." He called the NTP report "good science."
> *Consumer Reports* said that the new study was "groundbreaking" and encouraged people to take simple precautions to limit their exposures.
> (*News Media Nix NTP Cancer Study; "Don't Believe the Hype*," Exhibit R)

The NTP study also found that chronic, non-thermal exposure to non-ionizing radiation broke DNA in the brains of rats and mice. (See Exhibit S.)

In May of 2011, the World Health Organization's International Agency for Research on Cancer classified non-ionizing radiofrequency radiation, the kind of radiation APS's "smart" meters emit 24/7/365, as a 2B (possible) carcinogen. (Exhibit T)

Payment to avoid chronic, non-thermal exposure to non-ionizing radiation of APS's "smart" meters is extortion. The Settlement Agreement calls for such a payment. The Settlement Agreement is extortive.

Additional frequencies are transmitted by "smart" meters in the 2 to 50 kilohertz range. The ADHS never concerned its "smart" meter study with those frequencies.

Numerous studies have shown repeatedly that those frequencies disrupt the human nervous system. Indeed, "nerve block" is the phrase used in the studies to describe what occurs. The studies are not controversial. In others words, there are *no* studies that show otherwise. *Nerve block induced by frequencies in the 2 to 50 kilohertz range is an established fact.* The studies that show this nerve block are all from reputable sources including the epitome of "establishment" science when it comes to electricity, the Institute of Electrical and Electronics Engineers. A list of studies is found at my YouTube video of the discovery of these frequencies. Search YouTube for *Nerve Disrupting Frequencies Radiating from "Smart" Meters.*

In addition, Erik Anderson, P.E., C.F.E.I., is testifying as a witness on my behalf. His testimony proves the existence of the frequencies found in my video. As well, Dr. Sam Milham, MD, MPH is testifying as a witness on my behalf as to the health effects of those frequencies.

The payment proposed in the Settlement Agreement for those customers who wish to protect their health by avoiding those frequencies is extortion. Indeed, the presence of those frequencies make APS's entire "smart" meter system a public health hazard and clear violation of A.R.S. § 40-361.B.

It should be noted here that APS has lied repeatedly about the microwave transmissions of its "smart" meters (see my YouTube videos, *APS Caught Lying Again*, and *APS Caught Lying Revisited*). For example, at the March 23, 2012 ACC "smart"

meter workshop meeting and regarding APS's Elster "smart" meters, APS employee Michael Gogan declared unequivocally that "What the vendor actually states is that on average they communicate 15 minutes a day." Yet at APS's Supplemental Response to Woodward 2.2, APS stated, "... total Elster meter transmissions (both scheduled and unscheduled) are approximately 17 seconds per day."

III.B.7 Inaccuracy + Another Safety Issue and Rate Base Inflating Scam

A study, *Static Energy Meter Errors Caused by Conducted Electromagnetic Interference* (Exhibit U), performed last year by the University of Twente and the Amsterdam University of Applied Sciences, and published in the scientific journal, IEEE Electromagnetic Compatibility Magazine, proves what utility customers have been saying practically everywhere "smart" meters have been installed: *"Smart" meters are not accurate.*

Nine different "smart" meters were tested and compared with the readings of an electro-mechanical (analog) meter. Five of the nine, gave consistent readings much higher than the actual amount of power consumed, up to 582% higher, while two of the meters gave readings that were 30% lower than the actual amount of power consumed. The study found the very design of the meters to be flawed.

Of note to solar customers is the following quote from the study: "... in several cases [smart] electricity meters registered only a part of the energy factually fed into the public supply network from a PV inverter." Perhaps that is the real reason APS does not

want its solar customers to be able to refuse a "smart" meter. In any case, payment to avoid the billing inaccuracy or threat of billing inaccuracy inherent in "smart" meters is extortion. As such, the Settlement Agreement is extortion.

Actually, the inherent design flaw found in the aforementioned study has been known for years in the industry. A 2010 Electric Power Research Institute ("EPRI") White Paper 2010, *Accuracy of Digital Electricity Meters* (Exhibit V), found that all solid state meters are subject to software and electronic circuitry "glitches," a flaw analog (electro-mechanical) meters do not have. From the EPRI:

> … as electronic devices, there is the possibility of imperfections in the embedded software or sensitivities in the electronic circuitry. Hypothetically, such imperfections or sensitivities could result in glitches that could affect the meter reading. An error of this nature that occurred only rarely would be difficult to detect prior to field deployment.
>
> With electromechanical meters, modes of failure tend to be permanent. Once a meter or its register fails, due to wear, dust, etc, it is generally still found to be in a failed state when tested later. Software flaws, on the other hand, could create a transient glitch, leaving a meter that checks-out perfectly afterwards. This possibility complicates the diagnostic process for solid state meters and may make it difficult to discern the root cause of problems.
> (Exhibit V, pp. 6 & 7)

Such a "transient glitch" would also make it very difficult for a customer victimized by the "glitch" to obtain relief from either that customer's utility or the legal process. Indeed, that has been the case for victimized customers across the nation. Even in the face of outrageous bills way outside a customer's historical usage pattern, the utility very seldom admits fault because the utility incorrectly believes their meter just cannot be

wrong.

In light of the above, it is no wonder that in the previously mentioned *Static Energy Meter Errors Caused by Conducted Electromagnetic Interference* study in which seven out of nine meters were found grossly inaccurate, the control meter, the benchmark to which the solid state meters were compared, was *not* solid state but an analog (electro-mechanical) meter.

The EPRI White Paper, *Accuracy of Digital Electricity Meters*, also revealed another fundamental safety venerability inherent in all solid state ("smart" or non-communicating digital) meters, to wit:

> The electronic circuits of solid state meters connect to the AC line to draw operating power and to perform voltage measurement. ... A range of electronic clamping and filtering components are used to protect the electronics from these voltage surges, but these components have limitations. The ANSI C12.1 metering standard specifies the magnitude and number of surges that meters must tolerate. ... In any case, surges that exceed the tested limits, either in quantity or magnitude, **could cause meter damage or failure**.
>
> Electromechanical meters had no digital circuitry. They utilized spark-gaps to control the location of arc-over and to dissipate the energy of typical voltage events. As a result, **they were generally immune to standard surge events**. This nature is evidenced in the section of ANSI C12.1 that specifies voltage surge testing, but allows that "This test may be omitted for electromechanical meters and registers."
> (Exhibit V, p. 7, emphasis added)

Such inability to withstand surges explains the many fires and explosions attributed to solid state meters around the country and chronicled in Exhibit I.

In view of the aforementioned inherent flaws in both "smart" meters and non-

communicating digital meters, the Settlement Agreement proposal that would do away with analog meters altogether is neither just nor reasonable. Nor is it just or reasonable to require a fee from customers wishing to avoid those aforementioned inherent flaws by refusing "smart" meter.

No more analog meters for customers who refuse "smart" meters makes no sense. It did make some sense when APS wanted mandatory Demand and Time Of Use rates for everyone. APS would have needed digital meters to keep track of Demand and TOU. But those mandatory rates are now off the table and not in the Settlement Agreement. As such, the only reason there is now for replacing all analog meters is so that APS can inflate its rate base. Case in point: I got APS service at a Sedona address last year. Per my request, APS installed an analog meter. The meter appears brand new. I have seen them online at a retail price of $15 (here: www.visionmetering.com). The meter will likely last at least 30 years. Under the Settlement Agreement that analog meter would be removed and replaced with a digital, solid state meter that, according to APS's Response to Staff at 9.18.c, costs $104 installed and will probably last nowhere near as long. Multiply that scenario by all the APS customers with perfectly good, working analog meters and APS will have unnecessarily inflated its rate base. Such waste is shameful and unsustainable. The Settlement Agreement is thus wasteful and unsustainable. Furthermore, the Salt River Project provides analog meters to customers on a standard rate who refuse a "smart" meter. If SRP can do it, so can APS.

III.C ILLEGAL FEES IN THE SETTLEMENT AGREEMENT

Q. IS THE SETTLEMENT AGREEMENT'S PROPOSAL FOR FEES FROM CUSTOMERS WHO REFUSE "SMART" METERS IN VIOLATION OF ANY ACC DECISIONS?

A. Yes, the Settlement Agreement's proposal for fees from customers who refuse "smart" meters is in violation of ACC Decision # 69736 (Exhibit W).

In the Energy Policy Act of 2005, Section 1252, "smart metering," the word used repeatedly with regard to "smart" meters is "request". Electric utilities were to provide "smart" meters to those customers *who request them*. It was to be an "*opt in*" program – and even then only if state regulatory agencies found such a program "appropriate". (Energy Policy Act is here: http://www.gpo.gov/fdsys/pkg/PLAW-109publ58/html/PLAW-109publ58.htm)

The ACC's July, 2007 Decision # 69736 is entitled "IN THE MATTER OF SMART METERING REQUIREMENTS OF SECTION 1252 OF THE ENERGY POLICY ACT OF 2005." Twice, that Decision actually quotes the relevant Energy Policy Act wording mentioned above. Note the word, "requesting."

> (C) Each electric utility subject to subparagraph (A) shall provide each customer requesting a time-based rate with a time-based meter capable of enabling the utility and customer to offer and receive such rate, respectively. (Exhibit W, p. 3 & p. 8)

Additionally, in the Decision's "Staff's Recommendations" (which the commissioners adopted in Decision # 69736), we find the following under the heading

"TIME-BASED METERING AND COMMUNICATIONS." Note the phrase "upon customer request."

> "Within 18 months of Commission adoption of this standard, each electric distribution utility shall offer to appropriate customer classes, and provide individual customers **upon customer request**, a time-based rate schedule under which the rate charged by the electric utility varies during different time periods and reflects the variance, if any, in the utility's costs of generating and purchasing electricity at the wholesale level."
> (Exhibit W, p. 7, emphasis added)

Expecting people who do not "opt in" to pay for not "opting in" turns Decision # 69736 on its head. It's kind of like getting a bill from the airlines for not flying. If adopted, the Settlement Agreement would make "smart" meters a program in which everyone is automatically "opted in" and has to pay to get out, and that **has no basis in law**. **It is illegal.** Actually, since APS opted everyone in, any costs involved in servicing customers who refuse "smart" meters belong to APS's shareholders, not ratepayers. APS made a negligent and irresponsible business decision and must suffer the consequences.

It's worth noting here that APS has attempted to cement their illegal mandatory "opt in" program by proclaiming that "smart" meters are now their "standard meter," and any other meter is "non-standard." But APS's terminology does not convey or define legal status. APS's terminology does not override ACC Decision # 69736. It is just propaganda, and signifies nothing but arrogance.

How a voluntary, "opt in" program can morph into a mandatory one whereby people who never opted in are scapegoated as "cost causers" and are expected to pay

money to refuse something they never "requested" is a testament to APS's aggressivity and the ACC's passivity and acquiescence. APS has both in the past and in this rate case cited ACC Decision # 68112 (Exhibit X) as its rationale for installing "smart" meters and, in bully fashion, effectively making "smart" meters mandatory for all customers. Yet Decision # 68112 did *not* mandate "smart" meters for all APS customers. In actual fact Decision # 68112 was a settlement that involved a group of customers on Demand rates that alleged APS had improperly estimated their bills. Part of the Settlement Agreement (¶ 22) called for APS to:

> … design a cost effective Access Improvement Program to achieve a reduction in the number of instances of kW and kWh estimation due to "no access" issues. Unless otherwise ordered by the Commission, the Program shall apply solely to specific remedies, such as moving meters or installing appropriate meter-reading technologies, **for customer premises where access to the meter is a recurring problem.** Meter reading technologies applied **in these circumstances** shall include, but shall not be limited to, remote ports or similar devices, advanced metering systems, and enhanced radio technology. Expenditures made pursuant to this Program shall have a direct, measurable effect upon APS' ability to obtain access to premises where access is a recurring problem.
> (Exhibit X, p. 4, emphasis added)

So, the Settlement Agreement applied to customers with demand meters <u>where access was a recurring problem</u>. It did not apply to all classes of customers, or even all customers on Demand rates, or even all customers on Demand rates where access was a problem, but *only* where access was a *recurring* problem.

III.D <u>THE SETTLEMENT AGREEMENT PERPETUATES A BOONDOGGLE</u>

Q. DOES THE SETTLEMENT AGREEMENT PERPETUATE A

BOONDOGGLE OR DOES APS'S "SMART" GRID ACTUALLY BENEFIT RATEPAYERS?

A. APS's "smart"grid does not pencil out for anyone except APS and its cheerleaders at the Arizona Investment Council ("AIC"). Customers who refuse "smart" meters should actually get a refund for unwillingly subsidizing "smart" meters (and the related system) that those customers never asked for and do not want. By installing "smart" meters, APS will have a never-ending expansion of its rate base upon which APS will get an undeserved rate of return year after year. In short, APS's "smart" meters (and related costly operations and equipment – the "smart" grid) are a boondoggle with no benefit to ratepayers. As Northeast Utilities has stated, "... there is no rational basis for the implementation of AMI." (Exhibit B, p. 2)

At page 7 of APS's Scott Bordenkircher's direct testimony, Mr. Bordenkircher, in answering how AMI ["smart" meters] benefits customers, comes up with only one benefit: "For customers, AMI has increased the opportunity to gain more knowledge of their energy use." So, basically what he is saying is that APS has wasted millions of dollars (millions of dollars upon which APS gets a guaranteed return) so that customers can know when their lights are on – *yesterday* – yesterday because, for anyone who wants to bother looking at their energy consumption at the APS website, the information is a day old. Besides, what exactly does 'gaining more knowledge of energy use' have to do with the utility's sole obligation to provide electricity to customers? It has nothing to

do with it. In addition, anyone who wants to obsess over their energy use can buy a $20 Kill A Watt electricity usage meter or spend a few hundred dollars for a whole house energy monitor without having all classes of ratepayers foot the costly bill for their desire to "gain more knowledge of their energy use."

III.D.1 Exaggerated Meter Life – Settlement Agreement Accounting Fraud

Q. IS APS USING AN ACCURATE USEFUL LIFE TO DEPRECIATE ITS "SMART" METERS AND IS THE SETTLEMENT AGREEMENT JUST AND REASONABLE FOR ADOPTING APS'S PROPOSED USEFUL LIFE?

A. No. APS is currently using a baseless 26 year useful life for its "smart" meters, and the Settlement Agreement proposal of a 20 year useful life is not supported by APS's own historical experience. APS has failed to recognize that so-called Advanced Metering Infrastructure meters are not just plain metering devices but sophisticated network management and communication equipment with much shorter useful lives.

Q. EXPLAIN AND PROVIDE EVIDENCE WHY THE SETTLEMENT AGREEMENT IS FRAUDULENT AS REGARDS METER SERVICE LIFE.

A. Despite many APS "smart" meters failing and being removed from service long before 20 years, according to APS's Scott Bordenkircher: "APS is proposing a 20-year useful life for both AMI ["smart"] and non-AMI meters in the 2016 depreciation rate study." (See APS's Response to Staff at 9.18.d) Neither APS nor any signatories to the Settlement Agreement have provided any evidence to support a 20 year life. In fact what

has actually happened is that APS's 2G and 3G "smart" meters have failed to achieve even a 10 year life! The only meters that have a life of 20 years or more are analog.

A 20 year life is preposterous and not the guidance of the I.R.S. According to Big Four accounting firm PwC: "On November 2 [2012], the IRS released guidance concluding that certain utility smart meters are six-year property and thus eligible for five-year depreciation." (See Exhibit M.) Additionally, the extremely short life of "smart" meters has been confirmed by Bennett Gaines, Senior Vice President, Corporate Services and Chief Information Officer of FirstEnergy (the nation's largest investor owned utility with 6 million customers). Testifying in October, 2015 before a joint hearing of the U.S. House Subcommittee on Energy and the U.S. House Subcommittee on Research and Technology, Mr. Gaines said this about "smart" meters: "These devices have a life of between 5 to 7 years." (See him say it at 1:40:56 in the hearing's video minutes, here: https://science.house.gov/legislation/hearings/subcommittee-energy-and-subcommittee-research-and-technology-hearing or search YouTube for *Hearing: Cybersecurity for Power Systems (EventID=104072).*)

APS's proposition of a 20 year life is not without irony since the 9.18 section of APS's Response to Staff in which the 20 year proposition is found was preceded by 9.17 at which APS discussed some 140,000 "smart" meters that it replaced for becoming obsolete. The "smart" meters were installed during 2005 to 2008 and replaced in 2015 to 2016 – nowhere near 20 years. APS blew $19,707,925 on that fiasco. 140,000 analog

meters would have cost a fraction of that and would still be in service today – and probably for the next 30 years.

At APS's Response to Woodward's data request 2.12, APS admits thousands of meters failed to communicate and, after an average life of just 4 years, were replaced as follows:

> 2014 – 19,203 meters replaced
> 2015 – 22,287 meters replaced
> 2016 (As of 10/2016) – 20,172 meters replaced

This failure to communicate is a problem that is ongoing. APS: "This specific communication issue was first identified in 2014 and continues to be an issue today, albeit a minimal one." Some 20,000 meters failing every year is a "minimal issue?" At least (according to APS) the meters are under warranty and "some installation costs were covered," whatever "some" means. Meanwhile, APS estimates the bills of those customers whose meters fail to communicate. According to an April 1, 2015 email of Connie Walczak, the head of ACC Consumer Services:

> APS seems to not have a problem with this 'non' communication, they have Schedule 8,3.1 to rely on which enables them to estimate the bills. This can go on for months. They do not check the meter when they could retrieve the data, rather, they estimate usage. They do not feel the meter is malfunctioning if it begins communicating again. Even when it continues doing this for more than one month.
> (Exhibit Y)

"APS seems to not have a problem" indeed. In answering my data request on this topic, APS stated:

> APS disagrees with and objects to the question's premise that the need to estimate a bill due to issues with an AMI meter's ability to communicate constitutes a "problem."
> (APS Response to Woodward 2.12)

I remember when APS used to brag that one of the advantages of "smart" meters was fewer estimated bills. Now APS can only brag that thousands of broken "smart" meters aren't a problem, and that "For customers, AMI has increased the opportunity to gain more knowledge of their energy use."

At APS's Response to Woodward's data request 2.13, APS admitted to 49,788 more failed "smart" meters in the year 2014 alone, this time for "circuit board soldering, … blank LCD screens, non-communicating modules, voltage errors, and memory errors." *Voltage errors*? But APS's Scott Bordenkircher said in his direct testimony that "smart" meters benefited APS because "AMI meters also provide power quality data which is used to ensure that electricity is delivered to customers at the correct voltage." (p. 7) I guess they do except when they don't.

39,330 of the 49,788 broken "smart" meters were under warranty, but the point is that claiming a 20 year life for a device which is essentially an outdoor computer and has a history of unreliability is absurd, warranty or not. The point is that customers who use analog meters have the more reliable and inexpensive system. In meter service life alone, "smart" meter customers will go through about 5 "smart" meters for every one meter that an analog customer uses.

APS and its witness on depreciation, Ron White, need to brush up on the Uniform

System of Accounts Prescribed for Public Utilities and Licensees Subject to the Provisions of the Federal Power Act that states:

> 22. *Depreciation Accounting.*
> A. *Method.* Utilities must use a method of depreciation that allocates in a systematic and rational manner the service value of depreciable property over the service life of the property.
> **B. *Service lives.* Estimated useful service lives of depreciable property must be supported by engineering, economic, or other depreciation studies.**
> C. *Rate.* Utilities must use percentage rates of depreciation that are based on a method of depreciation that allocates in a systematic and rational manner the service value of depreciable property to the service life of the property. Where composite depreciation rates are used, they should be based on the weighted average estimated useful service lives of the depreciable property comprising the composite group.
> (http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=054f2bfd518f9926aac4b73489f11c67&rgn=div5&view=text&node=18:1.0.1.3.34&idno=18 , emphasis added)

Ron White's answers to various ACC Staff questions are very instructive. Evidently, Dr. White supported APS's 20 year service life assertion not with "engineering, economic or other depreciation studies" but with nothing but his own opinion.

> Staff 3.3:
> Does APS witness Dr. White or his firm, Foster Associates, Inc. possess any studies concerning meter service lives for any electric utilities or in the electric utility industry? If not, explain fully why not. If so, please identify each study. Please provide a copy of all such studies prepared or published from January 1, 2014 through the present.
>
> Response: Neither Dr. White nor Foster Associates possess any such study. **[Notice that Dr. White never explained fully why he had no studies.]**
>
> Staff 3.4:
> Does APS possess any studies concerning meter service lives for

any electric utilities or in the electric utility industry? If not, explain fully why not. If so, please identify each study. Please provide a copy of all such studies prepared or published from January 1, 2014 through the present.

Response: Other than Dr. White's study of APS meter service lives, APS does not possess any other studies related to meter service life.
[Again, no explanation why he had no studies.]

Staff 3.14:
Did Ron White rely on any external sources of information in developing his opinion? If so, please provide.

Response:
No, Ron White did not rely on any external sources of information in developing his opinion.

Staff 3.15:
Identify and provide copies of all industry statistics upon which Dr. White relied in formulating the depreciation proposals in this case.

Response: Dr. White did not reference any industry statistics in his testimony or exhibits. Certain industry publications are proprietary, and Dr. White does not have access to general industry depreciation statistics.

Staff 3.20:
Does Dr. White rely upon any information or guidance from the Society of Depreciation Professionals for any of his recommendations?
a. If not, explain fully why not.
b. If so, identify by publication name, date and author/presenter, the specific materials upon which Dr. White relies.

Response:
a. Dr. White does not cite or rely on the opinions of others, including the Society of Depreciation Professionals. His opinions are his own.
b. N/A

A twenty year "smart" meter service life is accounting fraud. The Settlement Agreement is therefore fraudulent.

III.D.2 Who is Subsidizing Whom in the Settlement Agreement?

Q. IS IT JUST AND REASONABLE FOR CUSTOMERS WITH THE CHEAPER METER READING SYSTEM TO SUBSIDIZE THOSE WHO DO NOT?

A. No, it is not. Customers who refuse "smart" meters have the cheaper metering system while at the same time they are subsidizing the grossly inefficient "smart" grid that they do not use, do not want, and to which they never "opted in." Such customers should not have to pay twice for meter reading as the Settlement Agreement would have them do. Such customers should not have to pay a penalty for using a cheaper system as the Settlement Agreement would have them do.

At page 35 of 47 at APSRC00352 of APS's Pre-Filed data, APS parent company Pinnacle West bragged to shareholders that APS "smart" meters saved $19 million in operational costs in 4 years. That works out to $4.75 million per year. But what APS does *not* brag about is that, using the numbers APS supplied in its Response to Woodward at 2.27 & 2.19.p, it costs over $28 million per year to "save" that $4.75M, assuming a "smart" meter service life of 6 years.

With APS's own numbers, I will demonstrate just how grossly inefficient APS's "smart" grid is.

"Smart" meter installed price = $132.22 per meter
$132.22 x 1.25M customers = $165,275,000
$165,275,000 divided by 6 years = $27,545,833.33
$27,545,833.33 + $600,000/yr. cellular cost to move data = $28,145,833.33

So, it costs over $28M per year to "save" $4.75M per year.

APS is running a rate base inflating scam of epic proportions! I have said it for years: *People who refuse "smart" meters do not cost APS money.* It's the "smart" grid that's costing us all, and *forever* since it will never break even much less save any money.

Giving APS and the parties endorsing the Settlement Agreement the benefit of an impossible 20 year "smart" meter service life, APS's "smart" grid is still financially unsustainable:

"Smart" meter installed price = $132.22 per meter
$132.22 x 1.25M customers = $165,275,000
$165,275,000 divided by 20 years = $8,263,750
$8,263,750 + $600,000/yr. cellular cost to move data = $8,863,750

So, even allowing for an impossible 20 year "smart" meter service life, it costs $8.8M per year to "save" $4.75M per year.

Bear in mind that the numbers above do <u>*not*</u> include return on rate base or such additional costs as data storage, software licensing fees and increased cybersecurity costs which all total in the millions and are ongoing (but which APS claims it does not account for separately vis-a-vis "smart" meters). Nor do the numbers above include the $120 million APS is going to blow on its new Customer Information System this year

and next to "better take advantage of AMI data" (Lockwood direct testimony at p. 9) So it costs *even more* than what's calculated above to "save" $4.75M per year.

To repeat, customers who have refused APS's financially unsustainable "smart" meter system owe APS nothing. If anything, those customers are due a refund of their forced subsidy of APS's rate base inflating "smart" meter scam.

I am not alone in saying that customers who refuse "smart" meters are subsidizing a boondoggle. In a Brief based on a "smart" meter pilot project that involved thousands of people and which was filed with the Connecticut Department of Public Utility Control, Connecticut Attorney General George Jepsen found that:

> ... the costs associated with the full deployment of AMI meters are huge and cannot be justified by energy savings achieved.
>
> Many customers do not want or cannot use the new AMI meters. Under the Company's plan, however, these customers will nonetheless be forced to subsidize the cost of the meters for the few customers who will use them. (Exhibit Z, p. 8)

In comments filed with the Michigan Public Service Commission, Michigan Attorney General Bill Shuette stated:

> ... under the utilities proposals, customers who opt-out of smart meters would be required to pay rates covering *both* the costs of the smart meter program, and the expansively defined incremental costs of retaining traditional meters.
> (Exhibit AA, p. 5)

Likewise, as a result of a cost/benefit analysis performed by Ernst & Young, Germany's Economy Ministry proclaimed the European Union's proposal for 80% of

homes to be "smart" metered by 2020 to be "inadvisable" since installation costs would be greater than energy saved. (Exhibit BB)

Just last February, Npower in the UK hiked its rates so high that the Prime Minister may intervene. According to *The Telegraph*:

> It is the first time an energy company has blamed a price rise on the Government's smart meter policy.
>
> Experts said the admission is the first hard evidence that smart meters, which are designed to help consumers save money, are actually flawed and will end up making people worse off.
> (Exhibit CC)

Actually that's only a first *for the UK*. Northeast Utilities in New England said as much a couple years ago: "For customers who will pay the price of this system, there is no rational basis for this technology choice." (Exhibit B, p. ii)

With its "smart" grid, APS has achieved an ever increasing rate base, a perpetual money machine system that guarantees APS rate increases (like the one APS is asking for now) from here to Kingdom Come.

In her direct testimony, APS's Barbara Lockwood concluded by saying,

> APS is modernizing and making more sustainable its electric system with improvements such as the SCRs, the OMP, ADMS, **AMI**, EIM and the new CIS.
> (p. 26, emphasis added)

Actually, AMI "smart" meters cost more and last less, and so the system is <u>*not*</u> sustainable. The only thing "sustainable" about "smart" meters is that, unless they are all

removed and replaced with cheaper, more accurate, long lasting, non-toxic analog meters, they will **sustain** APS's bottom line forever because ratepayers will *never* stop paying for them and their related equipment and systems. Thus APS "smart" meters are *not* "in all respects adequate, efficient and reasonable" per A.R.S. § 40-361.B. The Settlement Agreement props up this unsustainable, illegal system. The Settlement Agreement would have customers who refuse that system cross subsidize it while paying also what is essentially a penalty for using the cheaper analog system.

III.E UNJUST & UNREASONABLE RESIDENTIAL RATE AVAILABILITY IN THE SETTLEMENT AGREEMENT

Q. IS THE PROVISION AT XIX OF THE SETTLEMENT AGREEMENT THAT FORCES CUSTOMERS INTO TOU RATES JUST AND REASONABLE?

A. No way! It is both unjust and unreasonable to forcibly shunt all new customers after May l, 2018 into TOU-E, R-2, R-3 or if they qualify, R-XS or R-Tech, and to disallow those customers to choose R-Basic until after 90 days. 90 days on any sort of TOU rate could be financially devastating for certain customers.

While voluntary Time of Use rates can be beneficial to some customers, making them mandatory is neither just nor reasonable. Common sense should inform anyone that there are various customers for whom mandatory TOU rates would be financially punishing since those customers are simply unable to shift electricity use to off-peak times. Working people who have children – are they supposed to launder, bathe, and

cook after 8 pm, while holding off on the A/C, too? APS suggests people turn up their thermostats to cope. Public comments to this APS rate case Docket indicate that people stretched to the bone of their budgets are doing that already.

Working people with children are not the only ones financially punished by mandatory TOU rates. How do people re-schedule the use of medical equipment or air-conditioning that could mean the difference between life and death? Worse, often these types of customers are the ones least able to afford the financial punishment of a mandatory TOU rate. Meanwhile, APS suggests people wash their clothes in cold water (see Exhibit DD). Sure, just like APS CEO Don Brandt and the rest of the APS execs do.

Peak demand and the 'family peak' period in Australia: Understanding practice (in)flexibility in households with children is a study of TOU rates that was published in 2015 in the journal, *Energy Research & Social Science* (http://www.sciencedirect.com/science/article/pii/S2214629615300414). The study verifies my assertions regarding TOU and concludes:

> From our analysis we conclude that TOU tariffs are unlikely to effectively reduce peak period electricity consumption in households with children and may have inequitable financial and/or social impacts for these households.

Similarly, a study published in 2014 in the journal, *Technology Analysis & Strategic Management*, had this to say about the negative social impacts and financial punishing that certain types of people who need to use electricity during peak hours will suffer:

> Peak pricing was seen as inequitable, burdening the less affluent, the less healthy, families and working mothers. Adverse societal outcomes may result from peak pricing, with potential for disruption of time-dependent household routines including the socially vital ritual of family mealtimes. Householders perceived their peak-time consumption to be determined by society's temporal patterns and not within their control to change.

And:

> A disincentive to eat a cooked meal when needed and convenient may have adverse impact on the health and well-being of already disadvantaged groups. Within the households interviewed, it appeared that attempting to deal with peak tariffing would cause particular difficulties for working mothers. Carrying the responsibility on behalf of the household for most domestic tasks, working mothers explained that many tasks had to be completed between coming home from work and going to bed, including cooking, washing up and washing clothes which could be needed for school the next day. This gave little or no scope to vary the time in which chores were completed.
> (*A qualitative study of perspectives on household and societal impacts of demand response*,
> http://www.tandfonline.com/doi/full/10.1080/09537325.2014.974529)

APS is already a monopoly and there is nowhere else people in its service territory can get electricity. This provision of the Settlement Agreement would move APS from monopoly to dictator. As well, persons least able to afford it would be financially punished. Choice in choosing rates must be upheld if a decision in this rate case is to be just and reasonable. Also, the provision does not treat all customers the same and so is discriminatory.

III.F FLAWED PROCESS = FLAWED SETTLEMENT AGREEMENT

Q. Is the Settlement Agreement the result of a flawed process?

A. Yes. The Settlement Agreement discussion meetings are not evidentiary, not fact

based. In short, there is no due process. Nor is there any transparency since the media is not allowed into the meetings. As such there is no public scrutiny of issues and proposals that affect the public. Saying the Settlement Agreement has the support of a majority of Intervenors creates a false facade of democracy since Intervenors in attendance are not there to deliberate on all the issues but only to advocate for their own. A majority of Intervenors in support of the Settlement Agreement is meaningless because there may be many Intervenors advocating a position but only one Intervenor representing the other side. Similarly, there may be many Intervenors involved in one particular issue but only one Intervenor advocating on another, different issue. That other, completely different issue will not be a factor in the majority's decision to support or oppose Settlement since those majority Intervenors are paid only to concern themselves with their issue, naught else. In other words, the deck is stacked. A flawed process yields a flawed result.

IV. CONCLUSION

Q. **DO YOU HAVE ANY CONCLUDING REMARKS?**

A. Yes. For all the reasons given herein, none of the Settlement Agreement's provisions that relate to "smart" meters are just and reasonable. APS's "smart" grid is a toxic boondoggle that – for the sake of customers' comfort and convenience, rights, safety, and physical and financial health – the ACC should call a halt to at once. As Northeast Utilities stated about the "smart" grid, "For customers who will pay the price of this system, there is no rational basis for this technology choice." (Exhibit B, p. ii)

Customers who refuse "smart" meters should not be extorted or discriminated against. In fact they should be given a refund for their share of the "smart" grid that they subsidize but do not use. Such customers are the solution not the problem. The analog system is safe, secure, reliable and cheap. The "smart" grid is not. The Settlement Agreement's proposed changes to Service Schedule 1 that involve charging extortion fees to customers who refuse "smart" meters, and that deny commercial and solar customers the right to refuse a "smart" meter, are unjust and unreasonable. The Settlement Agreement's provision that denies analog meters to customers who refuse "smart" meters is neither just nor reasonable, and the reprehensibly discriminatory language aimed specifically at customers who refuse "smart" meters at Service Schedule I, section 8.5, is neither just nor reasonable.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

RESPECTFULLY SUBMITTED this 3rd day of April, 2017.

By 

Warren Woodward
200 Sierra Road
Sedona, Arizona 86336

Original and 13 copies of the foregoing hand delivered on this 3rd day of April, 2017 to: Arizona Corporation Commission, Docket Control, 1200 W. Washington St., Phoenix, Arizona 85007

Copies of the foregoing mailed/e-mailed this 3rd day of April, 2017 to: **Service List**

EXHIBIT A

home energy checkup

Get energy saving recommendations and estimates that make sense for you. Answer a few questions to start saving and see if your home would benefit from a home energy checkup.

start now

watch video

why get a checkup?

Request a Home Performance with ENERGY STAR® Checkup for just $99 (a $400 value) and specially trained contractors can diagnose your home and identify energy saving upgrades to:

- reduce hot/cold spots and balance temperatures year round
- make your home more energy-efficient which can save you money
- improve the health, safety, and indoor air quality of your home

Within a few days of your checkup, your contractors will present a customized assessment report of your home identifying energy saving upgrades.

Deciding to proceed with the recommended upgrades, could save you up to 30% on your energy bill and your contractor can help you take advantage of our rebates and financing offers.

get started

The Home Performance with Energy Star® program is funded by APS customers and approved by the Arizona Corporation Commission.

discover your energy saving potential

A Home Performance Checkup is a great way to identify opportunities to improve the comfort, efficiency and safety of your home.

start now

EXHIBIT B

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January 17, 2014

Mark D. Marini, Secretary
Department of Public Utilities
One South Station, Fifth Floor
Boston, MA 02110

Re: D.P.U. 12-76-A – Investigation into Modernization of the Electric Grid

Dear Secretary Marini:

Enclosed for filing are the Initial Comments submitted on behalf of NSTAR Electric Company ("NSTAR Electric"), and Western Massachusetts Electric Company ("WMECO")(collectively, "Northeast Utilities" or the "Companies") in response to the straw proposal issued by the Department of Public Utilities (the "Department") in relation to the modernization of the electric distribution grid in Massachusetts. Investigation by the Department of Public Utilities on its own Motion into Modernization of the Electric Grid, D.P.U. 12-76-A (December 23, 2013)("Straw Proposal"). The Straw Proposal was issued by the Department based on its review of the Massachusetts Grid Modernization Stakeholder Working Group Process: Report to the Department of Public Utilities from the Steering Committee ("Grid Modernization Report").

NSTAR Electric and WMECO were pleased to participate in the Grid Modernization Stakeholder Working Group and appreciate the opportunity to offer these Initial Comments in response to the Department's Straw Proposal. The Companies look forward to continuing to actively participate in the on-going grid modernization proceedings.

Thank you for your attention to this matter.

Sincerely,

Danielle C. Winter

Danielle C. Winter

Enclosures

cc: Alison Lackey, Esq., Hearing Officer
Benjamin Davis, Director, Electric Power Division

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC UTILITIES

Investigation by the Department of Public Utilities on its own Motion into Modernization of the Electric Grid	)	D.P.U. 12-76-A

INITIAL COMMENTS OF NORTHEAST UTILITIES

EXECUTIVE SUMMARY

NSTAR Electric Company ("NSTAR Electric") and Western Massachusetts Electric Company ("WMECO") (collectively, "Northeast Utilities" or the "Companies") are committed to the cost-effective modernization of the electric distribution grid with focus on four specific objectives designated by the Department of Public Utilities ("Department"): (1) to reduce the effects of outages; (2) to optimize demand, including reducing system and customer costs; (3) to integrate distributed resources; and (4) to improve workforce and asset management. These four objectives are beneficial to customers in today's operating environment. With certain modifications, the Department's Grid Modernization Straw Proposal represents a viable starting point for achievement of these objectives and the Companies' look forward to further proceedings in this docket to advance those elements.

The principle outcome of the Straw Proposal, however, is a mandate for the Companies to initiate the accelerated implementation of a particular technology choice, Advanced Metering Infrastructure ("AMI"). The Department's decision to mandate AMI comes without due consideration of key issues such as the immense cost attached to the technology choice; whether customers are willing and able to pay the price of this technology choice; whether the functionality provided by the technology choice will be utilized by customers or is even sought by customers; whether the imposition of significant costs on distribution customers for this

technology conflicts with other policies encouraging bypass of the distribution system through increased penetration of distributed resources; whether investment in distribution upgrades needed to accommodate distributed energy resources is a better investment of customer dollars given the relatively small incremental benefit afforded by AMI; and whether other issues such as market alternatives, time-varying rates, and cyber-security should be resolved *before* there can be any rational determination that this technology is a good choice for customers. The technology choice is made although there is no evidence that this is a good choice for customers. Conversely, there is ample evidence that this technology choice will be unduly costly for customers and that the objectives of grid modernization are achievable with technologies and strategies that rank substantially higher in terms of cost-effectiveness. For customers who will pay the price of this system, there is no rational basis for this technology choice.

Rather than furthering grid-modernization objectives, the Department's mandate to implement AMI creates an intractable obstacle to grid modernization. The mandate precludes NSTAR Electric and WMECO from designing and implementing grid modernization plans that are best suited to customers and that mitigate the cost that customers will bear for progress. The Straw Proposal also denies the option of targeted cost recovery for any grid modernization initiatives other than AMI. In order to support the accelerated implementation of grid-modernization plans, the Companies require targeted cost recovery to engage in the installation of technologies beyond what can be accommodated by current levels of capital investment fully dedicated to more traditional safety and reliability objectives.

The Department should adopt the Companies' recommendations set forth below. The recommendations will achieve the four objectives of grid modernization in a manner that is cost-effective for customers. There should be no other result for this proceeding.

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC UTILITIES

Investigation by the Department of Public Utilities on its own Motion into Modernization of the Electric Grid	)))))	D.P.U. 12-76-A

INITIAL COMMENTS OF NORTHEAST UTILITIES

I. Introduction

These initial comments are submitted on behalf of NSTAR Electric and WMECO in response to the straw proposal issued by the Department in relation to the modernization of the electric distribution grid in Massachusetts. Investigation by the Department of Public Utilities on its own Motion into Modernization of the Electric Grid, D.P.U. 12-76-A (December 23, 2013) (hereinafter "Straw Proposal"). The Straw Proposal was developed by the Department on the basis of the Massachusetts Grid Modernization Stakeholder Working Group Process: Report to the Department of Public Utilities from the Steering Committee ("Grid Modernization Report").[1]

Northeast Utilities supports the Department's efforts to address the important issue of grid modernization and generally views the Straw Proposal as a viable start in balancing the range of competing interests brought forth in the Grid Modernization Working Group

[1] On October 2, 2012, the Department issued its Investigation by the Department of Public Utilities on its own Motion into Modernization of the Electric Grid, D.P.U. 12-76 (the "Notice of Investigation"), commencing an investigation into the modernization of the electric distribution grid. The Department subsequently convened the Grid Modernization Working Group, comprised of the Massachusetts Distribution Companies, the Department of Energy Resources ("DOER"), the Office of the Attorney General ("Attorney General"), the New England Independent System Operator ("ISO-NE") and other stakeholders. NSTAR Electric and WMECO were active participants on the GMWG Steering Committee and other committees and participated in the preparation of the Grid Modernization Report. Northeast Utilities submitted written comments on the Grid Modernization Report on July 24, 2013.

("GMWG"). In the Straw Proposal, the Department identifies four grid-modernization objectives, which are to: (1) reduce the effects of outages; (2) optimize demand, including reducing system and customer costs; (3) integrate distributed resources; and (4) improve workforce and asset management. D.P.U. 12-76-A at 3. All four of these objectives are valid, reasonable and appropriate in light of today's operating environment. In these comments, Northeast Utilities offers certain recommendations as a means to better align the Straw Proposal with the interests of customers, who are the intended beneficiaries of the grid-modernization objectives.

As an initial note, significant time and resources were expended in the GMWG reviewing the costs and benefits of AMI. This dialogue established that there are a host of critical issues to be addressed before it will be possible to determine whether AMI is appropriate for implementation by the Companies, including evaluation of the impact of its sizeable cost and lack of attendant benefits. The six-month technical review conducted off the record for this proceeding cannot be duplicated here in 25 pages. However, there is no rational basis for the implementation of AMI. Among many other considerations, achievement of the Department's four grid-modernization objectives does not require the implementation of AMI, despite the Department's suggestion that it does. Therefore, the Companies' comments below recommend that the Department modify the Straw Proposal to eliminate the requirement to implement AMI as part of the required Grid Modification Plans ("GMPs"), along with a few other changes.

II. Analysis and Recommendations for the Straw Proposal

A. Overall Approach

The Department's decision identifies the goals and objectives of a modern electric grid, while expressly delineating that investment decisions relating to system planning and the

implementation of new technologies will remain within the responsibility of the electric companies. D.P.U. 12-76-A at 10, 12. This construct is vital because it will allow NSTAR Electric and WMECO to develop and implement GMPs that will benefit customers, while leveraging investments in technology previously made to modernize the distribution system. Allowing design flexibility will enable the Companies to deploy resources optimally; to develop and implement GMPs that encompass a workable strategy for achieving measurable progress in relation to the Department's four, overarching grid-modernization objectives; and to meet the core obligation to provide safe and reliable service at a reasonable cost. The flexibility to develop a company-specific plan based on company-specific circumstances is an element of the Department's Straw Proposal, which should not be changed or diminished in the final result.

B. Comprehensive Advanced Metering Plans

1. Advanced Metering Functionality

The Straw Proposal requires NSTAR Electric and WMECO to include a CAMP in the first GMP submitted to the Department following the issuance of a final decision in the Grid Modernization proceedings.[2] D.P.U. 12-76-A at 3, 18. The Straw Proposal further specifies a list of seven advanced metering functionalities that must be included in the CAMP. Id. at 11-12. In explaining its decision to require electric companies to develop and submit a CAMP, the Department asserts that advanced metering functionality is a "basic technology platform for grid modernization that *must be in place* before all of the benefits of grid modernization can be fully realized." Id. at 12 (emphasis added). In addition, the Department asserts that electric companies will make "individual choices about technology and systems, *but must meet the objectives and requirements.*" Id. (emphasis added). The Department further directs that the

[2] The Straw Proposal directs that the CAMP should consist of: (1) a technology proposal and implementation plan; (2) a business case with a benefit-cost analysis; (3) a request for pre-authorization of investments; and (4) a request for a mechanism to allow for more timely cost recovery than is typically available. Id. at 18.

CAMP submitted by each electric company should be designed to achieve the designated advanced metering functionality within three years of the plan's approval.[3] Id. Together, these predicates and associated directives, along with other requirements contained in the Straw Proposal, have the effect of mandating the accelerated implementation of AMI on the faulty basis that the benefits of grid modernization cannot be achieved without its implementation. This outcome is flawed and therefore undermines the integrity of the Straw Proposal.

An Advance Metering System is not a "basic technology platform" for grid modernization and is not needed to realize "all of the benefits of grid modernization." The Department identified four objectives for grid modernization, all of which can be achieved without the implementation of an advanced metering system. Meters do not reduce the number of outages; metering systems are not the only option for optimizing demand or reducing system and customer costs; and metering systems are not necessary to integrate distributed resources or to improve workforce and asset management. Therefore, it is not correct that advanced metering functionality is a "basic technology platform" that must be in place before all of the benefits of grid modernization can be fully realized, as the Department suggests. Id. at 12.

In fact, there are non-metering technologies that the Companies have implemented, or can implement in the future within a grid-modernization plan, that would tangibly advance the grid-modernization objectives set by the Department. For example, utilizing SCADA-enabled smart switches will both reduce outages and mitigate the effects that outages have on customers. Substation monitoring, remote controls and microprocessor relays can mitigate the impact of widespread outages; manage load constraints; and help to optimize the use of assets in real time. As a means to optimize demand, the installation of automated capacitor banks increases system

[3] The Department states that it will consider proposals to implement advanced metering functionality over a longer term so long as an alternative timeline is provided.

efficiency and reduces costs. Direct control of load or generation can be employed to manage system peaks. In order to allow for the integration of distributed resources, sensors and systems for advanced load flow models that allow for more distributed resources on a circuit can be installed. As for improving workforce and asset management, next generation mapping and outage management systems increase the efficiency of response to outages, while communications, sensors and systems provide system level situational awareness and enhanced safety. Therefore, it is clear that the Companies would be able to identify and implement a suite of non-meter technologies and processes, in addition to those already implemented, in order to advance the Department's grid-modernization objectives *without* the implementation of an advanced metering system.

There is also an important dynamic involved in relation to the integration of widespread distributed energy resources to the electric power grid. Industry study conducted by entities such as the Electric Power Research Institute shows that the electric distribution grid will require substantial investment to be positioned for the integration of distributed energy resources.[4] Therefore, grid-modernization efforts have to be closely coordinated with policies that are encouraging the growth of distributed energy resources. Finite capital resources available for grid modernization should be aimed at this integration effort before any additional monies are expended on metering capabilities that provide limited and/or speculative incremental benefits over current metering technology (following many years of investment in those systems).[5] Moreover, the growth of distributed generation and current subsidies results in the *bypass* of the electric distribution system by potential electric customers leaving fewer and fewer customers to

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[4] *Value of an Integrated Grid: Utilizing Utility-Scale and Distributed Energy Resources*, at 1 (January 6, 2014).

[5] NSTAR Electric and WMECO have deployed Automated Meter Reading ("AMR") drive-by meter reading capabilities deployed throughout their service territories.

pay for it. This creates a pricing crisis in practical terms for both residential and business customers remaining on the system. Huge additional investments to the distribution system will only have the effect of exacerbating the issue for customers.

Accordingly, not only is there a flaw in the Department's premise that an advanced metering system is a "basic technology platform" for grid modernization, but also the implementation of a costly, advanced metering system is at odds with policies designed to promote the growth of distributed energy resources. In directing the implementation of AMI, the Department's Straw Proposal does not address or consider this juxtaposition to any degree. However, immense, near-term investments in advanced metering systems should not be mandated without (1) methodical, valid analysis of the associated costs and benefits; and (2) the development of a plan to solve the detrimental impact of cost-shifting driven by the pervasive installation of distributed energy resources.

There Is No Rational Basis for Department-Mandated Implementation of AMI. The Straw Proposal is structured so that, given current technology alternatives, AMI is the only strategy that will satisfy all seven of the advanced metering functionalities required of the CAMP. Two criteria in particular dictate the implementation of AMI to satisfy the complete set of funtionalities. Specifically, it is impossible to collect customer interval data in near real-time (i.e. hourly), which could also be usable for settlement in the ISO-NE energy and ancillary service markets, absent the implementation of AMI. The same is true for the required functionality that enables two-way communication between customers and the Companies.[6] Throughout the GMWG, Northeast Utilities consistently raised the concern that the costs associated with AMI are currently astronomical, while the incremental benefits for customers are

[6] Two-way communication is feasible on an opt-in basis. From a practical perspective, to deliver the service to all customers on an opt-out basis, the Companies would need to deploy an AMI communications infrastructure.

small in comparison. The Companies will not repeat all of the dialogue that has occurred here due to space constraints; however, the ultimate conclusion has not changed. There are better technologies in which to invest customer funds for the achievement of grid-modernization objectives. The decision to implement AMI goes against the best business judgment of the Companies and cannot be rationally cost justified in terms of a net benefit for the overall customer base that will pay for the investment over the long term. Some of the significant concerns left unaddressed by the Department in the Straw Proposal include the following:

First, the mandated implementation of AMI is not a prerogative within the Department's discretion. The specification of particular technologies or technological platforms is an issue within the management judgment of the Companies and which would only be undertaken on the basis of all relevant investigation and analysis. For this reason alone, mandated AMI implementation is not the correct manner in which to advance the Department's identified grid modernization objectives. Rather than a rush to judgment, the Department should carry through with the acknowledgment that flexibility at this stage is advisable and that the Companies should be allowed to design their GMPs in a manner that provides cost-effective benefits to customers with the seven functionalities serving as long-term guidelines rather than short-term mandates.

Second, the Department has not given any credence to the concern raised in the GMWG that the implementation of AMI is a costly undertaking at this time and there is no cost justification that can support the implementation of AMI. As identified by Northeast Utilities throughout the GMWG process, an AMI roll-out is problematic due to the extraordinary cost associated with, at best, a modest increase in functionality. The implementation of AMI involves significantly more than the replacement of meters. An AMI roll-out would require either the significant enhancement or replacement of the following systems: Communications

Infrastructure used to transmit communications from the meter to the Companies; Meter Data Management System used to collect, store and process interval data and enable ISO settlement; Meter Asset Systems used to store information about all meter assets; Customer Information System ("CIS") used to calculate and present bills with time varying rates ("TVR");[7] ISO and Load Research Systems used to interface with internal metering, CIS and ISO processes; the Outage Management System used to utilize meter-level data to support restoration efforts; and any company-owned home technology systems, e.g., usage displays and thermostats. The Companies' media and call center capabilities would also need to be enhanced to address any AMI implementation. Costs would also exist in relation to the meters, associated technologies and related systems that are currently in place and that would have to be retired before the end of their useful life. Northeast Utilities estimates, conservatively, that the price tag for an AMI roll-out, including the recovery of existing investment on the Companies' books would likely approach, and possibly exceed, $1 billion over the course of the CAMP implementation – all of which is to be borne by customers *who may or may not be interested in interacting with the distribution system at the level implicated by AMI technology.*

Third, even if there is any chance that the cost of implementing AMI can be justified, it cannot be justified without resolution of the Department's investigation into TVR and other issues tied to the cost-benefit analysis. The Department may believe that it can work through the TVR investigation quickly to expedite the development of cost-benefit analyses in time for mid-year filings of the GMPs. However, TVR is a complex concept worthy of in-depth analysis and consideration. A key consideration is whether or not the supply component would be subject to TVR, considering this part of the business is unregulated. If not, it is questionable as to how

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[7] TVRs can include time-of-use rates, critical peak pricing, peak-time rebates, and real time pricing. D.P.U. 12-76-A, at 34.

effective TVR would be if it only affects half of a customer's electric bill. The development of a company-specific TVR proposal, including but not limited to the type and design of a TVR mechanism that best achieves grid-modernization objectives; which rate classes would be affected; whether TVR would be mandatory and, if so, for which rate classes; and how best to educate customers as to the opportunities and mechanics of the proposed TVR mechanism, are issues that are critical to the development of a TVR proposal that will take time to evaluate, present and decide. Without the Department's final determinations regarding TVR, the Companies cannot begin to develop a valid cost-benefit analysis for the required CAMPs.

Similarly, without resolution of the Department's investigation into cyber-security, it is not possible for the Companies to develop a suitable CAMP. AMI introduces a brand new portal into the Companies' information systems, significantly increasing the cyber-security risk. Currently, the only mandatory standard for electric distribution company cyber-security is the North American Electric Reliability Corporation Critical Infrastructure Protection ("NERC-CIP"), which applies only to bulk power systems and not to the electric distribution systems and metering infrastructure subject to the Department's jurisdiction.[8] D.P.U. 12-76-A at 35-36. In its investigation into cyber-security, the Department stated that it intends to explore whether or not to use existing standards to assess the Companies' cyber-security practices and, if warranted, could expand the investigation to broader cyber-security planning and risk management. Id. It is reasonable to assume that such an investigation could lead to the implementation of a series of cyber-security planning and risk management mandates. Implementation of these mandates

[8] There are voluntary cybersecurity recommendations and guidelines for electric distribution companies including: (1) the National Institute of Standards and Technology ("NIST") Interagency Report ("NISTIR") 7628, entitled, "Guidelines for Smart Grid Cyber Security;" (2) the United States Department of Energy's "Risk Management Process;" and (3) the Electricity Subsector Cyber Security Capability Maturity Model ("ES-C2M2"). Id. at 36. Additionally, NIST is developing a critical infrastructure security framework in response to the President's executive order on cybersecurity. Id.

would necessarily involve significant costs as they would affect all aspects of the Companies' distribution systems and related IT systems. These costs must be incorporated into the cost-benefit analysis for AMI.

It is also premature to assume that AMI can provide for large-scale conservation voltage reduction ("CVR"). D.P.U. 12-76-A at 11. Unlike many other grid modernization technologies and processes, CVR was not extensively discussed or analyzed during the course of the GMWG. CVR is an intricate and potentially problematic issue that affects, in addition to meters, numerous aspects of a distribution system warranting far more investigation than is contemplated under the Straw Proposal. To date, no major utility in the United States has implemented a large-scale CVR program, nor has such a program been introduced in Massachusetts to enable the Companies to gain either direct or indirect experience with such an initiative. The requirement to include a large-scale deployment in the CAMP without allowing for the proper investigation to determine the appropriateness of such a program is arbitrary and, most likely, will result in the expenditure of significant funds by customers for, at best, minimal benefits. Rather than the premature requirement of CVR, the Department should allow the Companies to exercise their expertise to evaluate CVR to determine if it is appropriate for implementation.

Fourth, there is no evidence that customers are willing to pay for the limited incremental functionality gained through implementation of AMI. In fact, there is evidence to the contrary. For example, industry studies show that only 46 percent of customers are aware of the concept of "smart metering," and of that percentage, 33 percent associate smart metering with complaints of meter inaccuracy, higher customer bills, invasion of privacy and health concerns. In the Companies' experience, even very large customers with sophisticated energy-management capabilities prefer *stabilized, fixed and/or predictable rates* to assist in managing their business

or personal interests rather than time varying rates. Certain customer segments, particularly the commercial and industrial sector, have significant reservations about AMI and TVR. Many customers have a deep aversion to technology that links them to the "grid" in a way that they perceive as an invasion of their privacy and/or detrimental to their health.

In addition to concerns about customer interest, the Department is requiring the implementation of costly infrastructure that would have to be paid for at the very same time that the Department's policies seek to allow customer exits from the distribution system to take advantage of distributed energy resources. No analysis of this dynamic has been undertaken; nor has any quantification whatsoever of customer bill impacts. Customers value price and reliability above all else and the implementation of AMI serves neither of these objectives.

Moreover, the Department should also consider the results and experiences of recent and ongoing pilots before blindly moving forward with an AMI mandate. Smart metering pilot programs across the country have produced similar results in terms of showing a lack of customer interest. Even the most successful residential time-of-use pricing programs have no more than 50 percent participation by the residential customer base. For example, NSTAR's Smart Energy Pilot has seen significant participant degradation relative to the initial number of customers installed. As reported to the GMWG, NSTAR Electric made 53,000 customer contacts in an attempt to enroll customers in its smart grid program; only 3,600 customers enrolled; only 2,700 customers were installed and approximately 40 percent of those 2,700 initial participants were removed or dropped out of the pilot by May 2013. PSE&G's "myPower" pricing pilot saw similar results in which 27 percent of participants were either removed or dropped out (excluding the control group). Roll-outs of AMI require careful consideration of the different implementation challenges, including customer perception about bills, security and

health-related issues. Market research will help to assess what functionalities are important to the different customer classes and whether or not those customers will view the achieved functionalities as worthy of the anticipated costs. Given the level of expenditures associated with AMI, it is prudent for the Companies to determine what the market will bear prior to designing their CAMPs. Failure to do so could result in decreased customer interest in grid modernization and other negative impacts. The success of the Companies' GMPs relies heavily on the participation of those who will ultimately bear the costs of those efforts.

Fifth, in mandating AMI, the Department has failed to consider the role that competitive markets should play in grid modernization and the costs that competitive market providers and other market participants have already invested in grid modernization efforts. For instance, home energy automation solutions like smart thermostats and appliances are advancing at a rapid pace and, in many cases, are leverage existing communications infrastructure such as broadband the internet. Rather than duplicating these expenditures and predetermining that the preferred communication should be enabled through the ill-considered implementation of AMI, the Companies should be afforded the flexibility to design GMPs that leverage the expenditures for the benefit, not to the detriment, of customers.

Last, but not least, there is little confidence that the incremental benefits of moving to an AMI platform will be sufficient to warrant the cost. Customers have already supported the investment associated with the installation of AMR metering technology and the incremental benefit afforded by AMI arises from the communications element, not from the metering element. Operational savings were realized with the implementation of AMR and are not further available with the implementation of AMI. This means that the incremental benefit of AMI is largely limited to the communications element, which can be addressed in other ways without

incurring the cost of the meter. Given that the grid modernization technology sphere is a dynamic, rapidly evolving marketplace, it is also unclear whether the incremental benefits, if any, would begin accruing to customers prior to the implemented AMI platform being rendered obsolete. In any event, the cost remains unjustified by the benefits.

Recommendation: The Companies recommend that the Department modify its mandate regarding implementation of the CAMP to establish the seven functionalities as optional, long-term guidelines for CAMPs, rather than required elements. In addition, the Department should reaffirm that electric companies retain the discretion to structure GMPs to incorporate components identified by the Companies as furthering the four grid-modernization objectives, subject to the approval of the Department. This flexibility will allow the Companies to design GMPs that are cost-effective, beneficial and assist in the continued modernization of the grid thus enabling the Companies to continue to provide safe and reliable service to customers.

2. CAMP Cost-Benefit Analysis

The Straw Proposal requires CAMPs to include a cost-benefit analysis using the business case approach, assessing all costs and benefits, including those that are difficult to quantify, as advocated by the Clean Energy Caucus in the Grid Modernization Report. Id. at 20; Grid Modernization Report at 82. Before it pre-authorizes the CAMP, the Department must find that the benefits, quantified and un-quantified, exceed the costs. D.P.U. 12-76-A at 20. However, the Department states that the Companies should not include any costs incurred for existing meters and associated systems in the CAMP cost-benefit analysis, which would be retired from service prior to the end of their useful lives pursuant to the CAMP. Id. Under the Straw Proposal, the Companies are required to base their CAMP cost estimates on various sources, including vendor quotes. Id.

Earlier in these comments, Northeast Utilities described the need to understand the costs and benefits associated with any mandates resulting from the separate TVR and cyber-security investigations. Additionally, it is necessary to have as much precision and specificity as practicable regarding the quantification of benefits associated with the CAMP, especially since the Department, in subsequent cost recovery proceedings, will evaluate the CAMP expenditures in light of the projections in the cost-benefit analysis. Id. at 21. The Companies understand the Department's position regarding the desire to include un-quantified benefits in the CAMP analysis to ensure robust CAMPs designed to help achieve the Department's grid modernization objectives. However, given that the Companies' ability to recover costs will be based in part on comparison to the original cost-benefit analysis, it is critical to quantify as many of the benefits as is practicable in order to avoid reliance on skewed cost-benefit analyses results and the potential for disallowance of cost recovery in subsequent proceedings. Failure to do this could lead to conservative CAMPs to minimize the risk of the disallowance of otherwise prudently incurred costs based on an overgenerous inclusion of un-quantified benefits in the initial CAMP cost-benefit analysis.

Furthermore, in ascribing a weight to un-quantified benefits, it is important to consider the time period over which the CAMP benefits are anticipated to accrue. Given that the Straw Proposal requires each GMP to cover a 10-year period and be updated in the Companies' base distribution rate cases, which must occur no less often than every five years pursuant to G.L. c. 164 §94, benefits that will not accrue until well in the future may not be appropriate for inclusion in the cost-benefit analysis given the likelihood a updating the CAMP due to changing technologies, processes and other related issues.

The Straw Proposal also requires the Companies to include projections about electricity and peak-load savings from the implementation of TVR, along with the underlying assumptions, in the CAMP cost-benefit analysis. Id., at 34. In recognition of the complexities involved with developing TVRs, the Department will open a separate investigation into TVRs in the near future to examine the optimal approach to rate design. Id. Northeast Utilities supports the Department's plan to conduct a separate investigation into TVRs and looks forward to actively participating in that investigation. The Companies agree that TVR is a complex concept worthy of in-depth analysis and consideration (see above). In the event that the Department chooses not to accept the Companies' recommendation that the Companies' develop their GMPs and CAMPs following the conclusion of the TVR investigation, the Companies believe that it is premature to include any projections of TVR-induced electricity and peak-load savings in the CAMP cost-benefit analysis prior to the conclusion of the investigation. Such projections would have to be based almost entirely on assumptions, as opposed to measureable facts, rendering them questionable, at best. As noted above, given that future cost recovery is based, in part, on a comparison to the CAMP cost-benefit analysis, any TVR savings projections would likely be very conservative which would tend to skew the results of the cost-benefit analysis. It is more appropriate to forego inclusion of TVR savings in the cost-benefit analysis and rely, in the future, on TVR savings projections that are grounded in experience following the conclusion of the separate TVR investigation, and the Companies' determination of the most appropriate TVR to implement in their respective service territories.

As for the costs to be included in the cost-benefit analysis associated with the CAMPs, it is necessary for the Companies to retain the discretion to select technically qualified vendors from whom the Companies' would seek cost information. Given that future cost recovery of

CAMP expenditures rests, in part, on comparison to the original CAMP cost-benefit analysis, it is critical to only include reliable cost estimates from vendors. Given their relationships with vendors, the Companies are best suited to determine which vendors' cost estimates are to be included in the CAMP cost-benefit analysis.

Lastly, Northeast Utilities strongly disagrees with the Department's determination that the costs associated with any meters and associated systems, such as those enumerated above, that are retired prior to the end of their useful life under the CAMP should not be accounted for in the CAMP cost-benefit analysis. The costs that currently exist on the Companies' books in relation to existing meter plant support existing functionality. The implementation of AMI infrastructure will duplicate this functionality to some, perhaps a significant, extent. Therefore, if the costs existing on a company's books are excluded from the cost-benefit analysis, then the benefit of functionality that is duplicated by AMI infrastructure must also be excluded or the result is a double-counting of benefits. In order to ensure that the Companies are implementing CAMPs where the costs are justified by the benefits (see D.P.U. 12-76-A at 3, 20), all associated costs must be included in the analysis or duplicative benefits must be eliminated from the analysis. Otherwise, the cost-benefit results will be skewed eliminating a rational basis for the investment decision.

Additional study and analysis is needed to assure that there is a solid business case for this colossal investment; yet, the Department is mandating implementation *within three years*, unless an exception is approved. The Department has indicated that it will undertake separate TVR and cyber-security investigations to resolve issues implicated in the implementation of AMI infrastructure; however, these aspects represent only part of the analytical foundation that

would be needed to support this investment decision. Any cost-benefit analysis, developed on the short timeline envisioned by the Straw Proposal, would be seriously deficient.

In addition, Northeast Utilities respectfully requests that the Department's pre-authorization of the Companies' CAMPs, discussed in greater detail below, also constitutes an endorsement of the Companies' decision to retire the meters and associated systems and obviates the need for further review of the Companies' decision in future cost recovery proceedings. The Companies acknowledge that they would bear the burden of demonstrating that the costs associated with the removal were prudently incurred.

C. Cost Recovery

During discussions with the GMWG, Northeast Utilities made it clear that cost recovery would need to be aligned with the objectives of the GMP in order to allow for its implementation, including the installation of technologies that would not otherwise be undertaken without the GMP, or would be undertaken on a time frame different from the timeframes laid out by the Department for the GMP. The Straw Proposal provides that the Companies may request implementation of a capital expenditure tracking mechanism for their proposed CAMP expenditures; however, the cost-recovery opportunity appears to be directly contingent upon the implementation of AMI. D.P.U. 12-76-A at 18. In allowing for this cost-recovery, the Department stated that it was seeking to remove perceived impediments to grid modernization. Id. However, because the Department has linked its cost-recovery option to the implementation of AMI, the Department has in effect created a recovery mechanism for the most expensive grid-modernization technology with the least certain benefits, without any evidence to support that this is the appropriate end-state for the Companies' distribution systems and

customers. The availability of a cost-recovery mechanism for a system that is unwarranted by a business case is not removing any impediments to grid-modernization efforts.

If the Department is truly seeking to accelerate the deployment of cutting-edge grid modernization technologies to achieve the delineated grid-modernization objectives and functionalities in the near term rather than through a traditional capital investment plan cycle, the Department must allow for implementation of a cost-recovery mechanism outside of the traditional rate case arena. Restricting the bulk of grid modernization efforts to traditional ratemaking treatment will limit the scope and breadth of the Companies' GMPs, where targeted cost recovery for these efforts would, instead, foster innovation and lead to more robust GMPs aimed towards more fully achieving the Department's delineated grid modernization objectives. Without targeted cost recovery, the grid-modernization initiatives contained in the Companies' GMPs will be forced to compete for funds with more traditional capital investments necessary to maintain the safety and reliability of the Companies' distribution systems. There is a finite pool of funds for capital projects and efforts such as vegetation management and system hardening[9] which provide a more immediate improvement to reliability and safety may be prioritized ahead of grid modernization initiatives whose benefits accrue over the longer term. In order to avoid this constraint on GMPs, the Department must extend targeted cost recovery to the grid-modernization initiatives contained in the Companies' GMPs, conditioned on the Companies' adherence to any mandated targeted cost recovery mechanism elements.

Regarding the form and required elements of the targeted cost recovery mechanism, specifically the requirement that the Companies bear the burden of demonstrating that all of the costs they seek to recover through their capital expenditure tracking mechanisms are incremental

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9 The Straw Proposal states that, while vegetation management and system hardening may improve reliability and prevent outages, these types of initiatives are not grid-modernization functionalities. D.P.U. 12-76-A at 10.

to those recovered in base rates, Northeast Utilities supports the use of the incremental test utilized by Bay State Gas Company d/b/a Columbia Gas of Massachusetts ("Bay State") in its targeted infrastructure recovery factor ("TIRF").

D. Pre-Authorization

In the Straw Proposal, the Department states that, if it approves the CAMP, its pre-authorization "endorses" the Companies' decision to proceed with the investment plan. D.P.U. 12-76-A at 18. The Department states further that the pre-authorization of the CAMP obviates the need for "further review of the Companies' decision or timeline for making the CAMP investments in subsequent cost recovery proceedings, although the Companies must still demonstrate to the Department's satisfaction that the CAMP investments are used and useful and that CAMP costs were prudently incurred. Id. at 18-19.

Northeast Utilities supports the direction that the Department has taken in relation to the CAMP preauthorization and the Department's "endorsement" prior to the expenditure of funds and the commitment of resources. The Companies understand this to mean that, following the pre-approval, there will be no subsequent second-guessing as to whether it was reasonable and prudent for the Company to implement the CAMP, while appropriately requiring an after-the-fact demonstration that the actual CAMP expenditures were reasonable in terms of prudent management of construction costs. However, two concerns are raised by this paradigm. First, the Department cannot leave open the determination as to whether the investments are "useful" to customers. Because technologies for grid modernization are evolving quickly and the Department is pushing the electric companies to implement cutting edge technologies on an accelerated basis, the "usefulness" of investments may be called into question after the fact, even though an electric company is executing its Department-approved GMP. Whether investments

are actually in service is a threshold that can only be met after installation and is appropriately deferred to a cost-recovery proceeding, where costs will be reviewed for reasonableness. Second, the Department must extend this treatment to all elements of the GMPs (not just the CAMP) so that the Department's approval of the GMP eliminates the need for further review of the Companies' decisions or timeline for making the GMP investments in any subsequent GMP-related cost-recovery proceeding. Without these two changes, the Companies would be forced to expend funds and commit resources based on a Department approval that might not withstand the test of time.

E. Grid Modernization Metrics

In order to evaluate the Distribution Companies' implementation of their respective GMPs and CAMPs and progress towards the Department's identified grid modernization objectives, the Department intends to develop company-specific implementation metrics and a standard set of targeted, statewide performance metrics for GMPs. Id. at 29. At this time, the purpose of the metrics will be to record and report relevant information without a determination of whether it may be appropriate to connect such metrics to financial penalties and rewards in the future. Id. Under the Straw Proposal, each electric company must include: (1) infrastructure metrics that track its implementation of grid modernization technologies or systems; and (2) performance metrics that measure progress towards the objectives of grid modernization. Id. at 29-30.

Northeast Utilities is supportive of performance-based metrics within the context of the GMPs as a means of providing information regarding progress towards grid modernization objectives. The Companies emphasize that these performance-based metrics must be based on grid modernization functions completely under their control and that the Companies'

performance under the metrics is measured using quantitative and objective, rather than subjective, criteria. It is important that valid performance indicators are created and a discernible correlation between Company efforts and progress towards grid modernization objectives is established. This principle will enable an equitable review of the Companies' progress and will provide a solid basis for determining whether modifications should be made to the GMPs.

F. Separate TVR Investigation

As noted above, the outcome of the TVR investigation is inextricably intertwined with the design of the GMPs and CAMPs. Given this and the Companies' need to develop and implement grid modernization initiatives that are designed to achieve the Department's identified grid modernization objectives, the Companies respectfully request that the Department initiate the separate TVR investigation and allow the Distribution Companies to apply the guidance and benefits of that investigation to their initial GMPs, including CAMPs.

G. Cyber-security

The Department also intends to explore, in the context of grid modernization, issues related to cyber-security, privacy, and access to meter data in a separate proceeding. D.P.U. 12-76-A at 4. The Straw Proposal requires all GMPs to describe the Distribution Companies' strategies for ensuring cyber-security, privacy, and safeguards in the sharing of meter data in conjunction with their grid modernization activities. Id. at 31. The Companies are supportive of the Department's determination to address cyber-security, privacy, and access to meter data in a separate proceeding and look forward to actively participating in that proceeding. As noted above, it is critical for the Companies to know the outcome of that investigation and to apply any directives to their GMPs and CAMPs. Northeast Utilities also stresses the critical nature a safeguarding this information and cautions against wide public dissemination of NSTAR Electric and WMECO's specific proposals to ensure that their respective electric distribution systems and related systems are safe from cyber-

attacks. Although the Companies acknowledge that it is important for the Department to be apprised of their plans and procedures, public dissemination of this information weakens the Companies' ability to safeguard their systems and customer information.

H. Research and Development

In its efforts to ensure continued grid modernization and the adoption of new grid modernization technologies, the Department requires the Distribution Companies to provide information about their current research and development ("R&D") activities. Id. at 32. Both NSTAR Electric and WMECO have developed robust and beneficial relationships with vendors, academic institutions and research entities to ensure that they are continually apprised of new or improved technologies and processes, including grid modernization technologies and processes, which enable the Companies to continue to provide safe and reliable service to their customers. By leveraging these relationships, the Companies gain the benefit of the vendors' and institutions' expertise and experience with both emerging and newly developed technologies and processes that, in turn, enables NSTAR Electric and WMECO to make informed decisions about which processes and technologies are best suited for short and longer-term safety and reliability needs. Although Northeast Utilities believes that its approach to R&D is the currently the most appropriate method, if the Department were to require the Companies to conduct grid modernization technology R&D in furtherance of grid modernization objectives, then recovery of any R&D costs would be appropriate for recovery from customers.

III. Conclusion

NSTAR Electric and WMECO are committed to fulfilling their obligation to provide safe and reliable service for their customers. Further enhancing the resiliency and safety of the distribution system through grid modernization is an important and complex issue. The

Companies appreciate the opportunity to comment on the Department's Straw Proposal and look forward to continuing to actively participating in the on-going grid modernization proceeding.

Appendix A

Specific Questions from the Department

1. Has the Department provided the correct directives to electric distribution companies on grid objectives?

In the Straw Proposal, the Department identifies four grid-modernization objectives, which are to: (1) reduce the effects of outages; (2) optimize demand, including reducing system and customer costs; (3) integrate distributed resources; and (4) improve workforce and asset management. D.P.U. 12-76-A at 3. All four of these objectives are valid, reasonable and appropriate "directives" in light of today's operating environment. The Department's specific directives regarding the requirement to develop and implement a Comprehensive Advanced Metering Plan ("CAMP") meeting seven pre-designated criteria that can only be met with the implementation of Advanced Metering Infrastructure are not the "correct directives" for electric distribution companies. The Companies have addressed the reasons for this conclusion in their comments on the Straw Proposal.

2. Has the Department established appropriate priorities and timelines for grid modernization?

The Companies have offered several recommendations relating to the requirement and timing of the submission of a CAMP. In sum, the Companies recommend that the Department modify its mandate regarding implementation of the CAMP to establish the seven functionalities as optional, long-term guidelines for CAMPs, rather than required elements. In addition, the Department should reaffirm that electric companies retain the discretion to structure GMPs to incorporate components identified by the Companies as furthering the four grid-modernization objectives, subject to the approval of the Department. This flexibility will allow the Companies to design GMPs that are cost-effective, beneficial and assist in the continued modernization of

the electric grid; thereby creating a regulatory construct consistent with the Companies' public service obligation to provide safe and reliable service to customers.

In addition, as described in the Companies' comments, the pending investigations by the Department into TVR and cyber-security should be completed before requiring the submission of a CAMP. This will ensure that assumptions of costs and benefits are aligned with outcomes of those proceedings. The timeline set out by the Department for filing of a CAMP is likely too aggressive to allow for reasonable consideration of these important issues.

3. Is the Department's requirement to achieve advanced metering functionality appropriate?

The Department's requirement to achieve advanced metering functionality is not appropriate, particularly where the seven functionalities identified by the Department are made mandatory. The Companies provide extensive comments on this question in Section II.B.1 - Advanced Metering Functionality. In summary, an Advanced Metering System is not a "basic technology platform" for grid modernization and is not needed to realize "all of the benefits of grid modernization."

4. Which aspects of the benefits cost analysis should include industry-wide figures?

The cost-benefit analysis should incorporate company-specific information wherever practical and feasible. If industry-wide figures are used, emphasis should be placed on using information that represents actual deployments rather than estimated deployments. Care must be taken with industry-wide figures as that data would likely include inherent biases and differences that would skew the results, making it difficult to compare actual results to the initial analysis.

5. Which aspects of the benefits cost analysis should be company-specific?

Please see the response to Question 4.

6. Has the Department established the correct categories of benefits associated with achieving advanced metering functionality?

At this point in time, the Companies do not have additional comments regarding the categories proposed by the Department. However, as explained in section II.B.2 - CAMP Cost-Benefit Analysis, the Companies emphasize the need to include all cost impacts created by the technology implementation.

7. Should the Department establish a targeted cost recovery mechanism for CAMP investments?

Please see the Companies' comments in section II.C - Cost Recovery.

8. Should the Department review and approve a cost-tracking accounting system in advance of allowing a targeting cost recovery mechanism?

Please see the Companies' comments in section II.C - Cost Recovery.

9. What aspects of a cost recovery mechanism should the Department establish?

Please see the Companies' comments in section II.C - Cost Recovery.

10. Should the Department establish an offset to O&M expenses to recognize cost savings from grid modernization technologies?

Offsets to O&M expenses may or may not be applicable or appropriate and should be evaluated in the context of a company's cost recovery proceeding.

11. Should the Department adopt metrics in this proceeding?

Please see the Companies' comments in section II.E – Grid Modernization Metrics.

12. What information or standards on cyber-security, if any, should apply to GMPs?

Please see the Companies' comments in section II.G – Cyber-security.

EXHIBIT C

FILED NOV 05, 2013
DOCUMENT NO. 06763-13
FPSC - COMMISSION CLERK

State of Florida

Public Service Commission

CAPITAL CIRCLE OFFICE CENTER • 2540 SHUMARD OAK BOULEVARD
TALLAHASSEE, FLORIDA 32399-0850

-M-E-M-O-R-A-N-D-U-M-

DATE: November 5, 2013

TO: Ann Cole, Commission Clerk, Office of Commission Clerk

FROM: Elisabeth J. Draper, Economic Supervisor, Division of Economics

RE: Docket No. 130223-EI

Please place that attached Responses from Florida Power & Light Company to Staff's First Data Request in the Docket file.

QUESTION

Please refer to Page 1 of the petition and also to Page 10, Paragraph 31 of the petition which indicate a proposed effective date for the optional non-standard meter rider (NSMR) tariff of April 1, 2014.

a. It is understood that the pilot project to inspect approximately 400 smart meter enclosures that is referred to in Order No. PSC-13-0387-DS-EI is expected to be completed "in the first quarter of 2014." Please indicate if the referenced pilot project will be completed prior to the April 1, 2014 effective date proposed for the NSMR tariff. Please state if staff will have a copy of the report before the NSMR tariff goes into effect.

b. Please indicate if the results of the referenced pilot project will have an impact on the costs submitted in support of the proposed NSMR tariff including specific examples of whether the pilot project findings could be used to adjust any of the cost estimates that have been provided for the proposed Enrollment Fee and the proposed Monthly Surcharge.

RESPONSE

a. The field testing for the meter enclosure project is scheduled to be completed during the first quarter of 2014. If the project milestones that FPL established in Docket No. 130160-EI hold, FPL's written report of the results and the plan for the future use of the model should be available for staff before the NSMR goes into effect. FPL's ability to achieve the milestones it set for itself in Docket No. 130160-EI is primarily dependent upon the willingness of FPL's customers to participate in the project.

b. The purpose of the meter enclosure project is to further validate and refine a predictive tool that FPL is developing to identify probable future smart meter communications failures likely to be caused by conditions within customer-owned meter enclosures. That project will have no impact on the costs submitted in support of the proposed NSMR tariff. There are no examples of pilot project findings that could be used to adjust any of the tariff costs.

QUESTION

Please refer to Page 7, Paragraph 23 of the petition, which refers to customers on the postpone list.

a. Please define smart meter eligible customers.

b. Are any customers exempt from being smart meter eligible?

c. Have any commercial customers asked to be on the postpone list?

RESPONSE

a. FPL expects to install smart meters for all customers, and therefore all customers will be smart meter eligible customers. The NSMR tariff will be available to all of these customers as long as they have not tampered with or used service in a fraudulent manner. FPL's current smart meter eligible customers are those customers whose premises currently are intended to receive a smart meter. This includes over 4.5 million customers to date.

b. There are customers whose premises are not yet included in the "eligible" group because their smart meter installations and activations have not yet been completed. This group of customers is primarily made up of Commercial/Industrial customers outside of Miami-Dade County. The remaining customers are scheduled to have smart meter installations completed by 2015.

c. Yes, 743 Commercial/Industrial customers have asked to be placed on the postpone list.

QUESTION

Describe the metering technology provided to net metering customers. Are net metering customers also considered to be customers who elect non-standard non-communicating meter service in lieu of the standard communicating smart meter service?

a. If yes, please explain why it is necessary for the net metering customers to pay the proposed opt-out fees.

b. If no, please advise where in the NSMR or other tariff sheets the net metering customers are exempt from the proposed NSMR?

RESPONSE

Electronic net meters are designed to measure energy flow in both directions through the meter. The meter measures the energy consumed and produced by a customer in two separate registers. A Smart Net Meter has the communications module allowing the usage data from the two registers to be read remotely. Smart Net Meters are currently being installed at all of FPL's net metering customers' locations as the standard net meter.

No, net metering customers will have the option of taking service pursuant to the NSMR tariff.

a. Not Applicable.

b. Net metering customers are not exempt from the NSMR tariff.

Subject: Re: Contact Us Form// (KMM5194778V63763L0KM)

From: Southern California Edison KANA Customer Service (cfiphc@sce.com)

To: w6345789@yahoo.com;

Date: Saturday, January 31, 2015 7:55 AM

Confidential Information

Dear Warren Woodward,

Thank you for visiting Southern California Edison's website.

Yes, we do have other meters available to customers, other than the Smart Meter.

If you have any additional questions, or if we may be of further assistance, please call our Net Energy Metering Department at (866)701-7868. We are available Monday through Friday, 8:00am to 5:00pm.

We appreciate the opportunity to serve you!

Sincerely,

T. Elsasser
Net Energy Metering Department
Southern California Edison

Original Message Follows: ----------

Please answer the simple question I asked. I cannot find the answer at your website which is why I emailed you in the first place.

The question is this: Can a customer with a grid-tied solar system refuse a "smart" meter and have just a non-transmitting analog meter?

From: Southern California Edison KANA Customer Service <cfiphc@sce.com>
To: w6345789@yahoo.com

PAGE # 92

EXHIBIT D

Automated Meters: Myth vs. Fact

Automated meters enable direct communication between the meter and APS, allowing an enhanced ability for customers to manage costs. The meters allow customers to know when and how much energy they are using, enabling them to make informed decisions about their energy usage.

Since 2005, APS has been replacing traditional customer meters—whose only function has been to measure electricity usage—with advanced metering infrastructure (AMI), also known as "automated" meters. The new meters have been distributed and installed among almost 1 million of our 1.1 million retail customers. Deployment of automated meters thus far has centered upon metro Phoenix, Flagstaff, Prescott, Yuma and other areas.

Automated meters provide APS aggregate usage information that is helping the company plan for the future needs of its customers; they give APS the ability to offer a host ofservice plans tailored to the different lifestyles of our customers; and they will help notify APS in the event of a customer outage, enabling the company to more efficiently begin restoration efforts.

While the technology is providing APS customers with better access to their usage information, the relative newness of the technology has resulted in some misinformation about what automated meters can and cannot do. Here are some of the myths and important facts about the APS automated meter program:

Myth: Automated meters pose a safety risk to APS customers.

Fact: Automated meters are safe. They use wireless technology to communicate information about electricity usage to APS. The meters transmit this information through radio frequency (RF) signals. Wireless automated meters result in much smaller levels of RF exposure than many existing common household electronic devices such as cell phones and microwave ovens. According to a study by the Electric Power Research Institute, a cell phone held against one's ear exposes someone to more than 1,000 times the RF as an APS automated meter from a distance of 10 feet.

Myth: APS will use automated meters to monitor the actions of its customers.

Fact: Automated meters do not have this capability. Like the old mechanical meters, automated meters measure how much energy customers use, not how they use energy. The automated meter does not store or transmit any personal identification information. The automated meters give APS no indication of who our customers are, what they are doing, nor can they determine what appliances customers are using.

Myth: The customer usage data that APS collects will be sold to others or will be accessible to outside parties.

Fact: APS places the highest priority on the security of customer account information. We continue to work with automated meter vendors, electric utilities and governmental agencies to refine security standards and practices to ensure that security remains at the highest level. APS also has outside security firms audit and review our automated meter system to validate our security practices.

APS does not sell customer automated meter data. The usage data collected is intended for customers to make choices that enable them to pay the least amount possible for their electric service. APS considers all customer information to be confidential.

Myth: The installation of automated meters results in higher costs to the customer.

Fact: False. APS customer rates have not gone up due to the installation of automated meters. In fact, APS expects that over time the meter reading charge on the customer monthly statement will be reduced as the company's costs to read the meters are reduced. As always, it is 100 percent up to our customers to choose the service plan they use, no matter which meter is installed on their home or business. APS customer associates are always available to help our customers select the service plan that is best for their lifestyle.

REF#1208056

EXHIBIT E

Smart Meter Data: Privacy and Cybersecurity

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Summary

Fueled by stimulus funding in the American Recovery and Reinvestment Act of 2009 (ARRA), electric utilities have accelerated their deployment of smart meters to millions of homes across the United States with help from the Department of Energy's Smart Grid Investment Grant program. As the meters multiply, so do issues concerning the privacy and security of the data collected by the new technology. This Advanced Metering Infrastructure (AMI) promises to increase energy efficiency, bolster electric power grid reliability, and facilitate demand response, among other benefits. However, to fulfill these ends, smart meters must record near-real time data on consumer electricity usage and transmit the data to utilities over great distances via communications networks that serve the smart grid. Detailed electricity usage data offers a window into the lives of people inside of a home by revealing what individual appliances they are using, and the transmission of the data potentially subjects this information to interception or theft by unauthorized third parties or hackers.

Unforeseen consequences under federal law may result from the installation of smart meters and the communications technologies that accompany them. This report examines federal privacy and cybersecurity laws that may apply to consumer data collected by residential smart meters. It begins with an examination of the constitutional provisions in the Fourth Amendment that may apply to the data. As we progress into the 21st century, access to personal data, including information generated from smart meters, is a new frontier for police investigations. The Fourth Amendment generally requires police to have probable cause to search an area in which a person has a reasonable expectation of privacy. However, courts have used the third-party doctrine to deny protection to information a customer gives to a business as part of their commercial relationship. This rule is used by police to access bank records, telephone records, and traditional utility records. Nevertheless, there are several core differences between smart meters and the general third-party cases that may cause concerns about its application. These include concerns expressed by the courts and Congress about the ability of technology to potentially erode individuals' privacy.

If smart meter data and transmissions fall outside of the protection of the Fourth Amendment, they may still be protected from unauthorized disclosure or access under the Stored Communications Act (SCA), the Computer Fraud and Abuse Act (CFAA), and the Electronic Communications Privacy Act (ECPA). These statutes, however, would appear to permit law enforcement to access smart meter data for investigative purposes under procedures provided in the SCA, ECPA, and the Foreign Intelligence Surveillance Act (FISA), subject to certain conditions. Additionally, an electric utility's privacy and security practices with regard to consumer data may be subject to Section 5 of the Federal Trade Commission Act (FTC Act). The Federal Trade Commission (FTC) has recently focused its consumer protection enforcement on entities that violate their privacy policies or fail to protect data from unauthorized access. This authority could apply to electric utilities in possession of smart meter data, provided that the FTC has statutory jurisdiction over them. General federal privacy safeguards provided under the Federal Privacy Act of 1974 (FPA) protect smart meter data maintained by federal agencies, including data held by federally owned electric utilities.

A companion report from CRS focusing on policy issues associated with smart grid cybersecurity, CRS Report R41886, *The Smart Grid and Cybersecurity—Regulatory Policy and Issues*, by Richard J. Campbell, is also available.

Contents

Figures

Contacts

Overview

Smart meter technology is a key component of the Advanced Metering Infrastructure (AMI)[1] that will help the smart grid[2] link the "two-way flow of electricity with the two-way flow of information."[3] Privacy and security concerns surrounding smart meter technology arise from the meters' essential functions, which include (1) recording near-real time data on consumer electricity usage; (2) transmitting this data to the smart grid using a variety of communications technologies;[4] and (3) receiving communications from the smart grid, such as real-time energy prices or remote commands that can alter a consumer's electricity usage to facilitate demand response.[5]

Beneficial uses of AMI are developing rapidly, and like the early Internet, many applications remain unforeseen.[6] At a basic level, smart meters will permit utilities to "collect, measure, and analyze energy consumption data for grid management, outage notification, and billing purposes."[7] The meters may increase energy efficiency by giving consumers greater control over their use of electricity,[8] as well as permitting better integration of plug-in electric vehicles and renewable energy sources.[9] They may also aid in the development of a more reliable electricity grid that is better equipped to withstand cyber attacks and natural disasters, and help to decrease peak demand for electricity.[10] To be useful for these purposes, and many others, data recorded by

[1] AMI includes the meters at the consumer's residence or business, the communications networks that send data between the consumer and utility, and the data management systems that store and process data for the utility. ELECTRIC POWER RESEARCH INST., ADVANCED METERING INFRASTRUCTURE (AMI) (2007), *available at* http://www.ferc.gov/eventcalendar/Files/20070423091846-EPRI%20-%20Advanced%20Metering.pdf. The primary function of AMI is to "combine interval data measurement with continuously available remote communications" to increase energy efficiency and grid reliability, and decrease expenses borne by the utility and consumer. *Id.*

[2] The Energy Independence and Security Act of 2007 (EISA) lists ten characteristics of a smart grid. These include "[i]ncreased use of digital information and controls technology to improve reliability, security, and efficiency of the electric grid"; "[d]evelopment and incorporation of demand response, demand-side resources, and energy-efficiency resources"; and "[d]eployment of "smart" technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation." EISA, P.L. 110-140, §1301, 121 Stat. 1492, 1783-84 (2007) (to be codified at 42 U.S.C. §17381).

[3] DEP'T OF ENERGY, COMMUNICATIONS REQUIREMENTS OF SMART GRID TECHNOLOGIES 1 (2010) [hereinafter DEP'T OF ENERGY COMMUNICATIONS REPORT], *available at* http://energy.gov/sites/prod/files/gcprod/documents/Smart_Grid_Communications_Requirements_Report_10-05-2010.pdf.

[4] *Id.* at 3, 5. These technologies include fiber optics, wireless networks, satellite, and broadband over power line. *Id.*

[5] *Id.* at 20. "Demand response is the reduction of the consumption of electric energy by customers in response to an increase in the price of electricity or heavy burdens on the system." *Id.*

[6] DEP'T OF ENERGY, DATA ACCESS AND PRIVACY ISSUES RELATED TO SMART GRID TECHNOLOGIES 5, 9 (2010) [hereinafter DEP'T OF ENERGY PRIVACY REPORT], *available at* http://energy.gov/sites/prod/files/gcprod/documents/Broadband_Report_Data_Privacy_10_5.pdf; *see also* ELIAS LEAKE QUINN, SMART METERING & PRIVACY: EXISTING LAW AND COMPETING POLICIES: A REPORT FOR THE COLORADO PUBLIC UTILITIES COMMISSION 1, 12 (2009) [hereinafter COLORADO PRIVACY REPORT], *available at* http://www.dora.state.co.us/puc/docketsdecisions/DocketFilings/09I-593EG/09I-593EG_Spring2009Report-SmartGridPrivacy.pdf.

[7] DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 12.

[8] Companies are developing several new applications that use smart meter data to offer consumers and utilities better control over energy usage, for example by determining the energy efficiency of specific appliances within the household. DEP'T OF ENERGY PRIVACY REPORT, *supra* note 6, at 5, 9; *see also* COLORADO PRIVACY REPORT, *supra* note 6, at 1, 12.

[9] DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 1.

[10] *Id.* at 3.

smart meters must be highly detailed, and, consequently, it may show what individual appliances a consumer is using.[11] The data must also be transmitted to electric utilities—and possibly to third parties outside of the smart grid—subjecting it to potential interception or theft as it travels over communications networks and is stored in a variety of physical locations.[12]

These characteristics of smart meter data present privacy and security concerns that are likely to become more prevalent as government-backed initiatives expand deployment of the meters to millions of homes across the country. In the American Recovery and Reinvestment Act of 2009 (ARRA), Congress appropriated funds for the implementation of the Smart Grid Investment Grant (SGIG) program administered by the Department of Energy.[13] This program now permits the federal government to reimburse up to 50% of eligible smart grid investments, which include the cost to electric utilities of buying and installing smart meters.[14] In its annual report on smart meter deployment, the Federal Energy Regulatory Commission cited statistics showing that the SGIG program has helped fund the deployment of about 7.2 million meters as of September 2011.[15] At completion, the program will have partially funded the installation of 15.5 million meters.[16] By 2015, the Institute for Electric Efficiency expects that a total of 65 million smart meters will be in operation throughout the United States.[17]

Installation of smart meters and the communications technologies that accompany them may have unforeseen legal consequences for those who generate, seek, or use the data recorded by the meters. These consequences may arise under existing federal laws or constitutional provisions governing the privacy of electronic communications, data retention, computer misuse, foreign surveillance, and consumer protection. This report examines federal privacy and cybersecurity laws that may apply to consumer data collected by residential smart meters. It examines the legal implications of smart meter technology for consumers who generate the data, law enforcement officers who seek smart meter data from utilities, utilities that store the data, and hackers who access smart grid technology to steal consumer data or interfere with it. This report looks at federal laws that may pertain to the data when it is (1) stored in a utility-owned smart meter at a consumer's residence; (2) in transit between the meter and the smart grid by way of various communications technologies; and (3) stored on computers in the grid. This report does not address state or local laws, such as regulations by state Public Utilities Commissions, that may establish additional responsibilities for some electric utilities with regard to smart meter data. It also does not discuss the mandatory cybersecurity and reliability standards enforced by the North

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[11] *See* NAT'L INST. OF STANDARDS AND TECH., GUIDELINES FOR SMART GRID CYBER SECURITY: VOL. 2, PRIVACY AND THE SMART GRID 14 (2010) [hereinafter NIST PRIVACY REPORT], *available at* http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf.

[12] *Id.* at 3-4, 23-24, 29.

[13] The act provides $4.5 billion for "electricity delivery and energy reliability," which includes "activities to modernize the electric grid, to include demand responsive equipment," as well as "programs authorized under title XIII of the Energy Independence and Security Act of 2007." ARRA, P.L. 111-5, 123 Stat. 115, 138-39.

[14] ARRA §405(5), (8), 123 Stat. 115, 143-44 (amendment to be codified at 42 U.S.C. §17386) (amending the Energy Independence and Security Act of 2007 (EISA) to allow for the reimbursement of up to 50% of qualifying smart grid investments instead of only 20%); *see also* EISA, P.L. 110-140, §1306, 121 Stat. 1492, 1789-91 (to be codified as amended at 42 U.S.C. §17386) (initially establishing the SGIG program).

[15] FED. ENERGY REGULATORY COMM'N, ASSESSMENT OF DEMAND RESPONSE & ADVANCED METERING 3 (2011), *available at* http://www.ferc.gov/legal/staff-reports/11-07-11-demand-response.pdf.

[16] *Id.*

[17] INST. FOR ELECTRIC EFFICIENCY, UTILITY-SCALE SMART METER DEPLOYMENTS, PLANS & PROPOSALS 1 (2011), *available at* http://www.edisonfoundation.net/iee/issuebriefs/SmartMeter_Rollouts_0911.pdf.

American Electric Reliability Corporation, which impose obligations on utilities that participate in the generation or transmission of electricity.[18]

General federal privacy safeguards provided under the Federal Privacy Act of 1974 (FPA) protect smart meter data maintained by federal agencies, including data held by federally owned electric utilities. Section 5 of the Federal Trade Commission Act (FTC Act) allows the Federal Trade Commission (FTC) to bring enforcement proceedings against electric utilities that violate their privacy policies or fail to protect meter data from unauthorized access, provided that the FTC has statutory jurisdiction over the utilities.

It is unclear how Fourth Amendment protection from unreasonable search and seizures would apply to smart meter data, due to the lack of cases on this issue. However, depending upon the manner in which smart meter services are presented to consumers, smart meter data may be protected from unauthorized disclosure or unauthorized access under the Stored Communications Act (SCA), the Computer Fraud and Abuse Act (CFAA), and the Electronic Communications Privacy Act (ECPA). If smart meter data is protected by these statutes, law enforcement would still appear to have the ability to access it for investigative purposes under procedures provided in the SCA, ECPA, and the Foreign Intelligence Surveillance Act (FISA).

Smart Meter Data: Privacy and Security Concerns

Residential smart meters present privacy and cybersecurity issues[19] that are likely to evolve with the technology.[20] In 2010, the National Institute of Standards and Technology (NIST) published a report identifying some of these issues, which fall into two main categories: (1) privacy concerns that smart meters will reveal the activities of people inside of a home by measuring their electricity usage frequently over time;[21] and (2) fears that inadequate cybersecurity measures surrounding the digital transmission of smart meter data will expose it to misuse by authorized and unauthorized users of the data.[22]

Detailed Information on Household Activities

Smart meters offer a significantly more detailed illustration of a consumer's energy usage than regular meters. Traditional meters display data on a consumer's *total* electricity usage and are typically read manually once per month.[23] In contrast, smart meters can provide *near real-time* usage data by measuring usage electronically at a much greater frequency, such as once every 15

[18] For additional information on the development of mandatory national smart grid privacy and cybersecurity standards by federal agencies, see MASS. INST. OF TECH., THE FUTURE OF THE ELECTRIC GRID 197-234 (2011) [hereinafter MIT GRID STUDY]; *see also* CRS Report R41886, *The Smart Grid and Cybersecurity—Regulatory Policy and Issues*, by Richard J. Campbell.

[19] According to the authors of the MIT study, cybersecurity "refers to all the approaches taken to protect data, systems, and networks from deliberate attack as well as accidental compromise, ranging from preparedness to recovery." MIT GRID STUDY, *supra* note 18, at 208. Closely related is the concept of "information privacy," which "deals with policy issues ranging from identification and collection to storage, access, and use of information." *Id.* at 219 n.viii.

[20] *See* NIST PRIVACY REPORT, *supra* note 11, at 1.

[21] *Id.* at 4, 11. Data that offers a high degree of detail is said to be "granular." *Id.*

[22] *See id.* at 4, 23-24, 29.

[23] *Id.* at 2, 9.

PAGE # 101

minutes.[24] Current smart meter technology allows utilities to measure usage as frequently as once every minute.[25] By examining smart meter data, it is possible to identify which appliances a consumer is using and at what times of the day, because each type of appliance generates a unique electric load "signature."[26] NIST wrote in 2010 that "research shows that analyzing 15-minute interval aggregate household energy consumption data can by itself pinpoint the use of most major home appliances."[27] A report for the Colorado Public Utilities Commission discussed an Italian study that used "artificial neural networks" to identify individual "heavy-load appliance uses" with 90% accuracy using 15-minute interval data from a smart meter.[28] Similarly, software-based algorithms would likely allow a person to extract the unique signatures of individual appliances from meter data that has been collected less frequently and is therefore less detailed.[29]

By combining appliance usage patterns, an observer could discern the behavior of occupants in a home over a period of time.[30] For example, the data could show whether a residence is occupied, how many people live in it, and whether it is "occupied by more people than usual."[31] According to the Department of Energy, smart meters may be able to reveal occupants' "daily schedules (including times when they are at or away from home or asleep), whether their homes are equipped with alarm systems, whether they own expensive electronic equipment such as plasma TVs, and whether they use certain types of medical equipment."[32] Figure 1, which appears in NIST's report on smart grid cybersecurity, shows how smart meter data could be used to decipher the activities of a home's occupants by matching data on their electricity usage with known appliance load signatures.

[24] *Id.* at 13.

[25] COLORADO PRIVACY REPORT, *supra* note 6, at 2. Some utilities may elect to receive data at less frequent intervals because "backhauling real-time or near real-time data from the billions of devices that may eventually be connected to the Smart Grid would require not only tremendous bandwidth" but also greater data storage capacities that could make the effort "economically infeasible." DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 20. However, the "trend" is for utilities to collect data more frequently. *See* COLORADO PRIVACY REPORT, *supra* note 6, at A-1 n.111.

[26] NIST PRIVACY REPORT, *supra* note 11, at 2, 14.

[27] *Id.* at 14. *But see* DEP'T OF ENERGY PRIVACY REPORT, *supra* note 6, at 9 (claiming, in 2010, that smart meter technology "cannot yet identify individual appliances and devices in the home in detail, but this will certainly be within the capabilities of subsequent generations of Smart Grid technologies").

[28] COLORADO PRIVACY REPORT, *supra* note 6, at 3 n.7, A-8.

[29] *Id.* at A-9.

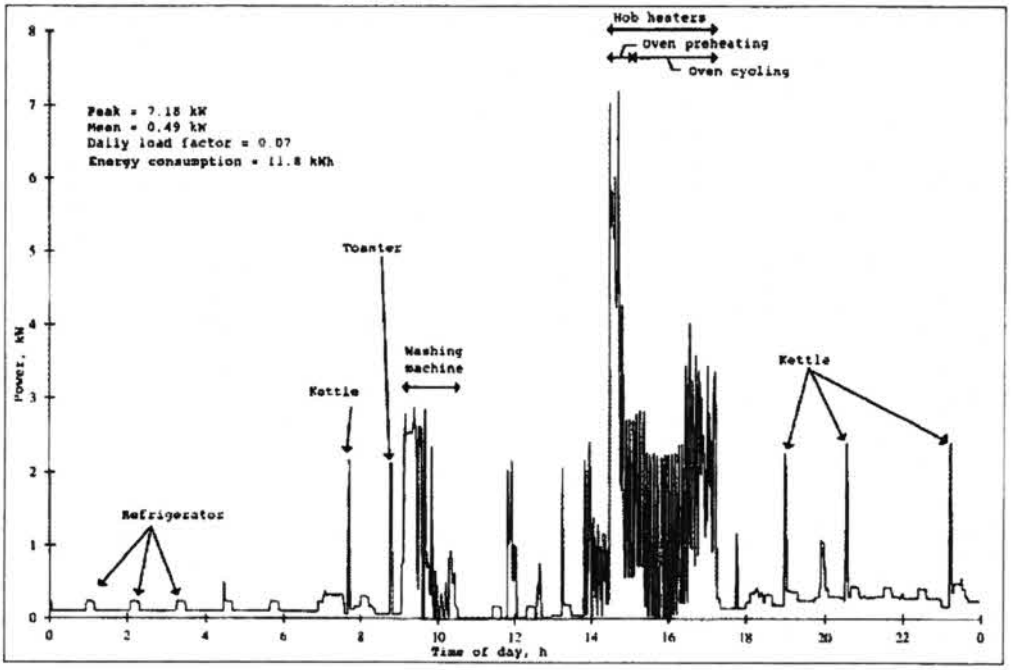
[30] NIST PRIVACY REPORT, *supra* note 11, at 6 & n.9.

[31] *Id.* at 11.

[32] DEP'T OF ENERGY PRIVACY REPORT, *supra* note 6, at 2.

Figure 1. Identification of Household Activities from Electricity Usage Data

Unique Electric Load Signatures of Common Household Appliances



Source: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST), GUIDELINES FOR SMART GRID CYBER SECURITY: VOL. 2, PRIVACY AND THE SMART GRID 13 (2010), available at http://csrc.nist.gov/publications/nistir/ir7628/nistir-7628_vol2.pdf.

Note: Researchers constructed this picture from electricity usage data collected at one-minute intervals using a nonintrusive appliance load monitoring (NALM) device, which is similar to a smart meter in the way that it records usage data. For a comparison of the technologies, see COLORADO PRIVACY REPORT, supra note 6, at A-1 to A-9.

Smart meter data that reveals which appliances a consumer is using has potential value for third parties, including the government. In the past, law enforcement agents have examined *monthly* electricity usage data from *traditional* meters in investigations of people they suspected of illegally growing marijuana.[33] For example, in *United States v. Kyllo*, a federal agent subpoenaed the suspect's electricity usage records from the utility and "compared the records to a spreadsheet for estimating average electrical use and concluded that Kyllo's electrical usage was abnormally high, indicating a possible indoor marijuana grow operation."[34] If law enforcement officers obtained near-real time data on a consumer's electricity usage from the utility company, their ability to monitor household activities would be amplified significantly.[35] For example, by observing when occupants use the most electricity, it may be possible to discern their daily schedules.[36]

[33] NIST PRIVACY REPORT, *supra* note 11, at 11, 29; *see also* United States v. Kyllo, 190 F.3d 1041, 1043 (9th Cir. 1999), *rev'd on other grounds*, 533 U.S. 27 (2001).

[34] *Kyllo*, 190 F.3d at 1043.

[35] *See supra* notes 26-32 and accompanying text.

[36] *See supra* note 32 and accompanying text.

As smart meter technology develops and usage data grows more detailed, it could also become more valuable to private third parties outside of the grid.[37] Data that reveals which appliances a person is using could permit health insurance companies to determine whether a household uses certain medical devices, and appliance manufacturers to establish whether a warranty has been violated.[38] Marketers could use it to make targeted advertisements.[39] Criminals could use it to time a burglary and figure out which appliances they would like to steal.[40] If a consumer owned a plug-in electric vehicle, data about where the vehicle has been charged could permit someone to identify a person's location and travel history.[41]

Even privacy safeguards, such as "anonymizing" data so that it does not reflect identity, are not foolproof.[42] By comparing anonymous data with information available in the public domain, it is sometimes possible to identify an individual—or, in the context of smart meter data, a particular household.[43] Moreover, a smart grid will collect more than just electricity usage data. It will also store data on the account holder's name, service address, billing information, networked appliances in the home, and meter IP address, among other information.[44] Many smart meters will also provide transactional records as they send data to the grid, which would show the time that the meter transmitted the data and the location or identity of the transmitter.[45]

Increased Potential for Theft or Breach of Data

Smart grid technology relies heavily on two-way communication to increase energy efficiency and reliability, including communication between smart meters and the utility (or other entity) that stores data for the grid.[46] Many different technologies will transmit data to the grid, including "traditional twisted-copper phone lines, cable lines, fiber optic cable, cellular, satellite, microwave, WiMAX, power line carrier, and broadband over power line."[47] Of these communications platforms, wireless technologies are likely to play a "prominent role" because they present fewer safety concerns and cost less to implement than wireline technologies.[48] According to the Department of Energy, a typical utility network has four "tiers" that collect and transmit data from the consumer to the utility.[49] These include "(1) the core backbone—the primary path to the utility data center; (2) backhaul distribution—the aggregation point for

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[37] NIST PRIVACY REPORT, *supra* note 11, at 14, 35-36.

[38] *Id.* at 27-28.

[39] *Id.* at 28.

[40] *Id.* at 31.

[41] *Id.*

[42] *Id.* at 13.

[43] *See id.* at 13, 25.

[44] *Id.* at 26-27.

[45] *Id.* at 12 (drawing a comparison to telecommunications providers' "call detail records").

[46] *Id.* at 3; DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 3 (stating that "integrated two-way communications ... allows for dynamic monitoring of electricity use as well as the potential for automated electricity use scheduling."). As more consumers become generators of electricity through the use of "fuel cells, wind turbines, solar roofs, and the like," the importance of two-way communication will increase. MIT GRID STUDY, *supra* note 18, at 201.

[47] DEP'T OF ENERGY COMMUNICATIONS REPORT, *supra* note 3, at 3.

[48] *Id.* at 5, 51 n.215.

[49] *Id.* at 16.

neighborhood data; (3) the access point—typically the smart meter; and, (4) the HAN—the home network."[50] Energy usage data moves from the smart meter,[51] and then to an "aggregation point" outside of the residence such as "a substation, a utility pole-mounted device, or a communications tower."[52] The aggregation points gather data from multiple meters and "backhaul" it to the utility using fiber, T1, microwave, or wireless technology.[53] Utilities typically rely on their own private networks to communicate with smart meters because they have found these networks to be more reliable and less expensive than commercial networks.[54]

As NIST explains, consumer data moving through a smart grid becomes stored in many locations both within the grid and within the physical world.[55] Thus, because it is widely dispersed, it becomes more vulnerable to interception by unauthorized parties[56] and to accidental breach.[57] The movement of data also increases the potential for it to be stolen by unauthorized third parties while it is in transit, particularly when it travels over a wireless network[58]—or through communications components that may be incompatible with one another or possess outdated security protections.[59]

Smart Meters and the Fourth Amendment

The use of smart meters presents the recurring conflict between law enforcement's need to effectively investigate and combat crime and our desire for privacy while in our homes. With smart meters, police will have access to data that might be used to track residents' daily lives and routines while in their homes, including their eating, sleeping, and showering habits, what appliances they use and when, and whether they prefer the television to the treadmill, among a host of other details.[60] Though a potential boon to police, access to this data is not limitless. The Fourth Amendment, which establishes the constitutional parameters for government investigations, may restrict access to smart meter data or establish rules by which it can be obtained.[61] The Fourth Amendment ensures that the "right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated...."[62] This section discusses whether the collection and use of smart meter data may

[50] *Id.*

[51] The home network will be used to provide *consumers* with near real-time data on their energy usage. *Id.* at 13-15.

[52] *Id.* Many urban installations use wireless mesh networks to carry data from the meters to the aggregation point. These networks are more reliable because each smart meter can serve as a router in the network, providing redundant network coverage. *Id.* at 18.

[53] *Id.* at 16, 19.

[54] *Id.* at 4, 19, 44.

[55] NIST PRIVACY REPORT, *supra* note 11, at 23.

[56] *Id.* at 23-24.

[57] *Id.* at 29.

[58] *See id.* at 9, 12, 33, and 36.

[59] MIT GRID STUDY, *supra* note 18, at 209, 213-16.

[60] Jack I. Lerner & Deirdre K. Mulligan, *Taking the "Long View" on the Fourth Amendment: Stored Records and the Sanctity of the Home*, 2008 STAN. TECH. L. REV. 3, ¶ 3 (2008).

[61] Additionally, as described below, there are federal statutory protections that may pertain to this data. State constitutional and statutory safeguards may also apply, but these are beyond the scope of this report.

[62] U.S. CONST. amend IV.

PAGE # 105

contravene this protection. Although there is no Fourth Amendment case on point, analogous cases may provide guidance.[63]

To assess whether there has been a Fourth Amendment violation, two primary questions must be asked: (1) whether there was state action; that is, was there sufficient government involvement in the alleged wrongdoing to trigger the Fourth Amendment; and (2) whether the person had an expectation of privacy that society is prepared to deem reasonable.[64] If the first question is answered in the affirmative, then the analysis moves to the second question. But if no state action is found, the analysis ends there and the Fourth Amendment does not apply. This subpart will first determine whether access to smart meter data by police, or by privately and publicly owned utilities, satisfies the state action doctrine, thereby warranting further Fourth Amendment review.

State Action: Privately Versus Publicly Owned Utilities

Most of the safeguards for civil liberties and individual rights contained in the U.S. Constitution apply only to actions by state and federal governments.[65] This rule, known as the state action doctrine, arises when a victim claims his constitutional rights have been violated, and therefore must prove the wrongdoer had sufficient connections with the government to warrant a remedy.[66] Applying the state action test is intended to determine whether a utility's collection and dissemination of smart meter data is governed by the Fourth Amendment, and if so, to what extent. Although there are many variations in the governance and ownership of utilities—some are privately owned, others publicly owned, some federally operated, and still others nonprofit cooperatives—they generally fall into two broad categories: public and private.[67] This section will analyze the constitutional differences between privately and publicly owned utilities under the state action doctrine and a public records theory.

Privately Owned and Operated Utilities

It is broadly said that the Fourth Amendment applies only to acts by the government.[68] But there are at least two exceptions to this rule. First, if a utility performs a function traditionally exercised by the government, it may be considered a state actor under the public function exception. Second, the Fourth Amendment may apply when a private utility acts as an instrument or agent of the police.[69]

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[63] For additional analyses of smart meters under the Fourth Amendment, see Cheryl Dancey Balough, *Privacy Implications of Smart Meters*, 86 CHI.-KENT L. REV. 161 (2011); *see also* QUINN, *supra* note 6, at 28 ("[I]nterval data of electricity consumption appears to be in something of a no-man's-land under Supreme Court Fourth Amendment jurisprudence.").

[64] California v. Ciraolo, 476 U.S. 207, 211 (1986) (citing Katz v. United States, 389 U.S. 347, 360 (1967) (Harlan, J., concurring)).

[65] Civil Rights Cases, 109 U.S. 3, 11 (1883) ("It is State action of a particular character that is prohibited. Individual invasion of individual rights is not the subject-matter of the [Fourteenth] amendment."); *see* JOHN E. NOWAK & RONALD D. ROTUNDA, CONSTITUTIONAL LAW §12.1(a)(i) (8th ed. 2010).

[66] NOWAK & ROTUNDA, *supra* note 65.

[67] Determining whether a private actor is sufficiently "public" is not clear-cut. Then Justice Rehnquist noted, "[t]he true nature of the State's involvement may not be immediately obvious, and detailed inquiry may be required in order to determine whether the test is met." Jackson v. Metropolitan Edison Co., 419 U.S. 345, 351 (1974).

[68] Burdeau v. McDowell, 256 U.S. 465, 475 (1921).

[69] *See* United States v. Jacobsen, 466 U.S. 109, 113 (1984).

Under the public function exception, a nominally private entity is treated as a state actor when it assumes a role traditionally played by the government.[70] Determining when this exception applies has not proved easy,[71] but it is reasonably clear that private utilities do not, in most instances, satisfy it. In *Jackson v. Metropolitan Edison Co.*, a customer sued a privately owned utility under the Civil Rights Act of 1871 for improperly shutting off her service without providing her notice or a hearing.[72] The Supreme Court asked whether there was a close enough nexus between the state and the utility for the acts of the latter to be treated as those of the former.[73] Although the utility was heavily regulated by the state, it was held not to be a state actor.[74] The Court reasoned that the provision of utility service is not generally an "exclusive prerogative of the State."[75] Also absent was the symbiotic relationship between the utility and the state found in previous cases.[76] Though its holding was broad, the Court did not foreclose the possibility that a privately owned utility could be a state actor under different circumstances.[77] This possibility, however, appears narrow.

The Fourth Amendment may also apply to a private utility if its acts were directed by the government. Generally, searches performed by private actors without police participation or encouragement are not governed by the Fourth Amendment.[78] A search by a private insurance investigator, for instance, was not a "search" in the constitutional sense, though the evidence was ultimately used by the government at trial.[79] This result differs, however, if there is sufficient government involvement. If the search has been ordered or requested by the government, the private actor will become an "instrument or agent of the state" and must abide by Fourth Amendment strictures.[80] For example, the Fourth Amendment does not apply when a telephone company installs a pen register on its own initiative.[81] The same action constitutes a search, however, if requested by the government.[82]

This theory applies not only to direct instigation, but also on a broad, programmatic level. In the 1960s and 1970s the federal government required privately owned and operated airlines to institute new security measures to combat airline hijacking.[83] In *United States v. Davis*, the airline

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[70] Marsh v. Alabama, 326 U.S. 501 (1946) (holding that privately owned property was equivalent to "community shopping center" thus private party was subject to the First and Fourteenth Amendments).

[71] *See* NOWAK & ROTUNDA, *supra* note 65, §12.2.

[72] *Jackson*, 419 U.S. at 347; *see also* Mays v. Buckeye Rural Elec. Coop., Inc., 277 F.3d 873, 880-81 (6th Cir. 2002) (holding that nonprofit cooperative utility was not a state actor under the federal constitution); Spickler v. Lee, No. 02-1954, 2003 U.S. App. LEXIS 6227, at *2 (1st Cir. March 31, 2003) (holding that private electric utility company was not a state actor).

[73] *Jackson*, 419 U.S. at 351.

[74] *Id.* at 358-59.

[75] *Id.* at 353.

[76] *Id.* at 357.

[77] *Id.* at 351.

[78] 1 WAYNE R. LAFAVE, SEARCH AND SEIZURE §1.8, at 255 (4th ed. 2004).

[79] United States v. Howard, 752 F.2d 220, 227-28 (6th Cir. 1985).

[80] Coolidge v. New Hampshire, 403 U.S. 443, 487 (1971) (internal quotation marks omitted); *see* LAFAVE, *supra* note 78, §1.8(b).

[81] United States v. Manning, 542 F.2d 685, 686 (6th Cir. 1976).

[82] People of Dearborn Heights v. Hayes, 82 Mich. App. 253, 258 (1978).

[83] United States v. Davis, 482 F.2d 893, 897-903 (9th Cir. 1973).

searched a passenger based on these requirements and found a loaded gun.[84] The Ninth Circuit held that it made no difference whether the search was conducted by a private or public official: "the search was part of the overall, nation-wide anti-hijacking effort, and constituted 'state action' for purposes of the Fourth Amendment."[85] Thus, if a private party is required to perform a search or collect data under federal or state laws or regulations, there will be sufficient state action for the Fourth Amendment to apply. Or, put another way, the government cannot circumvent the Fourth Amendment by requiring a private party to initiate a search or implement an investigative program.

This agency theory might apply to the collection of smart meter data. If the utility is accessing this information "independent of the government's intent to collect evidence for use in a criminal prosecution,"[86] the utility will not be considered an agent of the government for Fourth Amendment purposes. But there might be instances when government instigation will trigger further analysis. If, for example, the government requested the utility to record larger quantities of data than was customary (e.g., increasing the intervals from sub-15 minute intervals to sub-five minute or sub-one minute intervals), this would likely warrant Fourth Amendment scrutiny. Also, if the police requested the utility to hand over customer data, say, for spikes in energy commensurate with a marijuana growing operation, this would likely be a sufficient instigation to trigger further constitutional review. Other situations may arise where the government establishes a dragnet-type law enforcement scheme in which all smart meter data is filtered through police computers. This could also implicate the agency theory and warrant a finding of state action.

Publicly Owned and Operated Utilities

Although the Fourth Amendment (with its warrant and probable cause requirement) typically applies to public actors, in certain instances their collection of information may not fall under the Fourth Amendment or may prompt a lower evidentiary standard. The Supreme Court has infrequently considered the scope of the Fourth Amendment "on the conduct of government officials in noncriminal investigations,"[87] and even less frequently as to "noncriminal *noninvestigatory* governmental conduct."[88] Nonetheless, there are two lines of cases that may apply to smart meters in which the Fourth Amendment may not apply at all (noncriminal noninvestigatory conduct) or may be reduced (noncriminal investigations). The key to this analysis is the government's purpose in collecting the data.

The Supreme Court has developed a line of cases dubbed the "special needs" doctrine that permits the government to perform suspicionless searches if the special needs supporting the program outweigh the intrusion on the individual's privacy.[89] It is premised on the notion that "'special needs,' beyond the normal need for law enforcement, make the warrant and probable-cause requirement impracticable."[90] If, on the one hand, the objective of the search is not for law

[84] *Id.* at 895.

[85] *Id.* at 904.

[86] United States v. Howard, 752 F.2d 220, 228 (6th Cir. 1985).

[87] *The Supreme Court, 1986-Term—Leading Cases*, 101 HARV. L. REV. 119, 230 (1987).

[88] United States v. Attson, 900 F.2d 1427, 1430 (9th Cir. 1990) (emphasis in original).

[89] Ferguson v. City of Charleston, 532 U.S. 67, 77-78 (2001).

[90] Skinner v. Ry. Labor Executives' Ass'n, 489 U.S. 602, 620 (1989) (quoting Griffin v. Wisconsin, 483 U.S. 868, 873 (1987)).

enforcement purposes but for other reasons such as public safety[91] or ensuring the integrity of sensitive government positions,[92] then the doctrine will apply. If, however, the "primary purpose" or "immediate objective" was "to generate evidence *for law enforcement purposes*," then application of the special needs doctrine is not appropriate, and the government must adhere to general Fourth Amendment principles.[93] Again, the primary inquiry is the purpose of the search.

Some circuit courts of appeal have extended the special needs theory, holding that the Fourth Amendment does not apply (in contrast to a reduced standard of suspicion as with the special needs cases) unless the "conduct has as its purpose the intention to elicit a benefit for the government in either its investigative or administrative capacities."[94] In *United States v. Attson*, the Ninth Circuit held that the collection of blood by a government-employed physician, which was subsequently used by the police in a drunk driving prosecution, was not within the scope of Fourth Amendment protection.[95] The panel reasoned that the doctor drew the blood for medical purposes, not to further a governmental purpose in obtaining evidence against the defendant in its criminal investigation, so the Fourth Amendment did not apply.[96]

Applying these two theories to smart meters, a court would focus on the publicly owned utility's purpose in collecting the data. If it were for ordinary business purposes such as billing, informing the customer of its usage patterns, or aiding the utility in making the grid more energy-efficient, then it would not violate the Fourth Amendment. If, however, the public utility began aggregating data at the request of a law enforcement agency, with the purpose of aiding a criminal investigation or other administrative purpose, the Fourth Amendment would seemingly apply. As with private utilities, if the government requested that the public utility report any suspicious electricity usage, or created a program where certain data was regularly transmitted to the police, this might become investigatory and warrant Fourth Amendment protections. It appears law enforcement cannot evade Fourth Amendment restrictions by requesting a publicly owned utility to collect data for it.

Law enforcement might also request smart meter data under a public records theory. It is generally accepted that public records are not accorded Fourth Amendment protection.[97] Unless there is a state or federal statute prohibiting disclosure, "law enforcement access to state public records is unrestricted."[98] Thus the inquiry hinges on whether a document is a public record.

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[91] *Id.*

[92] Nat'l Treasury Employees Union v. Von Raab, 489 U.S. 656, 670 (1989).

[93] *Ferguson*, 532 U.S. at 83 (emphasis in original).

[94] *See* United States v. Attson, 900 F.2d 1427, 1431 (9th Cir. 1990); Poe v. Leonard, 282 F.3d 123, 137 (2d Cir. 2002); United States v. Elliot, 676 F. Supp. 2d 431, 435-36 (D. Md. 2009).

[95] *Attson*, 900 F.2d at 1433.

[96] *Id.*

[97] *See* Nilson v. Layton City, 45 F.3d 369, 372 (10th Cir. 1995) ("Information readily available to the public is not protected by the constitutional right to privacy."); Doe v. City of New York, 15 F.3d 264, 268 (2d Cir. 1994) ("Certainly, there is no question that an individual cannot expect to have a constitutionally protected privacy interest in matters of public record."); United States v. Ellison, 462 F.3d 557, 562 (6th Cir. 2006) (accessing license plate number from computer database held not an intrusion of a constitutionally protected area, thus not a Fourth Amendment "search"); United States v. Baxter, 492 F.2d 150, 167 (9th Cir. 1973) (holding that Fourth Amendment protections do not extend to telephone company toll and billing records); *see also* Christopher Slobogin, *The Search and Seizure of Computers and Electronic Evidence: Transaction Surveillance by the Government*, 75 MISS. L. J. 139, 156 (2005).

[98] Slobogin, *supra* note 97.

Whether a person's utility records are public records differs from state to state.[99] Some states deem records of a municipally owned and operated electric utility as public records open for public inspection, while others have accorded these records statutory and constitutional protections.

In Florida, for example, records kept in connection with the operation of a city-operated utility are considered public records.[100] A similar policy applies in Georgia, where all records of a government agency, including utility records, must be open for inspection.[101] South Carolina, too, takes a similar approach.[102] It is not clear, however, from the reported cases whether these statutes permit access to personally identifiable information or simply operating records of the utility. Oklahoma is more explicit, permitting access to "records of the address, rate paid for services, charges, consumption rates, adjustments to the bill, reasons for adjustment, the name of the person that authorized the adjustment, and payment for each customer."[103] Oklahoma does protect some confidentiality, including "credit information, credit card numbers, telephone numbers, social security numbers, [and] bank account information for individual customers."[104] Other states, like Washington, specifically protect personally identifiable utility records. Washington does not require a showing of probable cause, but instead "a reasonable belief" that the record will help establish the customer committed a crime.[105] North Carolina likewise states that any "[b]illing information compiled and maintained by a city or county or other public entity providing utility services in connection with the ownership or operation of a public enterprise" is not a public record.[106]

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[99] Because the focus of this report is federal law and the Fourth Amendment, a full treatment of state privacy law is beyond its scope.

[100] *In re* Public Records—Records of Municipally Operated Utility, Op. Att'y Gen. Fla. 74-35 (1974), *available at* http://www.myfloridalegal.com/ago.nsf/Opinions/B4AED736C2272860852566B30067371A; *see* FLA. STAT. §119.01(1) (2008) ("It is the policy of this state that all state, county, and municipal records are open for personal inspection by any person.").

[101] *See* GA. CODE ANN. §50-18-70(b) (2011); Op. Att'y Gen. Ga. 2000-4 (2000) (requiring personal utility records of certain public employees to be disclosed under public records law). Georgia defines a "public record" as "all documents, papers, letters, maps, books, tapes, photographs, computer based or generated information, or similar material prepared and maintained or received in the course of the operation of a public office or agency." GA. CODE ANN. §50-18-70(a).

[102] In South Carolina, public records include "information in or taken from any account, voucher, or contract dealing with the receipt or expenditure of public or other funds by public bodies." S.C. CODE ANN. §30-4-50 (2011). *See* Kelsey M. Swanson, *The Right to Know: An Approach to Gun Licenses and Public Access to Government Records*, 56 UCLA L. REV. 1579, 1601 (2009).

[103] OKLA. STAT. tit. 51, §24A.10 (2011).

[104] *Id.*

[105] WASH. REV. CODE §42.56.335 (2011). In Washington, the following rule applies to public utility districts and municipally owned electrical utilities:

> A law enforcement authority may not request inspection or copying of records of any person who belongs to a public utility district or a municipally owned electrical utility unless the authority provides the public utility district or municipally owned electrical utility with a written statement in which the authority states that it suspects that the particular person to whom the records pertain has committed a crime and the authority has a reasonable belief that the records could determine or help determine whether the suspicion might be true. Information obtained in violation of this section is inadmissible in any criminal proceeding.

WASH. REV. CODE §42.56.335. The Washington Supreme Court has raised this protection to state constitutional status in *In re* Personal Restraint of Maxfield, 133 Wash. 2d 332, 344 (1997).

[106] However, the North Carolina public records law declares that "[n]othing contained herein is intended to limit public disclosure by a city or county of bill information: ... that is necessary to assist law enforcement, public safety, fire (continued...)

Determining whether a utility is a state actor or whether smart meter data is a public record are merely threshold matters. A finding that an entity is a state actor or data is public does not foreclose law enforcement's ability to retrieve customer smart meter data, but instead activates the next step of Fourth Amendment analysis: whether the government invaded a reasonable expectation of privacy.

Reasonable Expectation of Privacy in Smart Meter Data

Under the modern conception of the Fourth Amendment, the government may not intrude into an area in which a person has an actual expectation of privacy that society would consider reasonable.[107] In the case of smart meter data, the government presumably seeks records in the custody of third-party utilities on the energy use at a specific home. However, a significant body of cases has refused to recognize constitutionally protected privacy interests in information provided by customers to businesses as part of their commercial relationships.[108] This theory, the third-party doctrine, permits police access to the telephone numbers a person dials[109] and to a person's bank documents,[110] free from Fourth Amendment constraints.

There are two relevant differences, however, between smart meters and the traditional third-party cases that may warrant a shift in approach. First is the possible judicial unease with the notion that advancement of technology threatens to erode further the constitutional protection of privacy.[111] From that perspective, as technology progresses, society faces an ever-increasing risk that an individual's activities will be monitored by the government. This is coupled with the concern that the breadth and granularity of personal information that new technology affords provide a far more intimate picture of an individual than the more limited snapshots available through prior technologies. Do the richness and scope of new information technologies warrant increased constitutional scrutiny?

Second, smart meters can convey information about the activities that occur inside the home, an area singled out for specific textual protection in the Fourth Amendment and one deeply ingrained in Anglo-Saxon law.[112] Even when the Court declared that "the Fourth Amendment protects people, not places,"[113] ostensibly shifting away from a property-based conception of the Fourth Amendment, it has still carved out special protections for the home.[114] However, concomitant with the increased use of technology in our private lives is increased exposure of our private activities, including those conducted in the home. Commonly, we share more personal

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protection, rescue, emergency management, or judicial officers in the performance of their duties." N.C. GEN. STAT. §132-1.1(c)(3).

[107] Katz v. United States, 389 U.S. 347, 361 (1967) (Harlan, J., concurring).

[108] *See* Smith v. Maryland, 442 U.S. 735 (1979).

[109] *Id.*

[110] United States v. Miller, 425 U.S. 435 (1976).

[111] Kyllo v. United States, 533 U.S. 27, 33-4 (2001) ("It would be foolish to contend that the degree of privacy secured to citizens by the Fourth Amendment has been entirely unaffected by the advance of technology.").

[112] *See* Entick v. Carrington, 19 How. St. Tr. 1029 (C.P. 1765).

[113] Katz v. United States, 389 U.S. 347, 351 (1967).

[114] *See* Orin S. Kerr, *The Fourth Amendment and New Technologies: Constitutional Myths and the Case for Caution*, 102 MICH. L. REV. 801, 809-10 (2004) [hereinafter Kerr, *Fourth Amendment and New Technologies*].

information, even as our concerns grow that more individuals, businesses, and others can glean more information about our personal lives as a matter of course. As with technology generally, does the fact that more of our lives are becoming "public" call for lesser or greater constitutional protection, and how does a "reasonable expectation"-based model continue to apply in a technologically intensive society?

This subpart will first look at the third-party doctrine as it is commonly conceived by the courts. Then it will discuss whether there are sufficient differences between the use of smart meters and traditional third-party cases to counsel against its application.

Third-Party Doctrine

Traditionally, there has been no Fourth Amendment protection for information a consumer gives to business as part of their business dealings.[115] This doctrine dates back to the secret agent cases, in which any words uttered to another person, including a government agent or informant, were not covered by the Fourth Amendment.[116] It was later extended to business records, giving police access to documents such as telephone records,[117] bank records,[118] motel registration records,[119] and cell phone records.[120] The Supreme Court has reasoned that the customers assume the risk that the information could be handed over to government authorities,[121] and also that they consent to such access.[122] Some lower courts have applied this theory to traditional analog utility meters.[123] This section discusses the possible application of the third-party doctrine to smart meters.

In *Miller v. United States*, agents of the Bureau of Alcohol, Tobacco, and Firearms (ATF) subpoenaed several banks for records pertaining to the defendant, including copies of the defendant's checks, deposit slips, and financial statements.[124] The defendant moved to suppress the records at trial, arguing that a warrantless retrieval of the bank records (his "private papers")[125] was an intrusion into an area protected by the Fourth Amendment. The Court

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[115] Orin S. Kerr, *The Case for a Third-Party Doctrine*, 107 MICH. L. REV. 561, 563 (2009) [hereinafter Kerr, *Third-Party Doctrine*]. While the third-party doctrine has supporters like Professor Kerr, this group is overshadowed by its vocal detractors. Professor LaFave described its underpinnings as "dead wrong" and that the "Court's woefully inadequate reasoning does great violence to the theory of Fourth Amendment protection which the Court developed in *Katz*." LAFAVE, *supra* note 78, §2.7(c). Justice Sotomayor lent credence to this sentiment in *United States v. Jones*, where she posited that it "may be necessary to reconsider the premise that an individual has no reasonable expectation of privacy in information voluntarily disclosed to third parties." United States v. Jones, 565 U.S. ___, 5 (Sotomayor, J., concurring in the judgment and the opinion).

[116] United States v. White, 401 U.S. 745, 750 (1971) (holding that the Fourth Amendment "affords no protection to a wrongdoer's misplaced belief that a person to whom he voluntarily confides his wrongdoing will not reveal it.") (internal quotation marks omitted).

[117] Smith v. Maryland, 442 U.S. 735 (1979).

[118] United States v. Miller, 425 U.S. 435 (1976).

[119] United States v. Willis, 759 F.2d 1486, 1498 (11th Cir. 1985).

[120] United States v. Hynson, No. 05-576, 2007 WL 2692327, at *6 (E.D. Pa. Sept. 11, 2007).

[121] *Smith*, 442 U.S. at 744.

[122] Kerr, *Third-Party Doctrine*, *supra* note 115.

[123] United States v. McIntyre, 646 F.3d 1107 (8th Cir. 2011).

[124] *Miller*, 425 U.S. at 437-438.

[125] Brief for Respondent at 4, *Miller*, 425 U.S. 435 (No. 74-1179), 1975 WL 173642, at *4 ("The Fourth Amendment is historically rooted in a concern for control over personal and private information in the face of governmental demands (continued...)

disagreed, broadly declaring "the Fourth Amendment does not prohibit the obtaining of information revealed to a third-party and conveyed by him to Government authorities, even if it is revealed on the assumption that it will be used only for a limited purpose and the confidence placed in the third-party will not be betrayed."[126] The Court further noted that "the depositor takes the risk, in revealing his affairs to another, that the information will be conveyed by that person to the Government."[127]

Three years later, the Court extended the third-party doctrine to outgoing numbers dialed from a person's telephone.[128] In *Smith v. Maryland*, the defendant robbed a woman and began making obscene phone calls to her.[129] Suspecting Smith placed the calls, the police used a pen register to track the telephone numbers dialed from his phone.[130] The police failed to obtain a warrant or subpoena before installing the pen register.[131] The register revealed that Smith was in fact making the phone calls to the woman. In denying Smith's motion to suppress, the Court relied on the third-party doctrine, stating that "this Court consistently has held that a person has no legitimate expectation of privacy in information he voluntarily turns over to third parties."[132] As applied to the telephone context, the Court found that "[w]hen he used his phone, [Smith] voluntarily conveyed numerical information to the telephone company and 'exposed' that information to its equipment in the ordinary course of business. In so doing, [Smith] assumed the risk that the company would reveal to police the numbers he dialed."[133]

Traditionally, utility records have been handled similarly to bank records and telephone records. Several lower federal courts have held that customers do not have a reasonable expectation of privacy in their utility records, thereby permitting warrantless access to these records. In *United States v. Starkweather*, the Ninth Circuit held that a person does not have a reasonable expectation of privacy in his utility records.[134] The panel reasoned that (1) these records were no different from phone records, and thus did not justify a different constitutional result; and (2) the public was aware that such records were regularly maintained, thereby negating any expectation of privacy.[135] The Eighth Circuit has also upheld warrantless police access to utility records in *United States v. McIntyre*.[136] The Eighth Circuit panel distinguished *Kyllo*, declaring that the means of obtaining the information in *Kyllo* (a thermal-imaging device) was significantly more intrusive than simply subpoenaing the records from the utility company.[137] The court held that "the means to obtaining the information is legally significant."[138] Likewise, the court in *United*

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for access and use.") (citing Entick v. Carrington, 19 How. St. Tr. 1029 (C.P. 1765)).

[126] *Miller*, 425 U.S. at 443.

[127] *Id.*

[128] Smith v. Maryland, 442 U.S. 735 (1979).

[129] *Id.* at 737.

[130] *Id.*

[131] *Id.*

[132] *Id.* at 743-44.

[133] *Id.* at 744.

[134] United States v. Starkweather, No. 91-30354, 1992 WL 204005, at *2 (9th Cir. Aug. 24, 1992).

[135] *Id.*

[136] United States v. McIntyre, 646 F.3d 1107 (8th Cir. 2011).

[137] *Id.* at 1111.

[138] *Id.*

States v. Hamilton held that the means of obtaining power records from a third-party by way of administrative subpoena as opposed to "intrusion on the home by 'sense enhancing technology'" is "legally significant," removing this type of situation from the *Kyllo*-home privacy line of cases into the *Miller*-third-party line.[139]

It is difficult to predict whether a court would extend this traditional third-party analysis to smart meters. The courts may seek to ensure the predictability and stability of the third-party doctrine generally and administration of utility services specifically, thus requiring a bright-line rule for all third-party circumstances.[140] There is an advantage to a rule that is easy to apply, that allows utilities to better govern their affairs, and does not permit "savvy wrongdoers [to] use third-party services in a tactical way to enshroud the entirety of their crimes in zones of Fourth Amendment protection."[141] However, there are three overarching considerations embodied in the use of smart meters that might weigh against the application of traditional third-party analysis. These include (a) a person's expectation of privacy while at home; (b) the breadth and granularity of private information conveyed by smart meters; (c) the lack of a voluntary assumption of the risk or consent to release of this data.

Privacy in the Home

The location of the search mattered little in the traditional third-party cases, but it may take on constitutional significance with smart meters.[142] In the case of smart meters, the information is generated in the home, an area accorded specific textual protection in the Fourth Amendment, and one the Supreme Court has persistently safeguarded.[143] In no uncertain terms the Court has asserted that "[a]t the very core [of the Fourth Amendment] stands the right of a man to retreat into his own home and there be free from unreasonable government intrusion."[144] Even as technology advances—whether a tracking or thermal-imaging device or something new—the Court has maintained this bulwark. Because of the significance of the home, access to smart

[139] United States v. Hamilton, 434 F. Supp. 2d 974, 980 (D. Or. 2006); Booker v. Dominion Va. Power, No. 3:09-759, 2010 U.S. Dist. LEXIS 44960, at *17 (E.D. Va. May 7, 2010); *see also* Samson v. State, 919 P.2d 171, 173 (Ala. App. 1996) (holding under state constitution that "utility records are maintained by the utility and do not constitute information in which society is prepared to recognize a reasonable expectation of privacy"); People v. Stanley, 86 Cal. Rptr. 2d 89, 94 (Cal. App. 1999) (same).

[140] *See* Duncan Kennedy, *Form and Substance in Private Law Adjudication*, 89 HARV. L. REV. 1687, 1710 (1976).

[141] Kerr, *Third-Party Doctrine*, *supra* note 115, at 564.

[142] In *Smith*, the "site of the call was immaterial for purposes of analysis" of that case. Smith v. Maryland, 442 U.S. 735, 743 (1979). Whether a person dials a telephone number from his home, a telephone booth, or any other location does not alter the nature of the activity, and thus does not affect the Fourth Amendment analysis. The privacy interests implicated are the same no matter where the call is placed. The same theory applies to bank records. It matters not where someone writes a check, or fills out a deposit slip—the privacy interest is the same.

[143] Payton v. New York, 445 U.S. 573, 589 ("The Fourth Amendment protects the individual's privacy in a variety of settings. In none is the zone of privacy more clearly defined than when bounded by the unambiguous physical dimensions of an individual's home—a zone that finds its roots in clear and specific constitutional terms: 'The right of the people to be secure in their ... houses ... shall not be violated.'") (quoting U.S. CONST. amend IV); Minnesota v. Carter, 525 U.S. 83, 99 (1998) (Kennedy, J., concurring) ("[I]t is beyond dispute that the home is entitled to special protection as the center of the private lives of our people. Security of the home must be guarded by law in a world where privacy is diminished by enhanced surveillance and sophisticated communication systems.").

[144] Silverman v. United States, 365 U.S. 505, 511 (1961).

meter data may prompt a doctrinal shift away from the third-party doctrine. Several home privacy cases shed light on this possible approach.[145]

In *Kyllo v. United States*, the Court had to decide whether the use of a thermal-imaging device from the outside of a home that detected the amount of heat coming from inside the home was a violation of the Fourth Amendment.[146] In *Kyllo*, an agent of the Department of the Interior suspected Danny Kyllo was growing marijuana in his home with the use of high-intensity lamps.[147] The agent used a thermal imager to scan the outside of Kyllo's apartment to determine if he was using these "grow" lamps.[148] Thermal imagers can detect energy emitting from the outside surface of an object.[149] When scanning the home, the thermal imager produced an image with various shades of black, white, or gray—the shades darker or lighter depending on the warmth of the area being scanned.[150] From the passenger seat of his car, the agent scanned Kyllo's home for several minutes.[151] From his scan, he determined that the area over the garage and one side of his home were relatively hot compared to neighboring homes.[152] Based on utility bills, informant tips, and the results of thermal imaging, the agents obtained a warrant to search Kyllo's home.[153] As suspected, inside the home the agents found a marijuana growing operation, including over 100 plants.[154]

Justice Scalia first posited that "with very few exceptions, the question whether a warrantless search of the home is reasonable must be answered no."[155] Searches of the home were historically analyzed under the common law doctrine of trespass,[156] but during the mid-20th century the Court instead anchored the Fourth Amendment to a conception of privacy.[157] While this test may be difficult to apply in the context of automobiles, telephone booths, or other public areas, it is made easier when concerning the home:

> In the case of the search of the interior of homes—the prototypical and hence most commonly litigated area of protected privacy—there is a ready criterion, with deep roots in the common law, of the minimal expectation of privacy that *exists*, and that is acknowledged

[145] In April 2012, the Supreme Court will hear oral arguments in its most recent home privacy case, Jardines v. Florida, 73 So. 3d 34 (Fla. 2011), *cert granted*, 2012 U.S. LEXIS 7 (Jan. 6, 2012) (No. 11-564), where it will decide whether a drug sniff at the front door of a suspect's house by a trained narcotics dog is a Fourth Amendment search requiring probable cause. This case should shed further light on the parameters of privacy surrounding the home.

[146] Kyllo v. United States, 533 U.S. 27, 29 (2001).

[147] *Id.*

[148] *Id.*

[149] *Id.*

[150] *Id.* at 29-30.

[151] *Id.* at 30.

[152] *Id.*

[153] *Id.*

[154] *Id.* The Ninth Circuit held that Kyllo had not exhibited a subjective expectation of privacy in the home because he did not attempt to prevent the heat emitting from the lamps from escaping his home. United States v. Kyllo, 190 F.3d 1041, 1046 (9th Cir. 1999). Further, the panel held that even if he had a subjective expectation of privacy, it was not a reasonable one since the imager "did not expose any intimate details of Kyllo's life." *Id.* at 1047.

[155] *Kyllo*, 533 U.S. at 31.

[156] *See* Olmstead v. United States, 277 U.S. 438 (1928).

[157] Katz v. United States, 389 U.S. 347, 361 (1967) (Harlan, J., concurring). The modern formulation of the reasonable expectation of privacy test derives not from the majority opinion but from Justice Harlan's concurrence.

> to be reasonable. To withdraw protection of this minimum expectation would be to permit police technology to erode the privacy guaranteed by the Fourth Amendment.[158]

The Court ultimately held that "obtaining by sense-enhancing technology any information regarding the interior of the home that could not otherwise have been obtained without physical intrusion into a constitutionally protected area constitutes a search—at least where (as here) the technology in question is not in general public use."[159] *Kyllo* affirmed the notion that "an expectation of privacy in activities taking place inside the home is presumptively reasonable."[160]

The Court also protected home privacy by prohibiting the monitoring of the location of a beeper while inside a residence.[161] In *United States v. Karo*, with the consent of a government informant the police attached a beeper to the false bottom of a can of ether, which was sold to Karo.[162] The can of ether was transported between several residences and storage facilities.[163] The police used the beeper to monitor the location of the can several times while it was located inside of the residences.[164] The Court was asked to determine "whether the monitoring of a beeper in a private residence, a location not open to visual surveillance, violates Fourth Amendment rights of those who have a justifiable interest in the privacy of the residence."[165] The Court answered in the affirmative.

The Court reiterated the long-standing notion that "private residences are places in which the individual normally expects privacy free of governmental intrusion not authorized by a warrant, and that expectation is plainly one that society is prepared to recognize as justifiable."[166] Unless there are exigent circumstances, "searches and seizures inside a home without a warrant are presumptively unreasonable...."[167] The Court ultimately held that the warrantless monitoring of the beeper in the home was a Fourth Amendment violation.[168]

Kyllo and *Karo* demonstrate that the Supreme Court "has defended the home as a sacred site at the 'core of the Fourth Amendment.'"[169] Although neither the Supreme Court nor any lower federal court has ruled on the use of smart meters, a few propositions can be deduced from *Kyllo* and *Karo* bearing on this question.

Because smart meters allow law enforcement to access information regarding intimate details occurring inside the home, a highly invasive investigation that could not otherwise be performed without intrusion into the home, a court may require a warrant to access this data. In *Kyllo*, the

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[158] *Kyllo*, 533 U.S. at 34.

[159] *Id.* (internal quotation marks omitted).

[160] Lerner & Mulligan, *supra* note 60, ¶ 18.

[161] United States v. Karo, 468 U.S. 705 (1984).

[162] *Id.* at 708.

[163] *Id.*

[164] *Id.* at 709-10.

[165] *Id.*

[166] *Id.* at 714.

[167] *Id.* at 714-15.

[168] *Id.* at 718.

[169] Stephanie M. Stern, *The Inviolate Home: Housing Exceptionalism in the Fourth Amendment*, 95 CORNELL L. REV. 905, 913 (2010) (citing Wilson v. Layne, 526 U.S. 603, 612 (1999)).

police merely obtained the relative temperatures of a house,[170] and in *Karo* the police only generally located the beeper in the house.[171] Although this information was limited, the Court nonetheless prohibited such investigatory techniques. Smart meters have the potential to produce significantly more information than that derived in *Kyllo* and *Karo*, including what individual appliances we are using; whether our house is empty or occupied; and when we take our daily shower or bath.[172] Further, a look at Figure 1, *supra*, makes it clear that this level of information is much more intimate than prior technologies used by law enforcement. This depth of intrusion suggests that customers may have a reasonable expectation of privacy in smart meter data.

There is also a question whether smart meters are in "general public use." (The police must use technology not in general public use for *Kyllo* to apply.)[173] Unfortunately, the Court provided no criterion for making this determination.[174] Several courts applying this test have held that night vision goggles were in general public use.[175] One federal district court reasoned that the goggles were regularly used by the military and police and could be found on the Internet, so were considered in general public use.[176] In 2009, the Department of Energy estimated that 4.75% of all electric meters were smart meters.[177] The department projects that by 2012 approximately 52 million more meters will be installed.[178] With little guidance on this issue, it is uncertain whether this jump in numbers would elevate smart meters into the general public use category.

The means by which data is gathered also differentiates the thermal-imaging in *Kyllo* from smart meters. In *Kyllo*, the police independently gathered the information using the thermal imager; an agent went outside Kyllo's house and used the thermal imager himself.[179] With smart meters, the utility company compiles the information and the police subpoena the company for the data. This difference in means was material in one lower court analyzing access to traditional utility data.[180] It is not clear whether this difference advises against application of *Kyllo* here.

Mosaic and Dragnet Theories

The second factor guiding against the application of the third-party doctrine is composed of two interconnected theories: the mosaic and dragnet theories. The mosaic theory is grounded in the idea that surveillance of the whole of one's activities over a prolonged period is substantially

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[170] United States v. Kyllo, 533 U.S. 27, 30 (2001).

[171] *Karo*, 468 U.S. at 705, 709-10.

[172] NIST PRIVACY REPORT, *supra* note 11, at 14 & n.35. It is unclear whether the specificity of the data from the smart meter will directly affect the constitutional analysis. *Kyllo*, 533 U.S. at 37 ("The *Fourth Amendment's* protection of the home has never been tied to measurement of the quality or quantity of information obtained."). With that said, the NIST report maintains that sufficient information about the activities inside of the home are presented to implicate a *Kyllo*, home search analysis.

[173] *Kyllo*, 533 U.S. at 34.

[174] *See* Douglas Adkins, *The Supreme Court Announces a Fourth Amendment "General Public Use" Standard for Emerging Technologies but Fails to Define It:* Kyllo v. United States, 27 DAYTON L. REV. 245 (2002).

[175] *See* United States v. Dellas, 355 F. Supp. 2d 1095, 1107 (N.D. Cal. 2005).

[176] United States v. Vela, 486 F. Supp. 2d 587, 590 (W.D. Tex. 2005).

[177] DEP'T OF ENERGY, SMART GRID SYSTEM REPORT vi (2009), *available at* http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/SGSRMain_090707_lowres.pdf.

[178] *Id.*

[179] United States v. Kyllo, 533 U.S. 27, 29 (2001).

[180] United States v. McIntyre, 646 F.3d 1107, 1111-12 (8th Cir. 2011).

PAGE # 117

more invasive than a look at each item in isolation.[181] In the case of smart meters, this is the difference between knowing a person's monthly energy usage, and being able to discern a person's daily activities with considerable accuracy. This theory intersects with dragnet-styled law enforcement techniques in which the police cast a wide surveillance net, taking in a wealth of personal information with the goal of finding criminal activity among the stream of data.

Although the Supreme Court has never formally adopted the mosaic theory, there seems to be a ready-made majority potentially willing to consider it.[182] In *United States v. Jones*, the police used a GPS tracking device to track Jones's movements for almost a month.[183] The majority, led by Justice Scalia, held that attaching a GPS device on a vehicle for the purpose of collecting information constituted a "search" under the Fourth Amendment.[184] The physical intrusion, rather than a *Katz*-type invasion of privacy, was the lynchpin of the decision.[185] Justices Alito and Sotomayor both agreed that this was a search, but on different grounds. Both discussed an adaptation of the mosaic theory as prohibiting police from tracking a person for an extended period of time. Justice Alito, joined by Justices Breyer, Ginsburg, and Kagan, assumed that a short-term search would not violate the Fourth Amendment, but that "the use of longer term GPS monitoring in investigations of most offenses impinges on expectations of privacy."[186] Likewise, Justice Sotomayor agreed with this "incisive" observation, noting that "GPS monitoring generates a precise, comprehensive record of a person's public movements that reflects a wealth of detail about familial, political, professional, religious, and sexual associations."[187] Both of these comments closely mirror those of the opinion below, which relied on the mosaic theory: "A person who knows all of another's travels can deduce whether he is a weekly church goer, a heavy drinker, a regular at the gym, an unfaithful husband, an outpatient receiving medical treatment, an associate of particular individuals or political groups—and not just one such fact about a person, but all such facts."[188]

Although the *Jones* majority did not embrace the mosaic theory, the concurrences demonstrate that five justices are flirting with the idea. These arguments resemble those made against the unfettered use of smart meter data. With smart meters, police would have a rich source of personal data that reveals far more about a person than traditional analog meters. Understanding a person's daily activities, including what appliances he is using, is a far leap from knowing his monthly energy usage. This is the difference between knowing about a single trip a person took and monitoring his movements over a month-long period. The breadth and granularity of the smart meter data may be seen as warranting application of the mosaic theory and may perhaps find receptive ears on the Court.

Additionally, the dragnet theory may apply to collection of energy usage data. This theory states that surveillance normally permitted under the Fourth Amendment—such as monitoring a person's movements on a public street—becomes an impermissible invasion of privacy when

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[181] *See* Cent. Intelligence Agency v. Sims, 471 U.S. 159, 178 (1985).

[182] *See* Orin Kerr, VOLOKH CONSPIRACY, What's the Status of the Mosaic Theory After Jones?, http://volokh.com/2012/01/23/whats-the-status-of-the-mosaic-theory-after-jones/.

[183] United States v. Jones, 565 U.S. ___, 2 (2012).

[184] *Id.* at 3.

[185] *Id.* at 4.

[186] *Id.* at 13 (Alito, J., concurring in the judgment).

[187] *Id.* at 3 (Sotomayor, J., concurring in the judgment and the opinion).

[188] United States v. Maynard, 615 F.3d 544, 562 (D.C. Cir. 2010).

conducted on a prolonged, 24-hour basis.[189] "If such dragnet-type law enforcement practices as respondent envisions should eventually occur," Justice Rehnquist asserted earlier in *United States v. Knotts*, "there will be time enough then to determine whether different constitutional principles may be applicable."[190] Twenty-four hour access to our intimate daily activities, including what appliances we use, when we take our daily shower or bath, eat, and sleep, may push smart meters into the dragnet category.

Coinciding with the mosaic and dragnet theories is the difference in sophistication and the quantity of the data revealed between traditional third-party cases and smart meters. Comparing *Smith* with *Katz* provides insight into this distinction. Pen registers, as used in *Smith*, have "limited capabilities"—they can only record the numbers dialed from a phone.[191] In comparison, in *Katz* the police listened to the contents of Katz's phone call—the actual words spoken.[192] In noting this distinction, it seems the *Smith* Court, in permitting the use of pen registers, intentionally limited its holding to the discrete set of data conveyed—the telephone numbers dialed. Smart meters, to the contrary, have the potential to collect and aggregate precise detail about the activities inside the home. It is more than one packet of data, but reveals minute-by-minute activity, something far more revealing, and arguably more like *Katz* than *Smith*.

Assumption of the Risk—Consent

The third difference between traditional third-party cases and smart meters is the nature of services involved and whether the customer actually assumes the risk or consents to this information being shared with others. Assumption of the risk and consent are the two leading theories supporting the third-party doctrine. In *United States v. Miller*, the customer "assumed the risk" that the bank would turn over the bank records to government authorities.[193] That was a risk he took in doing business with the bank. As to the consent theory, one commentator asked and answered the question as follows: "When does a person's choice to disclose information to a third-party constitute consent to a search? So long as a person knows that they are disclosing information to a third-party, their choice to do so is voluntary and the consent valid."[194]

With banking or telephone services, a customer has the option of transferring his business to another bank or another telephone carrier.[195] To the contrary, because electric utilities are essentially monopolies, the customer cannot simply switch services. The only way to avoid the recordation of his electric usage is to terminate his utility service altogether, an impracticable option in modern society. As one state court has noted:

> Electricity, even more than telephone service, is a "necessary component" of modern life, pervading every aspect of an individual's business and personal life: it heats our homes,

[189] *Id.* at 558.

[190] United States v. Knotts, 460 U.S. 276, 283-84 (1983). Because this statement was not essential to the holding, it was dictum: persuasive, but not binding.

[191] *Smith*, 442 U.S at 741 (citing Katz v. United States, 389 U.S. 347 (1967)).

[192] *Katz*, 389 U.S. at 348.

[193] *Smith*, 442 U.S. at 744 (citing United States v. Miller, 425 U.S. 435 (1976)).

[194] Kerr, *Third-Party Doctrine*, *supra* note 115, at 588.

[195] *Contra Smith*, 442 U.S. at 750 (Marshall, J., dissenting) ("[U]nless a person is prepared to forgo use of what for many has become a personal or professional necessity, he cannot help but accept the risk of surveillance. It is idle to speak of "assuming" the risk in contexts where, as a practical matter, individuals have no realistic alternative.").

> powers our appliances, and lights our nights. A requirement of receiving this service is the disclosure to the power company (and in this case an agent of the state) of one's identity and the amount of electricity being used. The nature of electrical service requires the disclosure of this information, but that disclosure is only for the limited business purpose of obtaining the service.[196]

It is not clear whether assumption of the risk or consent should apply to smart meters. It is reasonable to assume that customers understand utility companies must collect usage data to bill the customer for that usage. Customers receive their statement each month demonstrating this fact. However, most customers are probably not familiar with the sophistication of smart meters and the detailed data sets that can be derived from them. Even if customers are aware their utility usage can be recorded in sub-fifteen minute intervals, a reasonable customer would probably be surprised, if not shocked, to know that data from smart meters can potentially be used to pinpoint the usage of specific appliances. If knowledge of the sophistication of the data is a prerequisite to assumption of the risk or consent, it is difficult to say whether a reasonable customer would understand the privacy implications with this new technology.[197]

Because smart meters are an emerging technology not yet judicially tested, it is difficult to conclude with certainty how they would be handled under the Fourth Amendment. Further, beyond the possible constitutional implications of smart meters, federal communication and privacy statutes may also apply. As noted by Professor Kerr, "in recent decades, legislative privacy rules governing new technologies have proven roughly as privacy protective, and quite often more protective than, parallel Fourth Amendment rules."[198]

Statutory Protection of Smart Meter Data

This section discusses federal statutory protections that may be applicable to the contents of communications sent by a smart meter, independent of the Fourth Amendment, while they are either stored within the smart meter prior to transmission, during transmission, or after they have been delivered to the utility. Three federal laws, the Electronic Communications Privacy Act (ECPA),[199] the Stored Communications Act (SCA),[200] and the Computer Fraud and Abuse Act (CFAA)[201] may be applicable to these situations and are discussed in more detail below.

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[196] *In re* Restraint of Maxfield, 133 Wn.2d 332, 341 (Wash. 1997); *see also* Balough, *supra* note 63, at 185.

[197] *Cf.* United States v. Warshak, 631 F.3d 266, 288 (6th Cir. 2010) ("*Miller* involved simple business records, as opposed to the potentially unlimited variety of 'confidential communications' at issue here.").

[198] Kerr, *Fourth Amendment and New Technologies*, *supra* note 114, at 806.

[199] For more detailed information on ECPA, *see* CRS Report R41733, *Privacy: An Overview of the Electronic Communications Privacy Act*, by Charles Doyle.

[200] For a more detailed discussion of the SCA, *see* CRS Report R41733, *Privacy: An Overview of the Electronic Communications Privacy Act*, by Charles Doyle.

[201] For more detailed information on the CFAA, *see* CRS Report 97-1025, *Cybercrime: An Overview of the Federal Computer Fraud and Abuse Statute and Related Federal Criminal Laws*, by Charles Doyle.

The Electronic Communications Privacy Act (ECPA)

ECPA, enacted in 1986, "addresses the interception of wire, oral and electronic communications."[202] The statute defines electronic communications as "any transfer of signs, signals, writing, images, sounds, data, or intelligence of any nature transmitted in whole or in part by a wire, radio, electromagnetic, photoelectronic or photooptical system that affects interstate or foreign commerce...."[203] Based on the description of the smart meter network provided above,[204] the envisioned transmission of customers' energy usage data by smart meters would seem to fall squarely within the definition of electronic communications under ECPA.

ECPA generally prohibits the interception of electronic communications, but also provides a mechanism for government entities to conduct such surveillance, and a number of other exceptions.[205] Additionally, the statute provides that interception under the procedures and exceptions set forth in ECPA, or pursuant to the Foreign Intelligence Surveillance Act, are the exclusive means for intercepting electronic communications.[206] The unlawful interception of electronic communications in violation of ECPA is generally punishable by imprisonment for not more than five years and/or a fine of not more than $250,000 for individuals and not more than $500,000 for organizations.[207]

Of particular relevance to the immediate discussion is the fact that ECPA permits interception of an electronic communication where a party to the communication has consented to such interception.[208] In the context of a smart meter network that is the subject of this report, it appears that the utility would be a party to all of the communication sent by the smart meters, since it is primarily receiving that information for its own billing purposes. Therefore, if the utility consents to law enforcement's interception of the traffic which is addressed to it, that surveillance would not appear to violate the prohibitions in ECPA.

ECPA also provides a procedural mechanism for law enforcement to conduct surveillance activities for investigative purposes without the consent of any party to the communication. The statute limits the types of criminal cases in which electronic surveillance may be used[209] and requires court orders authorizing electronic surveillance to be supported by probable cause to believe that the target is engaged in criminal activities, that normal investigative techniques are

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[202] S.Rept. 99-541 at 3.

[203] 18 U.S.C. §2510(12).

[204] *See supra* note 47 and accompanying text (noting that smart meters may use a variety of communications technologies, including fiber optics, wireless networks, satellite, and broadband over power line).

[205] 18 U.S.C. §2516. Exceptions cover things such as interception with the consent of a party to the communication and interception by communication service providers as an incident to providing service.

[206] 18 U.S.C. §2511(2)(f). FISA defines electronic surveillance to include more than the interception of wire, oral, or electronic communications, 50 U.S.C. §1801(f), but places limitations on its definition based upon the location or identity of some or all of the parties to the communications involved.

[207] "Except as provided in (b) of this subsection or in subsection (5), whoever violates subsection (1) of this section shall be fined under this title or imprisoned not more than five years, or both." 18 U.S.C. §2511(4)(a).

[208] 18 U.S.C. §2511(2)(c).

[209] The list of covered criminal provisions can be found at 18 U.S.C. §2516(1), and includes offenses such as violence at international airports; animal enterprise terrorism; arson; bribery of public officials and witnesses; unlawful use of explosives; fraud by wire, radio, or television; terrorist attacks against mass transportation; sexual exploitation of children; narcotics production and trafficking; and many others.

insufficient, and that the facilities that are the subject of surveillance will be used by the target.[210] It also limits the use and dissemination of information intercepted.[211] In addition, when an interception order expires, authorities must notify those whose communications have been intercepted.[212] Law enforcement may also conduct electronic surveillance when acting in an emergency situation pending issuance of a court order.[213]

The government may also conduct electronic surveillance under the authority of the Foreign Intelligence Surveillance Act (FISA). FISA governs the gathering of information about foreign powers, including international terrorist organizations, and agents of foreign powers.[214] Although it is often discussed in relation to the prevention of terrorism, it applies to the gathering of foreign intelligence information for other purposes.[215] Although some exceptions apply, such as for emergency situations,[216] the government typically must obtain a court order, supported by probable cause, from the Foreign Intelligence Surveillance Court (FISC), a neutral judicial decision maker, in order to conduct electronic surveillance pursuant to FISA.[217]

The Stored Communications Act (SCA)

The SCA was enacted in 1986 as Title II of the Electronic Communications Privacy Act (ECPA),[218] to "address[] access to stored wire and electronic communications and transactional records."[219] The SCA prohibits unauthorized persons from accessing a facility through which an *electronic communication service* (ECS) is provided; or obtaining, altering, or preventing access to an electronic communication while it is in *electronic storage* in an ECS.[220] The SCA also limits the circumstances in which providers of ECS or a *remote computing service* (RCS) may disclose information that they carry or maintain.[221] The SCA also provides a mechanism by which law enforcement may compel the disclosure of stored communications.[222]

The terms "electronic communication service," "remote computing services," and "electronic storage" are all specifically defined by the SCA. As described above, the SCA applies only to providers of either an ECS or an RCS; stored communications held by other types of entities are not protected by the SCA. Therefore, in order to determine whether the SCA would protect stored information collected by a smart meter, this report will first examine whether a utility's deployment of a smart meter network falls within the definition of an ECS or an RCS and then

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[210] 18 U.S.C. §§2516, 2518(3).

[211] 18 U.S.C. §2517.

[212] 18 U.S.C. §2518(8).

[213] 18 U.S.C. §2518(7).

[214] *See* 50 U.S.C. §1801(a) (definition of "foreign power").

[215] For example, it extends to the collection of information necessary for the conduct of foreign affairs. *See* 50 U.S.C. §1801(e) (definition of "foreign intelligence information").

[216] 50 U.S.C. §1805(e).

[217] 50 U.S.C. §§1801-1808. FISA authorizes electronic surveillance without a FISA order in specified instances involving communications between foreign powers. 50 U.S.C. §1802.

[218] P.L. 99-508.

[219] S.Rept. 99-541 at 3.

[220] 18 U.S.C. §2701(a). Unauthorized access includes exceeding an authorization to use the facility. *Id.*

[221] 18 U.S.C. §2702.

[222] 18 U.S.C. §2703.

discuss the protections and disclosure restrictions that might apply to any smart meter network that qualifies as an ECS or RCS.

Electronic Communication Services

An ECS is defined by the SCA as any service which provides users "the ability to send or receive wire or electronic communications."[223] The statute also defines an "electronic communication" as "any transfer of signs, signals, writing, images, sounds, data, or intelligence of any nature transmitted in whole or in part by a wire, radio, electromagnetic, photoelectronic or photooptical system that affects interstate or foreign commerce."[224] As described above, one of the essential functions of a smart meter would appear to be the capability to transmit consumer electricity usage data to the smart grid using a variety of communications technologies.[225] These transmissions would seem to fall neatly within the SCA's definition of an electronic communication. Therefore, whether a smart meter network would qualify as an ECS would likely depend on whether the deployed smart meters could be said to be providing this ability to users.

It is not clear whether it would be accurate to categorically describe smart meters as providing customers with "the ability to send or receive" communications. It could be argued that a utility customer would use the smart meter to transmit usage information to the utility, in the same way that the same customer uses a traditional meter to record household electricity usage over a billing period. However, the Ninth Circuit has suggested that an ECS should not include situations in which electronic communications are used only "as an incident to providing some other service, as is the case with a street-front shop that requires potential customers to speak into an intercom device before permitting entry, or a 'drive-thru' restaurant that allows customers to place orders via a two-way intercom located beside the drive-up lane."[226] On one hand, it may not be accurate to describe utility customers as users of smart meters at all, particularly if the deployment of such smart meters is intended principally for the benefit of the utility and does not change the experience of utility customers. On the other hand, some of the proposed uses of deployed smart meters may include using collected data for the benefit of the customers, for example by determining the energy efficiency of specific household appliances.[227] As a result, the ultimate classification of a particular smart meter network as an ECS may depend largely on the specific facts present, such as the manner in which it is marketed, or the ostensible purposes for which the transmissions are intended to be used.

If a smart meter network qualifies as an ECS, then transmissions containing smart meter data would be protected under the SCA only while such transmissions are in electronic storage, as that term is defined by the statute.[228] Therefore, one must first determine whether, and under what circumstances, the data collected by a smart meter network is in electronic storage in order to determine what protections apply.

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[223] 18 U.S.C. §2510(15).

[224] 18 U.S.C. §2510(12). Wire communications are defined as communications containing the human voice and are not implicated here. 18 U.S.C. §2510(1).

[225] *See supra* note 47 and accompanying text.

[226] Company v. United States (*In re* United States), 349 F.3d 1132, 1141 (9th Cir. 2003) (holding that definition of ECS includes service that provides drivers with the ability to make phone calls from their car for directory assistance, driving directions, or roadside assistance because those activities are intrinsically communicative).

[227] *See supra* note 8.

[228] 18 U.S.C. §2701.

For purposes of the SCA, a communication is in electronic storage at an ECS if it is in temporary, intermediate storage incidental to electronic transmission or in storage for backup protection.[229] As applied to the smart meter network, data residing on the smart meter itself prior to being sent to the utility would appear to be in electronic storage, as such storage is likely temporary and undertaken solely in anticipation of some eventual transmission to the utility. In contrast, once the data has arrived at the utility and resides on its servers, it may no longer be in temporary or intermediate storage. However, some form of the communications may still be being held for backup purposes, and in such a case might be considered in electronic storage under the statute. To the extent that the data would be considered in electronic storage, either while on the meter or on the utility's computers, the data would appear to be subject to the SCA's provisions applicable to providers of ECS.

The SCA prohibits intentionally accessing without authorization, a facility through which an ECS is provided and obtaining, altering, or preventing access to an electronic communication while it is in electronic storage.[230] Criminal penalties for violating the SCA's prohibitions on unauthorized access start at imprisonment for not more than one year (not more than five years for a subsequent conviction) and/or a fine of not more than $100,000.[231] However, violations committed for malicious, mercenary, tortious or criminal purposes are subject to higher penalties and may be punished by imprisonment for not more than five years (not more than 10 years for a subsequent conviction) and/or a fine of not more than $250,000 (not more than $500,000 for organizations).[232] Victims of a violation of the SCA also have a civil cause of action for equitable relief, reasonable attorneys' fees and costs, and damages equal to the loss and gain associated with the offense but not less than $1,000.[233]

The SCA generally restricts the ability of providers of ECS to disclose the contents of communications in electronic storage, if the ECS is offering those services to the public.[234] However, the statute also permits certain disclosures to law enforcement. Such permitted disclosures by a provider of electronic communication services to law enforcement can be either voluntary or compelled. Normally, voluntary disclosure to law enforcement is authorized only if the contents of the communication were inadvertently obtained by the service provider and appear to pertain to the commission of a crime.[235] However, it should be noted that the utility in this case appears to be the intended recipient of all communications sent over the smart meter network, and the SCA's restrictions on disclosures of electronically stored information held by ECS or RCS providers may generally be overcome if an intended recipient of the communication consents to the disclosure.[236] Consequently, the utility may have more latitude to share communications in electronic storage with law enforcement than a traditional provider of ECS, such as a telephone company, would have.

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[229] 18 U.S.C. §2510(17).

[230] 18 U.S.C. §2701(a). Unauthorized access includes exceeding an authorization to use the facility. *Id.*

[231] 18 U.S.C. §2701(b)(2).

[232] 18 U.S.C. §2701(b)(1).

[233] 18 U.S.C. §2707.

[234] 18 U.S.C. §2702(a)(1) ("a person or entity providing an electronic communication service to the public shall not knowingly divulge to any person or entity the contents of a communication while in electronic storage by that service").

[235] 18 U.S.C. §2702(b)(7).

[236] *See* 18 U.S.C. §2702(b)(3).

For purposes of compelled disclosures to law enforcement, the SCA distinguishes between recent communications and those that have been in electronic storage for more than 180 days. A search warrant is required to compel providers to disclose communications held in electronic storage for 180 days or less.[237] However, communications held for more than 180 days may be obtained by law enforcement through a warrant, subpoena, or a court order supported by specific and articulable facts sufficient to establish reasonable grounds to believe that the contents are relevant and material to an ongoing criminal investigation.[238] Customers whose communications have been disclosed are generally required to be given notice of such disclosure, but such disclosure may be delayed if notification might result in endangering the life or physical safety of an individual; flight from prosecution; destruction of or tampering with evidence; intimidation of potential witnesses; or otherwise seriously jeopardizing an investigation or unduly delaying a trial.[239]

Remote Computing Services

It is likely that the classification of a smart meter network as an RCS would similarly be fact-dependent. The SCA defines an RCS as a service in which computer storage or processing services by means of an ECS are provided to the public.[240] It is conceivable that the data collected by smart meters may in fact be stored or processed by the utility, but there is no indication that such storage or processing would be categorically provided as a service to the public, rather than solely for the utility's internal benefit.[241] If such service is not provided to the public, then it would likely be inaccurate to classify the smart meter network as an RCS. However, if one of the features of a particular smart meter deployment is to give customers the ability to store or process their usage data, then it would appear to qualify as an RCS.

For those smart meter networks which qualify as an RCS, the SCA generally protects the contents of electronically transmitted communications "carried or maintained on that service" for customers of the service. Disclosures of such information are generally prohibited,[242] but the SCA also provides a means for law enforcement to obtain access to the contents of such communications. The government may obtain a warrant supported by probable cause, or use a subpoena or a court order supported by specific and articulable facts sufficient to establish reasonable grounds to believe that the contents are relevant and material to an ongoing criminal investigation.[243] However, use of a subpoena or court order supported by specific and articulable facts also requires the government to give prior notice to the customer whose information is sought, unless particular circumstances warrant delayed notice.[244] RCS customers whose

[237] 18 U.S.C. §2703(a).

[238] 18 U.S.C. §2703(d). Some courts have held that this "reasonable grounds" standard is a less demanding standard than "probable cause." *See In re* Application of the United States, 620 F.3d 304, 313 (3d Cir. 2010) ("We also conclude that this [§2703(d)] standard is a lesser one than probable cause.").

[239] 18 U.S.C. §2705(a).

[240] 18 U.S.C. §2711(2).

[241] However, if some other service provided by the utility allows the data collected by a smart meter to be stored or manipulated for the benefit of the utility's customers, it is possible that this system would fall within the definition of an RCS.

[242] The SCA allows providers of an RCS to disclose stored communications with the consent of the subscriber of an RCS. 18 U.S.C. §2702(b)(3).

[243] 18 U.S.C. §2703(b)(1).

[244] 18 U.S.C. §2703(b)(1)(B).

communications have been disclosed in violation of the SCA may pursue a civil cause of action for equitable relief, reasonable attorneys' fees and costs, and damages equal to the loss and gain associated with the offense but not less than $1,000.[245]

The Computer Fraud and Abuse Act (CFAA)

The Computer Fraud and Abuse Act (CFAA) prohibits intentionally accessing and obtaining information from a computer used in or affecting interstate commerce, without authorization or in excess of a granted authorization.[246] The definition of a computer for purposes of the CFAA is "an electronic, magnetic, optical, electrochemical, or other high speed data processing device performing logical, arithmetic, or storage functions, and includes any data storage facility or communications facility directly related to or operating in conjunction with such device" excluding "an automated typewriter or typesetter, a portable hand held calculator, or other similar device...."[247]

The servers on a utility's network would likely fall squarely within the definition of a computer under the CFAA. Similarly, smart meters themselves also appear to meet the definition of a computer, insofar as they store customers' energy usage data and also perform logical operations by routing transmissions across the utility's network. Additionally, in light of the significant role that energy utilities play in the modern economy, the smart meter network would also likely be considered to have an effect on interstate commerce, even if they operate entirely within one state. Therefore, intentionally gaining access to the utility's servers or smart meters to obtain customer data would likely constitute a violation of the CFAA if done without the utility's authorization or in excess of an authorization granted by the utility.

The criminal penalties for violating the unauthorized access provisions of the CFAA have a three tier sentencing structure. Simple violations are punished as misdemeanors, imprisonment for not more than one year and/or a fine of not more than $100,000 ($200,000 for organizations).[248] At the next level, cases in which: "(i) the offense was committed for purposes of commercial advantage or private financial gain; (ii) the offense was committed in furtherance of any criminal or tortious act in violation of the Constitution or laws of the United States or of any State; or (iii) the value of the information obtained exceeds $5,000" may be punished by imprisonment for not more than five years and/or a fine of not more $250,000 ($500,000 for organizations).[249] The third tier is for repeat offenders whose punishment is increased to imprisonment of not more than 10 years and/or a fine of not more than $250,000 ($500,000 for organizations) for a second or subsequent conviction.[250]

[245] 18 U.S.C. §2707.

[246] 18 U.S.C. §1030(a)(2). For more detailed information on the CFAA, *see* CRS Report 97-1025, *Cybercrime: An Overview of the Federal Computer Fraud and Abuse Statute and Related Federal Criminal Laws*, by Charles Doyle.

[247] 18 U.S.C. §1030(e)(1).

[248] 18 U.S.C. §1030(c)(2)(A).

[249] 18 U.S.C. §1030(c)(2)(B).

[250] 18 U.S.C. §§1030(c), 3571.

The Federal Trade Commission Act (FTC Act)

Section 5 of the FTC Act prohibits "unfair or deceptive acts or practices in or affecting commerce"[251] and gives the Federal Trade Commission (FTC) jurisdiction to bring enforcement actions against "persons, partnerships, or corporations" that engage in these practices.[252] In the past, the FTC has used its authority under Section 5 to take action against businesses that violate their own privacy policies or that fail to adequately safeguard a consumer's personal information.[253] Although there do not appear to be any cases in which the FTC has taken action against an electric utility for failing to protect consumer smart meter data, the Commission would have authority to enforce Section 5 against a utility that fell within its statutory jurisdiction.

Covered Electric Utilities

This section considers whether the FTC would have Section 5 jurisdiction over each of the four types of electric utilities identified by the Energy Information Administration (EIA): investor-owned, publicly owned, federally owned, and cooperative.[254] It finds that the FTC clearly has jurisdiction over investor-owned utilities. It is unclear whether the Commission has jurisdiction over publicly owned utilities or federally owned utilities. The FTC could enforce Section 5 against for-profit electric cooperatives, and case law suggests that nonprofit electric cooperatives may also be subject to the act's requirements.

The FTC has jurisdiction to enforce Section 5 against "persons, partnerships, or corporations," with exceptions not applicable here.[255] Utilities that are "persons" or "partnerships" would be subject to the FTC's enforcement powers automatically,[256] as the statute does not provide any additional jurisdictional requirements for these entities. Most electric utilities, however, are organized as legal entities that would potentially fit within the definition of "corporation." The FTC Act states that, for the purposes of Section 5, the term "corporation":

> shall be deemed to include any company, trust, so-called Massachusetts trust, or association, incorporated or unincorporated, which is organized to carry on business for its own profit or that of its members, and has shares of capital or capital stock or certificates of interest, and any company, trust, so-called Massachusetts trust, or association, incorporated or unincorporated, without shares of capital or capital stock or certificates of interest, except partnerships, which is organized to carry on business for its own profit or that of its members.[257]

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[251] 15 U.S.C. §45(a)(1).

[252] 15 U.S.C. §45(a)(2).

[253] *See* "Enforcement of Data Privacy and Security," *infra* p. 41; *see also* NIST PRIVACY REPORT, *supra* note 11, at 23 n.48.

[254] ENERGY INFO. ADMIN., ELECTRIC POWER INDUSTRY OVERVIEW (2007) [hereinafter EIA ELECTRIC POWER OVERVIEW], *available at* http://www.eia.gov/cneaf/electricity/page/prim2/toc2.html.

[255] 15 U.S.C. §45(a)(2).

[256] The FTC Act does not further define "persons" or "partnerships" or impose any additional jurisdictional requirements on these entities in the way that it does for "corporations." *See* 15 U.S.C. §44.

[257] 15 U.S.C. §44.

This definition, particularly in its use of the words "shall be deemed to include," suggests that a wide variety of legal entities could potentially constitute "corporations." Moreover, in *California Dental Ass'n v. FTC*, the Supreme Court remarked that the "FTC Act directs the Commission to prevent the *broad set of entities* under its jurisdiction" from violating Section 5.[258] In that case, the Court found that the term "corporation" also included *nonprofit* entities, so long as they imparted significant economic benefit to their members.[259] Thus, as the Court's opinion demonstrates, the key question when determining whether an entity is a "corporation" for the purposes of Section 5 jurisdiction is not what legal form the entity takes, but rather whether the entity is "organized to carry on business for its own profit or that of its members."

Investor-Owned Utilities

Investor-owned utilities are clearly subject to the FTC's Section 5 jurisdiction as "corporations." The EIA defines investor-owned electric utilities as those that "have the fundamental objective of producing a profit for their investors" and distributing these profits as dividends or reinvesting them in the business.[260] These utilities satisfy the definition of "corporation" under the statute because they are companies organized to carry on business for the profit of their investors.[261]

Publicly Owned Utilities

It is unclear whether the FTC has Section 5 jurisdiction over publicly owned utilities. The agency probably lacks jurisdiction over these utilities if it characterizes them as "corporations," but it is possible that it may have jurisdiction over them if it characterizes them as "persons." Publicly owned utilities include "municipals, public utility districts and public power districts, State authorities, irrigation districts, and joint municipal action agencies."[262] The EIA describes these as "nonprofit government entities that are organized at either the local or State level," are exempt from state and federal income taxes, and "provide service to their communities and nearby consumers at cost."[263] In contrast to investor-owned utilities or cooperatively owned utilities, publicly owned utilities obtain capital by issuing debt rather than selling an ownership interest in the utility to investors or members.[264]

As "Corporations"

Publicly owned utilities probably do not fall within the FTC's Section 5 jurisdiction over "corporations" because they are not organized to carry on business for profit. Rather, governments form these utilities for the sole purpose of distributing electricity to consumers at

[258] Cal. Dental Ass'n v. FTC, 526 U.S. 756, 768 (1999) (emphasis added) (internal quotation marks omitted).

[259] *Id.* at 766-69.

[260] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[261] Indeed, the FTC has asserted Section 5 jurisdiction over holding companies with investor-owned electric utility subsidiaries in the past. *See, e.g.*, *DTE Energy Co.*, 131 F.T.C. 962 (May 15, 2001) (complaint); *CMS Energy Corp.*, 127 F.T.C. 827 (June 2, 1999) (complaint). *See also In re* DTE Energy Co., FTC File No. 001 0067 (May 15, 2001) (consent order); *In re* CMS Energy Corp., FTC File No. 991 0046 (June 2, 1999) (consent order).

[262] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[263] *Id.*

[264] DAVID E. MCNABB, PUBLIC UTILITIES: MANAGEMENT CHALLENGES FOR THE 21ST CENTURY 165 (2005).

cost.[265] Significantly, when publicly owned utilities realize net income—that is, revenues they earn in excess of their expenses—they either (1) use it to finance their operations in lieu of issuing more debt,[266] or (2) transfer it to the general fund of the political subdivision that they serve.[267] These utilities typically lack investors or members to which they could distribute net income as dividends.[268] Thus, publicly owned utilities are probably not "organized to carry on business" for profit and are probably exempt from the FTC's Section 5 jurisdiction if characterized as "corporations."

As "Persons"

It is unclear whether a court would find that the FTC has Section 5 jurisdiction over publicly owned utilities as "persons," as a court could employ several different canons of statutory interpretation when deciding whether "persons" includes state or local government entities.[269] In the 1980s, the FTC attempted to assert Section 5 jurisdiction over two state-chartered municipal corporations—the cities of New Orleans and Minneapolis—as "persons," alleging that the cities engaged in unfair methods of competition by assisting taxicab companies in maintaining high prices and stifling competition.[270] The Commission later withdrew both complaints, and thus no court considered whether jurisdiction was proper. More recently, the Commission has asserted jurisdiction over state government agencies that regulate certain professions such as dentistry,[271] optometry,[272] and funeral services.[273]

There appears to be only one court case that engages in a full discussion and interpretation of the meaning of "persons" under Section 5. In *California State Board of Optometry v. FTC*, the D.C. Circuit Court of Appeals considered "whether a State acting in its sovereign capacity is a 'person' within the FTC's enforcement jurisdiction."[274] The FTC had issued a rule declaring "certain state laws restricting the practice of optometry to be unfair acts or practices."[275] Petitioners, which were state boards of optometry and professional associations, argued that the court should strike down the rule because it went beyond the FTC's statutory authority.[276] In vacating the rule, the court found nothing in the relevant provisions of the FTC Act "to indicate that Congress intended to authorize the FTC to reach the 'acts or practices' of States acting in their sovereign capacities."[277]

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[265] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[266] MCNABB, *supra* note 264, at 165.

[267] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[268] MCNABB, *supra* note 264, at 165.

[269] In contrast to entities that are "corporations," the FTC does not have to show that entities qualifying as "persons" are organized for profit. *See* 15 U.S.C. §44.

[270] *In re* City of Minneapolis, 105 F.T.C. 304 (May 7, 1985) (order withdrawing complaint); *In re* City of New Orleans, 105 F.T.C. 1 (Jan. 3, 1985) (order withdrawing complaint).

[271] *In re* N.C. State Bd. of Dental Exam'rs, 151 F.T.C. 607 (Feb. 3, 2011) (state action opinion); *In re* South Carolina State Bd. of Dentistry, 138 F.T.C. 229 (Sept. 12, 2003) (complaint).

[272] *In re* Mass. Board of Registration in Optometry, 110 F.T.C. 549 (June 13, 1988) (decision).

[273] *In re* Va. Bd. of Funeral Dirs. & Embalmers, 138 F.T.C. 645 (Oct. 1, 2004) (complaint).

[274] 910 F.2d 976, 979 (D.C. Cir. 1990).

[275] *Id.* at 978.

[276] *Id.* at 978-79.

[277] *Id.* at 980, 982.

A court approaching the question of whether "persons" includes publicly owned utilities would start with the language of the statute. Courts traditionally give broad deference to an agency when the agency interprets the extent of its own jurisdiction unless the reach of its jurisdiction is clear from reading the statute "under ordinary principles of construction."[278] Attempting to discern the Commission's jurisdiction under Section 5 of the FTC Act is difficult, as the statute does not define the term "persons" for the purposes of that provision. Title 1, Section 1 of the United States Code (the Dictionary Act) provides: "In determining the meaning of any Act of Congress, *unless the context indicates otherwise* ... the words 'person' and 'whoever' include corporations, companies, associations, firms, partnerships, societies, and joint stock companies, as well as individuals."[279]

However, the context in which "persons" appears in Section 5 probably forecloses the use of the default definition of "person" in the Dictionary Act. In Section 5, Congress listed the terms "persons," "partnerships," and "corporations" separately, which indicates that it intended to give each term independent significance. The terms "corporations" and "partnerships" would not have independent meaning in Section 5 if the term "persons" in Section 5 included the entities listed in the Dictionary Act. Furthermore, the FTC Act requires that "corporations" be organized for their own profit or the profit of their members in order for the FTC to exercise jurisdiction over them—a requirement it does not impose on the other entities.[280] By reading the term "persons" to include the entities listed in the Dictionary Act, the FTC could evade this additional requirement simply by bringing its complaint against an entity as a "person" rather than a "corporation"—a result that Congress probably did not intend. Thus, a court that ended its analysis here could find that the meaning of "persons" remains ambiguous. The court could then choose to defer to the FTC's broad interpretation of its own jurisdiction under the Supreme Court's decision in *Chevron U.S.A., Inc. v. NRDC, Inc.*[281]

The *California Optometry* court, however, declined to defer to the FTC's interpretation of its own jurisdiction because it found that principles of federalism outweighed *Chevron* deference.[282] Quoting the Supreme Court's decision in *Will v. Michigan Department of State Police*,[283] the

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[278] *See* Cal. Dental Ass'n v. FTC, 526 U.S. 756, 765-66 (1999) ("Respondent urges deference to this interpretation of the Commission's jurisdiction as reasonable. But we have no occasion to review the call for deference here, the interpretation urged in respondent's brief being clearly the better reading of the statute under ordinary principles of construction.") (internal citations omitted); *see also* Chevron U.S.A., Inc. v. NRDC, Inc., 467 U.S. 837, 842-43 (1984).

[279] 1 U.S.C. §1 (emphasis added).

[280] *See* 15 U.S.C. §44.

[281] *Chevron*, 467 U.S. at 842-43. In that case, the Court held that

> When a court reviews an agency's construction of the statute which it administers, it is confronted with two questions. First, always, is the question whether Congress has directly spoken to the precise question at issue. If the intent of Congress is clear, that is the end of the matter; for the court, as well as the agency, must give effect to the unambiguously expressed intent of Congress. If, however, the court determines Congress has not directly addressed the precise question at issue, the court does not simply impose its own construction on the statute, as would be necessary in the absence of an administrative interpretation. Rather, if the statute is silent or ambiguous with respect to the specific issue, the question for the court is whether the agency's answer is based on a permissible construction of the statute. *Id.*

[282] Todd H. Cohen, *Double Vision: The FTC, State Regulation, and Deciding What's Best for Consumers*, 59 GEO. WASH. L. REV. 1249, 1267 (1991) ("In sum, the *California State Board of Optometry* court relied on federalism principles to justify protecting state interests. The court extended the judicially-created *Parker* state action doctrine to cover FTC trade regulation rules and applied the clear statement doctrine to prevent the FTC from invalidating a state law as unfair without additional congressional action.").

[283] 491 U.S. 58 (1989).

California Optometry court stated that "in common usage, the term person does not include the sovereign, and statutes employing the word are ordinarily construed to exclude it."[284] In the *Will* case, the Court considered whether the term "person" as it appeared in 42 U.S.C. §1983 included a state.[285] The Court held that it did not, invoking the principles of federalism when it wrote that "[t]his approach is particularly applicable where it is claimed that Congress has subjected the States to liability to which they had not been subject before."[286] The Court found that the statute's language fell "far short of satisfying the ordinary rule of statutory construction that if Congress intends to alter the 'usual constitutional balance between the States and Federal Government,' it must make its intention to do so 'unmistakably clear in the language of the statute.'"[287]

The Court's decision in *Will*, as interpreted by the D.C. Circuit in *California Optometry*, suggests that Congress must clearly indicate in a particular statute when it wishes to subject states to a new form of liability, particularly when this would change the balance between state and federal authority by intruding on the actions a state takes in its sovereign capacity. There does not appear to be a clear indication that Congress intended the word "persons" in the FTC Act to subject publicly owned utilities to FTC enforcement actions.[288] Thus, if the FTC's enforcement of Section 5 against a publicly owned utility would alter the balance between the state and federal governments, a court might read "persons" to exclude these utilities. As the *California Optometry* court indicated, whether the balance is altered may depend on whether the operation of the utility amounts to the state acting in its sovereign capacity (balance altered) or merely engaging in a proprietary function (balance not altered).[289] The *California Optometry* court suggested that whether a state is acting in its sovereign capacity or engaging in a proprietary function may vary according to the antitrust laws' state action doctrine, a multi-pronged analysis that is beyond the scope of this report.[290] If a court found that the state was acting in its sovereign capacity when the state (or one of its subdivisions) operated an electric utility, the court could hold that the FTC does not have Section 5 jurisdiction because of the federalism principles and clear statement rule that guided the interpretation of the statute in *Will* and were adopted by the court in *California Optometry*.[291]

A third possible choice for a court would be to adopt the reasoning of the FTC and find that Congress clearly intended "persons" to include government entities, because under the other antitrust laws, the term "persons" includes state and local government entities, and the antitrust

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[284] *California Optometry*, 910 F.2d 976, 980 (D.C. Cir. 1990) (internal quotation marks omitted).

[285] *Will*, 491 U.S. at 60.

[286] *Id.* at 64.

[287] *Id.* at 65 (citations omitted).

[288] Representative Covington, the sponsor of the act, explained during floor debate on the measure that Section 5 "embraces within the scope of that section every kind of person, natural or artificial, who may be engaged in interstate commerce."51 CONG. REC. 14,928 (1914). Despite this remark, courts have not taken such a broad view of the FTC's jurisdiction under the act. Even the Supreme Court has held that there are some limits on the entities covered by Section 5. *See* Cal. Dental Ass'n v. FTC, 526 U.S. 756, 766-67 (1999) (requiring, for jurisdiction, that a "proximate relation" must exist between the activities of a nonprofit and the benefit it provides to its members, and implying that the activities must confer "more than *de minimis* or merely presumed economic benefits" on the members).

[289] *See California Optometry*, 910 F.2d at 980-81 ("This rule of statutory construction serves to ensure that the States' sovereignty interests are adequately protected by the political process.").

[290] *Id.* at 980. For more information on the factors that courts consider when making this determination, see FED. TRADE COMM'N, REPORT OF THE STATE ACTION TASK FORCE (2003), *available at* http://www.ftc.gov/os/2003/09/stateactionreport.pdf.

[291] *See* Cohen, *supra* note 282, at 1267.

laws, including the FTC Act,[292] should be read together.[293] The *California Optometry* court acknowledged this argument, writing that "several Supreme Court decisions hold that a State *is* a person for purposes of the antitrust laws."[294] The court ultimately rejected the argument, however, because it found that "when a State acts in a sovereign rather than a proprietary capacity, it is exempt from the antitrust laws even though those actions may restrain trade," and that this state action doctrine may "limit the reach of the FTC's enforcement jurisdiction."[295] Thus, if a court found that a state acted in its *proprietary* capacity when the state (or one of its subdivisions) operated a public utility, then the state action doctrine would not apply, and it would be possible for a court to find jurisdiction even under the *California Optometry* case. The FTC has advanced this reasoning, arguing that the state boards over which it asserts jurisdiction do not amount to the states acting in their sovereign capacities.[296] Whether the operation of a particular publicly owned utility consists of the state acting in its sovereign capacity or engaging in a proprietary function may vary according to the antitrust laws' state action doctrine, a multi-pronged analysis that is beyond the scope of this report.[297]

Thus, whether a court would find that the word "persons" in Section 5 includes certain government entities such as publicly owned utilities is unclear because it may depend on which, if any, of several principles of statutory construction the court adopts. A court could, among other options: (1) find that the meaning of "persons" in Section 5 is ambiguous, and thus defer to the FTC's broad interpretation of its own jurisdiction because of the *Chevron* doctrine; (2) find that the statute is ambiguous, but that principles of federalism outweigh the court's usual *Chevron* deference to the Commission's interpretation of its own jurisdiction—a determination that may require a court to find that the state is acting in its sovereign capacity when the state (or one of its subdivisions) operates an electric utility; or (3) find that Congress clearly intended "persons" to include government entities because Section 5 should be read together with the other antitrust laws, under which the term "person" includes state and local government entities—a determination that may require a court to find that the state is performing a proprietary function when the state (or one of its subdivisions) operates a utility.

Federally Owned Utilities

It is unclear whether the FTC could enforce Section 5 against a federally owned utility. Indeed, there does not appear to be any case in which the FTC has sought to enforce Section 5 against a federal agency.[298] The FTC probably lacks Section 5 jurisdiction over the nine federally owned

[292] Although this report focuses on the FTC's consumer law cases under Section 5 ("unfair or deceptive acts or practices"), and not its antitrust cases ("unfair methods of competition"), both types of prohibited activities share the same phrase for the purposes of determining the agency's jurisdiction: "persons, partnerships, or corporations." *See* 15 U.S.C. §45(a)(2).

[293] *See In re* Mass. Board of Registration in Optometry, 110 F.T.C. 549 (June 13, 1988) (decision) (citations omitted).

[294] *California Optometry*, 910 F.2d at 980 (citations omitted).

[295] *Id.* at 980 (citation omitted).

[296] *See, e.g.*, *In re* N.C. State Bd. of Dental Exam'rs, 151 F.T.C. 607 (Feb. 3, 2011) (state action opinion); *In re* Mass. Board of Registration in Optometry, 110 F.T.C. 549 (June 13, 1988) (decision).

[297] For more information on the factors that courts consider when making this determination, see FED. TRADE COMM'N, REPORT OF THE STATE ACTION TASK FORCE (2003), *available at* http://www.ftc.gov/os/2003/09/stateactionreport.pdf.

[298] This report does not consider whether any constitutional implications would result if the FTC, an independent executive branch agency, brought an enforcement proceeding against another executive branch agency. *See generally* Michael Eric Herz, *When Can the Federal Government Sue Itself?*, 32 WM. & MARY L. REV. 893 (1991).

utilities operating in the United States[299] if it characterizes them as "corporations." Like publicly owned utilities, federally owned utilities are not organized for profit. As the EIA notes, "federal power is not sold for profit, but to recover the costs of operations and repay the Treasury for funds borrowed to construct generation and transmission facilities."[300] If the Commission characterizes these utilities as "persons," it is unclear whether a court would find that this term includes government entities.[301]

As a practical matter, FTC enforcement of Section 5 against federally owned utilities is probably unnecessary in the context of smart meter data because of other federal laws, such as the Privacy Act,[302] that would likely protect this data when it is stored in records systems maintained by federal agencies, including federally owned utilities.[303]

Cooperatively Owned Utilities

For-profit electric cooperatives would clearly fall within the Commission's Section 5 jurisdiction over "corporations" operated for their own profit or that of their members.[304] Indeed, the FTC has maintained jurisdiction over for-profit cooperatives as "corporations" in the past, including a rural healthcare cooperative[305] and a wine maker.[306] However, it appears that most electric cooperatives—and particularly the cooperatives that will receive funds under the Department of Energy's Smart Grid Investment Grant program—are nonprofits.[307]

It is possible that the FTC would have Section 5 jurisdiction over these nonprofit electric cooperatives as "corporations" organized for profit. These distribution utilities are owned by the "consumers they serve," and those that are tax-exempt must "provide electric service to their members at cost, as that term is defined by the Internal Revenue Service."[308] However, when the activities of a cooperative result in revenues that exceed the cooperative's costs, these "net margins ... are considered a contribution of equity by the members that are required to be returned to the members consistent with the organization's bylaws and lender limitations imposed as a condition of loans."[309] Thus, in contrast to publicly owned utilities, which typically transfer any net income to the general fund of the government that they serve, electric cooperatives return net margins to their members as equity, and when that equity is retired by the board of directors, members receive cash payments.[310] Although it does not appear that a court has considered

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[299] EIA ELECTRIC POWER OVERVIEW, *supra* note 254. Among these utilities are the Tennessee Valley Authority, the four power marketing administrations in the Department of Energy, and the Army Corps of Engineers. *Id.*

[300] *Id.*

[301] *See supra* notes 269-97 and accompanying text.

[302] 5 U.S.C. §552a.

[303] *See* "The Federal Privacy Act of 1974," *infra* p. 45.

[304] 15 U.S.C. §44.

[305] *In re* Minn. Rural Health Coop., FTC File No. 051 0199 (Dec. 28, 2010) (decision and order).

[306] *In re* Heublein, Inc., 96 F.T.C. 385 (Oct. 7, 1980) (final order).

[307] *See* DEP'T OF ENERGY, CASE STUDY – NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION SMART GRID INVESTMENT GRANT 1, *available at* http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/NRECA_case_study.pdf.

[308] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[309] *Id.* "Net margins" is the term given to "revenues in excess of the cost of providing service." *Id.*

[310] *See, e.g.*, Cent. Rural Electric Coop., Patronage Capital, http://www.crec.coop/CRECAdvantage/PatronageCapital/tabid/711/Default.aspx ("Allocated patronage capital appears as an entry on the permanent financial records of the (continued...)

whether the FTC has Section 5 jurisdiction over a nonprofit electric cooperative that returns its net margins to its consumer-members in addition to providing them with electricity service, the Supreme Court, as well as lower federal courts, have issued guidance on factors that a court may consider in answering this question.

Applicable Law

Under Section 5, the FTC Act requires that a "corporation" be "organized to carry on business for its own profit *or that of its members*."[311] In *California Dental Ass'n v. FTC*, the Court considered whether the FTC could enforce Section 5 against a "voluntary nonprofit association of local dental societies" that was exempt from paying federal income tax and furnished its members with "advantageous insurance and preferential financing arrangements" in addition to lobbying, litigating, and advertising on their behalf.[312] The Court found that the FTC had jurisdiction over the California Dental Association as a "corporation," stating that

> the FTC Act is at pains to include not only an entity "organized to carry on business for its own profit," but also one that carries on business for the profit "of its members." While such a supportive organization may be devoted to helping its members in ways beyond immediate enhancement of profit, no one here has claimed that such an entity must devote itself single-mindedly to the profit of others. It could, indeed, hardly be supposed that Congress intended such a restricted notion of covered supporting organizations, with the opportunity this would bring with it for avoiding jurisdiction where the purposes of the FTC Act would obviously call for asserting it.[313]

The Court declined to specify the percentage of a nonprofit entity's activities that must be "aimed at its members' pecuniary benefit" to subject it to FTC jurisdiction.[314] However, the Court wrote that a "proximate relation" must exist between the activities of the entity and the profits of its members, and implied that the activities must confer "more than *de minimis* or merely presumed economic benefits" on the members.[315] The Court's justification for this result was that "nonprofit entities organized on behalf of for-profit members have the same capacity and derivatively, at

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cooperative and reflect [sic] your equity or ownership in CREC. When patronage capital is retired, a check or bill credit is issued to you and your equity in the cooperative is reduced. ... When considering a retirement, the board analyzes the financial health of the cooperative and will not authorize a retirement that will adversely affect the financial integrity of the cooperative."); Fall River Rural Electric Coop., Patronage Capital, http://www.frrec.com/myAccount/patronageCapital.aspx ("The Cooperative's Board of Directors retires patronage capital when finances allow, often on an annual basis. The oldest patronage capital is retired first. Fall River currently retires patronage capital on a rotation of approximately 20 years."); Kauai Island Util. Coop., Member Patronage Capital Information, http://www.kiuc.coop/member_patcap-qa.htm ("A portion of Patronage Capital may be periodically paid to the members upon approval of the Board of Directors and our lenders."); Sulphur Springs Valley Electric Coop., Inc., Patronage Capital Credits, http://www.ssvec.org/?page_id=583 ("Capital credits represent your share of the Cooperative's margins – margins are the operating revenue remaining after operating expenses. The amount assigned in your name depends on your energy purchases. To calculate this, we divide your annual energy purchase by the Cooperative's operating income for the year. The more electricity you buy, the more capital credits you earn.").

[311] 15 U.S.C. §44 (emphasis added).

[312] 526 U.S. 756, 759-60, 767 (1999).

[313] *Id.* at 766 (internal citations omitted).

[314] *Id.*

[315] *Id.* at 766-67.

least, the same incentives as for-profit organizations to engage in unfair methods of competition or unfair and deceptive acts."[316]

It is clear that the FTC may still have Section 5 jurisdiction even when the benefits that a nonprofit provides to its members are secondary to its charitable functions. In *American Medical Ass'n v. FTC*, the Second Circuit considered whether the FTC could enforce Section 5 against three medical professional associations, including the American Medical Association (AMA), a nonprofit corporation composed of "physicians, osteopaths, and medical students."[317] The court, acknowledging that the associations served "both the business and non-business interests of their member physicians," found jurisdiction because the "business aspects" of their activities, including lobbying for members and offering business advice to them, subjected them to the FTC's jurisdiction despite the fact that the business aspects "were considered secondary to the charitable and social aspects of their work."[318]

When determining whether jurisdiction exists, a court may consider other factors in addition to the benefits that the nonprofit provides to its members. In *Community Blood Bank v. FTC*, the Eighth Circuit considered whether a "corporation" included all nonprofit corporations.[319] The appeals court held that the FTC lacked Section 5 jurisdiction over nonprofit blood banks because the banks' activities did not result in "profit" in the sense of "gain from business or investment over and above expenditures."[320] The blood banks, the court observed, lacked shares of capital, capital stock, or certificates, and were "organized for and actually engaged in business for only charitable purposes."[321] One bank's articles of incorporation touted the entity's charitable purposes, and all of the banks were exempt from paying federal income taxes.[322] Upon dissolution, the corporations would transfer their assets to other charitable or nonprofit organizations.[323] In addition, none of the funds collected by the blood banks had "ever been distributed or inured to the benefit of any of their members, directors or officers."[324] The court found that these factors made the blood banks "charitable organizations" both "in law and in fact," exempting them from the FTC's Section 5 jurisdiction.[325]

Analysis

The case law suggests several factors that a court may weigh when determining whether a private, nonprofit entity composed of members, such as an electric cooperative, is subject to the FTC's Section 5 jurisdiction as a "corporation."[326] The most significant factor is whether the nonprofit

[316] *Id.* at 768.

[317] 638 F.2d 443, 446 (1980).

[318] *Id.* at 448. The court noted in passing that the AMA's articles of incorporation stated that one purpose of the organization was to "safeguard the material interests of the medical profession." *Id.*

[319] 405 F.2d 1011, 1015 (8th Cir. 1969).

[320] *See id.* at 1017. The court also remarked that at least one case had established that "even though a corporation's income exceeds its disbursements its nonprofit character is not necessarily destroyed." *Id.*

[321] *Id.* at 1020, 1022.

[322] *Id.* at 1020.

[323] *Id.*

[324] *Id.*

[325] *Id.* at 1019.

[326] This analysis assumes that a court would extend the holdings of the applicable case law, which covered entities organized as nonprofit corporations and professional associations, to include entities organized as nonprofit electric (continued...)

provides an economic benefit to its members that is more than *de minimis* and that is proximately related to the nonprofit's activities. This benefit need not be the sole—or even primary—function of the nonprofit. Additional factors that the case law suggests weigh in favor of a finding of jurisdiction include that the nonprofit: (1) has gain from its business or investments that exceeds its expenditures; (2) has shares of capital or capital stock or certificates; (3) is not organized solely for charitable purposes or does not engage only in charitable work; (4) has articles of incorporation that list profit-seeking objectives; (5) is subject to federal income tax liability; (6) would distribute its assets to profit-seeking entities upon dissolution; and (7) distributes any of the funds it collects to its members, directors, or officers.

It is possible that the FTC has Section 5 jurisdiction over nonprofit electric cooperatives, although the outcome in any particular case may depend on the characteristics of the individual utility. A court could find that the typical nonprofit electric cooperative provides "economic benefit" to its members in at least two ways: (a) by providing electricity service to members;[327] and (b) by returning net margins to members in the form of patronage capital, which is an ownership interest in the cooperative that is later converted to cash payments to members when that capital is retired.[328] With regard to (a), it is likely that a court would find that electricity service is an "economic benefit" as defined in the case law. In *California Dental Ass'n*, the nonprofit professional association provided "advantageous insurance and preferential financing arrangements," as well as lobbying, litigation, and advertising services to its members.[329] In *American Medical Ass'n*, the nonprofit lobbied on behalf of its members and offered business advice to members.[330] These benefits, it is assumed, enabled the members to more easily conduct business profitably. Electricity service allows people to conduct activities at all times of the day, and thus provides a similar and clearly significant economic benefit to those who use it, whether for business or recreational purposes. As the primary objective of an electric cooperative is to provide electricity service to members, the necessary proximate relation between the activities of the nonprofit and the benefit to its members clearly exists.

Despite its pecuniary nature, there are a few problems with considering benefit (b), patronage capital, to be an "economic benefit" as defined by the Court. First, it is not clear that patronage capital actually is a benefit. A court could view patronage capital as a no-interest *loan* from the consumer-member to the utility,[331] or, because it is typically allocated to member accounts in a manner proportional to members' spending on electricity, simply a *refund* of money collected from the members that reflects the actual cost of providing service in a particular year.[332] If

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cooperatives.

[327] Many cooperatives provide other services to their communities that could constitute "economic benefits." The National Rural Electric Cooperative Association notes that, "In addition to electric service, many electric co-ops are involved in community development and revitalization projects" that include "small business development and jobs creation, improvement of water and sewer systems, and assistance in delivery of health care and educational services." Nat'l Rural Electric Coop. Ass'n, Member Directory, http://www.nreca.coop/members/MemberDirectory/Pages/default.aspx.

[328] *See* sources cited *supra* note 310.

[329] Cal. Dental Ass'n v. FTC, 526 U.S. 756, 759-60, 767 (1999).

[330] Am. Med. Ass'n v. FTC, 638 F.2d 443, 448 (1980).

[331] *See, e.g.*, Cent. Rural Electric Coop., Patronage Capital, http://www.crec.coop/CRECAdvantage/PatronageCapital/tabid/711/Default.aspx ("These margins represent an interest-free loan of operating capital by the membership to the cooperative.").

[332] *See, e.g.*, Kauai Island Util. Coop., Member Patronage Capital Information, http://www.kiuc.coop/member_patcap-(continued...)

adopted by a court, neither of these characterizations would appear to be consistent with the "profit" that the statute describes[333] or the "economic benefit" that the Supreme Court requires for a nonprofit to be a "corporation."

Second, even if a court found patronage capital to be an economic benefit, it is not clear that it is more than *de minimis*. Patronage capital must be "retired" before members receive cash payments for it.[334] Retirements are made at the discretion of the cooperative's board of directors because the capital is needed to finance the cooperative's ongoing expenses, and thus retirement of a class of capital typically occurs after a long rotation period, such as 20 years.[335] Although the Supreme Court did not hold that an "economic benefit" must produce *immediate* advantage to the members of a nonprofit, a court could potentially view the decades-long delay in cash payments as significantly decreasing the degree of economic benefit that the capital provides. In addition, patronage capital would probably be considered *de minimis* if the cooperative's net margins were small, as this would mean that little capital would be issued to members. It is thus difficult to discern whether a court would find that an economic benefit accrues to members as a result of their receipt of patronage capital, which nevertheless probably bears the requisite "proximate relation" to the activities of the cooperative that produce any net margins distributed as capital.

With regard to the additional factors, those favoring jurisdiction include (2) cooperatives typically have shares of capital stock, including patronage capital;[336] (3) cooperatives do not operate solely for the benefit of the people outside of the organization like the nonprofits in *Community Blood Bank* did because cooperatives provide electricity service and patronage capital to their members;[337] and (7) an electric cooperative typically returns any net margins to members in the form of patronage capital, an ownership interest refunded to consumer-members as cash when the capital is retired.[338] Factors that cannot be evaluated because they are specific to each individual cooperative include (1) whether the revenues of the cooperative exceed its expenditures; (4) the particular objectives listed in a cooperative's articles of incorporation or other foundational document; (5) whether a nonprofit electric cooperative is exempt from federal income tax liability, which depends on whether it meets the requirements under Section 501(c)(12) of the Internal Revenue Code;[339] and (6) whether a cooperative would distribute its assets to profit-seeking entities upon dissolution—a factor that also may depend on state laws.[340]

It is likely that a court would find that nonprofit electric cooperatives impart economic benefits to their members by distributing electricity to them or, possibly, by issuing patronage capital to them. However, because many of the other factors that courts consider may differ for each

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qa.htm (characterizing the retirement of patronage capital as a "refund").

[333] 15 U.S.C. §44.

[334] *See* sources cited *supra* note 310.

[335] *See id.*

[336] *See* Nat'l Rural Electric Coop. Ass'n, Seven Cooperative Principles, http://www.nreca.coop/members/SevenCoopPrinciples/Pages/default.aspx (describing "Members' Economic Participation").

[337] Whether electricity service and patronage capital, which are clearly benefits, constitute "economic benefits" within the meaning of the Supreme Court's holding in *California Dental Ass'n* is a separate question.

[338] *See* sources cited *supra* note 310.

[339] I.R.C. §501(c)(12).

[340] *See* Cmty. Blood Bank v. FTC, 405 F.2d 1011, 1020 (8th Cir. 1969).

particular cooperative, it is not possible to draw any general conclusions about whether the FTC would have Section 5 jurisdiction over these entities as "corporations."

Enforcement of Data Privacy and Security

If the FTC has Section 5 jurisdiction over a particular electric utility, it may bring an enforcement action against the utility if its privacy or security practices with regard to consumer smart meter data constitute "unfair or deceptive acts or practices in or affecting commerce."[341] The FTC Act defines an "unfair" act or practice as one that "causes or is likely to cause substantial injury to consumers which is not reasonably avoidable by consumers themselves and not outweighed by countervailing benefits to consumers or to competition."[342] According to the FTC, an act or practice is "deceptive" if it is a material "representation, omission or practice" that is likely to mislead a consumer acting reasonably in the circumstances.[343] The history of the Commission's enforcement of consumer data privacy and security practices shows that the agency has brought complaints against entities that (1) engage in "deceptive" acts or practices by failing to comply with their stated privacy policies; or (2) employ "unfair" practices by failing to adequately secure consumer data from unauthorized parties.[344] Often, conduct constituting a violation could fall under either category, as a failure to protect consumer data may be an unfair practice because of the unavoidable injury it causes, as well as a deceptive practice because it renders an entity's privacy policy materially misleading.

"Deceptive" Privacy Statements

A utility that fails to comply with its own privacy policy may engage in a "deceptive" act or practice under Section 5 of the FTC Act. In *Facebook, Inc.*, the FTC alleged, among other things, that the social networking site violated promises contained in its privacy policy when it made users' personal information accessible to third parties without users' consent.[345] Facebook had claimed that users could limit third-party access to their personal information on the site. Despite this promise, applications run by users' Facebook friends were able to access the users' personal information. The Commission also charged that Facebook altered its privacy practices without users' consent, causing personal information that had been restricted by users to be available to third parties. This change, which allegedly "caused harm to users, including, but not limited to, threats to their health and safety, and unauthorized revelation of their affiliations" constituted both a "deceptive" and an "unfair" practice in the view of the Commission.[346] Finally, the Commission alleged that Facebook had represented to users that it would not share their personal information with advertisers but had done so anyway.

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[341] 15 U.S.C. §45(a)(1). For more details on FTC enforcement of consumer data privacy and security under Section 5, see CRS Report RL34120, *Federal Information Security and Data Breach Notification Laws*, by Gina Stevens.

[342] 15 U.S.C. §45(n).

[343] *In re* Cliffdale Assocs., Inc., 103 F.T.C. 110, 174 (1984) (policy statement at end of opinion).

[344] *See Consumer Privacy: Hearing Before the S. Comm. on Commerce, Sci., and Transp.*, 11th Cong. (2010) (statement of Jon D. Leibowitz, Chairman, Fed. Trade Comm'n) (describing the FTC's enforcement activity in the areas of consumer data privacy and security), *available at* http://www.ftc.gov/os/testimony/100727consumerprivacy.pdf. The FTC recently released a preliminary report on the consumer privacy implications of new technologies. FED. TRADE COMM'N, PROTECTING CONSUMER PRIVACY IN AN ERA OF RAPID CHANGE: A PROPOSED FRAMEWORK FOR BUSINESSES AND POLICYMAKERS (2010), *available at* http://www.ftc.gov/os/2010/12/101201privacyreport.pdf.

[345] FTC File No. 092 3184 (Nov. 29, 2011) (complaint).

[346] *Id.*

In *Twitter, Inc.*, the FTC alleged that the social networking site engaged in "deceptive" acts when it violated claims made in its privacy policy about the security of consumer data by failing to "use reasonable and appropriate security measures to prevent unauthorized access to nonpublic user information."[347] The Commission found that Twitter had permitted its administrators to access the site with easy-to-guess passwords and failed to limit the extent of administrators' access according to the requirements of their jobs. In a consent order, the company agreed not to misrepresent its privacy controls and to implement a comprehensive information security program that would be assessed by an independent third party.[348]

As smart meter data becomes valuable to third parties,[349] utilities may be tempted to sell or share this information with others to increase revenues and provide new services to their customers. If prohibited by the terms of the utility's privacy policy, it may be a "deceptive" act or practice for the utility to share a consumer's personal information with third parties without a consumer's consent.[350] The FTC could also find deception when a utility represents that its privacy controls are capable of protecting smart meter data when, in fact, they are not.

"Unfair" Failure to Secure Consumer Data

Failure to Protect Against Common Technology Threats or Unauthorized Access

The FTC may consider it an "unfair" practice when an electric utility fails to safeguard smart meter data from well-known technology threats as the data travels across the utility's communications networks. For example, in *DSW Inc.*, the FTC brought enforcement proceedings against the respondent, the owner of several shoe stores.[351] The agency alleged that the respondent failed to protect customers' credit card and check information as it was transmitted to the issuing bank for authorization. The information collected at the register traveled wirelessly to the store's computer network, and from there to the bank or check processor, which communicated its response back to the store through the same channels. The agency charged that

> [a]mong other things, respondent (1) created unnecessary risks to the information by storing it in multiple files when it no longer had a business need to keep the information; (2) did not use readily available security measures to limit access to its computer networks through wireless access points on the networks; (3) stored the information in unencrypted files that could be accessed easily by using a commonly known user ID and password; (4) did not limit sufficiently the ability of computers on one in-store network to connect to computers on other in-store and corporate networks; and (5) failed to employ sufficient measures to detect unauthorized access. As a result, a hacker could use the wireless access points on one in-store computer network to connect to, and access personal information, on the other in-store and corporate networks.[352]

[347] FTC File No. 092 3093 (Mar. 2, 2011) (complaint).

[348] FTC File No. 092 3093 (Mar. 2, 2011) (decision and order)

[349] NIST PRIVACY REPORT, *supra* note 11, at 14, 35-36.

[350] As suggested below, it may also be an "unfair" practice, regardless of whether the utility has a privacy policy.

[351] FTC File No. 052 3096 (Mar. 7, 2006) (complaint).

[352] *Id.*

Similarly, in *Cardsystems Solutions, Inc.*, the Commission brought a complaint against a credit and debit card authorization processor.[353] The FTC alleged that the respondent failed to protect its systems by neglecting to guard its network against "commonly known or reasonably foreseeable attacks" that could be avoided using low-cost methods.[354] As part of settlement agreements in *DSW* and *Cardsystems*, the respondents had to create "a comprehensive information security program" to protect consumer information that would be assessed periodically by an independent third party.[355]

Smart meters also transmit personal consumer information, often wirelessly, across several different communications networks located in various physical places.[356] Thus, it is possible that the FTC would view a utility's failure to protect smart meter data against common technology threats as an "unfair" practice if the utility could have avoided the threats by using low-cost methods such as encrypting the data; storing it in fewer places and for no longer than needed; implementing basic wireless network security; and taking other reasonable measures suggested by the agency in *DSW Inc.*

Failure to Dispose of Data Safely

A utility's failure to dispose of smart meter data safely may also constitute an "unfair" practice under Section 5. For example, in *Rite Aid Corp.*, the respondent, the owner of retail pharmacy stores, purportedly failed to safely dispose of personal information in its possession when it neglected to: "(1) implement policies and procedures to dispose securely of such information," including rendering "the information unreadable in the course of disposal; (2) adequately train employees to dispose securely of such information; (3) use reasonable measures to assess compliance with its established policies and procedures for the disposal of such information; and (4) employ a reasonable process for discovering and remedying risks to such information."[357] The information was later found in various publicly accessible garbage dumpsters in readable form. This suggests that utilities holding smart meter data and other personal information, whether on electronic or physical media, must ensure that the methods used to destroy this data render it unreadable to third parties.

Penalties

There is no private right of action in the FTC Act. If the Commission has "reason to believe" that a violation has occurred, it may, after notice to the respondent and an opportunity for a hearing, issue an order directing the respondent to cease and desist from acts or practices that the agency finds violate the act.[358] If the respondent disobeys an order that has become final, the U.S. Attorney General may bring an action in district court seeking the imposition of civil monetary

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[353] FTC File No. 052 3148 (Sept. 5, 2006) (complaint).

[354] *Id.*

[355] *See, e.g.*, *In re* Cardsystems Solutions, Inc., FTC File No. 052 3148 (Sept. 5, 2006) (decision and order).

[356] NIST PRIVACY REPORT, *supra* note 11, at 23.

[357] FTC File No. 072 3121 (Nov. 12, 2010) (complaint).

[358] 15 U.S.C. §45(b). The Commission may seek a preliminary injunction in district court if it "has reason to believe" that an entity subject to the Commission's jurisdiction "is violating, or is about to violate, any provision of law enforced" by the FTC, and such an injunction would be in the public interest. 15 U.S.C. §53(b). In "proper cases the Commission may seek, and after proper proof, the court may issue, a permanent injunction." *Id.*

penalties of up to $16,000 per violation ($16,000 per day for continuing violations), as well as further injunctive and equitable relief that the court deems appropriate.[359]

After a party becomes subject to a final cease and desist order under the act, the Commission may seek redress for consumers by bringing suit in state or federal court against the party if the Commission "satisfies the court that the act or practice to which the cease and desist order relates is one which a reasonable man would have known under the circumstances was dishonest or fraudulent."[360] "Such relief may include, but shall not be limited to, rescission or reformation of contracts, the refund of money or return of property, the payment of damages," and public notification of the violation, "except nothing in [15 U.S.C. §57b(b)] is intended to authorize the imposition of any exemplary or punitive damages."[361] Once the Commission has issued a final cease and desist order (not a consent order) finding an act or practice to be deceptive, then it may bring suit in district court to obtain a civil penalty against an entity that engages in that act or practice: (1) after the order became final ("whether or not such person, partnership, or corporation was subject to such cease and desist order"); and (2) "with actual knowledge that such act or practice is unfair or deceptive and is unlawful" under Section 5 of the FTC Act.[362]

The Federal Privacy Act of 1974 (FPA)

Smart meter electricity usage data pertaining to U.S. citizens or permanent residents that is retrievable by personal identifier from a system of records maintained by any federal "agency," including federally owned utilities, is subject to the protections contained in the Privacy Act[363] when it is maintained, collected, used, or disseminated by the agency.

Federally Owned Utilities as "Agencies"

All nine of the federally owned utilities are federal agencies covered by the Privacy Act. For the purposes of the act, the term "agency" includes, but is not limited to, "any executive department, military department, Government corporation, Government controlled corporation, or other establishment in the executive branch of the Government (including the Executive Office of the President), or any independent regulatory agency."[364] According to EIA, utilities that are part of an executive department include the four power marketing administrations in the Department of Energy (Bonneville, Southeastern, Southwestern, and Western), the International Boundary and Water Commission in the Department of State, and the Bureau of Indian Affairs and the Bureau

[359] 15 U.S.C. §45(l). The size of the civil monetary penalty was last adjusted for inflation in 2009. 16 C.F.R. §1.98.

[360] 15 U.S.C. §57b(a)(2).

[361] 15 U.S.C. §57b(b).

[362] 15 U.S.C. §45(m)(1)(B).

[363] 5 U.S.C. §552a. The federally owned utilities primarily sell electricity to nonprofit electric utilities on the wholesale markets rather than distribute electricity directly to consumers. EIA ELECTRIC POWER OVERVIEW, *supra* note 254. As these utilities provide only about 1% of total sales of electricity to end user consumers, *id.*, they may be unlikely to acquire consumer smart meter data, which is typically transmitted to distribution utilities. However, as the smart grid becomes more interconnected, more utilities at different points in the smart grid may come into possession of this data. NIST PRIVACY REPORT, *supra* note 11, at 23.

[364] *See* 5 U.S.C. §552(f)(1). The act also covers data in a "system of records" operated by a government contractor on behalf of a federal agency. *See* 5 U.S.C. §552a(m).

PAGE # 141

of Reclamation in the Department of the Interior.[365] The U.S. Army Corps of Engineers resides in the Department of Defense, which is an executive department.[366] The Tennessee Valley Authority is a government-owned corporation.[367]

Smart Meter Data as a Protected "Record"

The Privacy Act protects the type of electricity usage data gathered by smart meters, provided that the data pertains to U.S. citizens or permanent residents, is personally identifiable, and is retrievable by the individual's name or another personal identifier. The Privacy Act "governs the collection, use, and dissemination of a 'record' about an 'individual' maintained by federal agencies in a 'system of records.'"[368] Under the statute, a "record" is "any item, collection, or grouping of information about an individual that is maintained by an agency ... that contains his name, or the identifying number, symbol, or other identifying particular assigned to the individual, such as a finger or voice print or a photograph."[369]

An "individual" is defined as "a citizen of the United States or an alien lawfully admitted for permanent residence."[370] A "system of records" is "a group of any records under the control of any agency from which information is retrieved by the name of the individual" or other personal identifier "assigned to the individual."[371]

Smart meter data held by an agency certainly fits within the broad definition of a "record" because it is a grouping of information about an individual, namely, data on that individual's electricity usage. The data is typically stored along with a consumer's account information, which usually includes a consumer's name, social security number, or other "identifying particular."[372] Thus, smart meter data would constitute a protected "record" under the Privacy Act, assuming that it pertains to a citizen of the United States or lawful permanent resident and is retrievable by a personal identifier such as a consumer's name or account number.

Requirements

For information on the general safeguards that the Privacy Act provides for data that is maintained by a federal agency and meets the other requirements for a covered record under the act, see CRS Report RL34120, *Federal Information Security and Data Breach Notification Laws*, by Gina Stevens.

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[365] EIA ELECTRIC POWER OVERVIEW, *supra* note 254.

[366] DEP'T OF THE ARMY CORPS OF ENG'RS, CIVIL WORKS STRATEGIC PLAN 1 (2004), *available at* http://www.corpsresults.us/pdfs/cw_strat.pdf. It is also a "Major Command within the Army." *Id.*

[367] Tenn. Valley Auth., About TVA, http://www.tva.com/abouttva/index.htm.

[368] *See* CRS Report RL34120, *Federal Information Security and Data Breach Notification Laws*, by Gina Stevens (citations omitted).

[369] 5 U.S.C. §552(a)(4).

[370] 5 U.S.C. §552a(a)(2).

[371] 5 U.S.C. §552a(a)(5).

[372] NIST PRIVACY REPORT, *supra* note 11, at 26-27.

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PAGE # 143

EXHIBIT F

POLITICO

Smart grid powers up privacy worries

By **DAVID PERERA** | 01/01/15 09:00 AM EST

The next Big Data threat to our privacy may come from the electricity we consume in our homes.

"Smart" online power meters are tracking energy use — and that data may soon be worth more than the electricity they distribute.

The Department of Energy is publishing in January the final draft of a voluntary code of conduct governing data privacy for smart meters, 38 million of which have already been installed nationwide. The meters gather information about household electricity consumption and transmit it wirelessly at regular intervals to the supplier. It's a key

PAGE # 145

element in the push for the so-called smart grid, a more efficient way to distribute the nation's electricity.

(Also on POLITICO: Don't expect a Cuban oil bonanza)

But, despite the voluntary code, critics fear consumers will still be cajoled or conned into giving up their data, not just to power companies but to third-party data aggregators. Too much money is at stake, they say. And the huge profits to be made could upend the business model of energy utilities.

"I think the data is going to be worth a lot more than the commodity that's being consumed to generate the data," said Miles Keogh, director of grants and research at the National Association of Regulatory Utility Commissioners.

All sorts of inferences about people's private lives are potentially available from detailed energy consumption data. The number of people inside a house. Daily routines. Degree of religious observance. Household appliance usage. Even, according to two German hackers, what's on the television, given a fast enough meter refresh rate.

"Very sensitive information can be revealed about homes, and homes are the most sacred privacy environment," said Nancy King, an Oregon State University business law and ethics academic who's studying smart meter deployments.

(Also on POLITICO: Obama blocks Bristol Bay oil, gas development)

Access and control of that energy usage data will be key, she added. "Most consumers are just unaware about how their data feeds into the Big Data machine and are powerless to do much about it."

For now, electric utilities collecting the data use it to improve how they manage the distribution of power. They envision a smart grid of greater reliability and efficiency, able to respond rapidly to fluctuations in demand. A smart grid would be more economical and have a smaller environmental footprint.

The market for the kind of Big Data energy analytics that will run the smart grid will reach a billion dollars annually in the United States and Canada by 2019, predicts analysis firm Navigant Research.

PAGE # 146

But that same data could also be a gold mine for other purposes — retailers deciding where to open their next store, marketers profiling neighborhoods with an even finer tooth comb, or in ways we have yet to even think up.

Exhaustive electricity consumption data "is a holy grail, in many ways" for marketing analysts and consumer data aggregators, said Lee Tien, a senior attorney for the Electronic Frontier Foundation. "Few other types of data get inside the home the way that electrical usage data does."

(Also on POLITICO: McConnell: Keystone will be GOP Senate's first move)

The privacy-invading potential of smart meters hasn't gone unnoticed by the Energy Department, which in September published a draft voluntary code of conduct governing data privacy and the smart grid.

"Almost two years ago now, we said we should probably facilitate something among the industry that addresses the privacy concerns around this area before it really becomes an issue, before there's really a lot of demand for that data," said Eric Lightner, director of the Federal Smart Grid Task Force. He anticipates publication of the final draft in January.

Central to the draft code is "customer choice and consent," the concept that rate payers should control access to their data by third parties. Already there's a developing market for devices that hook up to smart meters and collect data at a rate far quicker than utilities. Home security vendor ADT, for example, can connect to smart meters in near real time for an energy management offering.

Critics wonder whether the code of conduct will stand up to the changes that Big Data will create in the energy industry. "When you become a company whose most valuable asset is not the kilowatt-hours but the data, that fundamentally changes what kind of company you are," Keogh warned.

For example, an exception to the consumer consent principle in the draft code is "aggregated or anonymized data" — data at the level that Keogh predicts will be the most valuable for data miners. Consumer market analysts don't care "whether I am washing my dishes at 4 in the afternoon or 5 in the afternoon," he said. But they do care about regional patterns formed by that individual usage.

(Also on POLITICO: How the "War on Coal" went global)

PAGE # 147

Utilities might find it a "lucrative business line for them to do the synthesis of the data, and then provide it to third parties," he suggested.

But many power utilities, operating in one of the world's most heavily regulated industries, are highly cautious businesses, and at least one says they are barred from using data like that. "Interval data is considered personally identifiable data, even if it's anonymized," said an executive with a West Coast public utility who asked not to be identified. "We just can't give that kind of thing up."

But that points to the other loophole contained in the code of conduct — the power of voluntary consent. Not even the most heavy-handed utility regulator can do much if consumers decide to permit access to their consumption data — perhaps in exchange for a price break.

"If the customer wants to share that kind of information with a third party, then that's a different story. They've allowed it to happen. It's their usage data," said the executive. DOE's Lightner agreed.

Consumers have a history of trading privacy for "very little monetary reward," noted King. "It would be fair to probably assume that many, many consumers would give unfettered access to their data through a smart meter to providers who would give them free energy."

So far, nobody appears to be proposing that, nor even lesser incentives, in exchange for consumers' meter data.

That leads some to believe that estimates of the value of smart meter consumption data are overblown — or at any rate, that it's too early to say whether the next big gold rush of consumer data will come from the smart grid.

"It's ... speculative to assume that the data will be incredibly valuable," said Richard Caperton, director of national policy and partnerships at Opower. The Arlington, Va.-based company has a stake in the energy Big Data game already. It partners with utilities to give consumers comparative analyses of their energy usage measured against similar households, letting them know if their consumption is greater or less than their neighbors.

Ultimately a voluntary code of conduct is too fragile a way to protect household data, says King, the privacy professor. Neither is the concept of consumer choice necessarily

an ideal way to protect consumer privacy, she added. DOE, of course, has little choice but to go the voluntary route, since it doesn't have regulatory authority over the consumer end of the power system.

The solution, she says, is a "basic, comprehensive data law in this country, and it does not need to be based on notice and consent," King said.

EXHIBIT G

Smart Meters

Now utilities can tell customers how much energy each appliance uses (just from the smart meter data)

May 15, 2014

It must be at least a decade since I first heard the idea of "disaggregating" electric bills. The idea back then was to "listen" for the electric signatures of different appliances and gradually figure out which appliances were using how much power.

Now a variation on this theme is in operation, as you will read in this guest editorial from Salim Popatia of Ecotagious. You'll have to decide for yourself if it's good enough in your territory. But I agree with his premise that this level of detail -- this ability to see which devices in your home or business are consuming the most electricity -- can be a powerful tool and motivator for customers. -- ***Jesse Berst***

By Salim Popatia

What gets measured gets managed: Taking home energy reports to the next level

The advent of smart meters, like smart phones, was just the beginning. A phone that allowed you to easily check and respond to email (Blackberry circa 2006) was a ten-fold increase in value as compared to the phones of the past. Today, however, the thought of being able to use a phone only for talking and emailing seems archaic. What about taking and editing pictures, paying for my coffee, measuring my steps or the tremendous amounts of other value that third party apps have brought to the smart phone?

Soon, the idea of using smart meters to simply tell us how much electricity is being used at any given time will seem similarly archaic. One of the next areas of value comes from taking smart meter data and 'disaggregating' it to tell us exactly how customers are using electricity. Do external devices already do this? Sure. Just as progress in the smart phone world reduced the need for external devices (cameras, alarm clocks, radios, pedometers, navigation systems, etc) the ability to get accurate, appliance level feedback, without the need to invest in external hardware, is the next step in the world of smart meters.

Why is this important?

As we all know, what gets measured gets managed. Knowing that I use more electricity than my neighbor, although motivating, unfortunately it's

not necessarily actionable. On the other hand, knowing specifically that I spend more money on *electric space heating* gives me much more context in which to act. *Studies indicate that the more specific the information, the better the conservation impact. The problem however, is that increased specificity is typically associated with increased cost and lower accessibility.

The idea behind smart meter disaggregation is to get specific information into the hands of the masses, cost effectively. Is more specific information available via external devices? Are better cameras available than what's on your phone? Yes and yes. The problem is that not everyone is willing to make the investment or go through the trouble of acquiring another device. The next iteration of smart meter disaggregation requires no additional hardware and allows for the detailed breakdown in consumption necessary to help drive conservation.

In a recent pilot, Greater Sudbury Hydro worked with Ecotagious Inc. to test the impact of delivering actionable information and recommendations. They disaggregated their smart meter data and combined it with behavioral science to deliver load specific feedback reports and recommendations to their highest potential customers. The result was impressive at over 4% conservation after just a few months. This could be just the beginning. In addition to conserving energy and saving money, customers were delighted with the initiative as it showed how their new smart meters could work for them.

Utility companies wanting to meet their specific conservation targets to drive customer engagement should ensure they are making the most of their smart meter investment. They can now use the power of smart meter data disaggregation to identify the customers who are most likely to help them reach their *specific* targets and turn them into willing partners in the drive for energy conservation.

*Electric Power Research Institute: Residential Electricity Use Feedback -A Research Synthesis and Economic Framework: http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001016844

Salim Popatia is the VP of Business Development for Ecotagious, a company that helps utility companies meet their specific demand and energy efficiency targets by using smart meter disaggregation to provide residential customers with appliance level feedback

EXHIBIT H

Securing the smart meter supply chain

Posted on July 30, 2013

Posted By: Michael John

Topic: Metering

Security issues have attracted more attention as smart meter rollouts have progressed. Consumers have expressed concerns about the privacy of their data, which has led to delays in smart metering programs in the US and the Netherlands. As this was not an area of focus before and therefore without specifications, there have in Europe been instances of smart metering implementations where the necessary features have not been enabled or older forms of encryption are used.

The industry is currently working closely with governments and consumer groups to address the issue of security. Technical specifications continue to evolve, while new or revised security and data privacy mandates may still be introduced. The European Commission's Smart Grids Task Force now requires that security and privacy be addressed even at the pilot stage of a smart metering program. There are also more governments taking the lead on smart metering programs, which often means more involvement from the regulator or national ministry.

This is why information security has to be a core part of smart metering rollouts from the start. Utilities can avoid scenarios where infrastructure must be upgraded or replaced to meet new requirements if end-to-end security is embedded within system design. With several utilities in Europe nearing an installed base of a million smart meters or more, it is important they recognize that security is not just about enabling the technical features on the smart meter, but ensuring the underlying processes are managed in a secure and trusted way across the supply chain.

Smart metering lifecycle

The lifecycle of the smart meter begins at the design and engineering phase. It is then manufactured and delivered to the party responsible for installing it at the premises of the consumer, at which point, it moves into the operational phase and becomes part of the smart metering network. Finally, at end of life, the smart meter must be decommissioned to ensure remaining sensitive data such as security credentials and personal information is disposed of securely.

At each phase of the smart meter lifecycle, an unauthorized third party might attempt to gain access to sensitive data and use it to launch a malicious attack on either a consumer or an organization. For example, if architecture design is not robust, an attacker could potentially manipulate the smart meter, data concentrator, or gateways in order to disconnect the supply of electricity. A large scale disconnect across multiple households would not only cause inconvenience to the residents in those locations, but may also lead to issues with the grid itself - such as a power outage.

Other potential security threats include tampering with meter data in order to manipulate the outcome of billing, or the leakage of personal information and utility-related data that could provide attackers with insight into a householder's behavior. Known as a `consumption signature', this type of information can be used to work out the times of day the householder is absent from a property, as well as the types of electronic appliances they own.

The attacker would need to be highly sophisticated and have significant resources at their disposal. However, given that data concentrators might not be located within secure premises, there is the potential for unauthorized parties to gain access to the sensitive data they hold by physically breaking into them.

Security by design

From the outset, the smart meter engineering process must be suitably robust. If a meter crashes (or is made to crash), attackers could potentially exploit this possibility either by injecting code or executing existing code that would allow them to manipulate the meter. Likewise, the engineering of firmware - i.e. software closely tied to the hardware components of the device - must be robust. Here, functional testing is necessary to ensure it is resistant to malware disguised as standardized communications protocols.

Secure firmware engineering will be essential for meter manufacturers moving forward. As recent history has shown, attackers are more likely to target the means of production, and there have been several cases of USB sticks shipping direct from offshore factories that contained malware. As such, even if a product is certified as being functionally compliant to the relevant standards, it doesn't necessarily mean it is secure, or indeed that there is authentic firmware on it.

This is why a `security and data protection by design' approach is recommended whereby data protection and security features are built into smart metering systems before they are rolled out. In the world of IT, robust security design is based on end-to-end communications where the receiver can prove the identity of the sender and knows that the message has not been tampered with in transit.

Building a Trust Provisioning model

Manufacturers for example, are trusted for engineering and producing secure and reliable products. To assure all stakeholders (utilities, meter network operators, consumers) that engineering and production processes of manufacturers are secure, manufacturers can express conformity by obtaining a dedicated certification, for example ISO 27001, the international standard for information security management.

In Europe, Elster, who was recently awarded ISO 27001 certification, has created what is effectively a secured cell within its factory. As shown in Figure 1, the meter enters one end of the cell as an un-trusted and unsecured device and emerges at the other end fully sealed and provisioned with unique key material and its `trust anchors'. The smart meter is therefore supplied to the utility as a `trusted' device - i.e. loaded and pre-configured with the correct, authentic firmware and credentials. Elster has also developed a secure process for exchanging the provisioned information with its customers.

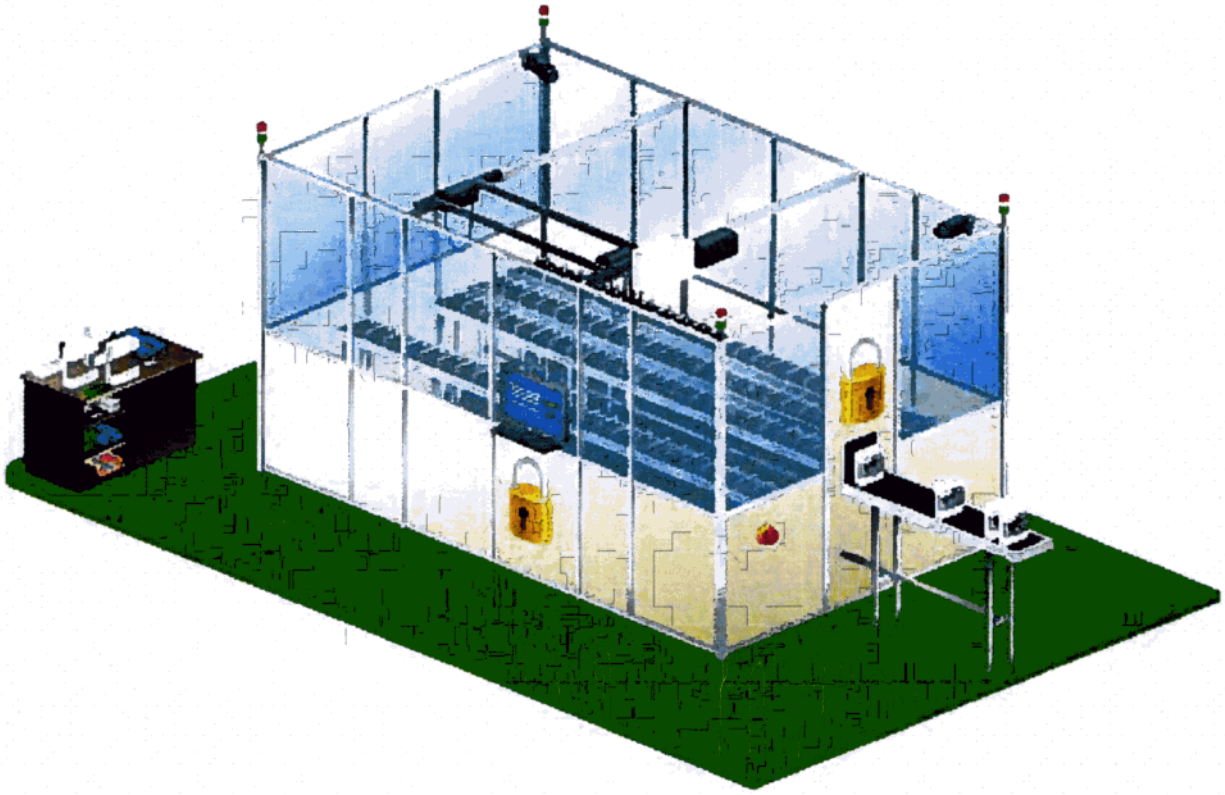


Figure 1: A secured cell for the factory environment
Source: Elster

A key benefit of the trust provisioning approach is that it is agnostic of market design and the smart metering infrastructure, given that every Member State chooses its own model of smart metering implementation and will be at a different stage of liberalization.

Once the meter is installed, ownership transfers to the utility or the party responsible for operating the meter. At this point, it is critical that the appropriate data security protocols and privacy protection are already enabled. Further down the line, the decommissioning is just as important, as there may still be security relevant data stored on the meter that, if obtained, could allow unauthorized parties to observe or decrypt previous communication or any personally identifiable information left on the meter.

Similarly, a secure process is required for re-provisioning devices. Utilities will need to ensure they have unique keys for all of their smart meters, and have a management process to update them, and to alter access controls should a smart meter be re-provisioned for a new tenant.

Roadmap and ramp-up plan

Although there are no standards designed to address the smart metering and smart grid supply chain

specifically, there are existing standards that provide a baseline and others that are being enhanced to meet the requirements of smart metering and smart grid programs.

In the UK, the central data and communications company (DCC), the function established to manage the data that travels to and from gas and electricity smart meters in households over the wide area network (WAN), will rely on external assurance and certification. This will be achieved via the CESG - the UK Government's National Technical Authority for Information Assurance (IA).

CESG is developing Commercial Product Assurance (CPA-Foundation) security characteristics for smart metering equipment. Once approved by DECC and CESG, they will be published to enable equipment manufacturers to have their equipment tested against the characteristics.

Meanwhile, in Germany the Federal Office of Information Security (Bundesamt für Sicherheit in der Informationstechnik - BSI) has specified the smart meter protection profile (PP for the Gateway of a Smart Metering System). It is based on the international Common Criteria (CC) and secures the communication between the smart meter in each household and the smart grid, as well as addressing German privacy laws. In meeting these rigorous requirements and being focused around a `single device' however, there is the possibility for further delays to roll-out.

Certainly, it is clear that all stakeholders must have confidence in the standardization and specification process, that the markets be better educated about the tools and technologies available to them, and that government and industry agree a sufficient rather than minimum set of security design requirements. Otherwise, the commercial introduction of certified devices can prove challenging.

With a current understanding of threats, and a current understanding of the required architecture, it is possible to agree on a roadmap that gets rollouts underway and a ramp-up plan to assure manufacturers achieve volume. Utilities that have yet to commence commercial smart meter rollouts now have the opportunity to address security from the outset, specify options that are well aligned with the recommendations made by the EC and relevant industry bodies, and avoid the complexity and expense of implementing security in retrospect.

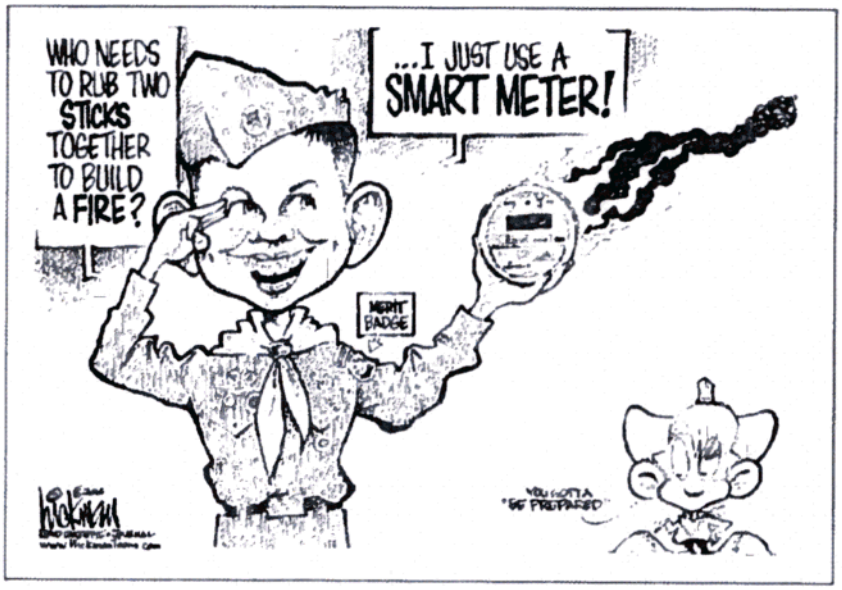
Michael John is Solution Manager at Elster. He is committed to ensuring Elster's Smart Grid and Smart Metering applications are secure by design and fully compliant with the latest EU standards for security and privacy. He has played a key role in developing Privacy Enhancing Technologies (PETs) for Smart Grids at Elster.
In addition to his role at Elster he is also actively involved in the European Commission's Smart Grids Task Force Expert Group 2, which focuses on the regulatory recommendations for privacy, data protection and cyber security in the Smart Grid environment. He is also involved in ESMIG's Security and Privacy Group. Michael is furthermore engaged in several related groups at member state level in Europe.

Michael John has a strong telecommunications and information security background. Prior to joining Elster in 2010, he was a Network Engineer at Nortel. He also holds an MSc in Computer Science.

http://www.energycentral.com/c/iu/securing-smart-meter-supply-chain

EXHIBIT I

Summary of Evidence on Smart Meter Fires



In California and around world, smart meters have been linked to fires, explosions, and damaged appliances. For every fire started at the meter, in an appliance, or on wiring, smart meter causality should be suspected.

In 2012 a Pacific Gas and Electric (PG&E) whistleblower Pat Wrigley, who worked as a meter reader for 9 1/2 years testified at California Public Utilities Commission judicial hearing:

- **Smart meters cause fires**
- **PG&E is covering up the risk**

https://youtu.be/EnxloltNUek

Matt Beckett, a California fire department captain stated, *"Two years ago PG&E replaced that meter [analog] with a "Smart Meter". Immediately following we noticed power surges in the form of our refrigerator motor intermittently speeding up simultaneously with our lights becoming brighter. As a seventeen year veteran and current Fire Captain this caused me to become very concerned."* The Smart meter on his house was replaced with an analog, and there were no problems, until a new Smart Meter was reinstalled. This time he had two surge protectors burn out. http://emfsafetynetwork.org/fire-captain-finds-hazardous-power-surges-follow-smart-meter-installations/

Another California fire captain, Ross writes, *"I was at home doing yard work in the late afternoon when my wife came outside and told me that "half the power was off again". This had been happening on and off for about two weeks ... I then went outside to*

where my meter was and I could instantly smell the burnt electrical smoke. As I was looking at the meter I inadvertently placed my hand on the meter itself and almost burned my hand...the metal box into which all the home's wiring from the meter is stored was also too hot to touch with a bare hand." http://emfsafetynetwork.org/smart-meter-arcing/

California Public Utilities Commission, and PG&E's response

In 2009 PG&E reported to the California Public Utilities Commission (CPUC) smart meters interfered with AFCI's and GFI's *"During the second quarter of 2009, PG&E discovered a limited number of cases of SmartMeter™ radio interference with customer electronics, including ground fault circuit interrupters (GFCI) and arc fault circuit interrupters (AFCI). Pages 6-7 Advanced Metering Infrastructure; January 2010 Semi-Annual Assessment Report and SmartMeter™*http://emfsafetynetwork.org/wp-content/uploads/2010/03/Updated-Semi-Annual-AMI-Report_Jan_2010-12.pdf

January 2011: PG&E, The Utility Reform Network, CPUC Office of Ratepayer Advocates, California Energy Commission, CPUC Energy Division and others discussed "smart meter incidences involving fires..." Meeting agenda: http://emfsafetynetwork.org/wp-content/uploads/2016/01/TAP-Agenda-1282011-inc-smart-meter-fires-SB_GTS_0652075.pdf

2.	Provide insight (incident rates) on TURN-identified issues: smartmeter incidences involving fires and electrical shorts; interference (900MHz, garage and consumer devices) and 'dead sockets' (Dec meeting)	Jim Meadows	January meeting

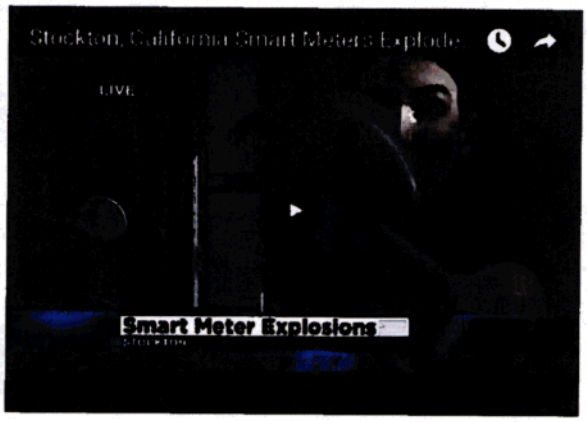
2013: PG&E Data Response on smart meter fires. http://emfsafetynetwork.org/wp-content/uploads/2010/03/Data-Response-PGE-smart-meter-fires.pdf Much of the document is redacted, and PG&E states, *"In no instance has PG&E found that a SmartMeter™, either gas or electric, has caused a fire."* However, PG&E now monitors temperature and voltage readings of smart meters for hazardous conditions. *"PG&E issues field orders to perform safety inspections at potentially overloaded and or high temperature sites. The data has led to panel inspections at customer premises that have found undersized wiring, physical panel damage, and overloaded conditions."*

The CPUC is charged with overseeing utility safety. In the CPUC's Annual Report to the Governor and the Legislature May 2014, they state, *"There was some concern regarding fires in smart meters but this was investigated by CPUC staff in 2013. Staff determined that, of reported fires involving smart meter installation, none were actually caused by the smart meter." (p.5)* **EMF Safety Network sent a records act request in December 2014 for the details of that investigation, however the CPUC has not provided any details.** http://emfsafetynetwork.org/wp-content/uploads/2016/01/Smart-Grid-Annual-Report-2013-.pdf

Smart meter fires, surges, exploding meters, and damaged appliances in California and around the world

Bakersfield, California, Smart Meter Blows Up At Business (2009): "*employees at Henry M.M. Engines said their Smart Meter caught fire, which sparked concern and questioned the safety of these new meters. On Wednesday, a PG&E technician was called out to replace the meter after employees found the device burned up and lying on the ground." "Basically it was an explosion. I saw the meter on the ground and the face plate was blew off and the whole meter was blackened. Even the breaker box that housed the meter was blackened by what seemed to be an electrical short," said Vernon Nelson, an employee."* http://www.turnto23.com/news/your-neighborhood/north-river-county/smart-meter-blows-up-at-business

Berkeley California Fire Department report (2010) states, *"Investigation revealed the newly installed PG&E Smart Meter in the kitchen was hot to touch and smoking, with a orange glow inside the meter housing"* http://emfsafetynetwork.org/wp-content/uploads/2010/07/Berkeley-Smart-Meter-Fire.pdf



Stockton California (2015): Dozens of smart meters exploded and caught fire after an electrical surge cut power to about 5800 homes near Stockton CA. CBS News reports, "*A power surge left thousands without power for most of the day in Stockton after smart meters on their homes exploded on Monday." "Neighbors in the South Stockton area described it as a large pop, a bomb going off, and strong enough to shake a house."* http://emfsafetynetwork.org/dozens-of-smart-meters-explode-from-power-surge/

Santa Rosa, California (2011): Three smart meters explode at a shopping mall. According to the incident report from the Santa Rosa Fire Department firefighters found the electrical room at the Santa Rosa Mall "charged with smoke" and *"upon investigation found 3 PG&E meters that had blown off the electrical panel causing damage to the interior wiring of the electrical panel. A fire was still smoldering…"* http://emfsafetynetwork.org/3-pge-smart-meters-explode-at-santa-rosa-mall/

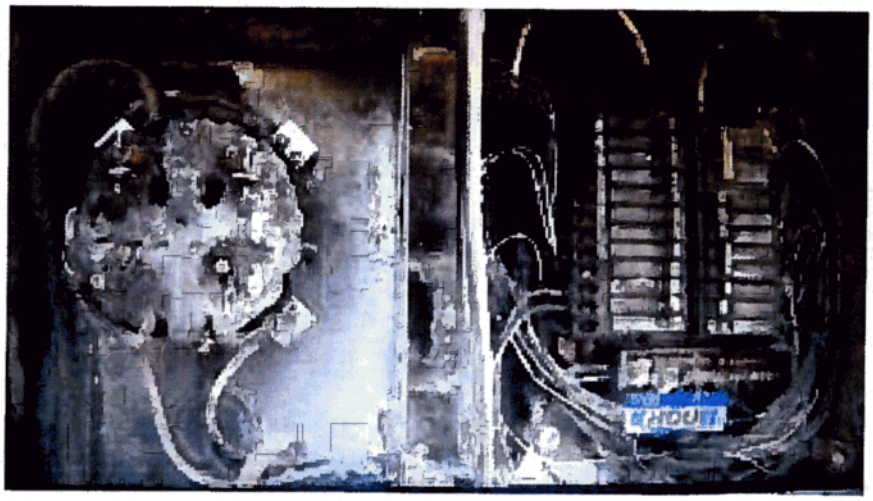
Palo Alto (2011): 80 PG&E smart meters caught on fire and burned out after a power surge. The incident raised questions for residents and utilities officials about smart meter safety. "*Mindy Spatt, communications director for The Utility Reform Network (TURN), said the utility-consumer advocacy group received many complaints about surges damaging appliances when the SmartMeters were first installed.* Comparing analog to the new meters, she added, *"In the collective memory of TURN, we have not seen similar incidents with analog meters."* http://www.paloaltoonline.com/news/2011/09/04/power-surge-raises-questions-about-smartmeters

Power mishap damages appliances for Livermore residents (2012): 28 smart meters were replaced by PG&E when a power line replacement caused a power surge which fried appliances, TVs and air conditioners. *"The surge of electricity ripped through 28 homes on Hudson Way in Livermore."* http://abc7news.com/archive/8770840/

Nevada (2014): Reno and Sparks fire chiefs call for smart meter fire investigation, *"in the wake of a troubling spate of blazes they believe are associated with the meters, including one recent fire that killed a 61-year-old woman."* http://www.rgj.com/story/news/2014/09/13/reno-sparks-fire-chiefs-call-smart-meter-probe/15580069/

Florida, News Investigative report (2011): *"I went over to the FPL meter and it had caught on fire, it was all black smoke and charred,"* http://www.wptv.com/news/region-c-palm-beach-county/some-homeowners-concerned-about-meter-installation#ixzz1d3MvQ4r5

Chicago Illinois (2012): 2012 ComEd confirms smart meter fires. http://articles.chicagotribune.com/2012-08-30/business/chi-comed-confirms-smart-meters-involved-in-small-fires--20120830_1_smart-meters-comed-customers-poor-connection



Philadelphia Pennsylvania (2012): utility PECO suspended smart meter installation due to fires. https://youtu.be/g8nwrRchtuk

Texas (2012): Customers of Centerpoint report smart meter fires. http://www.khou.com/story/news/2014/07/21/11803806/

Oncor Changing Smart Meter Installation After Fires « CBS Dallas / Fort Worth: *"The Chief Executive Officer of Oncor says the company has a new procedure for installation of smart meters after two house fires in Arlington last week. Robert Shapard says old wiring in two homes could not support the new smart meters."* http://dfw.cbslocal.com/2010/08/24/oncor-changing-smart-meter-installation-after-fires/

Canada: Nanaimo mother of two left without power for two days after smart meter smoked and caused a power outage https://youtu.be/9NO6wlx8UFc

New Zealand: Fire Prone Meter boxes causing concern. *"Front line firefighters are concerned about the number of household power meter boxes that are bursting into flames. There have been 67 callouts in Christchurch to electrical malfunctions so far this year, and new smart meters have been involved in three in the last five days."* http://www.3news.co.nz/nznews/fireprone-meter-boxes-causing-concern-2010060317#axzz3vYE7LXcr

Australia:

- **"Smart Meter Disaster"** is a 2012 Australian TV news report on smart meter hazards, including fires. https://youtu.be/4e71qAr_qGk
- **Smart meter shock: electrical hazards found in 3500 homes** *"Victoria's energy regulator has conceded smart meter contractors might lack required skills and is reviewing the qualifications of workers rolling out the $2 billion scheme." "smart meter installers have identified dangerous and possibly life-threatening electrical hazards in 3500 Victorian homes."* http://www.theage.com.au/victoria/smart-meter-shock-electrical-hazards-found-in-3500-homes-20110212-1are0.html?from=age_sb
- **Smart meter blasts covered up 2012:** A whistleblower claims power companies know smart meters are exploding and are lying to consumers to cover it up. 'John' works for Jemena and claims at least six smart meters have exploded in and around Pascoe Vale, since Christmas. John was installing a meter yesterday which burst into flames in front of him. He's told Neil Mitchell under strict anonymity power companies are misleading the public and smart meters are dangerous. http://www.3aw.com.au/blogs/breaking-news-blog/smart-meter-blasts-covered-up/20120222-1tmqr.html

Thousands of smart meters replaced due to fire risk

- Portland General Electric Oregon replaced 70,000 smart meters due to fire risk. http://www.oregonlive.com/business/index.ssf/2014/07/pge_replacing_some_electricity.html
- Lakeland Florida replaced 10,657 smart meters due to fire risk: http://www.theledger.com/article/20140826/NEWS/140829388/1410?Title=Overheating-Concerns-Lakeland-Electric-to-Replace-10-657-Residential-Smart-Meters-
- In Canada SaskPower replaces 105,000 smart meters due to fire risk.http://www.cbc.ca/news/canada/saskatchewan/saskpower-to-remove-105-000-smart-meters-following-fires-1.2723046
- Ontario, Canada Thousands of smart meters in Ontario to be removed over safety worries: "Some 5,400 of Ontario's 4.8 million smart meters are being removed and replaced because of a risk they could heat up, cause an electrical short and possibly spark a fire." http://www.thestar.com/news/queenspark/2015/01/22/thousands-of-smart-meters-in-ontario-to-be-removed-over-safety-worries.html

Industry and expert commentary

IEEE [professional technological association]: *"Obviously all companies with smart meter programs, and all their suppliers and sub-contractors, are going to have to take a close look at the issue of fire hazards. This is just the beginning of a difficult story."* http://spectrum.ieee.org/energywise/energy/the-smarter-grid/smart-meter-fire-reports

TESCO: According to research by TESCO smart meters are more prone to "hot socket" than analog meters. Failure modes include catastrophic (expected) "Catastrophic failure" is defined as "a meter which has burnt, melted, blackened, caught fire, arced, sparked, or exploded." See: "http://smartgridawareness.org/2015/11/03/catastrophic-failures-expected-with-smart-meters/ See also: http://emfsafetynetwork.org/wp-content/uploads/2010/03/TESCO-Lawton-on-Hot-Sockets.pdf

Wireless Smart Meters and Potential for Electrical Fires. Commentary by Cindy Sage, Sage Associates and James J. Biergiel, EMF Electrical Consultant July 2010: Smart meters can create an over-current condition on the wiring and produce heat, which the neutral cannot properly handle, which can lead to fires.

- "The use of smart meters will place an entirely new and significantly increased burden on existing electrical wiring because of the very short, very high intensity wireless emissions (radio frequency bursts) that the meters produce to signal the utility about energy usage."
- *"The location of the fire does NOT have to be in close proximity to the main electrical panel where the smart meter is installed."*
- *"A forensic team investigating any electrical fire should now be looking for connections*

to smart meters as a possible contributing factor to fires."

- http://emfsafetynetwork.org/wp-content/uploads/2011/06/Smart-Meters-Risk-for-fire.pdf

Ontario Fire Marshall Report: *"During our initial research of the new meters we encountered an unusual amount of fire incidents involving smart meters. "Anecdotal information supported [the fact that] problems occurred after the old analog meters were updated to the new digital smart meters." The report noted the possibility of a fire resulting from "a loose connection in the meter base."*
"What could be the reason for this? The old meter base connections may not have been in a condition for seamless exchange to a new meter. New meters may have defects that cause electrical failures or misalignment with old meter base. Careless installation during changeover."
http://www.oafc.on.ca/article/unusual-number-fires-smart-meters-linked-ontario-fire-marshal-says-faulty-base-plates-could

American Electric Power (AEP) How hot are your meters? 2015: *Today's meters are light. The old ones were heavy and dissipated heat a lot better, actually," said Ken Dimpfl, of American Electric Power (AEP). In 2010, they started seeing smart meter failures due to high temps or thermal overload. "This began our journey of looking at 'hot sockets,'" Dimpfl said. "Over the course of a two-year period, AEP analyzed roughly 25 meters that failed. Post event analysis concluded that the root cause was a poor connection at the meter."*
http://www.intelligentutility.com/article/15/10/how-hot-are-your-meters

Hydro Quebec requires 3 meters distance between a smart meter and gas tank
http://ofsys.hydroquebec.com/T/OFSYS/SM2/2/S/F/4947/13087532/Dnm3qyNW.html

Norm Lambe, an insurance claims adjustor, contends the utility companies are tampering with the evidence by immediately removing smart meters when there's a fire. *"A dangerous precedent is being followed in the insurance industry concerning the investigation of smart meter fires...When the local electrical utility arrives and determines that a smart meter is the issue, they have been removing the meter, and preventing the inspection of the meter by the experts...This is a serious situation, as the utility company, upon removal of the meter is tampering with what is evidence concerning the cause of the fire and can be held criminally responsible."* http://www.examiner.com/article/are-insurance-companies-avoiding-the-smart-meter-problem

Summary of Evidence on Smart Meter Fires compiled by Sandi Maurer, EMF Safety Network Director, January 2015. Sandi Maurer has intervened on smart meter proceedings at the CPUC since 2010. *See also EMF Safety Network Smart Meter Fires and Explosions:* http://emfsafetynetwork.org/smart-meters/smart-meter-fires-and-explosions/

EXHIBIT J

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928 204 6434

RECEIVED

2014 SEP -5 A 10:56

AZ CORP COMMISSION
DOCKET CONTROL

September 2, 2014

Arizona Corporation Commissioner (ACC)
Docket Control Center
1200 West Washington Street
Phoenix, Arizona 85007

Arizona Corporation Commission
DOCKETED
SEP 5 2014
DOCKETED BY

ORIGINAL

Re: Docket # E-01345A-13-0069

Commissioners;

A source within APS has revealed that APS "smart" meters are failing, and failing in a way that presents a fire risk to ratepayers.

My source, whose privacy I must protect, tells me that APS has replaced thousands of faulty "smart" meters, and is scheduled to replace 50 to 60 thousand this year alone due to heat induced failure of the remote disconnect switch and LCD display. (I have seen the failed LCDs.)

Remote disconnect switch failure resulted in a recall of over 10,000 "smart" meters in Lakeland, Florida where 6 house fires occurred [Meters overheating, to be replaced in Lakeland]. And in Portland, Oregon, remote disconnect switch failure resulted in a recall of 70,000 "smart" meters after 3 fires there [PGE replacing 70,000 electricity meters because of fire risk]. "Smart" meter-caused house fires have resulted in massive "smart" meter recalls in Pennsylvania (186,000) and Saskatchewan (105,000).

You must investigate APS at once. State statute demands it.

- **A.R.S. 40-361.B** – Every public service corporation shall furnish and maintain such service, equipment and facilities as will promote the safety, health, comfort and convenience of its patrons, employees and the public, and as will be in all respects adequate, efficient and reasonable.

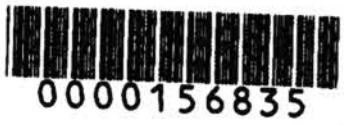
- **A.R.S. 40-321.A** – When the commission finds that the equipment, appliances, facilities or service of any public service corporation, or the methods of manufacture, distribution, transmission, storage or supply employed by it, are unjust, unreasonable, unsafe, improper, inadequate or insufficient, the commission shall determine what is just, reasonable, safe, proper, adequate or sufficient, and shall enforce its determination by order or regulation.

APS has painted a very rosy picture of their "smart" meters over the years, but have they told you about this dangerous and potentially life threatening inherent flaw, one that analog meters do not have? APS has a history of concealing information from the public and regulatory agencies. APS refuses to come clean about their "dark money" political donations, and, earlier this year, it was revealed that APS did not report an explosion at their Palo Verde nuclear plant for 5 months ['Explosion' at Palo Verde nuclear plant not reported for 5 months]. Also, if APS is replacing tens of thousands of "smart" meters, how long will it be until APS comes begging for a rate increase so that ratepayers bear the financial brunt of their (and your) "smart" meter fiasco?

Sincerely,

Warren Woodward

EXHIBIT K



Warren Woodward
55 Ross Circle
Sedona, Arizona 86336
928 204 6434

October 19, 2014

Arizona Corporation Commissioner (ACC)
Docket Control Center
1200 West Washington Street
Phoenix, Arizona 85007

ORIGINAL

Re: Docket # E-01345A-13-0069

Commissioners;

Enclosed is an email I received from your "Manager of Consumer Services", Connie Walczak. It is in response to my September 2nd, 2014 letter to you (docketed here: http://images.edocket.azcc.gov/docketpdf/0000155746.pdf) concerning information I received about thousands of APS's "smart" meters being replaced due to heat induced failure of the remote disconnect switch and LCD display. I'll remind you that the "smart" meter remote disconnect switch has been the cause of many "smart" meter related fires and subsequent "smart" meter recalls in the U.S. and Canada.

Ms. Walczak's email raises several concerns.

The first is that it is shocking to learn that here in Arizona we have our first "smart" meter related house fire lawsuit against APS and the "smart" meter manufacturer, Elster. The suit really should also name each of you for carelessly and negligently allowing "smart" meter installations despite repeated warnings from myself and others.

Back in 2012 for example, I sent all ACC commissioners a 21 page compilation of reports from the US, Australia and Canada about fires, explosions and burned out appliances due to "smart" meter installations. That list is at the following link and is, of course, longer now because the problem has not gone away: http://emfsafetynetwork.org/smart-meters/smart-meter-fires-and-explosions/.

The second concern is that your "investigation" of this very serious "smart" meter issue consisted of asking APS questions without placing APS under oath. When will you learn that this company cannot be trusted to give honest answers? Several times in the past I have pointed out the futility of asking APS anything unless they are under oath. When are you going to wake up?

One of the latest incidents of APS lying to you was their response to questions submitted to them by commissioner Brenda Burns. In my YouTube video, **APS Caught Lying Again**, I

proved that some of the answers APS gave commissioner Brenda Burns were lies. Typically, you did nothing about it.

It is very alarming to learn that there have been other fires in Arizona that APS has been able to blame on "broken or loose meter clips."

APS: "There have been some fires within the APS service territory that were initially alleged to be caused by Elster meters. However, in these instances, a root cause external to the meter itself, such as broken or loose meter clips or defective wiring at the location, was determined to be the cause of the fire."

"*Some fires*"? How many is "some"? Isn't the ACC at least curious? Are "smart" meter related fires so commonplace they are met with a yawn now? Just the 'price of progress'? Or is the ACC uninterested because meter clips are on the customer's side of the meter?

I called attention to the absurdity of APS's 'meter clip defense' three years ago in an email sent to all ACC commissioners on September 10th, 2011. I was commenting on APS's lame excuse made two days previous at an ACC "workshop" meeting when APS was asked about the "smart" meter fire issue. I wrote:

> "I could not believe you accepted the APS response about meters causing fires. Their response was on a par with *"The dog ate the homework"*. To refresh your memory, APS said if there is a fire it is probably because the old meter has not been changed for 40 years and the jaws that grip the new meter are corroded away. Think about that. What they are saying is the installer saw something was wrong but went ahead with installation anyway!"

The kicker is that, as you should well know, APS can legally deny responsibility for anything on the homeowner's side of the meter, which includes meter clips – clips that worked fine for God knows how many years until APS came along and messed with them by yanking out a perfectly good meter and replacing it with an expensive microwave radiation emitting fire hazard. What an absolutely sickening scenario, and APS gets to blame the victims! When was the last time you checked your meter clips?

The problem of a bad connection at the clips is known as a "hot socket". Tesco, self-described as "the trusted source for electric meter testing equipment and metering accessories for over 100 years", has determined through testing that, **"Electromechanical meters withstand hot sockets better than solid state meters."** In other words, analog meters withstand imperfect meter clips better than "smart" meters.

I have enclosed an article written by K.T. Weaver that explains the whole hot socket issue and includes slides from a Tesco presentation on same. Weaver's impressive bio includes a B.S. in Engineering Physics, an M.S. in Nuclear Engineering with a specialty in radiation protection, and employment in the nuclear division at a leading electric utility for over 25 years. (Article is online here: http://smartgridawareness.org/2014/10/16/analog-meters-withstand-hot-sockets-

better-than-smart-meters/)

Ms. Walczak's conclusion is typical of the ACC: "Staff's review found no issue with APS's response. If you feel this is not the case, you may file a formal complaint with Docket Control."

Staff's review found no issue with APS's response?

OK, here's *my* review: 1) "Smart" meter related fires are occurring in Arizona but APS gets to blame the victims so you don't care. 2) We aren't told how many of these fires have occurred or what the damage was. 3) We have our first Arizona "smart" meter house fire lawsuit. 4) Once again, the gullible (or is it corrupt?) ACC takes APS at their word. 5) If I don't like any of this I get to do the ACC's regulatory work for them once more by filing a formal complaint.

I already have one formal complaint pending against APS. I don't think I can take on more of your neglected work for free at this time.

As regulators you people are a sad joke.

Sincerely,

Warren Woodward

PS – Commissioner Gary Pierce, at a political event in early 2013 I heard you try to assuage a constituent's anxiety over "smart" meter related fires by telling her that we have not had any "smart" meter related fires in Arizona. What would your response be now that you know there in fact have been fires in Arizona? Tough luck for people who don't check their meter clips? Tough luck for people whose wiring worked fine until the "smart" meter came? The "smart" grid is so fantastic it's worth the risk of people's lives and property? What, Gary?

And one other thing: APS wrote, "APS is aware, through various media reports, that utilities in several jurisdictions have replaced advanced meters manufactured by Sensus Corporation after allegations that those meters were related to house fires."

To clarify, "smart" meter fires that are the result of actual meter malfunction (as opposed to hot socket, etc.) are not confined to the Sensus brand. For example, after a number of Sensus fires in Pennsylvania, PECO Energy switched to Landis & Gyr "smart" meters then still had another "smart" meter fire in which 16 apartments were damaged and 30 people were displaced in Bensalem, PA on February 6th, 2014.

Remote Disconnect Switch Failure Investigation

- Connie Walczak
- Oct 17 at 4:05 PM

Dear Mr. Woodward,

This email is being provided as a response to your September 2, 2014 letter to the Commissioners, docketed September 5, 2014. In that letter you requested that the Commission investigate APS regarding faulty "smart" meters that required replacement due to heat induced failure of the remote disconnect switch. You questioned recalls in states where house fires occurred due to remote disconnect switch failures.

Staff presented the following questions to APS in response to your request. APS's response is below each question.

1. Has APS removed any meters installed as part of APS's AMI system in the past year due to heat induced failure of the remote disconnect switch or LCD display? If so, how many?

APS has not removed any of the Company's AMI meters in the past year due to heat induced failure of the remote disconnect switch or LCD display.

APS did replace 32,000 AMI meters (roughly 3%) in 2014 from January 1st through August 31st. Approximately half of these meters were replaced by the meter manufacturer due to a problem with the soldering of a circuit board within the meter. The other meter replacements were for various reasons with the most common failures attributed to blank LCD displays and non-communicating radio modules. Those meters still under warranty were also replaced by the meter manufacturer. Again, none of these replacements were associated with heat induced failures.

2. Is APS aware of other utilities in the country that have replaced or recalled meters of the types installed as part of APS's AMI system as a result of disconnect switch or LCD display failure? If so, please provide the name of the utility(ies) and all information you may have about these replacements including meter manufacturer(s).

APS is not aware of any Elster (manufacturer of the AMI meters in use at APS) meters that have been replaced or recalled by another utility company as a result of remote disconnect failures or LCD display failures associated with heat induced failures. As noted above, LCD failures have occurred in some meters for other reasons.

3. Has APS experienced any house fires that are attributable to failures or flaws in meters installed as part of APS's AMI system? If so, please provide details.

No. There have been some fires within the APS service territory that were initially alleged to be caused by Elster meters. However, in these instances, a root cause external to the meter itself, such as broken or loose meter clips or defective wiring at the location, was determined to be the cause of the fire.

4. Finally, an insurance company otherwise responsible for paying a claim on a house fire, has filed a lawsuit against APS and Elster, claiming that the Elster meter was the cause of the fire. Elster, APS, and their internal and external investigators, disagree with the insurance company's claim. To date, the insurance company's claim remains unsupported by any expert testimony.

Interestingly enough, the very same insurance company has alleged that a second house fire was caused by an Elster meter. However, no lawsuit has been filed, and no evidence has been provided to support the allegation. It is APS's understanding that the insurance company is now focusing its investigation on an attic fan as the potential source of the second house fire.

5. Is APS aware of other utilities in the country that have experienced house fires that are directly attributable to failures or flaws in the types of meters installed as part of APS's AMI system? If so, please provide the name of the utility(ies) and all information you may have about these incidents.

APS is not aware of any Elster meters that have been implicated in house fires.

APS is aware, through various media reports, that utilities in several jurisdictions have replaced advanced meters manufactured by Sensus Corporation after allegations that those meters were related to house fires.

Hopefully, the above information will provide the answers you are looking for. Staff's review found no issue with APS's response. If you feel this is not the case, you may file a formal complaint with Docket Control.

Best Regards,

Connie Walczak
Manager Consumer Services
Utilities Division
Arizona Corporation Commission
602-542-0291

Analog Meters Withstand "Hot Sockets" Better Than Smart Meters

Posted on October 16, 2014 by SkyVision Solutions

Key Article Point

Even if electric utility companies are able to "blame" a hot socket or customer wiring for many **smart meter-related fires**, the meters themselves likely contributed to the fires, the severity of the fire damage, or the speed at which the fires spread.

Introduction

Subsequent to a house fire, one of the primary responsibilities for investigators is to determine the point of origin and cause of the fire. Determining the cause typically involves establishing whether the fire was accidental or criminal in nature. It is also possible that the final investigation report will document that the fire's cause remained "undetermined."

When a smart meter and associated meter box are the origin of a fire, many times the evidence is burned or "consumed" to the extent that a full cause determination is difficult to make with certainty. This is exemplified by examining the above photo for a smart meter-related fire in Reno, Nevada, still under investigation. For some smart meter fires, the fire may simply be documented as "accidental" and where the cause was "electrical" in nature. In other instances, a complete forensics investigation is not completed due to a lack of training, time, or other needed resources for the assigned investigators.

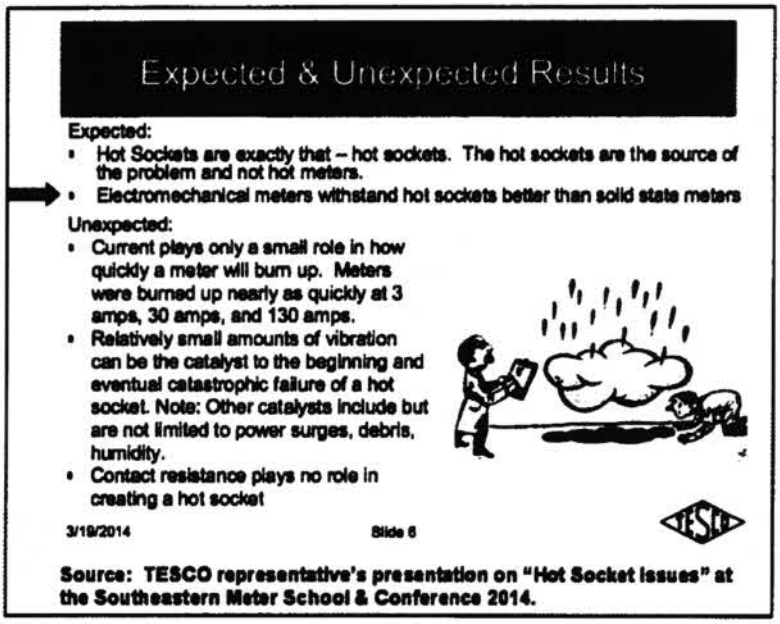
Utility companies are able to take advantage of the above situation where it is usually difficult for fire investigators to "definitively" establish the cause of smart meter-related fires. Utility companies (and particularly meter manufacturers) thus always blame the customer's wiring or a "hot socket" issue for smart meter-related fires even when contrary evidence exists. A hot socket is where there is a loss of tension in at least one of the meter socket jaws for the meter receptacle. This loss of tension contributes to micro-arcing that can lead to eventual **catastrophic failure of the smart meter** with a subsequent explosion and/or fire.

Industry Testing Results

The primary purpose of this article to establish that even if the "hot socket" is a source or "cause" of a smart meter-related fire, it is probable that the smart meter contributed to the eventual catastrophic failure. This has been confirmed through industry testing results that utilities won't disclose. ...

Industry testing by a company called TESCO – The Eastern Specialty Company, arrived at the following conclusion (and as pictured in the slide below):

"Electromechanical meters withstand hot sockets better than solid state meters."



Source: TESCO representative's presentation on "Hot Socket Issues" at the Southeastern Meter School & Conference 2014.

Slide 15 of the presentation by a TESCO representative indicates that:

"At the start of our laboratory investigation the oldest electro mechanical meters withstood hot sockets the best."

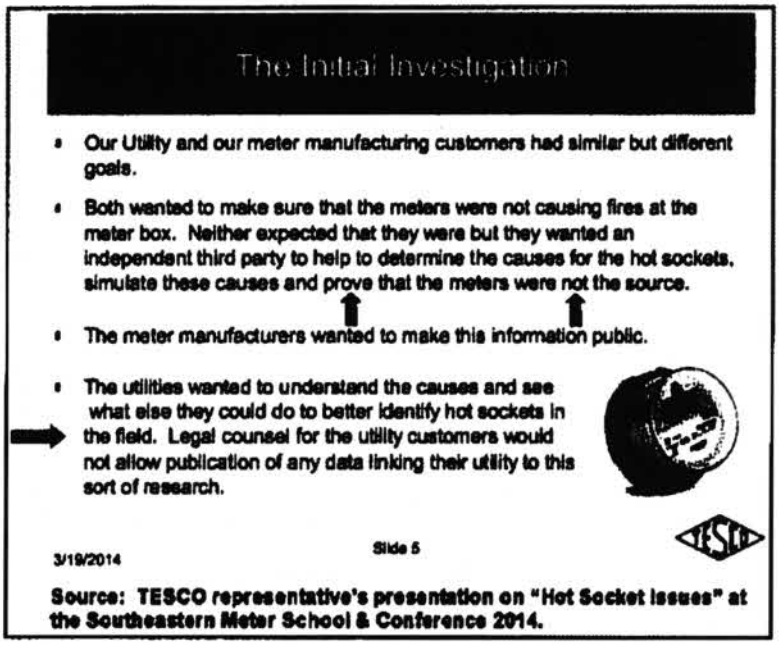
"The latest vintage solid state meters withstood hot sockets the least."

There was an acknowledgement that meter manufacturers recently ("over the course the past twelve months") have begun to release smart meters designed to better withstand hot sockets, but this is little comfort to the people and millions of homes across North America where smart meters have already been installed over the past several years.

Slide 5 (shown below) of the presentation by a TESCO representative states:

"Legal counsel for the utility customers would not allow publication of any data linking their utility to this sort of research."

Also note that Slide 5 indicates that meter manufacturers and utilities "wanted an independent third party to ... <u>prove</u> that the meters [themselves] were <u>not</u> the source [of fires]."



Source: TESCO representative's presentation on "Hot Socket Issues" at the Southeastern Meter School & Conference 2014.

What is described above is not exactly an objective testing goal. … So the presentation/ testing results makes the "desired" conclusion that "hot sockets are the source of the problem not hot meters," but yet solid state meters are more susceptible to catastrophic failure than traditional analog meters. **That logically means that smart meters are indeed a source of catastrophic failure "problems."** Hopefully you appreciate the "sleight of hand" on how these testing results are presented by the industry testing company.

Conclusions

SkyVision Solutions believes that there are inherent issues with smart meter construction and operation that makes fires more probable or severe than with traditional analog meters. These issues were discussed in a recent article, **Smart Meters Increase the Risk of Fires!** Some of these reasons deal with the potential flammability of plastic enclosure materials under fault conditions and the fact that electronic components contained within smart meters such as metal-oxide varistors (MOVs) can burst into flames when degraded over time from such conditions as voltage surges in the power lines.

Actually, one only needs to read documents written by Underwriters Laboratories to confirm this common sense conclusion whereby the UL wrote:

"The introduction of smart meters raises new concerns about functional safety, performance and product safety, data security, and interoperability, which are not fully addressed by the [current] standards. … This [new] standard was developed to address **problems that have been reported from field installations of smart meters, including fires, meters ejecting from meter socket bases and exposed live parts. When electronic components are overstressed, there is a potential for the components to explode."**

In any case, based upon the evidence presented that traditional analog meters withstand hot socket conditions better than smart meters:

Even if utility companies are able to somehow "blame" a hot socket or customer wiring condition for many smart meter-related fires, the smart meters likely contributed to the fires, the severity of the fire damage, or the speed at which the fires spread (as compared to a traditional

analog meter).

Do you still want a smart meter attached to your home? I didn't think so.

Source Material for this Article:

TESCO Presentation by Tom Lawton on "Hot Socket Issues – Causes and Best Practices" at the Southeastern Meter School & Conference 2014, available for viewing (as of October 16, 2014) at: http://www.slideshare.net/bravenna/hot-socket-issues-causes-best-practices.

"Writing a Fire Investigation Report," at http://www.interfire.org/res_file/reports.asp.

About the Website Moderator

K.T. Weaver, the website moderator for *SkyVisionSolutions.org* has earned a B.S. in Engineering Physics and an M.S. in Nuclear Engineering with a specialty in radiation protection, both degrees received from the University of Illinois at Urbana-Champaign. He was employed by a leading electric utility for over 25 years. He served in various positions and functions, including Station Health Physicist, Shift Overview Superintendent, Senior Health Physicist, corporate Health Physics Supervisor, and corporate Senior Technical Expert for Radiobiological Effects. He was considered qualified by the Nuclear Regulatory Commission (NRC) as a site Radiation Protection Manager in accordance with USNRC Regulatory Guide 1.8. The website moderator served in various on-call emergency response organization positions including Health Physics Director and Environmental Manager. He served as a member of the corporate Radiation Advisory Committee which dealt with radiation protection policy and litigation issues that included interaction with the company's General Counsel and company Medical Director. The website moderator has received specialized training in radiation biophysics, radiological emergency response planning and preparedness, and project management. The moderator has participated in various industry committees and activities related to the Edison Electric Institute, the Institute for Nuclear Power Operations, the American Nuclear Insurers, and the Nuclear Energy Institute. The moderator is a member of the Tau Beta Pi Association and is also a member of the Honor Society of Phi Kappa Phi. He is an emeritus member of the Health Physics Society and has three times served as President of the Midwest Chapter of the Health Physics Society.

EXHIBIT L

E-01345A-13-0069

OPEN MEETING AGENDA ITEM

ARIZONA CORPORATION COMM

0000158434

UTILITY COMPLAINT FORM

RECEIVED

2014 DEC -3 P 3:05

AZ CORP COMMISSION
DOCKET CONTROL

Investigator: Deb Reagan **Phone:** **Fax:**

Priority: Respond Within Five Days

Opinion No. 2014 - 119898 **Date:** 12/2/2014

Complaint Description: 01H Billing - Smart Meter
08A Rate Case Items - Opposed

ORIGINAL

	First:	Last:	
Complaint By:	Sandra	Scanlan	
Account Name:	Sandra Scanlan		**Home:**
Street:			**Work:**
City:	Paradise Valley		**CBR:**
State:	AZ Zip: 85253		**Is:**

Utility Company. Arizona Public Service Company
Division: Electric
Contact Name: For assignment **Contact Phone:**

Nature of Complaint:
*****E-01345A-13-0069 *****

Received the following -

APS's "smart meter" does not work correctly in every home. When APS first installed the "smart meter" in our home, they briefly turned the power off and installed the new meter. The second they turned the power back on, our burglar alarm started blaring and could not be turned off at the control panel. (The APS employee got in his truck and left.) Ever since, every time there is a power outage, when the power is restored, the burglar alarm blares for hours unless we are home to pull the wires out of the battery. We have spent endless hours discussing this with APS, Bonds alarm, electricians, all at our expense. In addition to the monetary expense, we have suffered hearing trauma from lengthy blaring of our home alarm (at times in excess of an hour.) Finally, a few months ago, APS agreed to reinstall the old meter. Since then, the blaring alarm problem has not reoccurred and we have been able to live in peace. In the best interest of the public, please do NOT grant APS the authority to change their customers additional fees for keeping their old meter. Especially since the problem begins and ends with APS's faulty meter, and not due to any fault on the part of APS's customers.
End of Complaint

Utilities' Response:

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Investigator's Comments and Disposition:
Comments entered for the record and filed with Docket Control.

Arizona Corporation Commission
DOCKETED
DEC 0 3 2014
DOCKETED BY

INQUIRY #119899 SENT TO APS.
End of Comments

EXHIBIT M

IRS rules certain smart meters can be depreciated over five years

Alternative & Renewable Energy Tax Newsalert
Nov 09, 2012

Share:

On November 2, the IRS released guidance concluding that certain utility smart meters are six-year property and thus eligible for five-year depreciation. The ruling provides beneficial treatment and will be welcome by many utilities that are installing smart meters.

Download PDF

Return to Tax research and insights
Alternative & Renewable Energy Tax Newsalert archive

US Tax Services
Human Resource Services
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International Tax
State and Local Tax
Tax Accounting
Tax Controversy and Regulatory Processes
Tax Credits, Deductions, and Studies
Tax Reporting & Strategy
Transfer Pricing
US Inbound Tax
Washington National Tax

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Courtney Sandifer
Director
Tel: +1 (202) 414 1315
Email

PAGE # 181

pwc

Alternative & Renewable Energy Tax Newsalert

IRS rules certain smart meters can be depreciated over five years

November 9, 2012

On November 2, the IRS released Taxpayer Advice Memorandum 201244015 that concludes certain utility smart meters are six-year property and thus eligible for five-year depreciation. This conclusion was contrary to the arguments advanced by the IRS examination personnel responsible for the taxpayer's case.

The taxpayer, a reulgated utility, replaced its decades-old standard electromechanical meters with new smart meters. The new meters are capable of real-time monitoring of electicity usage, as well as providing information on power outages and other data,

The issue raised is whether the meters are considered to be part of Rev. Proc. 87-56 asset class 00.12 and thus are six-year property, or as qualified technological equipment under §168(i)(2), in which case the asset life would relate to the utility's distribution assets.

Asset class 00.12 includes information systems such as computers and peripheral equipment used in administering normal business transactions and the maintenance, retrieval, and analysis of business records. It does not include equipment that is an integral part of other capital equipment that is included in other classes of economic activity.

The IRS agreed with the taxpayer that the meter is used in administering normal business transactions and in the maintenance, retrieval, and analysis of taxpayer's business records during the year at issue.

The IRS also determined that the meter is a computer under asset class 00.12 of Rev. Proc. 87-56 because it shares common features with computers such as a central processing unit with storage and other logic functions. In addition, it is programmable, electronically activated, and is capable of detecting energy tampering or service quality issues.

The IRS found the exceptions to asset class 00.12 inapplicable because the meter is not used primarily for process or production control, switching, channeling, or automating distributive trades and services such as those made by point-of-sale computer systems.

The IRS concluded that the meter has a class life of six years because it is clearly includable in asset class 00.12.

Finally, the IRS noted that this ruling could be modified or revoked if regulations addressing this issue are subsequently released by the Treasury Department. However, the IRS also noted that such modification or revocation may not be applied retroactively if the taxpayer meets certain criteria.

PwC Observations

The ruling here clearly provides beneficial treatment of smart meters in the factual circumstances set out. Many utilities are installing smart meters and a favorable asset life is likely a welcome development. In addition, five-year depreciation is consistent with the treatment of other clean energy property such as renewable energy assets.

For more information:

For prior alerts on alternative and renewable energy tax issues, please see our news archive. In addition to the Alternative & Renewable Energy Tax News alert, PwC also publishes a cross-disciplinary news alert providing updates on cleantech, sustainable development, and the business impacts of US climate and energy policy. For further information and to sign up for these alerts, click here.

For more information about using energy tax incentives to meet your renewable energy goals, please contact a member of PwC's Sustainable Business Solutions tax team:

Matthew Haskins	202.414.1570
Kerry Gordon	720.931.7364
Wendy Punches	408.817.5948
Courtney Sandifer	202.414.1315
Jason Spitzer	202.346.5287

INTERNAL REVENUE SERVICE
NATIONAL OFFICE TECHNICAL ADVICE MEMORANDUM

September 16, 2011

Number: 201244015
Release Date: 11/2/2012

Third Party Communication: None
Date of Communication: Not Applicable

Index (UIL) No.: 168.20-00
CASE-MIS No.: TAM-112103-11

Taxpayer's Name:
Taxpayer's Address:

Taxpayer's Identification No:
Year(s) Involved:
Date of Conference:

LEGEND:

Taxpayer =
Parent =

Regulatory Body =
Year 1 =
Year 2 =
A =
B =
C =
D =
E =
F =
G =
H =
I =

J =
Meter 1 =
Meter 2 =
Model A =
Model B =
Computer =

ISSUE:

For purposes of § 168 of the Internal Revenue Code, are Meter 2, a smart electric meter, and associated equipment placed in service by Taxpayer after October 3, 2008, classified as qualified smart electric meters under § 168(e)(3)(D)(iii) or are Meter 2 and associated equipment placed in service by Taxpayer during the year at issue classified as qualified technological equipment under § 168(e)(3)(B)(iv) or in asset class 00.12, Information Systems, of Rev. Proc. 87-56, 1987-2 C.B. 674, as clarified and modified by Rev. Proc. 88-22, 1988-1 C.B. 785?

CONCLUSION:

For purposes of § 168, Meter 2 and associated equipment placed in service by Taxpayer during the year at issue are classified in asset class 00.12 of Rev. Proc. 87-56 and, therefore, have a class life of 6 years. Accordingly, Meter 2 and associated equipment placed in service by Taxpayer after October 3, 2008, are not qualified smart electric meters under § 168(e)(3)(D)(iii).

FACTS:

Taxpayer is the subsidiary of Parent and operates as a utility company subject to regulation by the Regulatory Body.

For decades, Taxpayer has used standard electromechanical meters to measure customers' electrical usage. This longstanding technology uses a small motor to spin a disc, which is connected to gears and a set of dials that record cumulative kilowatt-hours ("KWH") of power that have passed through the meter. Historically, each meter was visited regularly, typically at monthly intervals, by a person who would read the meter and write down in a book the cumulative number of KWH of power shown on the meter, the date and location. That data was then passed to Taxpayer's central billing office. At the central billing office, Taxpayer's personnel would input the data into the mainframe computer, which would calculate the customer's electric usage in KWH since the last reading by subtracting the current reading from the prior reading, multiply the KWH usage times a rate (tariff) to arrive at the amount owed by the customer for the current period usage, and prepare a bill that would be mailed to the customer.

In Year 1, the data collection system was improved when Taxpayer began using portable handheld data log devices that its meter readers used to manually record the monthly readings from the standard meters. At the end of each day, the meter readings recorded on these devices were electronically transferred directly to the central office computers – saving time and labor, and minimizing errors. These devices also were used to record detailed information regarding customer accounts for each route in support of the next day's meter reading activity.

In Year 2, Taxpayer proposed the system-wide installation of a new set of electromechanical meters equipped with an optical scanner and a communication device. Using these meters, Taxpayer proposed to eliminate manual meter reads, saving costs and reducing billing errors. Taxpayer also envisioned operational cost savings through the ability to better locate outages because the meters were designed to be "pinged" to determine whether the meter was receiving power. Pinging involves the sending of a signal to a specific electronic address, which is designed to elicit a response if the meter is then operable (i.e., receiving electricity). These meters, known as Meter 1, utilized Taxpayer's power lines to carry the meter data signal back to substations, where it was gathered and transmitted automatically to Taxpayer's central computers.

The optical scanner and communication device on Meter 1 also gave Taxpayer the capability to implement time of use ("TOU") pricing. The optical scanning device was designed to read the mechanical rotations of a disc within the meter every hour and to send a signal of such usage to Taxpayer's central office every A hours. With its central billing computers and data systems, Taxpayer could then take the hourly usage data received from the meters and calculate customer bills using TOU rates.

While Taxpayer was in the process of installing Meter 1, the technology and capability of meters evolved. Because of the technological advances and the significantly enhanced capability of this new meter technology, Taxpayer decided that it would no longer continue to replace existing meters with Meter 1. Instead, Taxpayer sought and received permission from the Regulatory Body to begin installation of the new technologically advanced meters, known as Meter 2.

Meter 1 and Meter 2 are both approximately the same size and consist of a round dome clear glass cover, on a round base, which has four metal prongs at the bottom that insert into slots in the meter socket. When the meter is inserted into the socket a circuit is completed with half the prongs connecting to a receptacle on the utility side of the meter and the other prongs connecting to a receptacle on the customer's side of the meter, allowing electricity to flow from the power source on the utility's side of the meter into the customer's electric system. Both Meter 1 and Meter 2 are electrically activated and readily removable.

Meter 1 is a variation of an electromechanical induction meter that operates by counting the revolutions of an aluminum disc that is made to rotate by electrical fields at a speed proportional to the energy usage. The aluminum disc is supported by a spindle that has a worm gear that drives an analog register. The register is a series of dials that record the amount of electric energy used and can be viewed through the glass dome. Meter 1 also has an optical scanning device that reads the rotation of the aluminum disc by observing a line on the disc each time it makes a rotation. The observation of disc revolutions is sent back to the utility over the electric lines and is used to measure the electric energy usage.

The internal components of Meter 2 differ from those of Meter 1. Meter 2 measures electric energy usage using a solid state sensor and microprocessor, which then displays electric usage on a digital liquid crystal display screen, rather than through a direct mechanical measurement of energy usage that is registered on an analog dial.

Taxpayer has installed two models of Meter 2: Model A and Model B. Both models can be programmed. From a practical standpoint, these two models have essentially the same metrology components and perform essentially the same functions.

Inside the case of Meter 2 are various components that are designed to accomplish the following four functions:

1. Metrology, which senses and measures electric current, converts that measurement to a signal that goes to a register that records the measurement, and displays the accumulated amount of electricity used. The metrology portion of Meter 2 consists of two major components – a base and electronic module.

The base includes a precision current transformer that senses the current. The transformer reduces the current (amperage) and voltage to two sensors, which provide separate analog signals of voltage and amperage.

The electronic module has the metering circuitry, including a microcontroller, which enables energy accumulation and contains calibration information. The meter chips contained on the electronic module convert analog signals of current and voltage from the sensors into a digital form. The microcontroller calculates accumulated energy (volts multiplied by amps over time) and maintains the energy consumption for display. It uses non-volatile memory to store the metering data, including energy used, voltage, and amperage. The non-volatile memory does not require a battery to maintain information when power is unavailable. The Model A of Meter 2 contains memory of B bytes and Model B of Meter 2 contains memory of C bytes.

2. An advanced metering initiative (AMI) communications module that provides two-way wireless signal at a radio frequency of D megahertz. The AMI communications module of Meter 2 also is referred to as the local area networking (LAN) part of the

meter. It is electronic circuitry located on the Network Interface Card (NIC) within Meter 2, which is capable of using internet protocols addressing. Taxpayer uses this component to receive frequent usage readings (every few minutes) from the metrology parts of the meter and to send that data automatically to a data gathering system that leads to Taxpayer's central database. The AMI also has the capability, in conjunction with the meter, to control the disconnect switch.

The NIC is integrated with the meter at the factory using "through-pin" and serial port connections. The NIC includes an E processor with a speed of F MHz and contains A MB of flash storage capacity and G MB of random access memory (RAM), which is roughly comparable in terms of processing and storage capacity to early desktop computers, such as a Computer, which had a H MHz processor and similar amounts of storage.

The components of the NIC have the potential to perform some calculations that are now done on central office mainframe computers. For example, the NIC is capable of multiplying electrical usage by the tariff rate to calculate the customer's bill.

3. A Home Area Network (HAN) module to communicate from the meter to the customer's display or computer. It uses a separate radio circuit at I gigahertz frequency. The HAN was not functioning during the year at issue. However, the HAN is designed to be used by customers to access their account online or view their electricity usage data on a digital display or monitor, rather than waiting for a monthly bill.

4. A disconnect switch that can be programmed or directed by Taxpayer's credit collection and billing department to interrupt, initiate, or restore electric service by remote activation by the AMI communication module. The disconnect switch also can be programmed by the AMI communication module to perform a power-limiting function; that is, to shut off the service temporarily if the power usage through the meter exceeds a certain flow rate (amperage). While Meter 2 had the capability to operate the disconnect switch during the year at issue, the disconnect switch was not functioning then because it had not been programmed to do so.

These functions cannot be used and are not accessible for general computing uses in the same way as a personal computer. There is no connection jack, USB or other port, input keypad, computer display monitor, or physical connection with an external monitor. However, Taxpayer can program Meter 2 remotely through the wireless connectivity and internet protocols. This same wireless connectivity and internet protocol could potentially be used to give Meter 2 the capability to send information to display monitors at the customers' locations or Taxpayer's offices, where the information could be viewed. This potential function was not used during the year at issue.

While the above functions are integrated, should the AMI communications module, HAN module, and/or disconnect switch functions fail, Meter 2 would continue to measure the electrical current and store usage information in the memory register.

Meter 2 does not have an independent power source (battery) so that if power is unavailable, the meter cannot function. However, stored information is not lost in the absence of power. Meter 2 records and stores usage data in hourly increments for J days. Meter 2 is designed to continue to perform various functions (e.g., LAN communications), even though the disconnect switch is engaged and no power is flowing to the customer.

As previously mentioned, Taxpayer uses the LAN part of Meter 2 to receive frequent usage readings from the metrology parts of the meter and to send that data automatically to a data gathering system that leads to Taxpayer's central database. The equipment necessary for the automated relay of data between Meter 2 and Taxpayer's central database consists of wireless receiving and relay devices; that is, eBridges, relays, and access points (hereinafter, this equipment is referred collectively to as the "associated equipment"). Every one of these devices has embedded in it a microprocessor, which is the same one used in Meter 2. The associated equipment gathers data from many customers and feeds it to a specialized Meter Data Management (MDM) centralized computer system. Upon receiving the raw data from the Meter 2 system, the MDM checks for errors and then processes and translates the raw data into a form compatible with Taxpayer's existing customer care and billing central database. The other functions of the MDM include the monitoring of the system for meter failures and power outages. The MDM and customer care and billing central database are not dependent upon the type of meter used.

Meter 2 performs additional functions than Meter 1. The LAN part of Meter 2 and its associated equipment is designed to provide real-time usage data and other real-time information on a two-way basis between Meter 2 and Taxpayer's central billing office. Meter 2 also is designed through the HAN module to communicate information and other data to Taxpayer's customers. Finally, Meter 2 also is programmable so that it can be adapted to other information uses as conditions warrant. These capabilities will permit both Taxpayer and the customer to regulate electric usage by integrating customer billing and rate design with new dynamic rate structures and demand response programs.

Meter 2, like Meter 1, can be read remotely to enable more frequent meter reads needed to implement TOU rates. Meter 2, however, has enhanced capacity because it can communicate in real time rather than in hourly intervals. In addition, Meter 2 has the capability to read and record bi-directional power flows when a customer receives power and provides power at different times rather than simply measuring the net of the power flows over a meter reading time segment (e.g., over a segment that consists of several hours). Meter 2 then subtracts any customer-supplied power from Taxpayer-

supplied power thereby converting the bi-directional metering data to net metering data. This capability is available through use of the computerized memory register. The bi-directional metering data also includes detailed time-of-day data that will allow TOU pricing.

LAW AND ANALYSIS:

Section 167(a) provides that there shall be allowed as a depreciation deduction a reasonable allowance for the exhaustion, wear and tear (including a reasonable allowance for obsolescence) of property used in a taxpayer's trade or business.

The depreciation deduction provided by § 167(a) for tangible property placed in service after 1986 generally is determined under § 168. This section prescribes two methods of accounting for determining depreciation allowances. One method is the general depreciation system in § 168(a) and the other method is the alternative depreciation system in § 168(g). Under either depreciation system, the depreciation deduction is computed by using a prescribed depreciation method, recovery period, and convention.

For purposes of either § 168(a) or § 168(g), the applicable recovery period is determined by reference to class life or by statute. Section 168(i)(1) defines the term "class life" as meaning the class life (if any) that would be applicable with respect to any property as of January 1, 1986, under § 167(m) (determined without regard to § 167(m)(4) and as if the taxpayer had made an election under § 167(m)) as in effect on the day before the date of enactment of the Revenue Reconciliation Act of 1990. Former § 167(m) provided that in the case of a taxpayer who elected the Class Life Asset Depreciation Range system of depreciation, the depreciation allowance was based on the class life prescribed by the Secretary that reasonably reflected the anticipated useful life of that class of property to the industry or other group.

Section 1.167(a)-11(b)(4)(iii)(b) of the Income Tax Regulations provides rules for classifying property under former § 167(m). Under § 1.167(a)-11(b)(4)(iii)(b), property is classified according to primary use even though the activity in which such property is primarily used is insubstantial in relation to all the taxpayer's activity.

Rev. Proc. 87-56 sets forth the class lives of property subject to depreciation under § 168. This revenue procedure establishes two broad categories of depreciable assets: (1) asset classes 00.11 through 00.4 that consist of specific depreciable assets used in all business activities; and (2) asset classes 01.1 through 80.0 that consist of depreciable assets used in specific business activities. An asset that falls within both an asset group (that is, asset classes 00.11 through 00.4) and an activity group (that is, asset classes 01.1 through 80.0) would be classified in the asset group. See Norwest Corp. & Subs. v. Commissioner, 111 T.C. 105, 156-64 (1998).

Asset class 00.12, Information Systems, of Rev. Proc. 87-56 includes computers and their peripheral equipment used in administering normal business transactions and the maintenance of business records, their retrieval and analysis. Assets included in this asset class have a 6-year class life. Asset class 00.12 defines information systems as:

1) Computers: A computer is a programmable electronically activated device capable of accepting information, applying prescribed processes to the information, and supplying the results of these processes with or without human intervention. It usually consists of a central processing unit containing extensive storage, logic, arithmetic, and control capabilities. Adding machines, electronic desk calculators, etc., and other equipment described in asset class 00.13 are excluded from this category.

2) Peripheral equipment consists of the auxiliary machines which are designed to be placed under control of the central processing unit. Nonlimiting examples are: card readers, card punches, magnetic feed tapes, high speed printers, optical character readers, teleprinters, terminals, tape drives, disc drives, disc files, disc packs, visual image projector tubes, card sorters, plotters, and collators. Peripheral equipment may be used on-line or off-line.

Asset class 00.12 does not include equipment that is an integral part of other capital equipment that is included in other classes of economic activity, i.e., computers used primarily for process or production control, switching, channeling, and automating distributive trades and services such as point of sale computer systems. Asset class 00.12 also does not include equipment of a kind used primarily for amusement or entertainment of the user.

Asset class 49.14, Electric Utility Transmission and Distribution Plant, of Rev. Proc. 87-56, includes assets used in the transmission and distribution of electricity for sale and related land improvements. Assets included in this asset class have a 30-year class life.

Several appellate decisions discuss the "primary use" standard for asset classification under § 1.167(a)-11(b)(4)(ii)(b). See, e.g., Clajon Gas Co, L.P. v. Commissioner, 354 F. 3d 786 (8th Cir. 2004). Courts have concluded that the actual purpose and function of an asset determines its asset class (a use-driven functional standard) rather than the terminology used to describe an asset by its owners or others.

The Tax Court in PPL Corporation v. Commissioner, 135 T.C. 176 (2010), concluded that street light assets are not assets used in the distribution of electricity and, thus, not included in asset class 49.14 of Rev. Proc. 87-56. In reaching its conclusion, the Court looked at the definition of the word "distribution" as well as the primary use of the street light assets. The parties stipulated that distribution meant "the delivery of electric energy to customers" and "the final utility step in the provision of electric service to customers." The Court found this definition to be consistent with a standard definition of

distribution. 135 T.C. at 183. The Court also stated that the "distribution of electricity seems to us to be the process by which electricity (the commodity) gets to final consumers." Id. The Court found that street light assets could be disconnected from the distribution system without effecting electrical distribution to customers and they are distinct from distribution assets because they have a different purpose and function. On this last point, the Court found that distribution assets get final consumers electricity, service drops are the final part of the distribution of electricity to final consumers, and street light assets are not part of the service to get electricity to final consumers.

Section 306 of Division B of the Economic Stabilization Act of 2008, Pub. L. No. 110-343, 122 Stat. 3765 (2008), amended § 168 by adding §§ 168(e)(3)(D)(iii) and 168(i)(18). Both sections are effective for property placed in service after October 3, 2008.

Section 168(e)(3)(D)(iii) provides that the term "10-year property" includes any qualified smart electric meter.

Section 168(i)(18)(A) defines the term "qualified smart electric meter" as meaning any smart electric meter that: (i) is placed in service by a taxpayer who is a supplier of electric energy or a provider of electric energy services; and (ii) does not have a class life (determined without regard to §168(e)) of less than 10 years.

For purposes of § 168(i)(18)(A), § 168(i)(18)(B) defines the term "smart electric meter" as meaning any time-based meter and related communication equipment that is capable of being used by the taxpayer as part of a system that: (i) measures and records electricity usage data on a time-differentiated basis in at least 24 separate time segments per day; (ii) provides for the exchange of information between supplier or provider and the customer's electric meter in support of time-based rates or other forms of demand response; (iii) provides data to such supplier or provider so that the supplier or provider can provide energy usage information to customers electronically; and (iv) provides net metering.

Section 168(e)(3)(B)(iv) provides that any qualified technological equipment is 5-year property. Section 168(i)(2)(A) and (B)(i) define the term "qualified technological equipment" as meaning, in relevant part, any computer or any related peripheral equipment. Section 168(i)(2)(B)(ii) defines "computer" as meaning a programmable electronically activated device that: (I) is capable of accepting information, applying prescribed processes to the information, and supplying the results of these processes with or without human intervention; and (II) consists of a central processing unit containing extensive storage, logic, arithmetic, and control capabilities.

Section 168(i)(2)(B)(iii) defines "related peripheral equipment" as meaning any auxiliary machine (whether on-line or off-line) that is designed to be placed under the control of the central processing unit of a computer.

However, § 168(i)(2)(B)(iv) provides that the term "computer or peripheral equipment" shall not include, in relevant part, any equipment that is an integral part of other property that is not a computer.

The Tax Court in Broz v. Commissioner, 137 T.C. No. 3 (July 7, 2011), concluded that cell site equipment containing computerized parts, except for the switch, is not a computer under § 168(i)(2)(B)(ii). In reaching its conclusion, the Court determined that the key component of the base station and other cell site equipment was the radio. The Court found that the radio itself did not employ computer processing and did not contain a central processing unit containing extensive storage. The Court also found "compelling that even though the base station contained some of the same software as the switch, which is classified as a computer, the base station did not have the computer system or storage capacity to keep billing records." Further, the Court stated that the radio technology has functioned for many years without the use of computerized parts, suggesting that those parts are only ancillary.

In this case, the Director and Taxpayer agree that Meter 2 is a smart electric meter under § 168(i)(18)(B). A smart electric meter placed in service after October 3, 2008, is not a qualified smart electric meter under § 168(i)(18)(A) if the meter has a class life of less than 10 years. Thus, at issue in this technical advice memorandum is whether Meter 2 is classified in asset class 00.12 of Rev. Proc. 87-56 or is qualified technological equipment under § 168(i)(2).

Information systems

Meter 2, like Meter 1 and Taxpayer's electromechanical meters, is used in the distribution of electricity for sale to final consumers. Meter 2 is the device that allows electricity to flow from Taxpayer to its customers and that measures such electricity. Without these functions, Taxpayer would be unable to distribute and sell its electricity. Accordingly, Meter 2 (and Meter 1 and Taxpayer's electromechanical meters) are included in the activity category of asset class 49.14 of Rev. Proc. 87-56.

However, if an asset is included in both an asset category and an activity category, the asset is classified in the asset category unless it is specifically excluded from the asset category or specifically included in the activity category. See Norwest; Rev. Rul. 2003-81, 2003-2 C.B. 126. Accordingly, if Meter 2 also is included in the asset category of asset class 00.12 of Rev. Proc. 87-56, then Meter 2 is classified in asset class 00.12.

An asset is included in asset class 00.12 if the asset (i) is a computer or peripheral equipment and (ii) is used in administering normal business transactions and the maintenance of business records, their retrieval and analysis.

We first consider whether Meter 2 is used in administering normal business transactions and the maintenance of business records, their retrieval and analysis. During the year at issue, Meter 2 recorded the sale of electricity (the product) to Taxpayer's customers, stored this information for J days, and sent the information automatically to Taxpayer's data gathering system that leads to Taxpayer's customer care and billing central database. Meter 2 also protects Taxpayer from the loss of revenue generated by the sale of electricity. Meter 2 is tamper-resistant thereby preventing some common methods of electricity theft. Based on these uses of Meter 2 during the year at issue, we conclude that Meter 2 is used in administering normal business transactions and the maintenance of business records, their retrieval and analysis during the year at issue.

Next, we consider whether Meter 2 is a computer or peripheral equipment as defined in asset class 00.12 of Rev. Proc. 87-56.

Meter 2 is a computer as defined in asset class 00.12 of Rev. Proc. 87-56. First, it is a programmable electronically activated device. Taxpayer can program Meter 2 remotely through the wireless connectivity and internet protocols. Taxpayer's credit collection and billing department can program the disconnect switch contained in Meter 2 to interrupt, initiate, or restore electric service. The disconnect switch also can be programmed by the AMI communication module to perform a power-limiting function (i.e., shutting off electric service temporarily if the power usage through the meter exceeds a certain amperage). Meter 2 also can be programmed to detect energy tampering or service quality issues and to notify the central billing system when these events occur. Furthermore, Taxpayer can use the remote programming feature to enhance performance and features of Meter 2 (e.g., enhancing the security of Meter 2 and upgrading software programs).

Second, Meter 2 is capable of accepting information, applying prescribed processes to the information, and supplying the results of these processes with or without human intervention. For example, when customer-source power is supplied to the electric grid, Meter 2 does not immediately perform net metering. Instead, Meter 2 is capable of providing bi-directional metering. In this case, Meter 2 separately measures Taxpayer-supplied power and customer-supplied power, and then subtracts any customer-supplied power from Taxpayer-supplied power thereby converting the bi-directional metering data to net metering data. The bi-directional metering data also includes detailed time-of-day data that will allow TOU pricing. Meter 2 also has the capability to multiply electricity usage by the tariff rate to calculate the customer's bill, which is now done on Taxpayer's central office mainframe computers, and through the HAN module has the capability to send this information to display monitors at the customers' locations for viewing. While these functions were not used by Taxpayer during the year at issue, the plain language of asset class 00.12 focuses on the device's capability rather than the device's actual use during the year. Meter 2 also is capable of sending, and was used during the year at issue to send, usage data through Meter 2's LAN and

the associated equipment to the Taxpayer's centralized database, where the data is further processed, checked, and translated.

Finally, Meter 2 contains a central processing unit with extensive storage, logic, arithmetic, and control capabilities. In evaluating this requirement, the Director and Taxpayer had differing views. Taxpayer argues that this determination should be based on what was considered extensive storage in 1984 when the definition of computer in the predecessor of § 168(i)(2)(B) (i.e., former § 168(j)(5)(D)) was enacted. The Director argues that the determination should be based on what is considered extensive storage currently. Given the ever-changing and increasing processing and storage capacities of computers, we do not agree with either position. Using Taxpayer's position will render the term "extensive" meaningless in asset class 00.12. Using the Director's position could potentially cause a device that was considered to have extensive storage, logic, arithmetic, and control capabilities in its placed-in-service year not to have such storage, logic, arithmetic, and control capabilities in a subsequent year during its recovery period. Instead, we believe that the determination should be based on what is considered to be extensive storage, logic, arithmetic, and control capabilities in the placed-in-service year of the device that are needed for the device to perform its actual and potential functions.

Based on the information provided to us to date, we believe that Meter 2 has a central processing unit containing extensive storage, logic, arithmetic, and control capabilities that enables Meter 2 to perform its functions actually used during the year at issue and its potential functions. While Meter 2's processing and storage capacity is comparable to early desktop computers, we believe that Meter 2's processing and storage capacity is sufficiently extensive to perform its actual and potential functions.

The exceptions in asset class 00.12 of Rev. Proc. 87-56 do not apply to Meter 2. Specifically, Meter 2 is not used primarily for process or production control, switching, channeling, and automating distributive trades and services such as point of sale computer systems. While the disconnect switch of Meter 2 can be programmed by the AMI communication module to perform a power-limiting function (i.e., shutting off electric service temporarily if the power usage through the meter exceeds a certain amperage) and Meter 2 can be programmed to detect energy tampering or service quality issues (e.g., pinpoint power outages), these process or production control uses are not the primary uses of Meter 2.

Arguably, Meter 2 is similar to a point of sale computer system. For insight into this question, it is necessary to examine the modifications made by Rev. Proc. 80-15, 1980-1 C.B. 618, to the asset classes in Rev. Proc. 77-10, 1977-1 C.B. 548.

Rev. Proc. 80-15 added the following new asset classes to Rev. Proc. 77-10: 57.0, Distributive Trades and Services, and 57.1, Distributive Trades and Services-Billboard, Service Station Buildings and Petroleum Marketing Land Improvements. These new

asset classes include the assets that were included in asset classes 13.4, 50.0, 50.1, 70.2, and 70.21 of Rev. Proc. 77-10, which were deleted by Rev. Proc. 80-15. Rev. Proc. 80-15 also clarified asset class 00.12 of Rev. Proc. 77-10 by providing that asset class 00.12 does not include computers used primarily for automating distributive trades and services such as point of sale computer systems. Rev. Proc. 80-15 was effective for assets placed in service in taxable years ending on or after April 28, 1980. For taxable years ending prior to April 28, 1980, Rev. Proc. 80-15 provided that distributive trades and services automated equipment such as point of sale computer systems are properly classified in asset class 00.12, 50.0, or 70.2, depending upon which class was selected by the taxpayer on its original return.

Our review of the modifications made by Rev. Proc. 80-15 indicate that the addition of the new asset classes for distributive trades and services and the new exception to asset class 00.12 for computers used primarily for automating distributive trades and services such as point of sale computer systems are linked together. Accordingly, the exception to asset class 00.12 of Rev. Proc. 87-56 for computers used primarily for automating distributive trades and services such as point of sale computer systems is limited to business activities described in the asset classes for distributive trades and services (asset classes 57.0 and 57.1 of Rev. Proc. 87-56).

Based on Taxpayer's use of Meter 2, the plain language of asset class 00.12 of Rev. Proc. 87-56, and our conclusion that Meter 2 has a central processing unit containing extensive storage, logic, arithmetic, and control capabilities that enables Meter 2 to perform its functions actually used during the year at issue and its potential functions, Taxpayer's Meter 2 is an information system included in asset class 00.12 of Rev. Proc. 87-56.

We also conclude that the associated equipment is peripheral equipment as defined in asset class 00.12 of Rev. Proc. 87-56. The associated equipment is designed to be placed under the control of the central processing unit of Taxpayer's centralized computer system.

In this case, Meter 2 and the associated equipment serve a dual purpose. They are included in asset class 49.14 of Rev. Proc. 87-56, an activity category, and asset class 00.12 of Rev. Proc. 87-56, an asset category. An asset that is included in both an asset category and an activity category is classified in the asset category unless it is specifically excluded from the asset category or specifically included in the activity category. See Norwest; Rev. Rul. 2003-81. Because Meter 2 and the associated equipment are included in both asset class 00.12 and asset class 49.14, and not specifically excluded from asset class 00.12 or specifically included in asset class 49.14, Meter 2 and the associated equipment are classified in asset class 00.12. [1]

[1] Meter 1 and Taxpayer's electromechanical meters are not included in asset class 00.12 of Rev. Proc. 87-56. The Director and Taxpayer agree that Meter 1 is not a computer. Based on the information provided to date, we believe

The Director makes several arguments in support of its position that Meter 2 is not included in asset class 00.12 of Rev. Proc. 87-56. First, the Director argues that based on the heading for the "00" asset classes of Rev. Proc. 87-56, Specific Depreciable Assets Used In All Business Activities, Except As Noted, the asset must be of a type used in all business activities to be included in an asset class with a "00" prefix; but Meter 2 can only be used in one specific type of activity, i.e., the sale of electricity by an electric company. We disagree. Under the heading "Specific Depreciable Assets Used in All Business Activities, Except as Noted," there are 14 asset classes with a "00" prefix and one of them is titled "Information Systems." For the reasons previously stated, we conclude that Meter 2 is an information system. Further, the asset classes with a "00" prefix prescribe class lives for specific depreciable assets, such as information systems, regardless of the business activity in which they are used.

Second, the Director argues that Meter 2 is not an information system because Taxpayer primarily uses this meter to distribute and measure electricity for sale. We agree that Taxpayer uses Meter 2 in this activity. However, as previously discussed, we conclude that Meter 2 is dual-use property that also is used by Taxpayer as an information system. In such a case, the asset category of asset class 00.12 of Rev. Proc. 87-56 prevails over the activity category of asset class 49.14 of Rev. Proc. 87-56. See Norwest; Rev. Rul. 2003-81 (bookcase primarily used in connection with the production of electricity for sale is classified in asset class 00.11 of Rev. Proc. 87-56 even though bookcase also is included in asset class 49.13 of Rev. Proc. 87-56).

The Director also argues that the exception in asset class 00.12 for equipment that is an integral part of other capital equipment that is included in other classes of economic activity should be applied broadly rather than applied only to the listed items. Asset class 00.12 does not include equipment that is an integral part of other capital equipment that is included in other classes of economic activity, i.e., computers used primarily for process or production control, switching, channeling, and automating distributive trades and services such as point of sale computer systems (emphasis added). If the listed items were meant to be examples, then "e.g." instead of "i.e." should have been used. Accordingly, the plain language of asset class 00.12 does not support a broader application.

Finally, the Director argues that Meter 2 is not an information system because it is not used by Taxpayer in administering normal business transactions and the maintenance of business records, their retrieval and analysis. For the reasons previously stated, we do not agree with this argument.

Qualified technological equipment

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that Meter 1 is not peripheral equipment. Further, Taxpayer's electromechanical meters clearly are not computers or peripheral equipment.

In light of our conclusion that Meter 2 and the associated equipment have a class life of less than 10 years because these assets are properly includible in asset class 00.12 of Rev. Proc. 87-56, we will not address whether Meter 2 and the associated equipment is qualified technological equipment under § 168(i)(2)(B). We note, however, that the definition of computer or peripheral equipment in § 168(i)(2)(B) is not the same as the definition of such terms in asset class 00.12 of Rev. Proc. 87-56. Specifically, the exception in § 168(i)(2)(B)(iv)(I) is broader than the exception in the last paragraph of asset class 00.12 of Rev. Proc. 87-56.

CAVEAT:

Temporary or final regulations pertaining to one or more of the issues addressed in this memorandum have not yet been adopted. Therefore, this memorandum will be modified or revoked by the adoption of temporary or final regulations to the extent the regulations are inconsistent with any conclusions in the memorandum. See section 13.03 of Rev. Proc. 2011-2, 2011-1 I.R.B. 90, 106 (or any successor). However, a technical advice memorandum that modifies or revokes a letter ruling or another technical advice memorandum generally is not applied retroactively if the taxpayer can demonstrate that the criteria in section 13.02 of Rev. Proc. 2011-2 are satisfied.

A copy of this technical advice memorandum is to be given to the taxpayer. Section 6110(k)(3) of the Code provides that it may not be used or cited as precedent.

EXHIBIT N

Consumer Guide

Wireless Devices and Health Concerns

Current Exposure Limits

While there is no federally developed national standard for safe levels of exposure to radiofrequency (RF) energy, many federal agencies have addressed this important issue. In addition to the Federal Communications Commission, federal health and safety agencies such as the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) have been actively involved in monitoring and investigating issues related to RF exposure. For example, the FDA has issued guidelines for safe RF emission levels from microwave ovens, and it continues to monitor exposure issues related to the use of certain RF devices such as cellular telephones. NIOSH conducts investigations and health hazard assessments related to occupational RF exposure.

Federal, state and local government agencies and other organizations have generally relied on RF exposure standards developed by expert non-government organizations such as the Institute of Electrical and Electronics Engineers (IEEE) and the National Council on Radiation Protection and Measurements (NCRP). Since 1996, the FCC has required that all wireless communications devices sold in the United States meet its minimum guidelines for safe human exposure to radiofrequency (RF) energy. The FCC's guidelines and rules regarding RF exposure are based upon standards developed by IEEE and NCRP and input from other federal agencies, such as those listed above. These guidelines specify exposure limits for hand-held wireless devices in terms of the Specific Absorption Rate (SAR). The SAR is a measure of the rate that RF energy is absorbed by the body. For exposure to RF energy from wireless devices, the allowable FCC SAR limit is 1.6 watts per kilogram (W/kg), as averaged over one gram of tissue.

All wireless devices sold in the US go through a formal FCC approval process to ensure that they do not exceed the maximum allowable SAR level when operating at the device's highest possible power level. If the FCC learns that a device does not confirm with the test report upon which FCC approval is based – in essence, if the device in stores is not the device the FCC approved – the FCC can withdraw its approval and pursue enforcement action against the appropriate party.

Recent Developments

Several US government agencies and international organizations work cooperatively to monitor research on the health effects of RF exposure. According to the FDA and the World Health Organization (WHO), among other organizations, to date, the weight of scientific evidence has not effectively linked exposure to radio frequency energy from mobile devices with any known health problems.

The FDA maintains a website on RF issues at www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/default.htm. The World Health Organization (WHO), which has established an International Electromagnetic Fields Project (IEFP) to provide information on health risks, establish research needs and support efforts to harmonize RF exposure standards, provides additional information on RF exposure and mobile phone use at www.who.int/mediacentre/factsheets/fs193/en/index.html. For more information on the IEFP, go to www.who.int/peh-emf/en.

Federal Communications Commission · Consumer and Governmental Affairs Bureau · 445 12th St. SW. Washington, DC 20554
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EXHIBIT O

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 8 2002

OFFICE OF
AIR AND RADIATION

Janet Newton
President
The EMR Network
P.O. Box 221
Marshfield, VT 05658

Dear Ms. Newton:

Thank you for your letter of January 31, 2002, to the Environmental Protection Agency Administrator Whitman, in which you express your concerns about non-thermal effects of radiofrequency (RF) radiation and the adequacy of the Federal Communications Commission's RF radiation exposure guidelines. The Administrator has asked us to critically examine the issues you bring to our attention, and we will be responding to you shortly.

We appreciate your interest in the matter of non-thermal RF exposure, possible health risks, and Federal government responsibility to protect human health.

Sincerely,

Frank Marcinowski, Director
Radiation Protection Division

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 16 2002

OFFICE OF
AIR AND RADIATION

Ms. Janet Newton
President
The EMR Network
P.O. Box 221
Marshfield, VT 05658

Dear Ms.Newton:

This is in reply to your letter of January 31, 2002, to the Environmental Protection Agency (EPA) Administrator Whitman, in which you express your concerns about the adequacy of the Federal Communications Commission's (FCC) radiofrequency (RF) radiation exposure guidelines and nonthermal effects of radiofrequency radiation. Another issue that you raise in your letter is the FCC's claim that EPA shares responsibility for recommending RF radiation protection guidelines to the FCC. I hope that my reply will clarify EPA's position with regard to these concerns. I believe that it is correct to say that there is uncertainty about whether or not current guidelines adequately treat nonthermal, prolonged exposures (exposures that may continue on an intermittent basis for many years). The explanation that follows is basically a summary of statements that have been made in other EPA documents and correspondence.

The guidelines currently used by the FCC were adopted by the FCC in 1996. The guidelines were recommended by EPA, with certain reservations, in a letter to Thomas P. Stanley, Chief Engineer, Office of Engineering and Technology, Federal Communications Commission, November 9, 1993, in response to the FCC's request for comments on their Notice of Proposed Rulemaking (NPRM), Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation (enclosed).

The FCC's current exposure guidelines, as well as those of the Institute of Electrical and Electronics Engineers (IEEE) and the International Commission on Non-ionizing Radiation Protection, are thermally based, and do not apply to chronic, nonthermal exposure situations. They are believed to protect against injury that may be caused by acute exposures that result in tissue heating or electric shock and burn. The hazard level (for frequencies generally at or greater than 3 MHz) is based on a specific absorption dose-rate, SAR, associated with an effect

that results from an increase in body temperature. The FCC's exposure guideline is considered protective of effects arising from a thermal mechanism but not from all possible mechanisms. Therefore, the generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified.

These guidelines are based on findings of an adverse effect level of 4 watts per kilogram (W/kg) body weight. This SAR was observed in laboratory research involving acute exposures that elevated the body temperature of animals, including nonhuman primates. The exposure guidelines did not consider information that addresses nonthermal, prolonged exposures, i.e., from research showing effects with implications for possible adversity in situations involving chronic/prolonged, low-level (nonthermal) exposures. Relatively few chronic, low-level exposure studies of laboratory animals and epidemiological studies of human populations have been reported and the majority of these studies do not show obvious adverse health effects. However, there are reports that suggest that potentially adverse health effects, such as cancer, may occur. Since EPA's comments were submitted to the FCC in 1993, the number of studies reporting effects associated with both acute and chronic low-level exposure to RF radiation has increased.

While there is general, although not unanimous, agreement that the database on low-level, long-term exposures is not sufficient to provide a basis for standards development, some contemporary guidelines state explicitly that their adverse-effect level is based on an increase in body temperature and do not claim that the exposure limits protect against both thermal and nonthermal effects. The FCC does not claim that their exposure guidelines provide protection for exposures to which the 4 W/kg SAR basis does not apply, i.e., exposures below the 4 W/kg threshold level that are chronic/prolonged and nonthermal. However, exposures that comply with the FCC's guidelines generally have been represented as "safe" by many of the RF system operators and service providers who must comply with them, even though there is uncertainty about possible risk from nonthermal, intermittent exposures that may continue for years.

The 4 W/kg SAR, a whole-body average, time-average dose-rate, is used to derive dose-rate and exposure limits for situations involving RF radiation exposure of a person's entire body from a relatively remote radiating source. Most people's greatest exposures result from the use of personal communications devices that expose the head. In summary, the current exposure guidelines used by the FCC are based on the effects resulting from whole-body heating, not exposure of and effect on critical organs including the brain and the eyes. In addition, the maximum permitted local SAR limit of 1.6 W/kg for critical organs of the body is related directly to the permitted whole body average SAR (0.08 W/kg), with no explanation given other than to limit heating.

I also have enclosed a letter written in June of 1999 to Mr. Richard Tell, Chair, IEEE SCC28 (SC4) Risk Assessment Work Group, in which the members of the Radiofrequency Interagency Work Group (RFIAWG) identified certain issues that they had determined needed to be addressed in order to provide a strong and credible rationale to support RF exposure guidelines.

Federal health and safety agencies have not yet developed policies concerning possible risk from long-term, nonthermal exposures. When developing exposure standards for other physical agents such as toxic substances, health risk uncertainties, with emphasis given to sensitive populations, are often considered. Incorporating information on exposure scenarios involving repeated short duration/nonthermal exposures that may continue over very long periods of time (years), with an exposed population that includes children, the elderly, and people with various debilitating physical and medical conditions, could be beneficial in delineating appropriate protective exposure guidelines.

I appreciate the opportunity to be of service and trust that the information provided is helpful. If you have further questions, my phone number is (202) 564-9235 and e-mail address is hankin.norbert@epa.gov.

Sincerely,

Norbert Hankin
Center for Science and Risk Assessment
Radiation Protection Division

Enclosures:

1) letter to Thomas P. Stanley, Chief Engineer, Office of Engineering and Technology, Federal Communications Commission, November 9, 1993, in response to the FCC's request for comments on their Notice of Proposed Rulemaking (NPRM), Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation
2) June 1999 letter to Mr. Richard Tell, Chair, IEEE SCC28 (SC4) Risk Assessment Work Group from the Radiofrequency Radiation Interagency Work Group

EXHIBIT P

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

FEB - 7 2014

TAKE PRIDE IN AMERICA

In Reply Refer To: (ER 14/0001) (ER 14/0004).

Mr. Eli Veenendaal
National Telecommunications and Information
Administration
U.S. Department of Commerce
1401 Constitution Avenue, N.W.
Washington, D.C. 20230

Dear Mr. Veenendaal:

The Department of the Interior (Department) has reviewed the above referenced proposal and submits the following comments and attachment for consideration. Because the First Responder Network Authority (FirstNet) is a newly created entity, we commend the U.S. Department of Commerce for its timely proposals for NEPA implementing procedures.

The Department believes that some of the proposed procedures are not consistent with Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds, which specifically requires federal agencies to develop and use principles, standards, and practices that will lessen the amount of unintentional take reasonably attributed to agency actions. The Department, through the Fish and Wildlife Service (FWS), finds that the proposals lack provisions necessary to conserve migratory bird resources, including eagles. The proposals also do not reflect current information regarding the effects of communication towers to birds. Our comments are intended to further clarify specific issues and address provisions in the proposals.

The Department recommends revisions to the proposed procedures to better reflect the impacts to resources under our jurisdiction from communication towers. The placement and operation of communication towers, including un-guyed, unlit, monopole or lattice-designed structures, impact protected migratory birds in two significant ways. The first is by injury, crippling loss, and death from collisions with towers and their supporting guy-wire infrastructure, where present. The second significant issue associated with communication towers involves impacts from non-ionizing electromagnetic radiation emitted by them (See Attachment).

In addition to the 147 Birds of Conservation Concern (BCC) species, the FWS has listed an additional 92 species as endangered or threatened under the Endangered Species Act. Together with the bald and golden eagle, this represents 241 species of birds whose populations are in trouble or otherwise merit special protection, according to the varying criteria of these lists. The Department suggests that FirstNet consider preparing a programmatic environmental impact statement (see attachment) to determine and address cumulative impacts from authorizing FirstNet projects on those 241 species for which the incremental impact of tower mortality, when

added to other past, present, and reasonably foreseeable future actions, is most likely significant, given their overall imperiled status. Notwithstanding the proposed implementing procedures, a programmatic NEPA document might be the most effective and efficient method for establishing best management practices for individual projects, reducing the burden to individual applicants, and addressing cumulative impacts.

Categorical Exclusions
The Department has identified 13 of the proposed categorical exclusions (A-6, A-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14 A-15, A-16, A-17, and A-19) as having the potential to significantly affect wildlife and the biological environment. Given this potential, we want to underscore the importance of our comments on FirstNet's procedural guidance under Environmental Review and Consultation Requirements for NEPA Reviews and its list of extraordinary circumstances in Appendix D.

Environmental Review and Consultation Requirements for NEPA Reviews
To ensure there are no potentially significant impacts on birds from projects that may otherwise be categorically excluded, the Department recommends including the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act to the list of requirements in this section.

Extraordinary Circumstances
To avoid potentially significant impacts on birds from projects that may otherwise be categorically excluded, the Department recommends including species covered under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act to the list of environmentally sensitive resources. Additionally, adding important resources to migratory birds such as sites in the Western Hemisphere Shorebird Reserve Network and Audubon Important Bird Areas to the paragraph on areas having special designation or recognition would help ensure their consideration when contemplating use of a categorical exclusion.

Developing the Purpose and Need
The Department recommends inclusion of language that would ensure consideration of all other authorities to which NEPA is supplemental as opposed to simply the FirstNet mission. As currently written, the procedures are limited to ensuring the purpose and need considers the FirstNet mission. If strictly applied, this approach would severely limit the range of reasonable alternatives, and likely preclude consideration of more environmentally benign locations or construction practices.

Environmental Review Process, Apply NEPA Early in the Process, Where Action is by Non-Federal Entity
The Department recommends that FirstNet be required to coordinate with federal agencies having jurisdiction by law or special expertise on construction and lighting of its network of towers.

Thank you for the opportunity to comment on the draft document. If you have any questions concerning the comments, please contact Diana Whittington, NEPA Migratory Bird lead, at (703) 358-2010. If you have any questions regarding Departmental NEPA procedures, contact Lisa Treichel, Office of Environmental Policy and Compliance at (202) 208-7116.

Sincerely,

Willie R. Taylor
Director, Office of Environmental Policy
and Compliance

Enclosure

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Enclosure A

Background

The placement and operation of communication towers, including un-guyed, unlit, monopole or lattice-designed structures, impact protected migratory birds in two significant ways.

The first is by injury, crippling loss, and death from collisions with towers and their supporting guy-wire infrastructure, where present. Mass mortality events tend to occur during periods of peak spring and fall songbird bird migration when inclement weather events coincide with migration, and frequently where lights (either on the towers and/or on adjacent outbuildings) are also present. This situation has been well documented in the U.S. since 1948 in the published literature (Aronoff 1949, see Manville 2007a for a critique). The tallest communication towers tend to be the most problematic (Gehring *et al.* 2011). However, mid-range (~400-ft) towers as proposed by the First Responder Network Authority (FirstNet, a newly created entity under the Department of Commerce) can also significantly impact protected migratory birds, as can un-guyed and unlit lattice and monopole towers (Gehring *et al.* 2009, Manville 2007a, 2009, 2013a). Mass mortalities (more than several hundred birds per night) at unguyed, unlit monopole and lattice towers were documented in fall 2005 and 2011 in the Northeast and North Central U.S. (*e.g.*, Manville 2007a). It has been argued that communication towers including "short" towers do not impact migratory birds, including at the population level (*e.g.*, Arnold and Zink 2011), but recent findings have contradicted that assertion (Manville 2007a, 2013a, Longcore *et al.* 2012, 2013).

The second significant issue associated with communication towers involves impacts from non-ionizing electromagnetic radiation emitted by these structures. Radiation studies at cellular communication towers were begun circa 2000 in Europe and continue today on wild nesting birds. Study results have documented nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death (*e.g.*, Balmori 2005, Balmori and Hallberg 2007, and Everaert and Bauwens 2007). Nesting migratory birds and their offspring have apparently been affected by the radiation from cellular phone towers in the 900 and 1800 MHz frequency ranges – 915 MHz is the standard cellular phone frequency used in the United States. However, the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today. This is primarily due to the lower levels of radiation output from microwave-powered communication devices such as cellular telephones and other sources of point-to-point communications; levels typically lower than from microwave ovens. The problem, however, appears to focus on very low levels of non-ionizing electromagnetic radiation. For example, in laboratory studies, T. Litovitz (personal communication) and DiCarlo *et al.* (2002) raised concerns about impacts of low-level, non-thermal electromagnetic radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos – with some lethal results (Manville 2009, 2013a). Radiation at extremely low levels (0.0001 the level emitted by the average digital cellular telephone) caused heart attacks and the deaths of some chicken embryos subjected to hypoxic conditions in the laboratory while controls subjected to hypoxia were unaffected (DiCarlo *et al.* 2002). To date, no independent, third-party field studies have been conducted in North America on impacts of tower electromagnetic radiation on migratory birds. With the European field and U.S. laboratory evidence already available,

independent, third-party peer-reviewed studies need to be conducted in the U.S. to begin examing the effects from radiation on migratory birds and other trust species.

Discussion

Collision Deaths and Categorical Exclusions

Attempts to estimate bird-collision mortality at communication towers in the U.S. resulted in figures of 4-5 million bird deaths per year (Manville 2005, 2009). A meta-review of the published literature now suggests, based on statistically determined parameters, that mortality may be 6.8 million birds per year in Canada and the U.S.; the vast majority in the United States (Longcore *et al.* 2012). Up to 350 species of birds have been killed at communication towers (Manville 2007a, 2009). The Service's Division of Migratory Bird Management has updated its voluntary, 2000 communication tower guidelines to reflect some of the more recent research findings (Manville 2013b). However, the level of estimated mortality alone suggests at a minimum that FirstNet prepare an environmental assessment to estimate and assess the cumulative effects of tower mortality to protected migratory birds.

A second meta-review of the published mortality data from scientific studies conducted in the U.S. and Canada (Longcore *et al.* 2013) strongly correlates population effects to at least 13 species of Birds of Conservation Concern (BCC, USFWS 2008). These are mortalities to BCC species based solely on documented collisions with communication towers in the U.S. and Canada, ranging from estimated annual levels of mortality of 1 to 9% of their estimated total population. Among these where mortality at communication towers was estimated at over 2% annually are the Yellow Rail, Swainson's Warbler, Pied-billed Grebe, Bay-breasted Warbler, Golden-winged Warbler, Prairie Warbler, and Ovenbird. Longcore *et al.* (2013) emphasized that avian mortality associated with anthropogenic sources is almost always reported in the aggregate, *i.e.*, "number of birds killed," which cannot detect species-level effects necessary to make effective and meaningful conservation assessments, including determining cumulative effects. These new findings strongly suggest the need for at least an environmental assessment by FirstNet, or more likely, an environmental impact statement.

Radiation Impacts and Categorical Exclusions

There is a growing level of anecdotal evidence linking effects of non-thermal, non-ionizing electromagnetic radiation from communication towers on nesting and roosting wild birds and other wildlife in the U.S. Independent, third-party studies have yet to be conducted in the U.S. or Canada, although a peer-reviewed research protocol developed for the U.S. Forest Service by the Service's Division of Migratory Bird Management is available to study both collision and radiation impacts (Manville 2002).

As previously mentioned, Balmori (2005) found strong negative correlations between levels of tower-emitted microwave radiation and bird breeding, nesting, and roosting in the vicinity of electromagnetic fields in Spain. He documented nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death in House Sparrows, White Storks, Rock Doves, Magpies, Collared Doves, and other species. Though these species had historically been documented to roost and nest in these areas, Balmori (2005) did not observe these symptoms prior to construction and operation of the cellular phone towers. Balmori and Hallberg (2007) and Everaert and Bauwens (2007) found similar strong negative correlations

among male House Sparrows. Under laboratory conditions, DiCarlo *et al.* (2002) raised troubling concerns about impacts of low-level, non-thermal electromagnetic radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos – with some lethal results (Manville 2009). Given the findings of the studies mentioned above, field studies should be conducted in North America to validate potential impacts of communication tower radiation – both direct and indirect – to migratory birds and other trust wildlife species.

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EXHIBIT Q

MICRO WAVE NEWS
A Report on Non-Ionizing Radiation

Cell Phone Radiation Boosts Cancer Rates in Animals; $25 Million NTP Study Finds Brain Tumors

U.S. Government Expected To Advise Public of Health Risk

May 25, 2016

The cell phone cancer controversy will never be the same again.

The U.S. National Toxicology Program (NTP) is expected to issue a public announcement that cell phone radiation presents a cancer risk for humans. The move comes soon after its recently completed study showed statistically significant increases in cancer among rats that had been exposed to GSM or CDMA signals for two-years.

Discussions are currently underway among federal agencies on how to inform the public about the new findings. NTP senior managers believe that these results should be released as soon as possible because just about everyone is exposed to wireless radiation all the time and therefore everyone is potentially at risk.

The new results contradict the conventional wisdom, advanced by doctors, biologists, physicists, epidemiologists, engineers, journalists and government officials, among other pundits, that such effects are impossible. This view is based, in part, on the lack of an established mechanism for RF radiation from cell phones to induce

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cancer. For instance, earlier this week (May 22), a medical doctor in Michigan wrote an opinion piece for the *Wall Street Journal* stating that, "There is no known mechanism by which mobile phones might cause brain tumors." He went on to argue that there is no need to warn the public about health risks.

The NTP findings show that as the intensity of the radiation increased, so did the incidence of cancer among the rats. "There was a significant dose-response relationship," a reliable source, who has been briefed on the results, told *Microwave News*. No effect was seen among mice. The source asked that his/her name not be used since the NTP has not yet made a formal announcement. The rats were exposed to three different exposure levels (1.5, 3 and 6 W/Kg, whole body exposures) and two different types of cell phone radiation, GSM and CDMA.

An Amazing Coincidence?

Importantly, the exposed rats were found to have higher rates of two types of cancers: glioma, a tumor of the glial cells in the brain, and malignant schwannoma of the heart, a very rare tumor. None of the unexposed control rats developed either type of tumor.

A number of epidemiological studies have linked cell phones to both gliomas and to Schwann cell tumors. The Interphone study, for instance, found an association between the use of cell phones and gliomas.

The sheath that wraps around cranial nerves —such as the one that connects the inner ear to the brain— is made of Schwann cells. Tumors of those cells are called acoustic neuromas. That is, an acoustic neuroma is a type of schwannoma. At least four different epidemiological studies have found an association between the use of cell phones and acoustic neuromas.

Ron Melnick, who led the team that designed the NTP study and who is now retired, confirmed the general outline of the results detailed by the confidential source. "The NTP tested the hypothesis that cell phone radiation could not cause health effects and that hypothesis has now been disproved," he said in a telephone interview. "The experiment has been done and, after extensive reviews, the consensus is that there was a carcinogenic effect."

"These data redefine the cell phone radiation controversy," Melnick said. The safety of cell phones has been debated for more than 20

PAGE # 217

years, especially after the International Agency for Research on Cancer (IARC) classified RF radiation as a possible human carcinogen in 2011.

"This is a major public health concern because the cells which became cancerous in the rats were the same types of cells as those that have been reported to develop into tumors in cell phone epidemiological studies," Melnick added. "For this to be a chance coincidence would be truly amazing."

The NTP radiation project, which has been underway for more than a decade, is the most expensive ever undertaken by the toxicology program. More than $25 million has been spent so far.

Another interesting coincidence is that the Ramazzini study of rats in Bologna exposed to extremely low frequency (50 Hz) EMFs also developed a significant increase in malignant schwannoma of the heart.

NTP Stands By the Study Results

Because of the importance of these results to public health, the NTP alerted the highest levels of the National Institutes of Health (NIH), where resistance prompted further reviews. No serious flaws in the data or the conduct of the studies were identified.

Senior managers including Linda Birnbaum, the director of the National Institute of Environmental Health Sciences (NIEHS) who also serves as the director of the NTP, and John Bucher, the associate director of the NTP, who is in charge of the cell phone study, are standing by the study findings. They see the need to release the results as a public health imperative, according to the source.

Chris Portier, who once held Bucher's job, agrees that the NTP is doing the right thing. "I would be adamant that we should share the data with the public as soon as possible," he said in an interview. The cell phone study was initiated while Portier was serving as the associate director of the NTP. He is now retired, though he continues to work as a consultant.

After extended discussions, the two federal agencies responsible for regulating exposures to cell phone radiation, the Food and Drug Administration (FDA) and the Federal Communications Commission (FCC), were briefed on the results last week. It is not

PAGE # 218

clear how these regulatory agencies plan to respond.

All the various agencies are now in the process of planning the release of the NTP findings. Neither Birnbaum nor Bucher responded to a request for comment on how this will be done.

Unexpected Findings

Few outsiders are yet aware of the NTP results. When *Microwave News* told some of those who have been tracking the study for years what had been found, all expressed surprise.

Indeed, in an interview published years ago, NTP's Bucher said that he expected the results to show no association between RF radiation and cancer.

"Everyone expected this study to be negative," said a senior government radiation official, who asked that his name not be used. "Assuming that the exposures were carried out in a way that heating effects can be ruled out, then those who say that such effects found are impossible are wrong," the official said. (The study was designed to ensure that the body temperature of the exposed rats increased less than 1°C.)

"This is a game changer, there is no question," said David Carpenter, the director of the Institute for Health and the Environment at the University of Albany. "It confirms what we have been seeing for many years —though now we have evidence in animals as well as in humans." Carpenter went on to add, "The NTP has the credibility of the federal government. It will be very difficult for the naysayers to deny the association any longer." Carpenter's institute is a collaborating center of the World Health Organization (WHO).

John Boice, the president of the National Council on Radiation Protection and Measurements (NCRP), is one of the leading skeptics. "For most of us, the issue of brain cancer and cell phones is resolved. There is no risk. There is no biological mechanism and no animal study or cellular study that finds reproducible evidence of an effect," Boice told a reporter for Medscape Medical News earlier this month.

This view is so deeply held that in the summer of 2014, the NCRP pressured the Centers for Disease Control (CDC) to delete precautionary advice from a fact sheet on cell phones.

PAGE # 219

Boice was discounting last year's report from Germany by Alex Lerchl confirming an earlier animal study showing that cell phone radiation can promote tumors in mice that were induced by toxic chemicals. The NTP experiments did not use any agent to initiate cancer cells in the animals.

With respect to mechanisms, just a couple of months ago, Frank Barnes and Ben Greenebaum, two senior members of the RF research community, announced that they could explain how low levels of RF radiation could alter the growth rates of cancer cells.

Later…
See also our follow-up articles:

— NTP: RF Breaks DNA

— Setting the Record Straight on NTP Cell Phone Cancer Study

— News Media Nix NTP Phone Cancer Study; "Don't Believe the Hype"
Are More People Getting Brain Tumors?
GBMs, the Most Virulent Type, Are Rising

— Brain Tumors More Likely in Male than Female Rats
Historical Controls Show the Difference

NTP RF Animal Project: Timeline

1999 FDA nominates RF from wireless devices for testing by NTP

2001 NTP decides to sponsor RF–cancer studies

2003 NTP solicits proposals for RF–cancer experiments

2004 NTP issues second request for proposals

2005 NTP signs contract with IITRI in Chicago to carry out exposures

2007 Exposure systems made by IT'IS installed at IITRI

2009 The lead investigator Ron Melnick retires, Michael Wyde takes over

2014-15 Exposures of two-year studies completed

2016 Results in hand

PAGE # 220

Further reading:

— Institute of Environmental Health Secrets: NIEHS Mum on $25 million RF Animal Project

— NCRP Pressured CDC To Remove Cell Phone Safety Advice

— RF Cancer Promotion: Animal Study Makes Waves

— CDC Calls for Caution on Cell Phones, Then Gets Cold Feet

— Something Is Rotten in Denmark: Danish Cancer Society Plays Games with Tumor Rates

— It May Not Be Impossible After All

— Power-Frequency EMFs Promote Cancer in Massive Animal Study

— Will NIEHS Ever "Get" EMFs?

RF animal studies, NTP, NIEHS, NIH, John Bucher, Linda Birnbaum, Ron Melnick, Christopher Portier, John Boice, Alexander Lerchl, Frank Barnes, Ben Greenebaum, cancer, glioma, acoustic neuroma, schwannoma, brain cell phones,

EXHIBIT R

MICRO WAVE NEWS
A Report on Non-Ionizing Radiation

News Media Nix NTP Cancer Study
"Don't Believe the Hype"

Are More People Getting Brain Tumors?
GBMs, the Most Virulent Type, Are Rising

May 31, 2016
Last updated June 2, 2016

Senior managers at the National Toxicology Program (NTP) released the preliminary results of their cell phone radiation study late last week. They were so concerned about the elevated rates of two types of cancer among exposed rats that they felt an immediate public alert was warranted. They considered it unwise to wait for the results to wend their way into a journal sometime next year. Not surprisingly, the NTP report generated worldwide media attention.

There were some startling reactions. Both the American Cancer Society (ACS) and Consumers Reports immediately shelved their long-held, wait-and-see positions. In a statement issued soon after the NTP's press conference, Otis Brawley, ACS' chief medical officer, said the NTP results mark a "paradigm shift in our understanding of radiation and cancer risk." He called the NTP report "good science."

Consumer Reports said that the new study was "groundbreaking" and encouraged people to take simple precautions to limit their

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Microwave News The Web
Return to Main Article Archive
VIEW ARTICLES BY YEAR
2016 Articles 2009 Articles
2015 Articles 2008 Articles
2014 Articles 2007 Articles
2013 Articles 2006 Articles
2012 Articles 2005 Articles
2011 Articles 2004 Articles
2010 Articles

PAGE # 223

exposures.

However, much of the mainstream media saw it very differently. This was apparent at last Friday's news briefing where the skepticism among reporters was palpable. The *Washington Post* ran its story under the headline, "Do Cell Phones Cause Cancer? Don't Believe the Hype."

One question on many people's minds was why, if cell phones cause cancer, there hasn't been an uptick in the incidence of brain tumors in the American population. For instance, Gina Kolata, a science reporter at the *New York Times*, gave the NTP study zero credibility. In a short video accompanying the *Times*' news story, Kolata said that there is "overwhelming evidence" that cell phones do not lead to cancer. "Despite the explosion of cell phone use," she said, "it looks like the incidence of brain cancer has remained pretty much rock steady since 1992." The "bottom line," she concluded, is that, "You can use a cell phone without worrying."

There's More Than One Type of Brain Tumor

The issue of whether brain tumor rates are static or rising is more complicated than Kolata would have us believe. It's true that the overall incidence of brain tumors has not been changing much, but a different picture emerges if one looks, carefully, at the data.

The histogram below helps tell the story. It's based on brain tumor data from The Netherlands. The black segment of each column tracks the incidence of glioblastoma multiforme (GBM), the most aggressive and deadly type of brain tumors. While the total incidence of all types of brain tumors in The Netherlands rose at the rate of only about 0.7% per year, the increase in GBM was about 3.1% per year —that is, the incidence more than doubled over the period 1989-2010. (Follow the thin red line we superimposed on the histogram to track the trend.) This is a statistically significant increase. At the same time, the rate of all the other types of brain tumors went down; these changes are also significant. The higher incidence of GBMs is being masked by the lower rates of the other types of brain cancer.

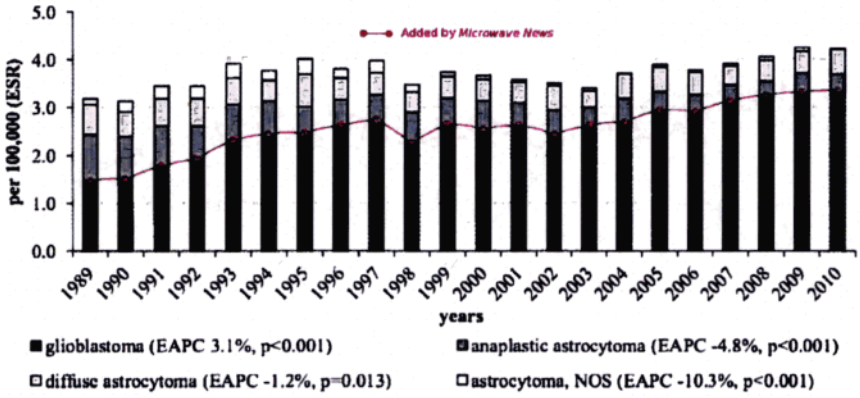

Fig. 1. Age-standardised incidence rates for astrocytic tumours in the Netherlands from 1989 to 2010.

EAPC stands for estimated annual percentage change
Source: Adapted from Ho et al, *European Journal of Cancer*, 2014, p.231

GBMs Are Also Rising in the U.S.

A similar trend is occurring in the U.S., according to a team from the University of Southern California Medical School in Los Angeles. The USC researchers looked at the incidence of brain tumors in three "major cancer registries" over a 15-year period (1992-2006). In a paper published in 2012, they reported that GBMs had gone up while the other types had gone down. The study showed "decreased rates of primary brain tumors in all sites with the notable exception of increased incidence of GBM in the frontal lobes, temporal lobes and cerebellum."

The increase in GBMs in the temporal lobe (the region of the brain closest to the ear and potentially to a phone) was seen in all three registries, ranging from approximately 1.3% to 2.3% per year, a finding that is statistically significant.

Some anecdotal evidence from Denmark also supports a rising incidence of GBMs. Back in 2012, the Danish Cancer Society reported a spike in GBMs. The Society quoted a neuro-oncologist at Copenhagen University Hospital as saying this was a "frightening development." There wasn't much of a follow-up other than the society's removal of the news advisory from its website. (See our "Something Rotten in Denmark.")

Cell Phones Linked to GBMs

Perhaps, the increasing rate of GBMs seen in the U.S., The Netherlands and Denmark is due to some unknown factor. But, whatever may be going on, GBMs are on the rise.

PAGE # 225

While most cell phone epidemiological studies do not break out the risks for different types of brain tumors, Lennart Hardell of Örebro University Hospital in Sweden has done so. "We have consistently found an increased risk for high-grade glioma, including the most malignant type, glioblastoma multiforme grade IV [GBM], and use of wireless phones," he told Medscape earlier this month. Hardell's epidemiological studies were instrumental in IARC's decision to classify RF radiation as a possible carcinogen.

In an e-mail exchange with *Microwave News*, Hardell confirmed the Medscape quote. He added that he has also found that, in an analysis of 1,678, patients with GBMs in Sweden, those who used wireless phones had shorter survival times.

How Big Were the Increases in Tumors in the NTP Study?

Another media skeptic, Seth Borenstein, a reporter at the Associated Press, posted a video in which he called the increase in cancer in the rats "very slight" and therefore the cancer risk "very small."

This is in line with the report the NTP posted online last week in which it called the incidence of tumors "low." But some observers think the cancer rates among the rats are in fact higher than the NTP is saying.

At the press conference, Joel Moskowitz of the University of California, Berkeley, School of Public Health pointed out that a number of the exposed animals, but none of the control rats, developed abnormally high cell growth rates —hyperplasia— in the same type of glial and Schwann cells where tumors developed in other animals. (An audio recording of the press briefing is available here.)

Moskowitz calls the hyperplasia cells "precancerous," as does John Bucher, the associate director of the NTP, who released the study on Friday. It is commonly believed that hyperplasias will likely later turn into malignant tumors. Moskowitz estimates that while the NTP found tumors in 5.5% of the exposed male rats at the end of the experiment, when those with hyperplasia are included, the rate goes up to 8.5%. "That's a remarkable finding," he told *Microwave News*.

"I totally agree with Joel," commented Ron Melnick, who led the team that designed the NTP study. "He has a valid argument."

PAGE # 226

Melnick also pointed out that, "The study had low power and was more likely to show no effect. The fact that it did makes the results more compelling."

If the exposures had continued for longer than two years, the results may have been clearer. During the study planning phase, Melnick argued for running the experiment for at least another couple of months. If he had prevailed, the status of the hyperplasias would have been clearer. He was overruled.

"It might be that extending the observation until the rats die, tumors could arise from some of the observed hyperplasias," said Fiorella Belpoggi of the Ramazzini Institute in Bologna, Italy, where she is the director of research and the head of pathology. "But," she added, "the NTP results are indeed sufficient for considering cell phone radiofrequency radiation as carcinogens."

Belpoggi and her colleague Morando Soffritti recently released their own large animal study which showed that another type of non-ionizing radiation, ELF EMFs, can promote cancer. They are also in the midst of their own large RF animal study, but it has been delayed by a shortage of funds.

Even if the naysayers are right, Melnick maintains that a small risk could result in a large number of people developing radiation-induced tumors. That's because there is a huge number of cell phone users across the world.

In the end, we checked in with Jonathan Samet of the USC School of Medicine for his opinion. Samet is a member of NCI's National Cancer Advisory Board. In 2011, he chaired the IARC panel that designated RF radiation as a possible human carcinogen. Here's part of what he told us via e-mail:

> "From my perspective, the new findings, like the epidemiological findings considered by IARC, provide an indication of potential risk that needs careful follow-up. Perhaps these findings, along with prior epidemiological research, will motivate a comprehensive research initiative."

NTP, NIEHS, RF animal studies, brain tumors, brain cell phones, glioma, GBM, schwannoma, John Bucher, Ron Melnick, Lennart Hardell, Joel Moskowitz, Fiorella Belpoggi, Morando Soffritti, Jonathan Samet,

PAGE # 227

Washington Post, New York Times, Associated Press,
Gina Kolata, Seth Borenstein, American Cancer Society,
Otis Brawley, Danish Cancer Society, Consumers Union,

PAGE # 228

EXHIBIT S

MICRO WAVE NEWS
A Report on Non-Ionizing Radiation

NTP: Cell Phone RF Breaks DNA

Consistent with Higher Tumor Counts 20 Years After Landmark Lai-Singh Study

September 6, 2016
Last updated September 8, 2016

In May, the U.S. National Toxicology Program (NTP) announced that male rats exposed to cell phone radiation developed higher rates of cancer. Soon, the NTP will explain how that might have happened.

The same RF/microwave radiation that led male rats to develop brain tumors also caused DNA breaks in their brains. Female rats —which did not have significant elevated tumor counts— had fewer DNA breaks.

All these findings are part of the same $25 million NTP project.

The NTP results provide "strong evidence for the genotoxicity of cell phone radiation," Ron Melnick told *Microwave News*. Melnick led the team that designed the NTP study; he is now retired. This "should put to rest the old argument that RF radiation cannot cause DNA damage," he said.

DNA breaks were also seen in the brains of the RF-exposed mice, though the increases were less pronounced than among the rats. The NTP has not yet released the tumor results for its study in mice.

PAGE # 230

Search
Microwave News The Web
Return to Main Article Archive
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2016 Articles 2009 Articles
2015 Articles 2008 Articles
2014 Articles 2007 Articles
2013 Articles 2006 Articles
2012 Articles 2005 Articles
2011 Articles 2004 Articles
2010 Articles
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The NTP project design called for a sample of rats to be sacrificed after 19 weeks of post-natal radiation exposure —five from each of the GSM and CDMA exposure groups, as well as five of the controls.[1] Tissue samples for DNA assays were collected from those animals.[2] The remainder of the rats continued to be exposed for the rest of the two-year cancer study.

A paper on the DNA findings has been submitted for publication and is currently under peer review, according to the NTP press office.[3] Michael Wyde, who runs the NTP RF project day-to-day, presented some preliminary results at the BioEM2016 meeting in Ghent, Belgium, in June and later that month at the NTP Board of Counselors meeting. (His slides[4] are here; and a video of his talk at the board meeting is here.[5])

Are DNA Breaks Harbingers of Tumors?

The new results prompt this $64 question: Did the DNA breaks found at the interim kill cause or lead to the tumors that were seen at the end of the experiment?

"You can't say that the DNA assay supports the finding of increased glioma," said one NTP insider who asked not to be named. But then this person went on to add, "You can say they are consistent."

Melnick, who spent close to 30 years at NTP before retiring in 2009, offered a more direct answer: "Finding DNA damage in the brain of rats supports NTP's tumor data," he said.

We posed the same question to John Bucher, the associate director of the NTP who is in charge of the cell phone study. He declined to respond. Nor would he say whether the apparent consistency of the DNA and tumor results played a role in his decision to expedite the release of the tumor findings in May before they were published in a journal.

20 Years of War Games

The NTP's finding of DNA breaks is the latest, and perhaps most decisive, chapter in a controversy that goes back more than 20 years. In 1994, Henry Lai and N.P. Singh of the University of Washington in Seattle reported that RF radiation could damage DNA in the brain cells of rats. (They used pulsed 2450 MHz, not cell phone-like signals.) The Lai-Singh study was immediately challenged by the wireless companies as it threatened their central

PAGE # 231

argument that cell phones cannot cause cancer.

Motorola led the charge. Q. Balzano, a senior Motorola executive, told us at the time that, even if the Lai-Singh experiment were to be validated, "the effects it purports to show may be inconsequential" (see *MWN*, N/D94, p.1). Balzano, an engineer by training, chose to sidestep the well-established principle that DNA damage can lead to cancer development and growth.

At the same time, PR operatives working for Motorola were developing a campaign to discredit the Lai-Singh work. The now-infamous "war gaming memo" was part of that effort (see *MWN*, J/F97, p.13).

Motorola went on to sponsor studies in Joseph Roti Roti's lab at Washington University in St. Louis. Roti Roti did not find DNA breaks (see "Two Labs at Odds over Microwaves and DNA Breaks.") As far as Motorola was concerned, Lai-Singh had been proved wrong and the matter was settled.

Nevertheless, the research continued.

A decade later, a similar dispute arose when a team at the University of Vienna, working under the EC-sponsored REFLEX project, reported seeing RF-induced DNA breaks. Those experiments were carried out *in vitro,* that is, in cell cultures (see *MWN*, M/A03, p.7). This clash was just as nasty —perhaps more so— and led to formal accusations of fraud and scientific misconduct. None of the charges stuck, but they left a taint on the whole enterprise. (Read about *Science* magazine's coverage.)

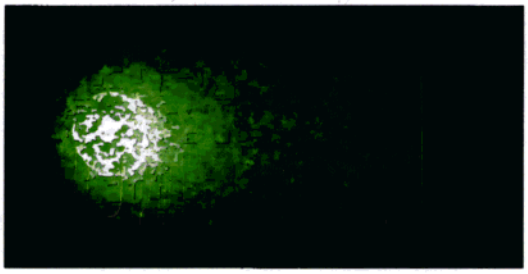
Today, no one talks much about DNA breaks anymore. Lai, who has retired from UW but still serves as the co-editor-in-chief of *Electromagnetic Biology and Medicine* (*EBM*) continues to keep close tabs on what others have been publishing. "There have been 73 studies on DNA breaks since our initial report," he told us in a recent interview, "A clear majority has found an effect similar to ours."[6]

The Comet Assay

All 73 studies on Lai's list measured DNA damage using what's known as the comet assay.[7] The assay was developed by Singh, Lai's collaborator, close to 30 years ago.[8] It can detect single- and double-strand DNA breaks, as well as other potentially genotoxic

PAGE # 232

changes. The assay gets its name from the comet-like tail formed by fragments of the broken DNA. The more DNA damage, the longer and more diffuse the tail (see an example below).



The comet assay is one of the standard techniques for evaluating genetic hazards —sometimes with DNA taken from animals (*in vivo*) and sometimes from cell cultures (*in vitro*). The assay is used routinely by the NTP for testing chemicals. The OECD, for instance, has called the comet assay carried out *in vivo* "especially relevant" for evaluating potential cancer agents. Both the original Lai-Singh and the new NTP studies used RF–exposed rats.

"An *in vivo* comet assay is usually more informative than an *in vitro* comet assay," said Raymond Tice. Back in the 1980's, Tice helped Singh develop the comet assay. He joined the NTP in 2005, becoming the chief of its Biomolecular Screening Branch before retiring last year. He currently serves as an advisor to the NTP.

Of the 73 RF–comet assay papers that Lai has catalogued, there are 28 studies that used *in vivo* exposures. "Those showing DNA breaks outnumber those that don't by more than three to one," he told us (22 vs. 6).[9]

"I have no doubt that low-intensity RF radiation is toxic to DNA," Lai said.

NTP's Genotoxicity Results

Before the NTP study got underway, Melnick's team targeted a number of the rats' body parts, including three regions of the brain, to be tested for DNA breaks. One of these was the frontal cortex of the brain, because, as Christine Flowers, NTP's Director of Communications, told us, it is "an area in which tumors were reported in humans."

Indeed, according to Melnick, the finding of brain cancer among cell phone users, as well as the original Lai-Singh DNA experiment,

PAGE # 233

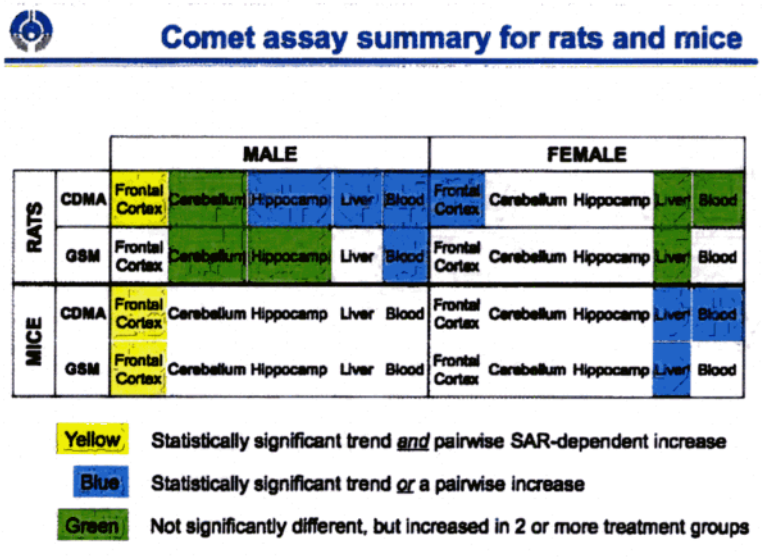
prompted him to include the DNA analysis as part of the NTP protocol. (Cell phone epidemiological studies led IARC to classify RF radiation as a possible human carcinogen in 2011.)

As it turned out, the frontal cortex is where the NTP saw the most significant increases in DNA breaks. (See the color-coded slide below, taken from Wyde's presentation at the BioEM2016 meeting in June.)

The NTP later found brain tumors —gliomas— among those rats exposed for the full two years. The NTP has not specified the specific locations in the brain where the gliomas were seen. The DNA assayed in the brain was from a mix of various types, including glial cells, the kind that later turned cancerous.

Wyde has pointed that there were responders and non-responders among the male rats that were exposed to radiation.[10] Only some of the animals showed DNA effects but these were large enough to move the averages up to indicate significant differences.

No DNA analysis was done for rat tissues with Schwann cells in the heart, the other site where tumors were seen after two years of exposure.[11] The Schwannomas were unexpected, and only uncovered long after the samples had been collected following the interim kill.



Slide No.30 from NTP's Michael Wyde presentation at the BioEM2016 meeting in June in Ghent, Belgium

PAGE # 234

1. The exposures lasted 18 hours a day (power on for 10 minutes and off for 10 minutes), seven days a week. The total RF exposure time was 9 hours a day. Three different exposure levels were used: SARs of 1.5, 3 and 6 W/Kg. Details of the experiment are here.

2. The exposure of the rats began while they were still in the womb. The protocol for the mice was similar except that those exposures began at the age of six weeks. After 13 weeks or exposure, 15 mice were sacrificed and their DNA analyzed.

3. Stephanie Smith-Roe *et al.*, "Evaluation of the Genotoxicity of Cell Phone Radiofrequency Radiation Male and Female Rats and Mice Following Subchronic Exposure," in press.

4. See also Wyde's PowerPoint presentation at the GLORE meeting in November 2013. GLORE stands for Global Coordination of Research and Health Policy on RF Electromagnetic Fields.

5. Wyde's discussion of the genotoxicity results begins at the 31:51-minute mark of the video.

6. Of the 73 studies on Lai's list, 46 (63%) found an effect and 27 (37%) did not. Lai and Singh have also shown that power-frequency (ELF) EMFs can cause DNA breaks (see their 1997 paper). Here again, Lai has catalogued the papers that followed their initial report. As of now, there have been 44 studies, of which 32 (73%) found an effect and 12 (27%) did not.

7. This summer, a team from Germany published a detailed review of the comet assay. Note that the assay is just one of a number of techniques used to measure genetic effects. Lai has also catalogued this larger RF-genotoxicity literature. At last count, in 2014, there was a total of 125 papers, of which 84 (66%) showed effects and 41 (34%) did not.

8. Singh recently wrote up his reflections on the comet assay's development, evolution and applications.

9. Not taken into account in Lai's analysis is the funding source of the studies. For a discussion of industry, military and other influences on RF–DNA research, see our "*Radiation Research* and the Cult of Negative Studies," written ten years ago.

10. Wyde says this in a talk to the NTP Board of Scientific Counselors in June 2016. The discussion of the genotoxicity results begins at the 31:51-minute mark of the video (also here).

11. At the same NTP Board of Scientific Counselors meeting, Linda Birnbaum, the director of NTP (& NIEHS), talked about the link between RF and the Schwannommas of the heart. In the video of the meeting, she called the association "unequivocally clear" (@43:20-minute mark) and a few minutes later described it as having a "beautiful dose-relationship." A full set of videos from the meeting are here.

NTP, NIEHS, RF animal studies, DNA breaks, comet assay, Henry Lai, N.P. Singh, John Bucher, Michael Wyde, Raymond Tice, schwannoma, Linda Birnbaum,

PAGE # 235

EXHIBIT T

International Agency for Research on Cancer

World Health Organization

PRESS RELEASE
N° 208

31 May 2011

IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

Lyon, France, May 31, 2011 -- The WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as **possibly carcinogenic to humans (Group 2B)**, based on an increased risk for **glioma**, a malignant type of brain cancer[1], associated with wireless phone use.

Background

Over the last few years, there has been mounting concern about the possibility of adverse health effects resulting from exposure to radiofrequency electromagnetic fields, such as those emitted by wireless communication devices. The number of mobile phone subscriptions is estimated at **5 billion globally**.

From **May 24–31 2011, a Working Group of 31 scientists from 14 countries has been meeting at IARC in Lyon, France, to assess the potential carcinogenic hazards from exposure to radiofrequency electromagnetic fields**. These assessments will be published as Volume 102 of the IARC *Monographs*, which will be the fifth volume in this series to focus on physical agents, after **Volume 55** (Solar Radiation), **Volume 75** and **Volume 78** on ionizing radiation (X-rays, gamma-rays, neutrons, radio-nuclides), and **Volume 80 on non-ionizing radiation (extremely low-frequency electromagnetic fields)**.

The IARC Monograph Working Group discussed the possibility that these exposures might induce long-term health effects, in particular an increased risk for cancer. This has relevance for public health, particularly for users of mobile phones, as the number of users is large and growing, particularly among young adults and children.

The IARC Monograph Working Group discussed and evaluated the available literature on the following exposure categories involving radiofrequency electromagnetic fields:

- occupational exposures to radar and to microwaves;
- environmental exposures associated with transmission of signals for radio, television and wireless telecommunication; and
- personal exposures associated with the use of wireless telephones.

International experts shared the complex task of tackling the **exposure data**, **the studies of cancer in humans**, the **studies of cancer in experimental animals**, and the **mechanistic and other relevant data**.

[1] **237 913 new cases of brain cancers** (all types combined) occurred around the world in 2008 (gliomas represent 2/3 of these). Source: **Globocan 2008**

IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

Results

The evidence was reviewed critically, and overall evaluated as being *limited*[2] among users of wireless telephones for glioma and acoustic neuroma, and *inadequate*[3] to draw conclusions for other types of cancers. The evidence from the occupational and environmental exposures mentioned above was similarly judged inadequate. The Working Group did not quantitate the risk; however, one study of past cell phone use (up to the year 2004), showed a 40% increased risk for gliomas in the highest category of heavy users (reported average: 30 minutes per day over a 10-year period).

Conclusions

Dr Jonathan Samet (University of Southern California, USA), overall Chairman of the Working Group, indicated that "the evidence, while still accumulating, is strong enough to support a conclusion and the **2B classification**. The conclusion means that there could be some risk, and therefore we need to keep a close watch for a link between cell phones and cancer risk."

"Given the potential consequences for public health of this classification and findings," said IARC Director Christopher Wild, "it is important that additional research be conducted into the long-term, heavy use of mobile phones. Pending the availability of such information, it is important to take pragmatic measures to reduce exposure such as hands-free devices or texting. "

The Working Group considered hundreds of scientific articles; the complete list will be published in the Monograph. It is noteworthy to mention that several recent in-press scientific articles[4] resulting from the **Interphone study** were made available to the working group shortly before it was due to convene, reflecting their acceptance for publication at that time, and were included in the evaluation.

A concise report summarizing the main conclusions of the IARC Working Group and the evaluations of the carcinogenic hazard from radiofrequency electromagnetic fields (including the use of mobile telephones) will be published in **The Lancet Oncology in its July 1 issue, and in a few days online**.

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[2] '***Limited evidence of carcinogenicity***': A positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

[3] '***Inadequate evidence of carcinogenicity***': The available studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of a causal association between exposure and cancer, or no data on cancer in humans are available.

[4] a. 'Acoustic neuroma risk in relation to mobile telephone use: results of the INTERPHONE international case-control study' (the Interphone Study Group, in Cancer Epidemiology, *in press*)
b. 'Estimation of RF energy absorbed in the brain from mobile phones in the Interphone study' (Cardis et al., Occupational and Environmental Medicine, *in press*)
c. 'Risk of brain tumours in relation to estimated RF dose from mobile phones – results from five Interphone countries' (Cardis et al., Occupational and Environmental Medicine, *in press*)
d. 'Location of Gliomas in Relation to Mobile Telephone Use: A Case-Case and Case-Specular Analysis' (American Journal of Epidemiology, May 24, 2011. [Epub ahead of print].

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IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

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Link to the **audio file** posted shortly after the briefing:
http://terrance.who.int/mediacentre/audio/press_briefings/

About IARC

The International Agency for Research on Cancer (IARC) is part of the World Health Organization. Its mission is to coordinate and conduct research on the causes of human cancer, the mechanisms of carcinogenesis, and to develop scientific strategies for cancer control. The Agency is involved in both epidemiological and laboratory research and disseminates scientific information through publications, meetings, courses, and fellowships.

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IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

ABOUT THE IARC MONOGRAPHS

What are the IARC Monographs?

The ***IARC Monographs*** identify environmental factors that can increase the risk of human cancer. These include chemicals, complex mixtures, occupational exposures, physical and biological agents, and lifestyle factors. National health agencies use this information as scientific support for their actions to prevent exposure to potential carcinogens. Interdisciplinary working groups of expert scientists review the published studies and evaluate the weight of the evidence that an agent can increase the risk of cancer. The principles, procedures, and scientific criteria that guide the evaluations are described in the **Preamble** to the IARC Monographs.

Since 1971, more than 900 agents have been evaluated, of which approximately 400 have been identified as **carcinogenic or potentially carcinogenic** to humans.

Definitions

Group 1: The agent is *carcinogenic to humans*.

This category is used when there is *sufficient evidence of carcinogenicity* in humans. Exceptionally, an agent may be placed in this category when evidence of carcinogenicity in humans is less than *sufficient* but there is *sufficient evidence of carcinogenicity* in experimental animals and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity.

Group 2.

This category includes agents for which, at one extreme, the degree of evidence of carcinogenicity in humans is almost *sufficient*, as well as those for which, at the other extreme, there are no human data but for which there is evidence of carcinogenicity in experimental animals. Agents are assigned to either Group 2A (*probably carcinogenic to humans*) or Group 2B (*possibly carcinogenic to humans*) on the basis of epidemiological and experimental evidence of carcinogenicity and mechanistic and other relevant data. The terms *probably carcinogenic* and *possibly carcinogenic* have no quantitative significance and are used simply as descriptors of different levels of evidence of human carcinogenicity, with *probably carcinogenic* signifying a higher level of evidence than *possibly carcinogenic*.

Group 2A: The agent is *probably carcinogenic to humans*.

This category is used when there is *limited evidence of carcinogenicity* in humans and *sufficient evidence of carcinogenicity* in experimental animals. In some cases, an agent may be classified in this category when there is *inadequate evidence of carcinogenicity* in humans and *sufficient evidence of carcinogenicity* in experimental animals and strong evidence that the carcinogenesis is mediated by a mechanism that also operates in humans. Exceptionally, an agent may be classified in this category solely on the basis of *limited evidence of carcinogenicity* in humans. An agent may be assigned to this category if it clearly belongs, based on mechanistic considerations, to a class of agents for which one or more members have been classified in Group 1 or Group 2A.

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IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

Group 2B: The agent is *possibly carcinogenic to humans*.

This category is used for agents for which there is *limited evidence of carcinogenicity* in humans and less than *sufficient evidence of carcinogenicity* in experimental animals. It may also be used when there is *inadequate evidence of carcinogenicity* in humans but there is *sufficient evidence of carcinogenicity* in experimental animals. In some instances, an agent for which there is *inadequate evidence of carcinogenicity* in humans and less than *sufficient evidence of carcinogenicity* in experimental animals together with supporting evidence from mechanistic and other relevant data may be placed in this group. An agent may be classified in this category solely on the basis of strong evidence from mechanistic and other relevant data.

Group 3: The agent is *not classifiable as to its carcinogenicity to humans*.

This category is used most commonly for agents for which the evidence of carcinogenicity is *inadequate* in humans and *inadequate* or *limited* in experimental animals.

Exceptionally, agents for which the evidence of carcinogenicity is *inadequate* in humans but *sufficient* in experimental animals may be placed in this category when there is strong evidence that the mechanism of carcinogenicity in experimental animals does not operate in humans.

Agents that do not fall into any other group are also placed in this category.

An evaluation in Group 3 is not a determination of non-carcinogenicity or overall safety. It often means that further research is needed, especially when exposures are widespread or the cancer data are consistent with differing interpretations.

Group 4: The agent is probably not carcinogenic to humans.

This category is used for agents for which there is *evidence suggesting lack of carcinogenicity* in humans and in experimental animals. In some instances, agents for which there is *inadequate evidence of carcinogenicity* in humans but *evidence suggesting lack of carcinogenicity* in experimental animals, consistently and strongly supported by a broad range of mechanistic and other relevant data, may be classified in this group.

Definitions of evidence, as used in IARC Monographs for studies in humans

The evidence relevant to carcinogenicity from studies in humans is classified into one of the following categories:

Sufficient evidence of carcinogenicity: The Working Group considers that a causal relationship has been established between exposure to the agent and human cancer. That is, a positive relationship has been observed between the exposure and cancer in studies in which chance, bias and confounding could be ruled out with reasonable confidence. A statement that there is *sufficient evidence* is followed by a separate sentence that identifies the target organ(s) or tissue(s) where an increased risk of cancer was observed in humans. Identification of a specific target organ or tissue does not preclude the possibility that the agent may cause cancer at other sites.

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Limited evidence of carcinogenicity: A positive association has been observed between exposure to the agent and cancer for which a causal interpretation is considered by the Working Group to be credible, but chance, bias or confounding could not be ruled out with reasonable confidence.

Inadequate evidence of carcinogenicity: The available studies are of insufficient quality, consistency or statistical power to permit a conclusion regarding the presence or absence of a causal association between exposure and cancer, or no data on cancer in humans are available.

Evidence suggesting lack of carcinogenicity: There are several adequate studies covering the full range of levels of exposure that humans are known to encounter, which are mutually consistent in not showing a positive association between exposure to the agent and any studied cancer at any observed level of exposure. The results from these studies alone or combined should have narrow confidence intervals with an upper limit close to the null value (e.g. a relative risk of 1.0). Bias and confounding should be ruled out with reasonable confidence, and the studies should have an adequate length of follow-up. A conclusion of *evidence suggesting lack of carcinogenicity* is inevitably limited to the cancer sites, conditions and levels of exposure, and length of observation covered by the available studies. In addition, the possibility of a very small risk at the levels of exposure studied can never be excluded.

In some instances, the above categories may be used to classify the degree of evidence related to carcinogenicity in specific organs or tissues.

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EXHIBIT U

Practical Papers, Articles and Application Notes

Kye Yak See, Technical Editor

In the smart grid era, conventional electromechanical meters will be replaced by electronic energy meters. There are concerns from consumers on potential electromagnetic interference (EMI) that may affect the accuracy of readings taken from these electronic energy meters. Frank Leferink and Cees Keyer from University of Twente and Anton Melentjev from University of Applied Sciences Amsterdam, the Netherlands have performed an investigative study on possible reading errors taken from these meters based on controlled laboratory experiments. The experimental results are presented in the first paper, "Static Energy Meter Errors Caused by Conducted Electromagnetic Interference". With more nonlinear and fast switching loads connected to the power grid, the types of current sensors used in electronic energy meters do have an impact on the variations in the meter readings. Such investigative study will be a useful reference for electronic energy meter manufacturers to improve the electromagnetic immunity of these meters.

The second paper "Characteristic Mode Analysis of Radiating Structures in Digital Systems" was contributed by Qi Wu, Heinz-Dietrich Brüns and Christian Schuster from Hamburg University of Technology, Germany. This paper adopts the characteristic mode analysis (CMA) to analyze radiating structures in digital systems up to 3 GHz. Through visualization of the CMA, it provides useful insight into the optimal placement of signal and power routing, grounding and placement of loads. Some examples presented in the paper show that a significant reduction of radiated power is achievable by using CMA and hence, illustrate its usefulness for EMC design of digital systems.

The third and last paper, "Comparison of Injected and Radiated EMC Testing of Active Implanted Cardiac Medical Devices at the Boundary Frequency of 450 MHz", is authored by Howard Bassen and Gonzalo Mendoza from U. S. Food and Drug Administration Center for Devices and Radiological Health. They compared testing via radiated versus injected susceptibility methods specified in the ISO 14117 standard for EMC of implantable cardiac medical devices. Experimental and computational studies were performed to determine voltages induced in a model of an implant. At the border frequency of 450 MHz separating the two methods, the radiated and injected tests do not agree well in terms of the voltage induced at the input of an implanted device. They present a very detailed study and analysis in this paper for the cause of disagreement.

As this is the last issue of the magazine in 2016, I would like to take this opportunity to wish all our readers a Happy New Year! I thank all the authors who have contributed the wonderful papers in 2016 and I look forward to receiving more good papers in the year ahead. Do drop me an e-mail at ekysee@ntu.edu.sg if you have a good paper in mind and would like to share it with our readers.

Static Energy Meter Errors Caused by Conducted Electromagnetic Interference

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Abstract - Static, or electronic, energy meters are replacing the conventional electromechanical meters. Consumers are sometimes complaining about higher energy readings and billing after the change to a static meter, but there is not a clear common or root cause at present. Electromagnetic interference has been observed between active infeed converters as used in photo-voltaic systems and static meters. Reducing the interference levels eliminated inaccurate reading in static meters. Several field investigations failed to identify a clear root cause of inaccurate readings of static energy meters. Experiments were performed in a controlled lab environment. Three-phase meters showed large deviations, even when supplied with an ideal sinusoidal voltage from a four-quadrant power amplifier. Large variations could be observed when non-linear, fast switching, loads were connected. A deviation of +276 % was measured with one static energy meter, +265% with a second and -46% with a third static energy meter. After dismantling it was revealed that the meters with the positive deviation used a Rogowski coil current sensor. The meter with a Hall effect-based current sensor gave the -46% deviation. The fourth meter, with a current transformer, resulted in -10% in one

experiment and +8% in another experiment, where the deviations are with respect to a conventional electromechanical meter. Measurements were repeated with more meters and supplied from standard, low internal impedance, mains supply in the laboratory. Deviations of +475%, +566%, +569%, +581%, +582% and -31% and -32% were registered, with again the positive deviation for Rogowski coil current sensors and negative deviations for the Hall sensors.

Keywords: Electromagnetic Compatibility, Static Meter, Smart Meter, Electronic Meter, Interference

I. Introduction

Electromechanical energy meters with moving parts, based on the Ferraris principle, are rapidly being replaced by static, or electronic, energy meters. These static meters can also measure other electrical parameters such as phase voltages and currents, frequency, power factor, active, reactive and apparent power. By adding a communication link, either via a wireless interface, a data line, or through Power-Line Telecommunication (PLT), these static meters are also capable of transmitting measured data. The target is a rollout of at least 80% in Europe by 2020, with the aim to use energy data in a smart grid.

Some consumers are complaining about their energy bills after replacement of the energy meter, because the registered energy is higher with the static meter compared to the old Ferraris meter. The utility companies use the argument that the old meters were incorrect because of mechanical wear and consumers should be happy because they have been under-charged for many years.

Generation of energy through Photo-Voltaic (PV) installations has become very popular. Energy generated through the PV is fed into the power grid using Active Infeed Converters (AIC). The lack of proper Electromagnetic Interference (EMI) standards, especially in the range 2-150 kHz, created possibilities to generate high interference levels, causing EMI [1]. Two neighboring farmers using the same PV system observed that on sunny days one PV generated only 40% of the energy generated by the other. Measurements have been carried out and it was found that the power drive systems for the fans in the barn generated high conducted interference on the power lines. As a result, the static energy meter failed to register the actual value. The problem could be solved by replacing the power drive system [2]. A similar case was observed during experimentation with PV installations in Germany. In other cases high interference levels generated by AICs were also observed, which caused faulty readings of the static energy meters [3], [4], [5]. This observation, possibly combined with a higher number of complaints and failures, resulted in faster publication of the TR50579 [6] technical report and IEC 61000-4-19 standard [7]. Specifically the voltages generated by PLT and currents generated by other equipment connected to the grid are taken into account. These requirements can be considered as an extension for the EN 50470-1 [8] and EN 50470-3 [9], which were made in reply to the Measurement Instruments Directive (MID) [10]. The MID of 2004 has been superseded by the new MID [11]. The tests as described in [6] are developed to achieve immunity against disturbing currents between 2 kHz and 150 kHz. In [7] it is stated that in several cases electricity meters registered only a part of the energy factually fed into the public supply network from a PV inverter. The investigations showed that this malfunction was caused by the ripple current of the inverter in the frequency range 3 kHz to 150 kHz, stemming from the switching frequency of the inverter (several tens of kHz) and its harmonics.

After observing the PV interference as described above and in [2], and later replying to complaints and requests from consumers, several audits and field survey measurements have been performed by us to investigate possible interference causes of potentially faulty higher static energy meter readings. Investigations showed that no basic mistakes were made, such as incorrect readings or faulty connections, before experiments were conducted. No obvious cause was identified during field investigations, although the current consumed was often highly distorted, the energy consumption was highly unbalanced, and relatively high PLT signals were measured. To investigate the possible cause of EMI influencing the static energy meter reading, measurements were performed in a controlled laboratory environment on 1- and 3- phase meters.

II. Constraints

When a consumer makes a complaint about the meter reading, he/she can request re-calibration of the meter. If the meter performance falls within the specified values, the consumer has to pay for the re-calibration. Our research revealed, however, that calibration is carried out using an ideal sinusoidal voltage of 50 Hz, and a linear load. Only the effect of phase lag and phase lead (cos ϕ) is investigated. The effect of non-linear loads and switching equipment is not investigated during the recalibration. For example, in case of a faulty capacitor the EMI filtering effect is reduced in the meter, which will not be revealed during such recalibration. The other problem is that faulty meters are scrapped and are not available for further research and no information is given on a probable cause. A third problem is that static meters are supplied by the utility companies and are not freely available on the market in the Netherlands. We had to purchase static energy meters used for the experiments in another European country. The fourth problem is that meters are sealed and documentation is extremely limited. After opening meters the seal has to be broken, and we observed that all manufacturers use their own specific digital signal processor with proprietary software. In [12] an overview of techniques used by integrated circuit manufacturers such as Texas Instruments, Analog Devices, ST and Maxim, shows that there are various options for signal processing. In case the reactive power and energy are measured, the different metrics corresponding to different mathematical models can provide conflicting results for non-sinusoidal conditions [13], e.g. 90° shifting of the voltage by means of an integrator, or by means of a time shift of a quarter of a period, or digital implementation of the definition of the "non-active power". Measurements showed differences of up to 52% [13], and -61% to +47% [14]. It is also stated in the IEEE 1459 standard [16]: 'VARmeters that use 90° phase shift in time of fundamental may measure correctly the reactive power under sinusoidal conditions. When the voltage and current waveforms are highly distorted, such meters yield a reading that has questionable significance'. No data could be obtained on the active power reading, the processing of the data, and neither the technology for the sensors being used by the manufacturers.

III. Simple Energy Monitor

The effect of faulty readings due to conducted electromagnetic interference has been demonstrated using low-cost energy monitors. Four energy monitors were connected to a four-quadrant amplifier generating an ideal sinusoidal voltage, and a distorted voltage. The distorted voltage is shown in Figure 1, and it is an exact replica of the measured voltage waveform in a modern building as described in [2]. The load was a string of 30 Compact Fluorescent Lamps (CFL) and 20 Light Emitting Diode (LED) lamps. Using the ideal sinusoidal voltage the measured power and energy consumption was the same for all four meters. In this case the orthogonality, i.e. the RMS value of a sum of two orthogonal currents or voltages contains no cross-products and the squared total RMS value is equal to the sum of the squared RMS values, resulted in a valid reading. But when the distorted voltage was supplied, the reading was 361 W, 8 W, 349 W and 0 W, while a calibrated energy meter stated 360 W. The meter with 8 W reading also measured 107 Hz, instead of the supplied 50 Hz fundamental frequency, which supports the idea that the algorithm uses zero-voltage detection, causing the misreading in this meter. A picture of the display is shown in Figure 2.

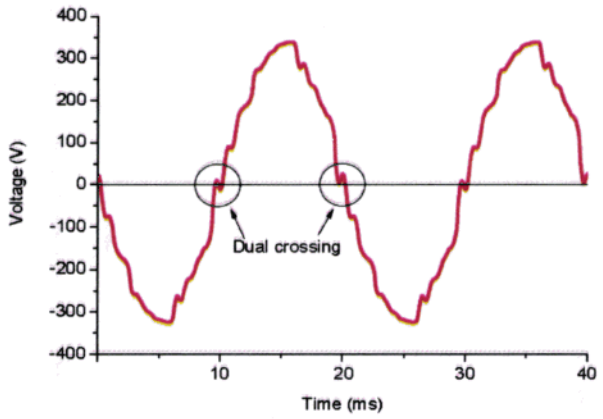

Fig. 1: High level of harmonic distortion

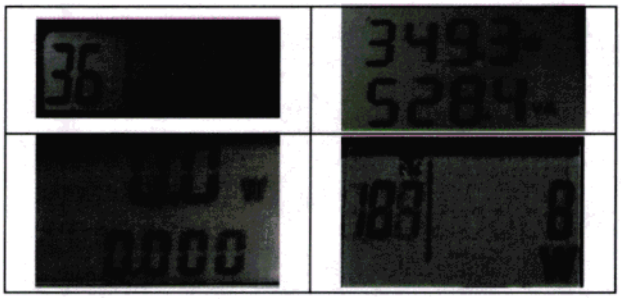

Fig. 2: Readings of the 4 energy monitors

Most static meters use an analog to digital converter (ADC) based on audio sigma delta technology. To reduce power consumption in the meter chip itself the sample rate can be reduced. If all signal content was at the line frequency then in theory a second order sigma delta with a 500 Hz, or 600 Hz sample frequency would be adequate. But a switched mode power supply for instance, especially under a light load, would consume a lot of power at higher frequencies, resulting in a misread by a low sampling frequency ADC.

PLT is used in several static meters to allow communication for developing a Smart Grid. PLT systems use the 2-150 kHz band and the modulation system can vary while voltage levels of up to 10 Vpp are present. These signals need to be removed before the ADC by a low-pass filter. Cheaper systems may not contain such a filter, which could result in inaccurate readings. In [17] an inaccurate reading of 1600% was observed at a frequency of 10 kHz and at 20 kHz. The reason for these susceptibilities was traced back to aliasing effects that are connected to a sampling frequency of 10 kHz. Due to aliasing, disturbing frequencies close to the sampling frequency can appear as low frequencies, that is, with a sampling frequency of 10 kHz a disturbing frequency of 9.95 kHz can appear as a 50 Hz signal that is recorded by the static meter [17]. However, this should not occur in properly designed energy meters, because they should be fitted with low-pass filters.

PLT signals have been shown to interfere with various systems, like touch-dimmer lights [5]. In case of low-impedance loads, the PLT voltages can cause high amplitude current at the consumer premises. This could also be a cause of misreading of static energy meters.

IV. Single-Phase Energy Meters

Several single-phase static energy meters were measured in various setups. The generator was a four-quadrant amplifier from Spitzenberger & Spies (S&S) PAS 5000, driven by the SyCore generator, also from S&S. This equipment can perform EMI measurements according several standards such as the IEC 61000-4-11 [18]. Measurements with ideal sinusoidal and with distorted voltage waveform have been performed. Furthermore, interfering signals were injected using the CS101 test setup of MIL-STD 461E [19]. The frequency range was 30 Hz up to 150 kHz, and levels were around 10 Vpp. This setup replicates the IEC 61000-4-19 [7] test. The loads used during the tests were power resistors, strings of CFL and LED lamps, a power drive system, and a dimmer driving these lamps. A Dranetz PowerXplorer PX5-400, and an oscilloscope were used for reference energy measurements. The results can be summarized in one sentence: no deviation beyond the specification could be observed; no influence of interference due to interfering or distorted voltage, and no influence caused by interfering currents were observed.

V. Three-Phase Energy Meters

Four different three-phase static energy meters have been tested in series with an electromechanical meter. The accuracy class of the static meters is defined by the IEC 62053.21-22 standard [20] and are either class 1 or class 2. The variations in percentage error limits for the specific classes are shown in Table I. The meters used in all tests were rated at 80, 85, 100, 120 A, except for the electromechanical Ferraris meter which was rated at 30 A for I_{max}.

Table 1: Accuracy of static meters

Range for test current	Power Factor	Class 1	Class 2
$0.05I_n < I < I_{max}$	1	± 2.0%	± 2.5%
$0.2I_n < I < I_{max}$	0.5 inductive	± 2.0%	± 2.5%

The three-phase meters were used in a three-phase test setup using normal mains supply, and in a single-phase test setup using the programmable power source with the four-quadrant amplifier from Spitzenberger & Spies (S&S) PAS 5000. The S&S SyCore generator and the PAS 5000 are used to generate a controlled distortion-free ideal sinusoidal voltage waveform. The internal impedance of this source is less that 0.4+j0.25 Ω, as defined in the standard [18]. The test setup is drawn in Figure 3.

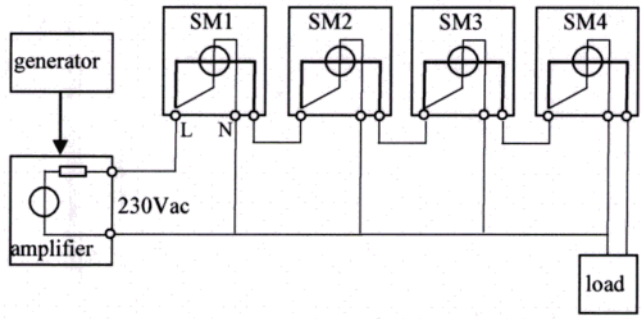

Fig. 3: Test setup

Various loads were used, including an electric heater (resistive load), a string of CFL lamps and a string of LED lamps. These loads were controlled by a dimmer creating a chopped part of a sinusoidal waveform, in case a resistive load would be used. The waveforms for a dimmer at 45^0, and at 135^0, when using the electric heater and 30 CFL and 20 LED are shown in Figures 4 and 5 respectively.

The voltage dips in the voltage waveform are caused by the internal impedance of the four-quadrant amplifier, which is less than 0.4+j0.25 Ω. Tests were performed during at least 24 hours, and sometimes over the weekend, over a 48 hour period. The registered energy of the static meters was measured using an Arduino microprocessor and optical sensors for detecting the pulses from the LED on the static meter fronts. The readings were verified using the liquid crystal display (LCD) reading on the meter. For example, the LCD displayed 18 kWh, and the Arduino measured 17902 Wh, while on another meter the display showed 7.43 kWh, and the Arduino measured 7430 Wh. A conventional electromechanical meter based on the Ferraris principle was used as reference, because consumers are also using this as reference. Most experiments have been repeated to confirm the conclusions, and repeated again, and again, because some of the static energy meters gave large differences. In Figure 6 the deviation with respect to the Ferraris meter is shown, using

$$deviation_{\%} = \frac{E_{SM} - E_{ferraris}}{E_{ferraris}} 100\%$$

The test results are also listed in Table II.

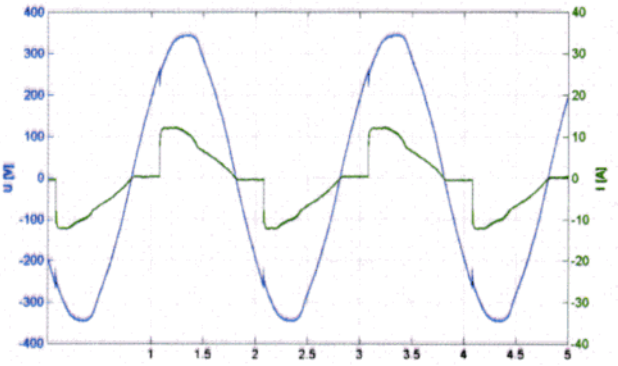

Fig. 4: Voltage and current, for heater, CFL and LED as load, dimmer at 45^0

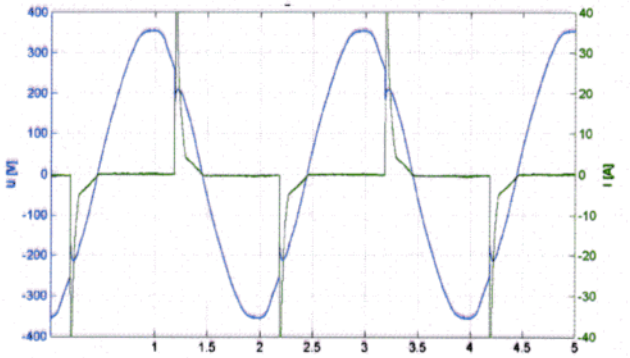

Fig.5: Voltage and current, for heater, CFL and LED as load, dimmer at 135^0

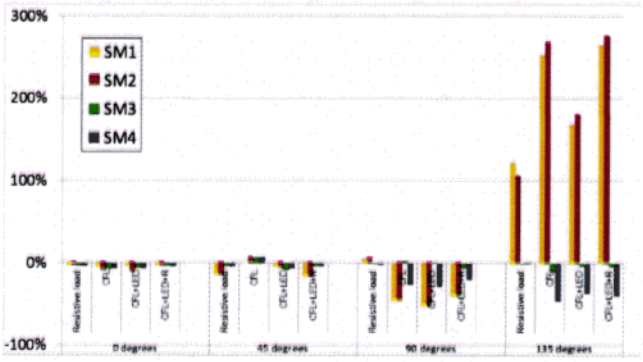

Fig.6: Deviation of static meter (SM) 1 to 4, referenced to an electromechanical (Ferraris) energy meter

Table II: Deviation of static meter (SM) 1 to 4, referenced to an electromechanical energy meter

Dimmer		Resistive	CFL	CFL+ LED	CFL+ LED+ Resistive
0^0	SM1	-2%	-4%	-4%	-3%
	SM2	-3%	-9%	-11%	-3%
	SM3	-3%	-7%	-6%	-3%
	SM4	-3%	-7%	-6%	-4%
45^0	SM1	-14%	0%	-4%	-16%
	SM2	-14%	6%	-5%	-16%
	SM3	-3%	7%	-8%	-3%
	SM4	-4%	7%	-6%	-3%

90⁰	SM1	5%	-46%	-52%	-40%
	SM2	5%	-46%	-53%	-40%
	SM3	-1%	3%	1%	-6%
	SM4	-2%	-26%	-28%	-20%
135⁰	SM1	122%	253%	169%	265%
	SM2	105%	268%	180%	276%
	SM3	-1%	-10%	-3%	-4%
	SM4	2%	-46%	-36%	-39%

These measurements have been performed using a standard non-distorted voltage generated by the four-quadrant amplifier with a defined low-impedance internal impedance. The observed effects are due to the pulsed currents consumed by the loads.

VI. Root Cause Analysis

Four types of current sensors are widely used in static meters: the shunt resistor, current transformer, Hall effect-based current sensor, and Rogowski coil. Static Meter 1 (SM1) and SM2 are from the same manufacturer. SM1 was produced in 2013 and SM2 in 2007. After opening it was revealed that both are using the Rogowski principle. SM3, from 2007, used a current transformer, and SM4, 2014, the Hall sensor. The current transformer is the most expensive technique, and SM3 is the most costly meter, it results in the best reading, very similar to the reading of the electromechanical meter. The meter with the Hall sensor, SM4, is the best for the consumer because it resulted often in a negative reading, with a maximum of -46%. Readings taken by Rogowski coil meters are dramatically higher, at +265 % for SM1 and +276% for SM2. The effect was consistent over the three phases, as is shown in Figure 7. Tests were repeated several times and the results were very repeatable, within a few percent.

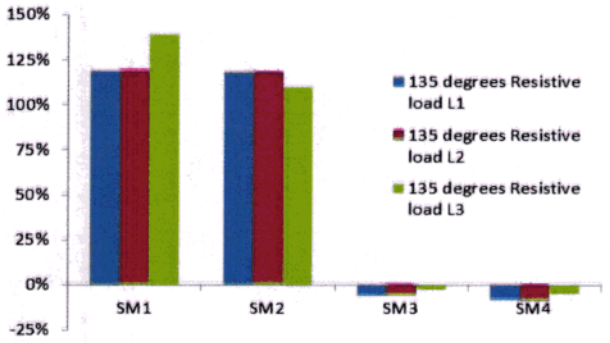

Fig. 7: Deviation of static meter (SM) 1 to 4, with resistive load (heater) and dimmer at 135⁰, for all three phases

Measurements were also performed using the mains supply and a balanced load over the three phases, but with the dimmer circuit in only one single phase. The deviations were consistent, but only a factor 3 lower because of the balanced loading.

VII. Extended Experiments On More Meters

A series of experiments have been tested over a period of 6 months, with tests lasting at least 1 week, sometimes several weeks. The tests have been performed using standard mains supply. In this series, 9 static meters were connected in series with 1 electromechanical energy meter, and 1 phase was used, because some of the meters are single-phase types. The test setup is shown in Figure 8. Also measurements using energy and power meters for lab use have been performed. One static meter is using a shunt, others are using a Rogowski and Hall sensors. The fabrication dates are 2004, 2007 (2), 2009, 2011, 2013 (2), 2014 (2). The meters are representative of the installed base of energy meters in The Netherlands. The following experiments have been performed, and the key results are noted:

- Resistive load 1800 W <3%
- 20 LED + 30 CFL <3%
- 20 LED + 30 CFL + C_x <3%
- Dimmer 90⁰, LED+CFL -28%, +64%
- Dimmer 90⁰, LED+CFL + line choke <3%
- Dimmer 135⁰, LED+CFL -32%, +575%
- Dimmer 135⁰, LED+CFL repeated -32%, +582%

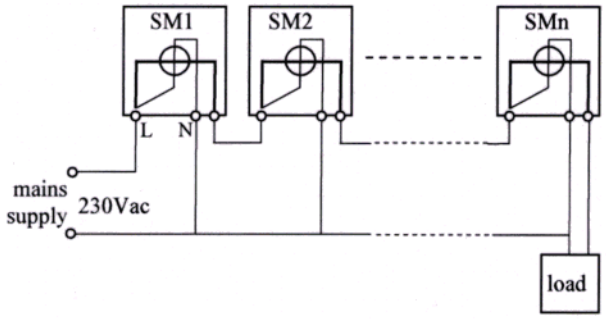

Fig. 8: Test setup

The C_x is a capacitance of 200µF between phase and neutral to create a very low mains impedance. This did not result in extreme high inrush current using the LED and CFL lights. The series inductance of 1.2 mH reduced the inrush current rise-time, as shown in Figure 9.

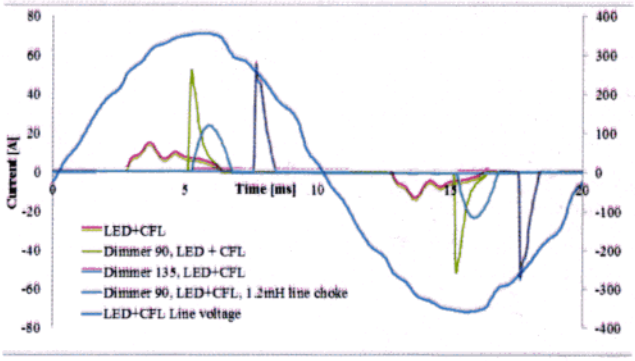

Fig. 9: Current waveform LED+CFL lights, with dimmer at 90o and dimmer at 135⁰, and with additional line choke

The rise times are

- Dimmer 90⁰, LED+CFL and line choke 0.086 A/µs
- Dimmer 90⁰, LED+CFL 0.67 A/µs
- Dimmer 135⁰, LED+CFL 1.1 A/µs

The deviations for the experiment with the dimmer and LED+CFL are shown in Table III.

SM8 is a meter using the shunt principle. We could not confirm, without breaking the seals, if SM5 is also using the shunt, but it is likely. SM1, SM2, SM6, SM7 and SM9 are using the Rogowski coil and SM4, and we expect also SM10, are using the Hall principle.

Table III: Deviation of energy meters

Meter	Year of production	Dimmer 90°	Dimmer 135°	Dimmer 135°, repeat
SM1	2013	60%	559%	566%
SM2	2007	64%	574%	581%
SM4	2014	-28%	-32%	-32%
SM5	2004	0%	-5%	-6%
SM6	2007	60%	563%	569%
SM7	2009	61%	575%	582%
SM8	2011	1%	0%	0%
SM9	2013	28%	480%	475%
SM10	2014	-25%	-31%	-31%

The deviation shown in Table II is based on the calculation using

$$deviation_{\%} = \frac{E_{SM} - E_{ferraris}}{E_{ferraris}} 100\%$$

If the reading would be listed, using

$$reading_{\%} = \frac{E_{SM}}{E_{ferraris}} 100\%$$

then the reading of, for instance SM7, is 682% (deviation 582%), and for SM4 it is 68%.

VIII. Discussion

Many experiments were performed to find out if static energy meters can provide inaccurate readings. Based on our own experience [2] the large conducted interference caused by power drive systems or some active infeed converters, as well as the high PLT levels, were assumed to be a potential culprit. This interference can be solved by reducing the emission level of the interference sources, often simply by replacing the power drive system [2] or the AIC [21]. Large harmonic distortion of the mains supply could be another source of misreading, but, although observed for low-cost energy monitors, this could not be confirmed for the static energy meters.

The reason for faulty readings appears to be the current sensor, and the associated circuitry. As a Rogowski coil results in a time-derivative of the measured current, the measured voltage has to be integrated. Probably active integration is used instead of passive integration, and the input electronics are pushed in saturation caused by the high rise-time of the current. Although the peak current level is below the maximum level stated for the meters. As stated before, no information or documentation at all is available from meter manufacturers.

The recently introduced standards [6], [7] only assume a damped sinewave current and voltage as potential interference. These signals are actually the pulse response of a larger system formed by the cabling. The experimental results presented in this paper show that static energy meters can be pushed into faulty reading (positive and negative) if sufficiently fast pulsed currents are drawn by the consumer. The actual response (damped sinewave) is not of interest anymore.

The observations of a consumer that were reported on an internet forum are consistent with the results contained in this paper: a small electronic circuit consumed only a very small amount of peak current, but caused the meter to read 500 W, resulting in a yearly additional energy 'consumption' of 4380 kWh [22].

IX. Conclusion

Conducted electromagnetic interference can cause misreading of static electronic energy meters. This was already observed in the past, but only for cases with lower energy reading. In one actual case the cause of this misreading is the interfering currents caused by active infeed converters for renewable energy. In this paper it is shown that also higher readings are possible. Electromagnetic interference tests have been introduced so that static meters will be immune against this type of interference. The static energy meters are used for billings and if a customer files a complaint the meter can be calibrated. However, this is done using ideal sinusoidal voltages and currents, while in our current living environment the currents deviate substantially due to the non-linear loads of modern equipment.

Controlled experiments performed on static energy meters confirm that they can present still faulty, and substantially higher, readings. The main cause of interference appears to be the current sensor. Meters with a Rogowski coil current sensor showed a positive deviation of 276%, or an increased reading of 376%, using a controlled power supply with undistorted voltage and defined impedance, compared to the reading of a conventional electromechanical meter based on the Ferraris principle. Meters with a Hall sensor showed a deviation of registered energy of -46%, or a decrease in energy reading to 54%.

Using the mains supply in the laboratory, from 9 static meters 5 showed positive deviations of up to 582%, which is a higher energy reading of 682%, and 2 showed deviations of around -30%, equivalent to a reading of 68%.

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Biographies

Frank Leferink *(M'91–SM'08) received his B. Sc. in 1984, M.Sc. in 1992 and his Ph.D, in 2001, all electrical engineering, at the University of Twente, Enschede, The Netherlands. He has been with THALES in Hengelo, The Netherlands since 1984 and is now the Technical Authority EMC. He is also manager of the Network of Excellence on EMC of the THALES Group. In 2003 he was appointed as (part-time, full research) professor, Chair for EMC at the University of Twente. Prof. Dr. Leferink is past-president of the Dutch EMC-ESD Association, Chair of the IEEE EMC Benelux Chapter, member of ISC EMC Europe, and associate editor of the IEEE Transactions on EMC.*

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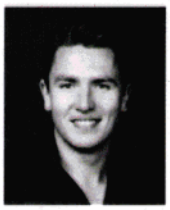


Anton Melentjev *received his B.Sc. degree in electrical engineering at the University of Applied Sciences of Amsterdam in 2015, with a minor in power- and high-voltage engineering and a major in telecommunication engineering. He performed his final research on the subject of electromagnetic interference in smart energy meters at the University of Twente, while also using the test facilities at THALES. Currently he is working at Scarabee at Schiphol Airport as a Research and Development Engineer.*

EXHIBIT V

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Accuracy of Digital Electricity Meters

May 2010

Background

The meter is a critical part of the electric utility infrastructure. It doesn't provide a control function for the power system, but it is one of the most important elements from a monitoring and accounting point of view. Meters keep track of the amount of electricity transferred at a specific location in the power system, most often at the point of service to a customer. Like the cash-register in a store, these customer meters are the place where the transaction occurs, where the consumer takes possession of the commodity, and where the basis for the bill is determined. Unlike a cash-register, however, the meter sits unguarded at the consumer's home and must be trusted, by both the utility and the home owner, to accurately and reliably measure and record the energy transaction.

Electricity is not like other commodities because it is consumed in real-time. There is nothing to compare or measure later, nothing to return, nothing tangible to show what was purchased. This makes the meter all the more critical for both the utility and the homeowner. For this reason, meters and the sockets into which they are installed are designed to standards and codes that discourage tampering and provide means of detecting when it is attempted. Intentional abuses aside, the electricity meter itself must be both accurate and dependable, maintaining its performance in spite of environmental and electrical stresses.

In general, electricity meters have been able to achieve these goals and in so doing to earn the trust of utilities and homeowners alike. The average person may have experienced a broken-down car, a worn-out appliance, or a piece of electrical equipment that died in a lightening storm, but most don't likely recall their electricity meter ever failing. Such is the reliable legacy of the electromechanical meter.

Historical Perspective – The Electromechanical Meter

By anyone's assessment, traditional electromechanical meters are an amazing piece of engineering work. Refined over a hundred years, the design of a standard residential electricity meter became an impressive combination of economy, accuracy, durability, and simplicity. For this reason, electricity meters have been late in converting to solid state electronics, compared to other common devices.

Three phase commercial and industrial meters, being inherently more complex, were first to make the transition to solid state, beginning in the 1980s, and becoming the norm in the 1990s. As recently as the year 2000, however, some still questioned if and when the simpler residential meter would be replaced by a solid state version, and whether they could attain the same balance of economy and durability.

Now just a decade later, it is clear that this conversion has taken place. Over the last decade, major electricity meter manufacturers have introduced solid state models and discontinued electromechanical production as indicated in Figure 1. This transition diminished the value of both the facilities and the art of traditional meter making and opened the doors of the meter business to new companies.

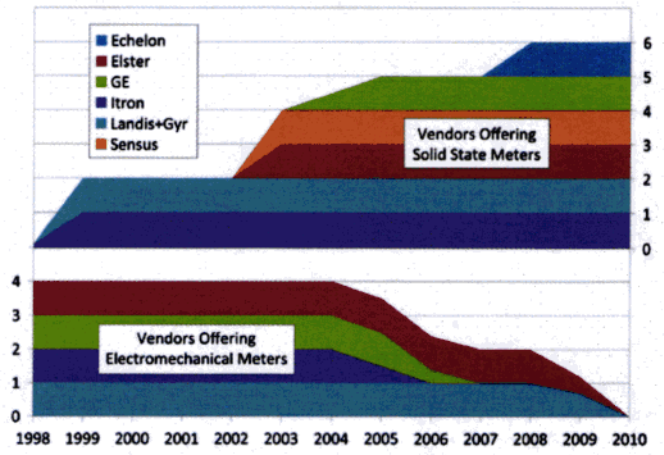


Figure 1 – Replacement of Electromechanical Meter Production with Solid State Versions

Table of Contents

This white paper was prepared by Brian Seal and Mark McGranaghan of Electric Power Research Institute.

Functionality, the Driving Factor for Change

The impetus that finally drove the transition to solid state metering was not cost reduction, nor improvements in service life or reliability, but the need for more advanced functionality. Electromechanical meters, with that familiar spinning disk, did a fine job of measuring total energy consumption, but became extremely complex if required to do anything more. Versions that captured peak demand and versions that measured consumption in multiple time-of-use (TOU) registers have existed, but were not economical for residential purposes.

Today, residential meters are expected to provide a range of measurements, with some including demand, TOU, or even continuous interval data. Some may also be required to keep a record of additional quantities like system voltage – helping utilities maintain quality of service in a world that includes fast-charging electric vehicles and solar generation. In many cases, these solid state meters also include communication electronics that allow the data they measure to be provided to the utility and to the home owner without requiring a meter reader to visit the site.

The Solid State Electricity Meter

Manufacturers who designed the first solid state residential meters understood the challenge they faced. The electromechanical devices they intended to replace held the trust of both utilities and the general public. Because dependable power delivery is critical for the economy, public safety and national security, utilities and regulators have been appropriately cautious in undertaking change. Manufacturers had to not only design a suitable replacement, but also to prove that the new meters could perform and be trusted.

From a utility perspective, several meter performance factors are of concern, including robustness, longevity, cost, and accuracy. But from the homeowner's perspective, the dominant concern is accuracy. If a meter breaks, the utility will fix it. If it becomes obsolete, it is the utility's problem to deal with. If however, a meter is inaccurate in the measurement of energy use, there is a potential that customers could be charged for more energy than they actually used. If the effect were only slight, then it could go undetected. For this reason, accuracy and dependability remain a common concern and a continued focus of dialogue regarding solid state meters.

Keeping in-step with the technology improvements associated with solid state metering, the American National Standards Institute (ANSI) developed new standards with more stringent accuracy requirements during the late 1990s. ANSI C12.20[1] established Accuracy Classes 0.2 and 0.5, with the Class numbers representing the maximum percent metering error at normal loads. Typical residential solid state electricity meters are of Class 0.5, whereas electromechanical meters were typically built to the less stringent ANSI C12.1 standards, as illustrated in Figure 2.[2] In addition, C12.20 compliant meters are required to continue to meter down to 0.1A (24 Watts), whereas C12.1 allowed metering to stop below 0.3A (72 Watts). While metering of such low loads is not likely significant on a residential bill, it is an accuracy improvement nonetheless.

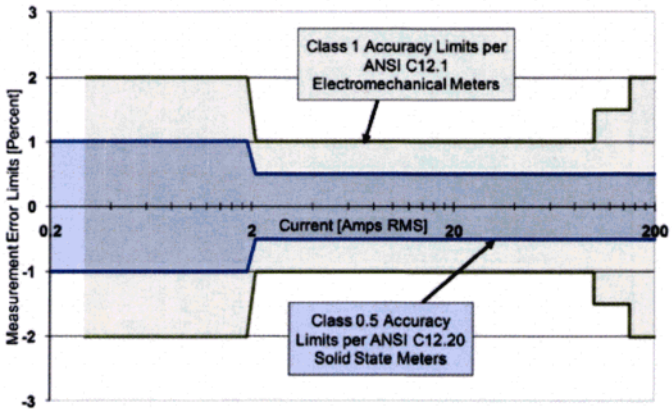


Figure 2 – Accuracy Class Comparison

Manufacturers and utilities use a range of tests and equipment to verify that meters adhere to the ANSI requirements. During the manufacturing process, it is common that each individual meter is calibrated and verified. Once a utility receives new meters, there is often another accuracy test, either on each meter or on a sample basis. States generally establish requirements for how utilities are to check accuracy when new meters are received and at intervals thereafter.

Regardless of their specified performance, solid state meters have been met with mistrust in some early deployments. The most significant of the complaints has been that the meters are simply inaccurate, resulting in higher bills. Given that these new meters are designed to the more stringent ANSI requirements, the factors that may lead to these observations and perceptions are important to understand.

1 American National Standards Institute, 1998, 2002, available from NEMA at http://www.nema.org/stds/c12-20.cfm

2 Data from Metering Standards ANSI C12.1-1988 and ANSI C12.20-2002

Factors in How Digital Meters May Be Perceived

Changes in Billing Periods

The duration of billing periods can vary from month to month, making it difficult to compare one month's bill to the next. If deployment of solid-state meters happens to correspond to a month with a billing period that is particularly long, then customers could incorrectly interpret the associated higher bill with the meter itself. An example of such a long billing period during new meter deployment occurred in January for many customers of Texas utility Oncor. Due to holidays, this billing period was as long as 35 days for some customers.

Complexity of Commissioning New Meters of Any Type

When meters are replaced, and automated reading is instituted, care must be taken to associate the new meter with the correct billing address. Automated tools and processes may be used to aid in this process and are important to guarantee that the right consumption is associated with each residence.

When a meter is replaced, the metering and billing process for that month is more complicated than usual. A closing read from the old meter has to be captured and the associated consumption added to that from the new meter to cover the full billing period. Although the meter replacement process is generally automated to minimize opportunity for human mistakes, the data-splicing process adds complexity and opportunity for error.

If such an error were unreasonably large, it would be recognized as such by both the homeowner and the utility. If, however, a small error occurred, it could be difficult to distinguish from real consumption. It is therefore hypothetically possible that a bill could be in error for the month when the meter replacement occurred, even if both the old and the new meter were accurate.

Connectivity and Estimation

Utility billing systems often have an estimating capability that can apply an algorithm to estimate a customer's bill until an actual read is collected. Historically, such estimation has been used when a manual meter read is missing and any errors in the estimation are corrected in the next bill.

When solid state meters are installed as part of an advanced metering infrastructure program, manual meter reading will halt as the automated process begins. New communication systems may not have good connectivity to every premise at first, so the number and frequency of estimated intervals may be elevated during the first few months after deployment. It is possible that such estimation could result in consumption from one month being billed in another, and hence more variation in bills.

Early Life Failures

Products of many kinds exhibit changes in failure rate over time. As illustrated in Figure 3, these changes often follow a familiar trend. More products tend to fail either very early or very late in the service life of individual devices, with the rate of failure stabilizing at a low level during most of the useful life of the product.

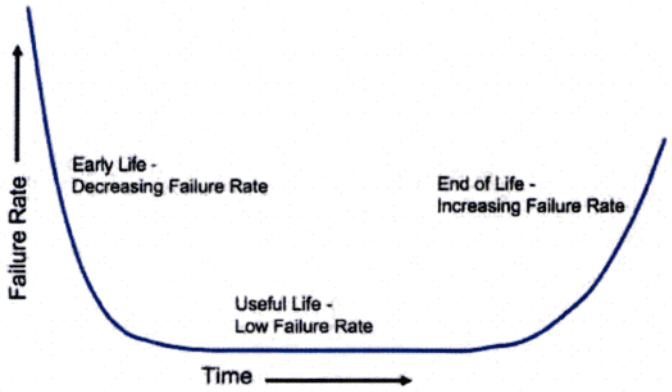


Figure 3 – The Failure Rate Bathtub Curve

Electricity meters are no exception. Both electromechanical and solid state meters have components and assemblies that can result in higher failure rates early in life, and wear-out after their useful life expires. A typical meter population is mature, is centered in the "useful-life" portion of the bathtub curve, and includes only a few new meters installed each year.

Today, the majority of solid state meters put into service are elements of advanced metering systems that are being mass deployed. These deployments can result in an entire meter population that is just a year or two old and therefore may experience sharply increased, but not unexpected, early-life-failure rates. If high registration were among the failure modes of a meter, then an exaggerated percentage of the population could experience higher bills during a new deployment.

Extraordinary Weather

Extraordinary weather can occur at any time. Both record cold winters and hot summers have occurred in North America in recent years and can result in electric bills that are higher than normal. If such events coincide with a deployment of solid-state meters, some may conclude that the new meter is the cause.

One example of how extraordinary weather can result in higher consumption of electricity relates to the use of electric heat pumps used to heat homes in moderate climate zones. These heat pumps, while normally much more efficient than resistive heating, are typically designed with a second stage of electric resistance heat which is triggered when the heat pump itself can no longer satisfy the indoor set point temperature. As outdoor temperature declines, this second stage is called for more frequently. As was the case in many parts of the U.S. this past winter, extreme cold causes abnormally high dependence on second-stage electric heat and in-turn, unusually high electric bills.

Growing Consumption

Average residential electricity consumption has risen for decades, with the addition of increasing numbers and types of electronic devices. Larger televisions, outdoor lighting, and new pools and spas are common additions that can result in notable increases in residential consumption. In other cases, faulty equipment can cause increases. Loss of refrigerant in an HVAC system or a duct that has fallen loose in an attic can cause devices to run excessively, unnoticed until exposed by an electric bill.

If these new purchases or equipment failures happen to coincide with a new electricity meter, one might assume that the resulting bill is the fault of the metering device.

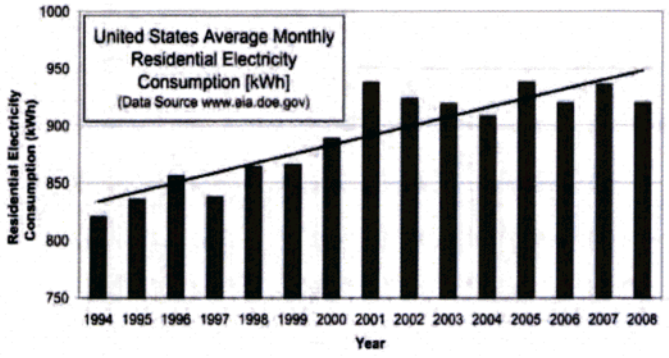


Figure 4 – Residential Electricity Consumption vs. Time

New Rate Structures

New meters may enable new rate structures such as time-of-use or critical peak pricing. These programs offer to make the grid more efficient by motivating consumers to use less energy during times of peak consumption and more when energy is readily available. The improvement in load factor allows for better utilization of assets and, in some cases, deferral of infrastructure upgrades.

While new rate structures may benefit customers on average, individual results depend on the degree to which the consumer heeds the high and low price periods. Customers who select time-based rate plans and do not modify their behavior accordingly could experience higher bills, even though lower bills were possible. Because the new rate plans may go into effect about the same time as a meter-replacement, homeowners could mistakenly associate increased bills with metering errors.

Replacing Defective Meters

Although electromechanical meters are extremely reliable, they do fail. The most common "failure" mode is reduced registration. Anything that increases the drag on the rotating disk can cause a meter to run slow, resulting in reduced bills. Worn gears, corrosion, moisture, dust, and insects can all cause drag and result in an electromechanical meter that does not capture the full consumption of the premise. Failure modes also exist that could cause an electromechanical meter to run fast, but are less common. Figure 5[3] illustrates this effect, based on the average registration versus years-of-service for a sample of 400,000 electromechanical meters.

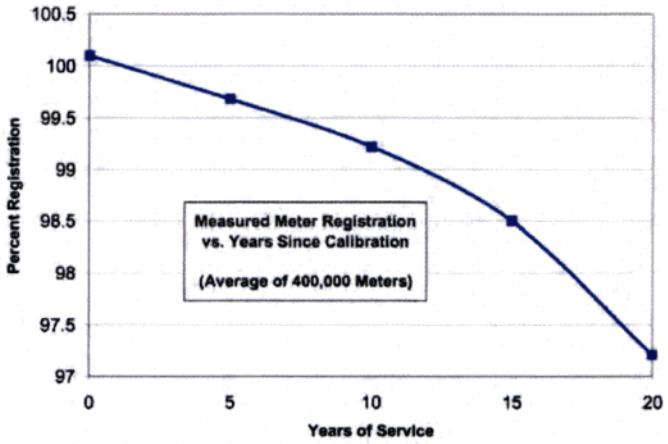
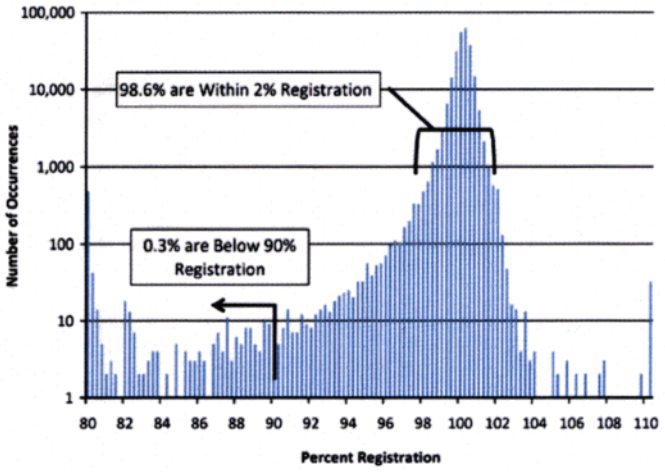


Figure 5 – Electromechanical Meter Registration Loss vs. Time

3 Data by permission from Chapman Metering, www.chapmanmetering.com

When all the meters in a service area are replaced, it is reasonable to expect that some of those taken out of service were inaccurate and running slow. Some may have gradually slowed over many years so that the homeowner never noticed and became accustomed to lower electricity bills. The sudden correction to full accounting and billing could naturally surprise these homeowners and result in questioning of a new meter. While the average meter might be only slightly slow, a few could be significantly so. As indicated in the distribution shown in Figure 6,[4] 0.3% of electromechanical meters tested registered less than 90% of actual consumption. Although 0.3% is small as a percentage, in a service area of a million meters, it represents 3,000 residences that might be under-billed by 10 to 20% prior to a new meter deployment.



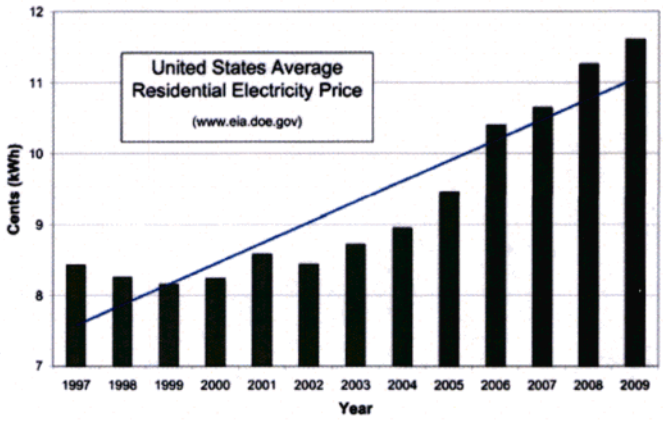
Note the Logarithmic Vertical Scale for Better Resolution

Figure 6 – Electromechanical Meter Registration Distribution

Rising Electricity Costs

Although not the case everywhere, basic energy rates have risen in most areas as a result of increased costs of generating electricity and increased costs of the infrastructure required to deliver electricity to the consumer. As indicated in Figure 7, the average residential electricity price in the United States has increased at an average rate of 0.3 cents per kilowatt-hour per year over the last 12 years. In the event that a rate increase coincides with a rollout of new meters, homeowners experiencing higher bills might conclude that their new meter is in error.

4 Data by permission from Chapman Metering, www.chapmanmetering.com



Note the Exaggerated Vertical Scale

Figure 7 – Average Residential Electricity Price vs. Time

Use of Embedded Software

Electromechanical meters utilized a set of gears and dials to keep a running count of how many times the disk rotated. This assembly, referred to as a "register," maintained a measure of the total power consumption that passed through the meter over time. Like a car's mileage odometer, each gear fed the next so that ten turns of the less significant dial were required to make one turn of the next. These registers had only one input, driven by the spindle of the meter's disk, and could not be moved from one reading to another by any other mechanism. Although simple and mechanical, the result was like a vault, locking-in and protecting the reading of cumulative consumption and immune to sudden shift or loss of data.

Solid state electronic meters are designed to provide this same register function, but using embedded software and non-volatile memory chips as the storage mechanism. Even before the recent deployment of "smart meters," millions of solid state meters have been deployed by utilities since the 1990s and the accuracy of their registration has not been an issue.

Still, as electronic devices, there is the possibility of imperfections in the embedded software or sensitivities in the electronic circuitry. Hypothetically, such imperfections or sensitivities could result in glitches that could affect the meter reading. An error of this nature that occurred only rarely would be difficult to detect prior to field deployment.

With electromechanical meters, modes of failure tend to be permanent. Once a meter or its register fails, due to wear, dust, etc, it is

generally still found to be in a failed state when tested later. Software flaws, on the other hand, could create a transient glitch, leaving a meter that checks-out perfectly afterwards. This possibility complicates the diagnostic process for solid state meters and may make it difficult to discern the root cause of problems.

If it were to occur, the effect of a glitch in a solid state meter or in an AMI system may be mitigated using interval data. Typically, the homeowner's consumption is measured in individual time intervals, such as 15 minutes or 1 hour. This interval data is typically collected by the utility every few hours or daily. Verification of data is thereby made simple because the sum of the entries in each time interval must add up to the total. If a meter's aggregate reading were to suddenly shift, or if a single interval suggested an unrealistic level of consumption, then validation, estimation, and editing software in the utility office could automatically identify the problem and either correct it or flag the issue for customer service.

Voltage Transient Susceptibility

The electronic circuits of solid state meters connect to the AC line to draw operating power and to perform voltage measurement. Although the line voltage is nominally regulated to a stable level, such as 240VAC, transients and surges can occur during events such as electrical storms. A range of electronic clamping and filtering components are used to protect the electronics from these voltage surges, but these components have limitations. The ANSI C12.1 metering standard specifies the magnitude and number of surges that meters must tolerate. In addition, some utilities have instituted surge withstand requirements for their meters that exceed the specification. In any case, surges that exceed the tested limits, either in quantity or magnitude, could cause meter damage or failure.[5]

Electromechanical meters had no digital circuitry. They utilized spark-gaps to control the location of arc-over and to dissipate the energy of typical voltage events. As a result, they were generally immune to standard surge events. This nature is evidenced in the section of ANSI C12.1 that specifies voltage surge testing, but allows that "This test may be omitted for electromechanical meters and registers."[6]

5 *Testing and Performance Assessment for Field Applications of Advanced Meters*, EPRI, Palo Alto, CA. 2009. 1017833

6 ANSI C12.1-2001, Section 4.7.3.3 Test No. 17: *Effect of High Voltage Line Surges*

Summary

Electromechanical meters are dependable products that have served society well. Over a hundred years, their design was optimized so that they provided an excellent combination of simplicity and reliability while providing a single measurement - cumulative energy consumption. Unfortunately, these products did not support the additional functionality needed to integrate customers with a smart grid, such as time of use and real time prices, a range of measured quantities, communication capability, and others.

For these utilities, the transition to solid-state electric meters is therefore not one of choice, but of necessity. Due in part to the large number of announced AMI programs, many homeowners in the United States will likely see their electromechanical meter replaced by a solid-state electronic device in the next five to ten years. During such a transition, there will likely be both real and perceived issues with solid-state designs that need addressing. Care must be taken to consider each case thoroughly and to use sound diagnostic practices to trace each issue to its root cause. Temptations to either blame or exonerate the solid state meter must be resisted. Ideally, each investigation should not only resolve any homeowner concerns, but also discover any product imperfections so that solid-state meter designs may be continually improved. When advanced metering functions are needed, reverting to electromechanical meters is not a viable option.

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Smart Distribution Applications and Technologies (Program 124)

1020908 May 2010

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EXHIBIT W

BEFORE THE ARIZONA CORPORATION COMMISSION

MIKE GLEASON
Chairman
WILLIAM A. MUNDELL
Commissioner
JEFF HATCH-MILLER
Commissioner
KRISTIN K. MAYES
Commissioner
GARY PIERCE
Commissioner

IN THE MATTER OF SMART METERING REQUIREMENTS OF SECTION 1252 OF THE ENERGY POLICY ACT OF 2005

DOCKET NO.E-00000A-06-0038

DECISION NO. 69736

ORDER

Open Meeting
July 24 and 25, 2007
Phoenix, Arizona

BY THE COMMISSION:

FINDINGS OF FACT

Introduction

1. The Energy Policy Act of 2005 requires each state regulatory authority to consider certain PURPA[1] standards, including one on Time-based Metering and Communications, included in the section entitled Smart Metering. The Commission may decline to implement the standard or adopt a modified standard. The Commission was required to begin its consideration by August 8, 2006, and must complete its consideration by August 8, 2007. On January 23, 2006, Staff filed a memo in Docket Control to open a docket on Smart Metering.

2. A workshop was held on June 7, 2007. Participants in the Workshops included representatives from utilities, government agencies, advocates for renewable resources, product

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[1] Public Utility Regulatory Policies Act of 1978.

suppliers, and others. Written comments were received by Arizona Public Service Company ("APS"), and Tucson Electric Power Company ("TEP")/UNS Electric, Inc.

PURPA Standard on Time-Based Metering and Communications

3. In Section 1252 Smart Metering, the Energy Policy Act of 2005 (EPACT) requires each state regulatory authority to consider a PURPA standard on Time-based Metering and Communications. The standard would apply to utilities with greater than 500,000 MWh in annual retail sales. The Commission may decline to implement the standard or adopt a modified standard. The standard is as follows:

(14) TIME-BASED METERING AND COMMUNICATIONS. –

(A) Not later than 18 months after the date of enactment of this paragraph, each electric utility shall offer each of its customer classes, and provide individual customers upon customer request, a time-based rate schedule under which the rate charged by the electric utility varies during different time periods and reflects the variance, if any, in the utility's costs of generating and purchasing electricity at the wholesale level. The time-based rate schedule shall enable the electric consumer to manage energy use and cost through advanced metering and communications technology.

(B) The types of time-based rate schedules that may be offered under the schedule referred to in subparagraph (A) include, among others –

(i) time-of-use pricing whereby electricity prices are set for a specific time period on an advance or forward basis, typically not changing more often than twice a year, based on the utility's cost of generating and/or purchasing such electricity at the wholesale level for the benefit of the consumer. Prices paid for energy consumed during these periods shall be pre-established and known to consumers in advance of such consumption, allowing them to vary their demand and usage in response to such prices and manage their energy costs by shifting usage to a lower cost period or reducing their consumption overall;

(ii) critical peak pricing whereby time-of-use prices are in effect except for certain peak days, when prices may reflect the costs of generating and/or purchasing electricity at the wholesale level and when consumers may receive additional discounts for reducing peak period energy consumption;

(iii) real-time pricing whereby electricity prices are set for a specific time period on an advanced or forward basis, reflecting the utility's cost of generating and/or purchasing electricity at the wholesale

level, and may change as often as hourly; and

(iv) credits for consumers with large loads who enter into pre-established peak load reduction agreements that reduce a utility's planned capacity obligations.

(C) Each electric utility subject to subparagraph (A) shall provide each customer requesting a time-based rate with a time-based meter capable of enabling the utility and customer to offer and receive such rate, respectively.

4. Although the 18-month utility compliance deadline contained in paragraph A of the standard appears to be in conflict with the two-year statutory deadline for the Commission to consider the standard, the Commission can modify the utility compliance deadline in the standard to be a different time period.

5. In addition, there is a related provision in the Energy Policy Act of 2005 which states the following:

(i) TIME-BASED METERING AND COMMUNICATIONS. - In making a determination with respect to the standard established by section 111(d)(14), the investigation requirement of section 111(d)(14)(F) shall be as follows: Each State regulatory authority shall conduct an investigation and issue a decision whether or not it is appropriate for electric utilities to provide and install time-based meters and communications devices for each of their customers which enable such customers to participate in time-based pricing rate schedules and other demand response programs.

6. The Commission is required to consider the three purposes of PURPA in its determination of whether to adopt the Time-based Metering and Communications standard. The three purposes of PURPA are as follows:

- conservation of energy supplied by electric utilities,
- optimal efficiency of electric utility facilities and resources, and
- equitable rates for electric consumers

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7. Information regarding the timing of electric usage may enable customers to modify usage patterns, and the associated price signals may provide an incentive to modify usage patterns or to conserve. When customers shift load to lower cost periods, utilities may utilize their facilities more efficiently. Electric rates can become more equitable for customers by charging prices that are more in line with the underlying cost at the time of consumption. However, both the benefits and the costs of Advanced Metering and Communications should be considered before requiring full-scale implementation.

Background

8. EPACT uses all of these terms: "Advanced Metering and Communications," "Smart Metering," and "Time-based Metering and Communications."

9. Advanced Metering and Communications is usually known as Advanced Metering Infrastructure (AMI). AMI should not be confused with Automated Meter Reading (AMR) which only refers to the meter reading process which includes drive-by and hand-held meter reading systems. AMR meters have one-way communication. AMI is a fixed network system that can read meters at any time and support a variety of complex rates.

10. A Smart Meter can be defined as an interval meter with two-way communication capability that can relay data from the meter to the utility or vice versa. The end-point devices must be capable of being upgraded remotely, and the interval data need to be collected at least daily. However, the functionality of AMI can also be achieved with a "dumb" meter/smart network by moving the processing out of the meters and into the communication network to be shared by many meters.

11. Capabilities of Smart Meters and AMI include on-demand meter reading, outage management, critical peak pricing support, direct load control program support, demand response program support, pre-paid metering support, virtual disconnects, and others.

12. Time-based Metering and Communications consists of meters and systems that enable customers to participate in time-of-use (TOU), critical peak pricing (CPP), or real-time pricing (RTP) programs by either recording consumption during specific time periods or providing information to customers about market costs at specific times.

Discussion and Analysis

13. Some Arizona electric distribution utilities already offer time-based rates to their customers, and some of those utilities have already begun to introduce AMI in their service areas. The AMI technology varies substantially among the utilities. It appears that one technology may be most feasible for a densely populated area, but a different technology would be used in a rural area.

14. APS has begun implementation of an AMI system that consists of a cellular wireless public network with hub meters and client meters. Each hub meter is in contact with multiple client meters. These meters are considered Smart Meters. TEP has begun using a dumb meter/smart network approach. It uses one-way communications from the radio frequency meter but derives interval data which are passed back to the meter data management system. The investment is in the network rather than in the meter. Trico Electric Cooperative uses a cellular AMI system for its TOU, commercial, and interruptible customers. Trico's largest customers can obtain real time information through Trico's website. Half of Trico's meters are read remotely, and half are read using a drive-by system.

15. Both benefits and costs of AMI and time-based rates should be considered. Benefits of AMI include reduced meter reading costs, reduced meter reading access issues, ability to remotely program meters to facilitate rate changes, flexibility in billing cycles, and fewer field visits. Fewer field visits result in less mileage, reduced fuel consumption, fewer emissions, and possibly fewer vehicular accidents. AMI provides a tool for innovative rate design, a source for load data and system planning data, a gateway for future services the utility may choose to provide, increased reliability because of outage and restoration notification, a decrease in energy theft with the ability of looking at energy patterns, and a change in the utility mindset from re-active to pro-active.

16. Costs of AMI can include the costs for the meters, meter installation, a Meter Data Management System, data management labor, communications, back office software and servers, the integration of the AMI system to other systems, repairs to customer equipment, and other associated costs. As of February 2007, APS had purchased 29,872 AMI meters at an average cost

of about $97 per meter. The communication cost per AMI meter was about $0.15 per month, compared to a meter read cost of about $0.90 per conventional meter. During a six-month period, APS spent about $700,000 for integration of the AMI system and the Customer Information System.

17. AMI represents a significant investment by utilities and is still an evolving technology. Utilities should investigate their needs and those of their customers to determine if the benefits of AMI outweigh the costs and which AMI technology would be most appropriate to use.

18. Benefits of time-based rates may include an improved load shape for the utility with a reduced peak and the potential to defer capacity construction, increased reliability, better alignment of rates to costs, mitigation of price increases, an ability for the customer to save, increased customer satisfaction, and potential environmental benefits. Negative outcomes of time-based rates could include increased off-peak usage, increased load on the call center, and customer dissatisfaction.

19. Costs related to TOU include costs for meters, meter installation, meter reading, back office and operational support, customer education, marketing, training customer service staff, and other items. TEP has found the cost to read a TOU meter manually to be $2.24 per read, compared to $0.56 for the aggregated meter read cost for all meter reads within the TEP service territory. Changes to the TOU rates require reprogramming the meter through field visits. The costs for CPP include all of the costs for TOU plus the costs for communication to customers, the costs for the collection of interval data (including the costs for the interval meters, the costs for obtaining the data, and additional back-office cost to process the data), costs for increased customer education, and acceleration of depreciation of meter stock. Costs for RTP include the costs for TOU and CPP plus higher costs for communication to customers.

20. Utilities should offer voluntary time-based rate schedules that can provide benefits to both customers and utilities. However, each utility should be allowed to determine which type(s) of time-based rate schedules are appropriate for which customer classes in its area.

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Staff Recommendations

21. Staff recommends that the Commission adopt a modified version of the PURPA standard on Time-based Metering and Communications.

22. The modified standard would be as follows:

(14) TIME-BASED METERING AND COMMUNICATIONS. –

(A) ~~Not later than 18 months after the date of enactment of this paragraph,~~ Within 18 months of Commission adoption of this standard, each electric distribution utility shall offer to appropriate customer classes, and provide individual customers upon customer request, a time-based rate schedule under which the rate charged by the electric utility varies during different time periods and reflects the variance, if any, in the utility's costs of generating and purchasing electricity at the wholesale level. Within 18 months of Commission adoption of this standard, each electric distribution utility shall investigate the feasibility and cost-effectiveness of implementing advanced metering infrastructure for its service territory and shall begin implementing the technology if feasible and cost-effective. ~~The time-based rate schedule shall enable the electric consumer to manage energy use and cost through advanced metering and communications technology.~~

(B) The types of time-based rate schedules that may be offered under the schedule referred to in subparagraph (A) include, among others-

(i) time-of-use pricing whereby electricity prices are set for a specific time period on an advance or forward basis, typically not changing more often than twice a year, based on the utility's cost of generating and/or purchasing such electricity at the wholesale level for the benefit of the consumer. Prices paid for energy consumed during these periods shall be pre-established and known to consumers in advance of such consumption, allowing them to vary their demand and usage in response to such prices and manage their energy costs by shifting usage to a lower cost period or reducing their consumption overall;

(ii) critical peak pricing whereby time-of-use prices are in effect except for certain peak days, when prices may reflect the costs of generating and/or purchasing electricity at the wholesale level and when consumers may receive additional discounts for reducing peak period energy consumption;

(iii) real-time pricing whereby electricity prices are set for a specific time period on an advanced or forward basis, reflecting the utility's cost of generating and/or purchasing electricity at the wholesale level, and may change as often as hourly; and

(iv) credits for consumers with large loads who enter into pre-established peak load reduction agreements that reduce a utility's planned capacity obligations.

(C) Each electric utility subject to subparagraph (A) shall provide each customer requesting a time-based rate with a time-based meter capable of enabling the utility and customer to offer and receive such rate, respectively.

23. Staff's proposed standard would apply to all electric distribution companies in Arizona that are regulated by the Commission. This would be in contrast to the PURPA standard that applies only to electric distribution companies with retail sales of more than 500,000 MWh.

24. In summary, Staff has recommended that the Commission adopt a modified version of the PURPA standard on Time-based Metering and Communications, as included in Finding of Fact No. 22, that would apply to all electric distribution companies in Arizona that are regulated by the Commission.

CONCLUSIONS OF LAW

1. The Commission has jurisdiction the subject matter of the application.

2. The Commission, having reviewed the application and Staff's Memorandum dated July 18, 2007, concludes that it is in the public interest to adopt a modified version of the PURPA standard on Time-based Metering and Communications.

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ORDER

IT IS THEREFORE ORDERED that a modified version of the PURPA standard on Time-based Metering and Communications, as included in Finding of Fact No. 22, that would apply to all electric distribution companies in Arizona that are regulated by the Commission is adopted.

IT IS FURTHER ORDERED that this Decision shall become effective immediately.

BY THE ORDER OF THE ARIZONA CORPORATION COMMISSION

CHAIRMAN COMMISSIONER

COMMISSIONER COMMISSIONER COMMISSIONER

IN WITNESS WHEREOF, I BRIAN C. McNEIL, Executive Director of the Arizona Corporation Commission, have hereunto, set my hand and caused the official seal of this Commission to be affixed at the Capitol, in the City of Phoenix, this 30th day of July, 2007.

BRIAN C. McNEIL
Executive Director

DISSENT: _____

DISSENT: _____

EGJ:BEK:lhm\RM

SERVICE LIST FOR: Smart Metering
DOCKET NO. E-00000A-06-0038

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Ajo, Arizona 85321

Arizona Public Service Company
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Phoenix, Arizona 85072

Columbus Electric Cooperative, Inc.
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Deming, New Mexico 88031

Dixie-Escalante Rural Electric Association, Inc.
71 East Highway 56
Beryl, Utah 84714-5197

Garkane Energy Cooperative, Inc.
Post Office Box 465
Loa, Utah 84747

Graham County Electric Cooperative, Inc.
Post Office Drawer B
Pima, Arizona 85543

Mohave Electric Cooperative, Inc.
Post Office Box 1045
Bullhead City, Arizona 86430

Morenci Water and Electric Company
Post Office Box 68
Morenci, Arizona 85540

Navopache Electric Cooperative, Inc.
1878 West White Mountain Boulevard
Lakeside, Arizona 85929

Sulphur Springs Valley Electric Cooperative, Inc.
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EXHIBIT X

BEFORE THE ARIZONA CORPORATION COMMISSION

COMMISSIONERS

JEFF HATCH-MILLER, Chairman
WILLIAM A. MUNDELL
MARC SPITZER
MIKE GLEASON
KRISTIN K. MAYES

IN THE MATTER OF: AVIS READ, individually, on behalf of all similarly situated, COMPLAINANTS, vs. ARIZONA PUBLIC SERVICE COMPANY, RESPONDENT.	DOCKET NO. E-01345A-04-0657
IN THE MATTER OF THE APPLICATION OF ARIZONA PUBLIC SERVICE COMPANY FOR A DECLARATORY ORDER REGARDING BILL ESTIMATION PROCEDURES.	DOCKET NO. E-01345A-03-0775 DECISION NO. 68112 **OPINION AND ORDER**

DATES OF HEARING: October 14, 2004, January 28, February 2 (Public Comments), Feburary 4, and April 7, 2005

PLACE OF HEARING: Phoenix, Arizona

ADMINISTRATIVE LAW JUDGE: Lyn Farmer

IN ATTENDANCE: Jeff Hatch-Miller, Chairman
William A. Mundell, Commissioner
Marc Spitzer, Commissioner
Mike Gleason, Commissioner
Kristin K. Mayes, Commissioner

APPEARANCES: Mr. Barry Reed, ZIMMERMAN REED; Mr. David A. Rubin, THE RUBIN LAW FIRM; and Mr. Jeffrey M. Proper, Attorney at Law, on behalf of the Complainant;

Mr. Thomas L. Mumaw, PINNACLE WEST CAPITAL CORPORATION, PNW LAW DEPARTMENT and Mr. William J. Maledon and Ms. Debra A. Hill, OSBORN MALEDON, P.A., on behalf of Arizona Public Service Company; and

Ms. Janet Wagner, Staff Attorney, Legal Division, on behalf of the Utilities Division of the Arizona Corporation Commission.

BY THE COMMISSION:

On June 4, 2002, Avis Read filed a complaint in the Superior Court of the State of Arizona against Arizona Public Service Company ("APS"), alleging that APS had failed to read her meter for months at a time, that APS' estimates of her energy consumption tended to result in higher bills, that APS' estimated bills did not accurately reflect actual usage and demand, and that APS had intentionally engaged in this conduct. The Complaint also alleged that APS had not employed a sufficient number of meter readers, had systematically failed to read customer meters, had arbitrarily estimated electric consumption and demand resulting in overcharging, and that APS had failed to obtain the Arizona Corporation Commission's ("ACC") approval of its estimating procedures in violation of Arizona Administrative Code ("A.A.C.") R14-2-210(A)(5).[1]

On October 23, 2003, APS filed an application requesting a declaratory order finding that its past and present procedures for bill estimation either are exempt from or comply with the requirements of A.A.C. R14-2-210 and R14-2-1612 ("Application for Declaratory Order").

On September 9, 2004, Avis Read ("Complainant"), on her own behalf and on behalf of a class of customers of APS filed a complaint ("Complaint") against APS, raising allegations similar to those raised in the Superior Court Complaint. On September 20, 2004, APS filed its Response to the Complaint stating that the claims are without merit and that the estimated bills that were sent to the Complainant consistently underestimated the amount of electricity consumed.

By Procedural Order issued November 2, 2004, the Application for Declaratory Order and the Complaint were consolidated.

In its Direct testimony filed on January 24, 2005, Staff indicated that its chief concern with the Complaint was not how the bills were estimated, but that APS did not send Mrs. Read a bill for five months; that when the bills were eventually rendered, they were unreasonably confusing; and that the large amount of the bill created a financial burden, but APS was not willing to work on an extended payment plan for any time longer than three months. Staff concluded that the plain language of R14-2-210(A)(5)(a) indicates that the rule was intended to apply to APS. Staff noted that

[1] The Complaint was subsequently dismissed without prejudiced.

APS had Commission-approved bill estimation procedures for Rate Schedules EC-1 and ECT-1R, but that APS apparently had not implemented those methods and was in non-compliance with those tariffs. (Rowell Direct pp 12-13).

Staff found that APS had failed to comply with R14-2-210(A)(5)(a); it failed to send bills on a monthly basis; and it failed to comply with its EC-1 and ECT-1R tariffs. Staff recommended fines of $953,000 for APS' failure to follow its tariffs and $20,000 for APS' failure to send bills. Staff recommended that in addition to the recommendations contained in the December 28, 2004 Staff Inquiry into the Usage Estimation, Meter Reading, and Billing Practices of APS ("Staff Inquiry") initial report by Staff consultants, APS should: refund overestimated demand charges totaling at least $171,686 plus interest; change its current methodology for estimating demand to one using customer-specific, prior month kW to estimate demand; and commence an internal audit of its compliance with Commission rules and Commission-approved tariffs. Staff further recommended that for the next five years, APS be required to submit verification to the Commission that APS is in compliance with its tariffs dealing with billing practices and with Commission rules on billing practices.

In Rebuttal testimony, APS witness David Rumolo testified that the settlement in the APS rate case had two elements that would reduce the number of demand estimations in the future: residential Schedule EC-1 would be eliminated; and the proposed Schedule E-32 would eliminate the demand charge for general service customers with demands of 20 kW or less[2]. APS also disagreed with some of Staff's recommendations, including crediting customers for estimated demand readings and the internal auditing on bill estimation, metering, and billing practices, as well as the use of an independent auditor.

On February 25, 2005, Staff filed a Proposed Settlement Agreement ("Settlement Agreement") behalf of APS, the estate of the Complainant, and Staff. The Settlement Agreement is attached hereto as Attachment A.

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[2] E-32 general service customers requiring demand readings for billing purposes will decrease from 95,000 to approximately 20,000 customers.

PAGE # 275

The key provisions of the Settlement Agreement are generally summarized as follows:[3]

Estimation Issues:

- The Parties agree that APS did not implement the demand estimation methodology contained in its Rate Schedules EC-1 and ECT-1R when it designed its bill estimation procedures for its customer information system;
- From April 1999 to the present, APS has used class average load factors to estimate demand in most instances, and the parties agree that this tends to result in a net underestimation of kW. The Parties agree that APS' class average load factor method is less accurate than the tariffed method;
- APS' use of class average load factors to estimate demand is consistent with the requirements of A.A.C. R14-2-210 but inconsistent with the provisions of Rate Schedules EC-1 and ECT-1R;
- APS' methods for estimating Mrs. Read's kW and kWh resulted in underestimation, which in turn resulted in underbills;
- APS acknowledges that it has an independent obligation to implement its Commission-approved tariffs;
- The parties agree that the use of customer specific kW from the prior month is the most accurate method for estimating demand when compared with the other kinds of methods analyzed in this proceeding;
- APS shall use customer specific kW from the prior month to estimate demand for all of its demand tariffs, when the appropriate data is available;
- Procedures are adopted for determining appropriate initial bills with demand charges;
- Procedures are adopted for estimating demand when customer-specific kW is not available;
- APS agrees to implement the demand estimation methodologies set forth in the Settlement Agreement within seven months of the Commission's approval of the bill estimation tariff;
- APS agrees to conduct a study to determine the impact of reclassifying May as a non-summer

[3] See Attachment A for the full, complete language of the settlement.

month for purposes of kWh estimation and to file the report by December 30, 2005;

- APS is not required to recalculate demand estimations that were based upon class average load factors that occurred between April 1999 and the effective date of the new kW demand estimation procedures set forth in the Settlement Agreement, except that APS shall credit all customers who between September 1, 1998 and October 1, 2003, had an actual demand reading that was lower than the immediately preceding estimate (see Exhibit A to the Settlement Agreement, estimating total potential settlement credits, not including interest, to be $2,217,232). APS will file a report with the Commission that accounts for the credits issued;
- APS shall make reasonable efforts to locate all customers who have left its system and who are entitled to credits or five dollars and greater;
- APS shall design a cost effective Access Improvement Program to achieve a reduction in the number of instances of kW and kWh estimation due to "no access" issues and shall expend $600,000 on this program (not including and separate from any ongoing or anticipated expenditures) and will submit the details of its proposed Access Improvement Program for Commission approval;
- The costs to implement the actions required by APS, as set forth in Paragraph 25 are not recoverable by APS;
- APS' estimation procedures for all rates shall be governed by a bill estimation tariff that shall be consistent with the Decision in this matter and APS shall file its bill estimation tariff for Commission review within thirty days and APS shall also amend all applicable rate schedules to remove language related to estimation procedures;
- All APS amendments to its bill estimation procedures must be filed as a tariff with the Commission.

Meter Reading Issues:

- The Parties acknowledge that customers have an obligation to provide safe and unrestricted access to the customer's electric meter in accordance with A.A.C. R14-2-209(D) and APS acknowledges that it has an obligation to undertake reasonable efforts to accomplish timely

reads of its customers' meters.

- APS estimated Mrs. Read's demand meter for the months of January, March, April, and May of 1999;
- APS acknowledges that accuracy in meter reading and in estimation of kW and kWh is an important public and regulatory policy, and that an effective way to improve the accuracy of billing is to reduce the number of times that APS estimates kW or kWh;
- In order to decrease the incidence of "no access" to customers, APS will implement the following:
    a. APS will provide the Commission with a report in six months that explains new procedures it has put in place to ensure that staffing resources are sufficient to address emergency short-term needs for meter reading shops that are either smaller or remote;
    b. APS shall revise its "No Access Meters" report to prioritize accounts to focus first on demand-billed customers when working the "no access" report and take other steps to identify and prioritize "no access" problems;
    c. APS shall develop and install a performance measure to monitor the extent to which it is complying with the Commission requirement to read meters monthly, and shall provide to the Commission a description of its performance measure and the results of its analysis within six months;
    d. APS shall modify the options in its software to prevent the Itron HHC meter readers from displaying the previous month's reading and usage;
    e. For the next six years, APS shall provide biannual reports to the Commission related to the status of the remote meter reading pilot and implementation plans;
    f. APS will implement a pilot program to evaluate whether using an auto-dialer to communicate with customers who have experienced two consecutive months of "no access" will facilitate resolution of additional "no access" accounts and shall report the results;
    g. APS shall implement a policy to ensure that meter reading supervisors or their designees periodically inspect meter locations reported as "no access" to verify that

appropriate corrective measures are taken, and APS shall file a copy of this policy within ninety days;

h. APS shall continue to participate in benchmarking studies that compare its practices to other utilities in the industry and shall provide such benchmarking analysis to the Commission and Staff on a confidential basis;

i. APS shall develop and install performance measures to document the efforts that it has taken to secure an accurate reading of the meter after the second consecutive month of estimating the customer's bill for other than weather;

j. APS shall include the use of EZ-Read as one of the steps taken to resolve a "no access" situation;

k. APS shall use available DB Microware reports to review lock-outs by route to monitor trends in lock-outs and reduce the number of "no access" meters; and

l. APS shall establish an internal process whereby, after three consecutive estimates, continued instances of consecutive estimates due to "no access" situation are reported and made visible to increasingly higher levels of APS management.

- In order to improve its communication with its customers, APS will train its billing service representatives and others involved in kW and kWh estimation, meter reading, and billing processes to understand that customers value an accurate bill, to recognize that underestimation may result in problems for their customers, and will familiarize these personnel with applicable Commission rules and APS tariffs and stress the importance of adherence thereto. APS will provide Staff with a description of its training process within six months;
- APS shall provide a clearer notice on a re-billed account and will make the appropriate modifications to its billing system to implement the change no later than sixty days;
- The Settlement takes no position on the validity or the applicability of the amendment to A.A.C. R14-2-210 and for the purposes of the Settlement, the parties agree that APS should not be assessed a penalty for any alleged violations of A.A.C. R14-2-210(A)(5)(a) or

210(A)(6)(b) and that any such alleged violations do not affect the validity of any estimated bills issued before the effective date of the Commission's approval of APS' bill estimation tariff;

- If the Commission approves the Settlement Agreement, the Read Complaint will be dismissed with prejudice, provided that such dismissal shall not be deemed to preclude Mrs. Read's attorneys from seeking any attorneys fees to which they might be entitled.

Billing Issues

- APS did not send Mrs. Read any bills for five months due to implementation problems associated with its Customer Information System ("CIS");
- APS acknowledges that it has an obligation to bill each of its customers in accordance with A.A.C. R14-2-201(A);
- The Settlement Agreement is not intended to diminish or to establish any rights in any other customers who were not issued bills by APS as a result of the CIS implementation problems, nor is it intended to eliminate APS' duty to properly, accurately, and consistently apply any specific bill estimation procedures.

Compliance

- APS' Regulatory Compliance Department shall conduct an audit of APS' kW and kWh estimation, meter reading, and billing practices and those results will be certified by APS' Director of Regulatory Compliance and provided on a confidential basis to the Commission and Staff within nine months, and at least once every three years thereafter;
- APS shall conduct an internal review of its compliance program relating to all its Commission approved tariffs and shall submit a report on a confidential basis within twelve months;
- After APS submits its reports, if the Commission believes that an additional audit is required, APS shall participate in a third-party audit by an independent auditor selected by Staff and paid for by APS.

In its settlement testimony filed March 18, 2005, Staff discussed its concerns about the allegations raised in the Complaint, including: APS' meter reading resources, billing language,

demand and usage estimation practices and about the accuracy of APS' bills to its customers. Staff stated that during the course of Staff's inquiry into the billing and meter reading practices, more concerns came to light, including issues related to APS' implementation of its 1998 CIS, instances where APS failed to appropriately credit customers when a demand estimate turned out to be higher than a subsequent meter read, and APS' "apparent non-compliance with sections of rate schedules EC-1 and ECT-1R that apply to residential customers taking service through demand rates." (Jaress Settlement testimony p.2)

Staff concluded that:

- Mrs. Read, "although the recipient of poor customer service from APS," was under billed, and not over billed as alleged;
- APS' estimation practices most commonly result in underestimations, rather than overestimations;
- APS, rather than using the method for estimating demand contained in its tariffs, uses customer class average load factors in its calculation of estimated demand;
- Approximately eight percent of APS' residential customers and 93 percent of its non-residential customers are served through demand meters and this constitutes a high number of demand meters when compared to other electric utilities. Consequently, problems arising from non-access to demand meters and estimation of demand are significant in both impacts on the customer and on APS' costs of achieving a meter read; and
- Implementation of APS' new CIS caused certain deficiencies in the bill estimation process and caused APS to miss sending bills to certain customers for a limited time period.[4]

Staff testified that the Settlement Agreement addresses its concerns: meter access problems are addressed by requiring APS to invest $600,000 in the Access Improvement Program; problems with APS' demand estimation procedures are resolved by APS' agreement to use the most accurate method of those studied for estimating demand; Staff's concerns about APS' current and future

[4] Jaress Settlement testimony pp. 3-4.

PAGE # 281

compliance with Commission rules, APS' tariff and with this decision are addressed by the ongoing audits and reports to aid the Commission in its oversight of APS; Staff's concerns about confusing language on customer bills is resolved by the adoption of Staff witness Rowell's recommendations about billing language; and APS' agreement that most costs associated with training, reports, and implementation of improvements be absorbed by the Company insures that customers do not bear the costs of remediation.

Staff believes that the Settlement Agreement is in the public interest because it addresses and resolves the Complaint and problems associated with APS' meter reading and bill estimation procedures. Benefits are provided to all customers through the Access Improvement Program, and for those customers who were over billed demand charges from September, 1998 when the new CIS was implemented through September 2003, when changes were made to correct the problem, credits/refunds will be issued that are expected to total approximately $2.2 million - $2 million for general service customers and $170,000 for residential customers.

APS testified that the Settlement is a fair and reasonable compromise. Mr. Rumolo testified that it provides substantial benefits to its customers, both current and former; it should lead to a reduction in access-related bill estimation; it provides regulatory certainty and clarity, and it ends a time and resource consuming dispute.

Counsel for the Complainant in his opening statement indicated that the Settlement Agreement accomplishes what his client set out to do: an accounting and refund of actual credits to those who were overcharged and a mechanism in place going forward whereby the estimating procedures will be approved by the Commission.

Although APS stressed that its billing of estimated demand resulted in a net under billing to the Company, the important issue is the accuracy of each individual customer's bill, not whether APS' metering and billing procedures produced a net under or over estimation of all bills. The Settlement Agreement is designed to focus APS' attention upon the importance of this issue, to consistently render timely, accurate, and understandable bills to each of its customers. The Settlement Agreement puts an end to a protracted dispute and maintains Commission oversight of APS' billing and metering procedures through the tariff requirements. Accordingly, we find that the

Settlement Agreement is a reasonable resolution of the issues raised in the Complaint and the Application for Declaratory Order, and should be approved.

* * * * * * * * * *

Having considered the entire record herein and being fully advised in the premises, the Commission finds, concludes, and orders that:

FINDINGS OF FACT

1. On October 23, 2003, APS filed its Application for Declaratory Order requesting a declaratory order finding that its past and present procedures for bill estimation either are exempt from or comply with the requirements of A.A.C. R14-2-210 and R14-2-1612.

2. On May 26, 2004, APS filed an Amended Application for Declaratory Order.

3. On August 6, 2004, APS filed a Second Amended Application for Declaratory Order.

4. On September 9, 2004, Complainant, on her own behalf and on behalf of a class of customers of APS filed a Complaint against APS.[5] The Complaint alleged that "APS has systematically deceived and overcharged Complainant and the class in the sale of electricity to them, by systematically failing to follow legally required procedures regarding estimated charges for electricity services; by billing estimated demand readings as if they were actual readings of demand for the month being billed; and by charging the class for electricity using estimating procedures not approved by the Arizona Corporation Commission as required by law, but arbitrarily invented by APS employees."

5. The class complaint was brought on behalf of a "class consisting of all current and former residential and business APS customers in Arizona who, since January 1, 1999, have been, or in the future will be, subject to improper estimation and billing procedures on demand meters not approved" by the ACC.[6]

6. On November 2, 2004, a procedural order was issued consolidating these matters and setting them for hearing on January 20, 2005.

7. On November 23, 2004, APS and the Complainant filed direct testimony.

[5] Mrs. Read passed away on October 14, 2004, and her estate has proceeded with this Complaint.

[6] By Procedural Order issued January 6, 2005, the Commission determined that it was unnecessary to certify a class in order to address any relief that may be found necessary.

8. On December 17, 2004, Staff filed a Motion to Extend Filing Deadline requesting additional time for filing its Staff Report.

9. On December 21, 2004, APS filed its Response to Staff's Motion requesting a corresponding extension of time for filing subsequent prefiled testimony and exhibits.

10. On December 28, 2004, Staff filed its Staff Report "Staff Inquiry into the Usage Estimation, Meter Reading, and Billing Practices of Arizona Public Service Company".

11. On January 5, 2005, a telephonic procedural conference was held to discuss the procedural schedule for these matters, and by Procedural Order issued January 6, 2005, the procedural schedule was modified as requested by APS, the hearing was set for February 2, 2005, and APS was order to publish notice of the hearing and Staff was directed to post the notice and its testimony/Staff Report on the ACC's website.

12. On January 24, 2005, Staff filed its direct testimony, APS filed its rebuttal and APS docketed its Notice of Publication which indicated that the required notice was published in *The Arizona Republic* on January 15, 2005.

13. On January 28, 2005, a telephonic procedural conference was held pursuant to request by APS and a Procedural Order was issued granting APS' request for a suspension of the procedural schedule in order to allow it and the parties to discuss settlement of these consolidated matters.

14. The February 2, 2005 noticed hearing date was held to take public comment and no members of the public appeared to make public comment.

15. On February 25, 2005, Staff filed a Proposed Settlement Agreement on behalf of APS, the estate of the Complainant, and Staff. The Settlement Agreement is attached hereto as Attachment A.

16. On March 2, 2005, a Procedural Order was issued setting the consolidated matters for hearing on the Settlement Agreement.

17. The hearing was held on April 7, 2005 before a duly authorized Administrative Law Judge of the Commission at its offices in Phoenix, Arizona. The Complainant, APS, and Staff appeared through counsel, and APS and Staff presented witnesses who testified in support of the Settlement Agreement. On April 18 and 20, 2005, APS and the Complainant's attorneys,

respectively, filed information with the Commission about their time and expense litigating these matters.

18. As of October 18, 2004, APS had over one million meters installed in the field of which approximately 175,000 were on accounts billed on a demand rate, and APS employed approximately 158 meter readers.

19. Billing on non-demand accounts is based on accumulated usage, so that when a bill is estimated one month, the next month's "actual reading" will be used to "true-up" and charge for the actual usage. Billing on demand accounts requires a read and resetting of the demand on the meter each month, so if an estimated demand is used, there is no way to "true-up" a demand charge the following month.

20. Prior to implementing a new CIS in September, 1998, APS used a customer-specific load factor demand estimating methodology and in March 1999, APS began using class average load factors to estimate demand for residential customers and certain general service customers.

21. Based upon its analysis of five different demand estimation methodologies, Staff concluded that the use of class average load factors is the least accurate method of estimating demand, and that the use of customer specific kW from the prior month is the most accurate method of estimating demand.

22. The number of estimated bills can be reduced by improved access to customer meters.

23. Customers value and expect to receive timely, accurate, and understandable bills for electric usage.

24. The findings contained within the Settlement Agreement are incorporated herein.

25. The Settlement Agreement addresses and resolves the issues raised in the Complaint and in the Application for Declaratory Order in a fair and reasonable manner.

CONCLUSIONS OF LAW

1. Arizona Public Service Company is a public service corporation within the meaning of Article XV of the Arizona Constitution and A.R.S. §§ 40-202, 203, 245, 248, 321, 322, and 361.

2. The Commission has jurisdiction over Arizona Public Service Company and the subject matter of the Complaint and application.

3. Notice of the application was provided in accordance with the law.

4. APS is required to implement and follow its tariffs on file with the Commission.

5. The Settlement Agreement resolves all matters raised by the Complaint and in the Application for Declaratory Order (as amended) in a manner that is just and reasonable, and promotes the public interest.

ORDER

IT IS THEREFORE ORDERED that the Settlement Agreement attached hereto as Attachment A, is approved.

IT IS FURTHER ORDERED Arizona Public Service Company shall comply with all the terms of the Settlement Agreement, including timely filing all reports/audits and issuing credits to its customers.

IT IS FURTHER ORDERED that this Decision shall become effective immediately.

BY ORDER OF THE ARIZONA CORPORATION COMMISSION.

CHAIRMAN COMMISSIONER

COMMISSIONER COMMISSIONER COMMISSIONER

IN WITNESS WHEREOF, I, BRIAN C. McNEIL, Executive Director of the Arizona Corporation Commission, have hereunto set my hand and caused the official seal of the Commission to be affixed at the Capitol, in the City of Phoenix, this 9th day of Sept., 2005.

BRIAN C. McNEIL
EXECUTIVE DIRECTOR

DISSENT _____

DISSENT _____

LF:mj

PAGE # 286

SERVICE LIST FOR: ARIZONA PUBLIC SERVICE COMPANY

DOCKET NOS.: E-01345A-04-0657 and E-01345A-03-0775

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PROPOSED SETTLEMENT AGREEMENT

Arizona Public Service Company ("APS" or "the Company"), the Estate of the late Mrs. Avis Read ("Read"), and the Arizona Corporation Commission Staff ("Staff") (collectively, "the Parties") hereby propose settlement of the following matters currently pending before the Arizona Corporation Commission ("Commission"): APS' Application for a Declaratory Order, Docket No. E-01345A-03-0775; Read's Formal Complaint, Docket No. E-01345A-04-0657 (including any matters raised in the related Superior Court case previously brought by Mrs. Read); and Staff's Inquiry into APS' Usage Estimation, Meter Reading, and Billing Practices. These matters shall be collectively referred to as the "Bill Estimation Matter." The following numbered paragraphs are intended to resolve all issues associated with the Bill Estimation Matter.

RECITALS

1. The purpose of this Agreement is to settle all issues presented by the Bill Estimation Matter in a manner that will promote the public interest. The Parties agree that the terms of this Agreement will serve the public interest by providing a just and reasonable resolution of the issues presented by the Bill Estimation Matter.

2. The Parties agree that the negotiation process undertaken in this matter was open to all Parties and provided all Parties with an equal opportunity to participate. All Parties were notified of the settlement process and encouraged to participate.

3. APS acknowledges the concerns raised by Staff regarding APS' failure to implement the demand estimation procedures set forth in Rate Schedules EC-1 and ECT-1R, notwithstanding APS' contention that these tariffs were implemented up until the time that APS implemented its 1998 customer information system. APS expresses its regret over its failure to properly implement these tariffs and states its intention to fully implement all Commission-approved tariffs in the future.

4. APS acknowledges the concerns raised by Staff regarding APS' failure to send Mrs. Read a monthly bill from September 1999 to January 2000 with respect to Mrs. Read's non-demand account, notwithstanding APS' contention that its failure to bill Mrs. Read was the result of complications associated with the implementation of its customer information system. APS expresses its regret over its failure to send Mrs. Read timely bills during those months and states its intention to use all reasonable efforts to provide monthly bills to all customers in the future.

5. APS acknowledges that there were instances when it did not obtain access to Mrs. Read's meter and that Staff has concerns about whether APS made all reasonable efforts to resolve those access issues, notwithstanding APS' contention that it could not obtain access to the meter. APS acknowledges that it could have done more to obtain

access to Mrs. Read's meter and states its intention to work to decrease the number of "no access" meters in the future.

I. ESTIMATION ISSUES

6. The Parties agree that APS did not implement the demand estimation methodology contained in Rate Schedules EC-1 and ECT-1R when it designed its bill estimation procedures for its customer information system. The demand estimation methodology set forth in those schedules provides for the use of customer specific kW from the last actual read in order to estimate a customer's demand.

7. From April 1999 to the present, APS has used class average load factors to estimate demand in most instances. The Parties agree that this estimation method tends to result in a net underestimation of kW. The Parties also agree that the use of this estimation method resulted in a greater overall net underbilling for customers subscribing to Rate Schedules EC-1 and ECT-1R than would have resulted had APS implemented the estimation methodology set forth in those schedules. The Parties agree that APS' class average load factor method is less accurate than the tariffed method. Specifically, for the statistical samples of customers with known kW considered in this proceeding, the use of the tariffed method to estimate kW resulted in a greater central tendency toward the known kW of the sample groups than the use of APS' class average load factor method.

8. APS' use of class average load factors to estimate demand is consistent with the requirements of A.A.C. R14-2-210 but inconsistent with the provisions of Rate Schedules EC-1 and ECT-1R.

9. APS' methods for estimating Mrs. Read's kW and kWh resulted in underestimation, which in turn resulted in underbills.

10. APS acknowledges that it has an independent obligation to implement its Commission-approved tariffs.

11. The Parties agree that the use of customer specific kW from the prior month is the most accurate method for estimating demand of those methods analyzed in this proceeding, by which the Parties mean that, for the statistical samples of customers with known kW considered in this proceeding, the use of customer specific kW from the prior month to estimate kW resulted in a greater central tendency toward the known kW of the sample groups than the use of any of the other estimation methods considered in this proceeding, including APS' class average load factor method.

12. When the appropriate data is available, APS shall use customer specific kW from the prior month to estimate demand for all of its demand tariffs.

13. Customer-specific kW from the prior month will not be available if the prior month's bill was an initial bill or an estimated bill.

14. For initial bills covering a period of fewer than eleven days, APS will not bill demand. The customer's bill will consist of a prorated basic service charge, and kWh will be trued up in the subsequent bill. For initial bills covering a period of eleven or more days, demand will be estimated using actual premises history from the prior month. If no demand exists for the prior month or if the prior month's demand was estimated, APS will estimate demand using the actual kW reading from the same month of the prior year at the same premises. If it is determined that the general characteristics of the previous customer vary significantly from those of the current customer or if there is no kW history for the premises, APS will estimate kW by first estimating kWh and then applying a class average load factor to estimate kW. Any initial bills issued in any of the circumstances described in this paragraph shall contain a clear description of the charges depicted in the bill. APS shall collaborate with Staff to develop appropriate language for each of these circumstances.

15. If the prior month's customer-specific kW is not available, APS will use the customer's kW from the same month of the prior year as the basis for the estimated demand reading. If this customer-specific historical information is not available, APS will estimate kW based upon premises-specific history, using the actual kW reading from the last month at the same premises. If this information is not available, APS shall use the actual kW reading from the same month of the prior year at the same premises. If none of the above customer-specific or premises-specific information is available, APS will estimate kW by first estimating kWh and then applying a class average load factor to estimate kW.

16. APS shall implement the demand estimation methodology set forth in Paragraphs 12-15 of this Agreement within seven months of the Commission's final approval of APS' bill estimation tariff. APS may use its existing bill estimation procedures until APS has completed the implementation required by Paragraphs 12-15, and bills issued before such implementation will not be invalidated for being based upon APS' bill estimation procedures as they exist as of the date of this Agreement, except as set forth in Paragraphs 19 through 21. Nothing in this Agreement shall be construed as eliminating APS' duty to properly, accurately, and consistently apply any specific bill estimation procedure.

17. APS shall conduct a study to determine the impact of reclassifying May as a non-summer month for purposes of kWh estimation. By December 30, 2005, APS shall file a report with the Commission that describes the results of this study and that discusses whether revisions to APS' bill estimation procedures are desirable.

18. APS shall not be required to recalculate demand estimations that are based upon class average load factors and that occurred between April 1999 and the effective date of the new kW demand estimation procedures specified in Paragraphs 12-15. Demands estimated pursuant to APS' existing or prior class average load factor estimation methodology shall not be subject to subsequent adjustment for being based upon this methodology, except as specified in Paragraphs 19 through 21. Nothing in this

Agreement shall be construed as eliminating APS' duty to properly, accurately, and consistently apply any specific bill estimation procedure.

19. APS acknowledges that, due to implementation problems associated with its customer information system, some of its demand estimates were higher than the subsequent reads. APS shall credit all customers who, between September 1, 1998 and October 1, 2003, had an actual demand reading that was lower than the immediately preceding estimate. An estimate of these credits is set forth in Exhibit A. Credits shall include interest at the established one year Treasury Constant Maturities rate, effective on the first business day of each year, as published on the Federal Reserve Website. Credits for general service customers shall be adjusted to prevent double credits for the same adjustment and to reflect ratchet demands and contract demands. APS' calculations of these credits shall be reviewed in the audit required by Paragraph 39 and, if the Commission determines that the audit referred to in Paragraph 41 is necessary, in the audit contemplated by that paragraph. Within thirty days after the conclusion of APS' implementation of Paragraphs 19 through 21, APS shall file a report with the Commission that accounts for the credits issued pursuant to this Agreement.

20. APS shall make reasonable efforts to locate all customers who have left its system and who are entitled to credits greater than or equal to $5.00 pursuant to Paragraph 19. APS shall confer with Staff in order to determine the specific efforts that APS will undertake to locate these customers. In order to be eligible for a credit, a customer who has left APS' system must contact APS within 180 days after the conclusion of APS' location efforts undertaken pursuant to this paragraph. If a customer who is entitled to a credit greater than or equal to $5.00 cannot be located, APS shall add the amount of the credit to the expenditures required by Paragraphs 22 through 24.

21. APS shall not be required to locate customers who have left its system and who are entitled, pursuant to Paragraph 19, to credits under $5.00. Such credits shall be added to the amount of expenditures required by Paragraphs 22 through 24.

22. APS shall design a cost effective Access Improvement Program to achieve a reduction in the number of instances of kW and kWh estimation due to "no access" issues. Unless otherwise ordered by the Commission, the Program shall apply solely to specific remedies, such as moving meters or installing appropriate meter-reading technologies, for customer premises where access to the meter is a recurring problem. Meter reading technologies applied in these circumstances shall include, but shall not be limited to, remote ports or similar devices, advanced metering systems, and enhanced radio technology. Expenditures made pursuant to this Program shall have a direct, measurable effect upon APS' ability to obtain access to premises where access is a recurring problem.

23. APS shall expend $600,000 on the program described in Paragraph 22, and these expenditures must be separate from any ongoing or anticipated expenditures. The $600,000 may be increased pursuant to Paragraphs 20 and 21. Expenditures

associated with this Program shall be limited to implementing the measures set forth in Paragraph 22.

24. APS shall submit the details of its proposed Access Improvement Program to the Commission for approval within sixty days of the Commission's decision in this case. After Commission review and approval, APS shall implement the Program over the next six months. No later than fifteen months after the conclusion of the Program's implementation, APS shall file a report with the Commission that addresses the impact of the Program and that details and verifies the Program's expenditures. APS' report shall contain, among other things, a comparison of the number of estimated bills per thousand bills issued during the twelve months following the Program's implementation to the number of estimated bills per thousand bills issued during 2004. Expenditures associated with this Program shall be examined in the audits set forth in Paragraphs 39 and 41.

25. The following items shall not be recoverable:

a. Any amounts expended pursuant to Paragraphs 19 through 24.

b. Any training costs specifically attributable to implementing Paragraphs 12 through 15. This provision is not intended to preclude APS from seeking cost recovery of any reasonable and prudent training costs that are not specifically associated with implementing Paragraphs 12 through 15.

c. Any costs of the audits, reviews, or reports required by Paragraphs 39 through 41.

d. Any amounts expended in order to comply with Paragraphs 12-15 to implement CIS changes that are related in any way to estimating demand for residential customers. This provision is not intended to preclude APS from seeking cost recovery of any reasonable and prudent costs of implementing CIS changes that are solely applicable to general service customers.

e. Any one-time costs of implementing Paragraphs 32(b), 32(d), 32(k), and 33(b), and all other costs associated with implementing Paragraphs 32 and 33 incurred within 36 months after the Commission's decision in this matter.

26. APS shall amend all applicable rate schedules to remove language related to estimation procedures. APS' estimation procedures for all rates shall be governed by a bill estimation tariff that shall be consistent with the Commission's decision in this matter. APS shall file its bill estimation tariff for Commission review within thirty days after Commission approval of this Agreement.

27. For the purposes of APS' bill estimation procedures, the ten circumstances set forth in Exhibit A to the January 24, 2005 testimony of Staff Witness Matthew Rowell

shall be considered to be part of APS' bill estimation procedures, and APS shall adopt all Staff recommendations contained in that Exhibit A.

28. If APS wishes to amend any of its bill estimation procedures in the future, it must file them as a tariff filing with the Commission.

II. METER READING ISSUES

29. The Parties acknowledge that customers have an obligation to provide safe and unrestricted access to the customer's electric meter in accordance with A.A.C. R14-2-209(D), and APS acknowledges that it has an obligation to undertake reasonable efforts to accomplish timely reads of its customers' meters.

30. APS estimated Mrs. Read's demand meter for the months of January, March, April, and May of 1999.

31. APS acknowledges that accuracy in meter reading and in estimation of kW and kWh is an important public and regulatory policy. APS also acknowledges that an effective way to improve the accuracy of billing is to reduce the number of times that APS estimates kW or kWh.

32. APS will implement the following provisions in order to decrease the incidence of "no access" to customer meters:

a. APS shall provide evidence to the Commission that new procedures have been put in place to ensure that staffing resources are sufficient to address emergency short-term needs for meter reading shops that are either smaller or remote. A report that describes the new procedures and explains how they reduce the potential for "skipped" meter readings due to staffing resource issues will be provided to the Commission within six months of a decision in this matter.

b. APS shall revise the "No Access Meters" report, KM06R20, to provide the following additional features:

--Report the present number of consecutive months that the meter reading department could not access the meter so that the Administrative Coordinator can track the steps required for each month of access problems and prioritize the APS response.

--Report the other instances that the meter reading department was unable to read the meter during the previous twenty-four months to simplify identification of recurring "no access" problems at the same premises.

--Prioritize accounts to focus first on demand-billed customers when working the "no access" report. APS should compile and maintain these reports for purposes of the audits required by Paragraphs 39 and 41.

c. APS shall develop and install a performance measure to monitor the extent to which APS is complying with the Commission requirement to read meters each month (no less than twenty-five days after the last meter read and no more than thirty-five days after the last meter reading). APS shall provide to the Commission a description of its performance measure and the results of its analysis within six months of a decision in this matter.

d. APS shall change the options settings in the Itron software in all locations so that the Itron HHC used by meter readers in each of the APS meter read shops no longer includes the last month's usage and the last month's meter reading. This feature shall be disabled throughout APS' service territory within thirty days of a decision in this matter.

e. For the next six years, APS shall provide the Commission with biannual reports related to the status of the remote meter reading pilot and implementation plans. The reports shall provide a description of the meter reading technology being implemented, APS' plan for implementation, the number and type of customers involved in the pilot program, the costs associated with implementation, and the operational efficiencies associated with implementation.

f. APS will implement a pilot program to evaluate whether using an auto-dialer to communicate with customers who have experienced two consecutive months of "no access" will facilitate resolution of additional "no access" accounts. Such calls will be made within ninety-six hours before the scheduled read date, will indicate the time frame in which the next read is scheduled to occur, and will indicate that the schedule may be subject to change. APS' failure to call a customer in the circumstances described in this paragraph shall not relieve the customer of the obligation to provide APS with unrestricted access to the meter. APS shall maintain records on the number of instances that the auto-dialer is used to call customers in these circumstances so that one may determine whether use of the auto-dialer improves APS' access to "no access" meters. For the twelve months following Commission approval of this Agreement, the results of this practice shall be reported to the Commission in quarterly reports, beginning with the quarter ending September 30, 2005.

g. APS shall be required to implement a policy to ensure that meter reading supervisors or their designees periodically inspect meter locations reported as "no access" to verify that appropriate corrective measures are taken. APS shall file a copy of this policy within ninety days of a decision in this matter.

h. APS shall continue to participate in benchmarking studies that compare its practices to other utilities in the industry. APS shall provide such

benchmarking analysis to the Commission and Staff on a confidential basis within ninety days of the completion of such studies.

i APS shall develop and install performance measures to document the efforts that it has taken to secure an accurate reading of the meter after the second consecutive month of estimating the customer's bill for other than weather.

j. APS shall specifically include the use of EZ-Read as one of the steps taken to resolve a "no access" situation.

k. APS shall utilize available DB Microware reports to review lock-outs by route to monitor trends in lock-outs and reduce the number of "no access" meters.

l. APS shall establish an internal process whereby, after three consecutive estimates, continued instances of consecutive estimates due to "no access" situations are reported and made visible to increasingly higher levels of APS management.

33. APS shall implement the following provisions in order to improve its communications with its customers:

a. APS shall train its Billing Service Representatives and others involved in kW and kWh estimation, meter reading, and billing processes to understand that customers value an accurate bill. APS shall also train them to recognize that the underestimation of kW and kWh may result in problems for their customers. Finally, APS shall develop training procedures to familiarize these personnel with applicable Commission rules and APS tariffs. These procedures shall stress the importance of APS' adherence to Commission rules and tariffs. APS shall provide Staff with a description of its training process within six months of a Commission decision in this matter.

b. APS shall provide a clearer notice on a re-billed amount. Such notice shall clearly state that the new bill replaces the previously issued bill and that the customer should only pay the reissued bill amount. APS shall make the appropriate modifications to its billing system to implement this change no later than sixty days after a final Commission decision in APS' pending rate case, Docket No. E-01345A-03-0437.

34. This Settlement takes no position on the validity or the applicability of the amendments to A.A.C. R14-2-210. For purposes of this Settlement, the Parties agree that APS should not be assessed a penalty for any alleged violations of A.A.C. R14-2-210(A)(5)(a) or 210(A)(6)(b) and that any such alleged violations do not affect the validity of any estimated bills issued before the effective date of the Commission's approval of APS' bill estimation tariff.

35. If the Commission approves this Settlement, the Read Complaint shall be dismissed with prejudice, provided that such dismissal shall not be deemed to preclude Mrs. Read's attorneys from seeking any attorneys' fees to which they might be entitled

under applicable law. This paragraph shall not be construed as an admission by any party that attorneys' fees are appropriate in any forum.

III. BILLING ISSUES

36. APS did not send Mrs. Read any bills for five months from September 1999 to January 2000 due to implementation problems associated with its CIS, which became operational in September, 1998.

37. APS acknowledges that it has an obligation to bill each of its customers in accordance with A.A.C. R14-2-210(A).

38. This Agreement is not intended to diminish or to establish any rights in any other customers who were not issued bills by APS as a result of APS' CIS implementation problems, nor is this Agreement intended to eliminate APS' duty to properly, accurately, and consistently apply any specific bill estimation procedure.

IV. COMPLIANCE

39. APS' Regulatory Compliance Department shall conduct an audit of APS' kW and kWh estimation, meter reading, and billing practices after the Commission issues a final order in this matter and at least once every three years thereafter. These audits shall also address APS' compliance with the provisions set forth in this Agreement, any Commission order resulting therefrom, and Commission tariffs, rules, and regulations regarding estimation, meter reading, and billing. The results of the audit shall be certified by APS' Director of Regulatory Compliance. The results of the audit along with any management response shall be provided on a confidential basis to the Commission and Staff. APS shall either implement the audit's recommendations or provide the Commission with a written explanation as to why any recommendations were not implemented. APS shall complete the initial audit required by this paragraph and file a copy of the audit report, along with any management response, with the Commission no later than nine months after Commission approval of this Agreement. Subsequent audit reports conducted pursuant to this paragraph shall be filed within thirty days of the completion of the audit.

40. APS shall conduct an internal review of its compliance program relating to all Commission-approved tariffs and shall submit a report on a confidential basis to the Commission and its Staff within twelve months of the Commission's approval of this Agreement. Such report shall include a description of all programs, processes, and organizations utilized by APS to educate employees about tariff provisions and to ensure compliance. The report will address APS' ongoing plans to ensure compliance with Commission tariffs, any specific changes or additions to current practices that may be necessary to ensure compliance, and the implementation plan for any recommended modifications.

41. Within thirty days after the completion of the actions referred to in Paragraphs 39 and 40, APS shall file a report with the Commission that fully describes the results of those actions and the Company's compliance efforts in this matter. If, after consideration of those items, the Commission believes that an additional audit is required, APS shall participate in a third-party audit by an independent auditor selected by Staff and paid for by APS. This audit shall evaluate whether the Company's meter reading, billing practices, estimation methods, and related management processes are adequate and whether APS has appropriately conducted the actions required by Paragraphs 39 and 40. The audit shall also evaluate whether the Company has complied with the Commission's decision in this matter. The Commission will establish the timing and budget for the independent audit at the time that it determines its necessity.

V. MISCELLANEOUS PROVISIONS

42. APS shall withdraw the testimony of APS Witness Alan Kessler. APS may offer the Accion Report through the testimony of another witness who is not affiliated with the Accion Consulting Group. All other filed testimony and exhibits shall be accepted into the Commission's record as evidence.

43. Each provision of this Agreement is in consideration and support of all other provisions, and it is expressly conditioned upon acceptance and approval by the Commission without change. Unless the Parties to this Agreement otherwise agree, if the Commission does not accept and approve this Agreement according to its terms, it shall be deemed withdrawn by the Parties, and the Parties shall be free to pursue their respective positions without prejudice.

44. This Agreement represents the Parties' mutual desire to compromise and settle all disputed claims in a manner consistent with the public interest. This Agreement represents a compromise of the positions of the Parties. Acceptance of this Agreement is without prejudice to any position taken by any party, and none of the provisions may be referred to, cited, or relied upon by any other party as precedent in any proceeding before this Commission, any other regulatory agency, or any court of law for any purpose except in furtherance of the purposes and results of this Agreement.

45. All negotiations relating to or leading to this Agreement are privileged and confidential, and no party is bound by any position asserted in negotiations, except to the extent expressly stated in this Agreement. As such, evidence of conduct or statements made in the course of negotiation of this Agreement are not admissible as evidence in any proceeding before the Commission, any other regulatory agency, or any court.

46. This Agreement represents the complete agreement of the Parties. There are no understandings or commitments other than those specifically set forth herein. The Parties acknowledge that this Agreement resolves all issues that were raised in the Bill Estimation Matter and is a complete and total settlement between the Parties.

47. Each Signatory Party will support and defend this Agreement and any Commission order approving this Agreement before the Commission, before any other regulatory agency, or before any court in which it may be at issue. This Agreement shall not be construed to require the Commission to participate in any proceeding related to the recovery of attorneys' fees in this or any related matter.

Dated this 25th day of February 2005.

Arizona Corporation Commission Staff

By: _____

Ernest Johnson
Utilities Division Director
1200 West Washington Street
Phoenix, Arizona 85007-2927

Arizona Public Service Company

By: _____

Steven Wheeler
Executive Vice President of
Customer Service and Regulation
400 North Fifth Street
Phoenix, AZ 85072

Estate of Avis Read

By: _____

Barry G. Reed
Zimmerman Reed P.L.L.P.
14646 N. Kierland Blvd., Suite 145
Scottsdale, Arizona 85254

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Exhibit A

Estimate of Potential Settlement Credits

September 1, 1998 through October 1, 2003

General Service[1]	Residential	Total[2]
$2,045,546	$171,686	$2,217,232

Notes:
[1] Does not reflect any potential reductions due to account review. Actual Credits will reflect any reductions due to double credits for same adjustment, ratchets and/or contract demands.
[2] Does not include interest which would be calculated in accordance with Paragraph 19.

EXHIBIT Y

From: Connie Walczak
Sent: Wednesday, April 01, 2015 1:32 PM
To: Al Amezcua; Carmen Madrid; Deborah Reagan; Jenny Gomez; Michael Buck; Richard Martinez; Tom Davis; Trish Meeter
Subject: FW: APS SMART METERS

FYI

What you might hear from APS is..... the meter stopped 'communicating' with the company. Seems the Smart Meters are doing this more and more often. It may be for only a brief period or a week or a month. APS seems to not have a problem with this 'non' communication, they have Schedule 8, 3.1 to rely on which enables them to estimate the bills. This can go on for months. They do not check the meter when they could retrieve the data, rather, they estimate usage. They do not feel the meter is malfunctioning if it begins communicating again. Even when it continues doing this for more than one month.

From: Michael Buck
Sent: Wednesday, April 01, 2015 11:04 AM
To: Richard Martinez; Jenny Gomez; Al Amezcua; Deborah Reagan; Carmen Madrid; Trish Meeter; Tom Davis
Cc: Connie Walczak
Subject: APS SMART METERS

Per Connie,

Has anyone in Consumer Services had any complaints concerning APS's inability to read their Smart Meter's and estimating the bill? Appreciate the information.

Thank you

Mike Buck

EXHIBIT Z

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC UTILITY CONTROL

APPLICATION OF THE CONNECTICUT LIGHT AND POWER COMPANY TO IMPLEMENT TIME-OF-USE, INTERRUPTIBLE LOAD RESPONSE, AND SEASONAL RATES - REVIEW OF METER STUDY, DEPLOYMENT PLAN AND RATE PERIOD	:	DOCKET NO. 05-10-03RE04
	:	FEBRUARY 8, 2011

BRIEF OF GEORGE JEPSEN, ATTORNEY GENERAL FOR THE STATE OF CONNECTICUT

George Jepsen, Attorney General for the State of Connecticut ("Attorney General"), hereby submits his brief in the above-captioned proceeding. For the reasons stated herein, the Department of Public Utility Control ("DPUC" or "Department") should reject the Connecticut Light and Power Company's ("CL&P" or "Company") proposed full deployment of Advanced Meter Infrastructure ("AMI") from 2013-2016. CL&P's proposal would force the Company's ratepayers to spend at least $500 million on new meters that are likely to provide few benefits in return.

Prudence demands that the DPUC adopt a more measured approach to advanced metering than the path proposed by CL&P. The DPUC has already recognized that CL&P's existing AMR meters meet the requirements of Conn. Gen. Stat. § 16-243w(c), which generally requires metering systems that can support dynamic, time-of-use rates. Indeed, CL&P already offers time-based rates to its customers using the existing AMR meters. Therefore, the Department should not rush headlong into AMI meters as CL&P has proposed, but rather should continue to evaluate emerging meter system technologies as well as other conservation programs and only

approve the deployment of advanced metering systems at such a time and in such a manner that is cost-effective.

Should the Department choose to proceed in any fashion with AMI meters at this time, it should do so in a far more limited fashion than CL&P has proposed. Specifically, the DPUC should approve no more than a "surgical" deployment, which provides AMI meters only to those customers who request them – and are willing to pay for them. In the alternative, the DPUC could allow CL&P to gradually roll-out AMI meters by replacing obsolete AMR meters with AMI technology, perhaps coupled with a user-pays surgical deployment.

If the DPUC approves any sort of deployment of AMI meters in this case, however, it must reject CL&P's proposed "presumption" of prudence and guaranteed cost recovery. The DPUC should treat any deployment of AMI technology as it should most any other utility plant addition. That is, the Department should require CL&P to install the technology at its own expense and then demonstrate during a full rate proceeding, once the technology is installed, the costs are known and measurable and the meters are used and useful, that its expenditure for this purpose was prudently incurred. Only then should the DPUC consider whether, and to what extent, those costs should be included in rates.

I. BACKGROUND

A. Procedural History

On March 30, 2007, CL&P submitted a metering plan in response to Order Number 7 of the Department's decision in Docket No. 05-10-03, Application of the Connecticut Light and Power Company To Implement Time of Use, Interruptible of Load Response, and Seasonal Rates, dated December 21, 2006. On July 2, 2007, CL&P filed a revised metering plan as

required by Section 98 of Public Act 07-242, An Act Concerning Electricity and Energy Efficiency, codified at Conn. Gen. Stat. § 16-243w(c).[1] The Company's revised metering proposal included six options for the deployment of AMI meters.[2] These options ranged from a very limited deployment of the new meter technology on demand at a cost of $0 to $10 million to a full deployment of new AMI meters at a cost of $264 million to $274 million. DPUC Docket No. 05-10-03RE01, 9.

In a prior phase of this docket, the DPUC properly adopted a cautious approach, approving a 10,000 Meter Study to evaluate the technical capabilities and reliability of the OpenAMI metering system. DPUC Docket No. 05-10-03RE01, Application of the Connecticut Light and Power Company To Implement Time of Use, Interruptible of Load Response, and Seasonal Rates – Review of Metering Plan, dated December 19, 2007, 1 ("Docket No. 05-10-

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[1] Conn. Gen. Stat. § 16-243w(c) states that:

> (a) On or before July 1, 2007, each electric distribution company shall submit a plan to the Department of Public Utility Control to deploy an advanced metering system. In lieu of submitting a plan pursuant to this section, an electric distribution company may seek a determination by the department that such company's existing metering system meets the requirements of this section. Such metering systems shall support net metering and be capable of tracking hourly consumption to support proactive customer pricing signals through innovative rate design, such as time-of-day or real-time pricing of electric service for all customer classes.
>
> (b) Each plan to implement an advanced metering system developed pursuant to subsection (a) of this section shall outline an implementation schedule whereby meters and any network necessary to support such meters are fully deployed on or before January 1, 2009. On or after January 1, 2009, any customer may obtain a meter on demand.
>
> (c) The cost of the advanced metering system, including, but not limited to, the meters, the network to support the meters, software and vendor costs to obtain the required information from the metering system and administrative, installation, operation maintenance costs, shall be borne by the electric distribution company and shall be recoverable in rates. Any unrecovered cost of the current metering system shall continue to be reflected in rates.
>
> (d) Not later than six months after June 4, 2007, electric distribution companies, competitive electric suppliers and aggregators shall offer time-of-use pricing options to all customer classes. These pricing options shall include, but not be limited to, hourly and real-time pricing options.

[2] Open advanced electric meters are intended to allow customers to monitor their electric usage on a continuous basis and also facilitate the use of "smart" appliances, which are appliances that can be programmed to run or not run at particular times of the day.

03RE01"). The DPUC also directed CL&P to conduct a rate pilot within that study to determine customer acceptance of and response to time-based rates. Docket No. 05-10-03RE01, 20. The Department made "no commitment" to move forward beyond the 10,000 Meter Study at that time. Docket No. 05-10-03RE01, 17.

On February 25, 2010, CL&P submitted the results of its rate pilot to the Department. It subsequently filed its cost-benefit analysis and its proposed deployment plan for smart meters and dynamic rates. The purpose of the present proceeding is to review the results of the Company's meter study and determine the appropriate next steps for "smart metering" and dynamic rates for CL&P's customers.

B. <u>CL&P's Pilot Program</u>

CL&P conducted its Plan-it Wise Energy Program Pilot (referred to herein as the "Pilot" or "Pilot Report") from June 1, 2009 through August 31, 2009. The Company tested three time-based rates on 2,437 customers; 1251 residential customers and 1186 small commercial and industrial ("C&I") customers. EL-5; Transcript ("Tr."), 2058-2060. Consistent with the DPUC's direction when it approved the pilot, participation in the study was voluntary and participating customers were allowed to choose their preferred time-based rate. Pilot Report, 2. Participants were paid for their participation. Residential customers received $100 and C&I customers received $200. Tr. 2022-2023.

CL&P offered three time-of-use rate options:

-Critical Peak Pricing (CPP) – increased prices up to $1.60/kWh during peak hours, and provided a discount of up to $0.05/kWh during off-peak hours;

-Peak Time Rebate (PTR) – retained normal tariff pricing during all hours but provided rebates of up to $1.60/kWh during the peak hours if customers reduced their energy usage during that time; and

-Time of Use (TOU) – applied a substantially wider price differential for on-peak times, which were from noon to 8:00 p.m.

Pilot Report, 3-4.[3]

For the purposes of this pilot, "peak hours" were the ten critical peak day events called by CL&P from 2 p.m. to 6 p.m., which amounted to a total of over forty hours during the three month pilot study. Pilot Report, 5. Controlling technologies, such as smart thermostats, switches and new appliances, were used by some pilot participants but came at the customers' own expense. Those customers that had purchased controlling technologies in their homes showed greater savings. Pilot Report, 4.

C. <u>CL&P's Proposed Deployment Plan</u>

After the pilot, the Company proposed a full deployment to the Department which called for the installation of AMI meters for all 1.2 million of its customers over a four year period that begins by December 31, 2012. Deployment CBA, 4, 11; EL-38. CL&P argued that full deployment is the only cost-effective scenario because it provides the ability to achieve broad participation by all customers. Deployment CBA, 6. According to the Company's deployment plan, every customer would receive an AMI meter, but enrollment in a dynamic pricing plan would be voluntary, done on an "opt-in" approach. Deployment CBA, 6; EL-75.

A critical aspect of the Company's deployment plan is what it described as "conditional" DPUC approval. CL&P asked that the Department, in the present case, guaranty it full, up-front recovery of any and all costs that it may incur associated with its AMI deployment. Tr. 2163. According to the Company's proposal, the only question for the DPUC that would remain after

[3] The current rate is roughly $.17/kWh. Tr. 2119.

installation was "how" the Company would collect the costs of this project, not "whether" all of those costs should be recovered from customers. Tr. 2164; 1880-1881. CL&P proposed to file a specific cost recovery plan by the end of July, 2012, claiming that the cost recovery proposal would be more appropriately designed once CL&P knows the final deployment plan and its costs. EL-45.

II. DISCUSSION

The DPUC should reject CL&P's proposed full deployment of AMI meters. Full deployment is not required by law and is neither cost-effective nor prudent. If the Department is intent on approving the use of AMI meters, it should do so on a far more limited basis than the Company has proposed.

A. The DPUC need not approve AMI meters to comply with Conn. Gen. Stat. § 16-243w(c)

Conn. Gen. Stat. § 16-243w(c)[4] does not require that the Department approve CL&P's AMI meter proposal. The DPUC already noted in its final decision in Docket No. 05-10-03RE01, 16, that the existing AMR meters can meet the requirements of the Act.

B. The Results of CL&P's Pilot Program Do Not Support Full Deployment At the Present Time

The Company's rate pilot simply does not support full deployment of AMI meters. First, the rate pilot consisted of 2,437 customers, less than 0.2% of the Company's 1.2 million customers. Moreover, this group consisted entirely of customers who were motivated to try the new technology and the associated time-based rates, and they were paid for their participation in the pilot. This self-selected subset of the Company's customers cannot be considered

[4] See footnote 1, supra.

representative of the average CL&P customer. As the Company admitted during the hearings in this case, the average CL&P customer is likely far less motivated to consider time-of-use rates and install the associated advanced technologies that are required to improve their savings than those that participated in the pilot. See EL-4. Tr. 1943-1944.

Second, despite the fact that the pilot group had much more motivation to embrace the new time-of-use rate technology, the pilot results showed no beneficial impact on total energy usage. Specifically:

> -for CPP, total energy usage increased by 0.2% for residential customers and there was no change for C&I customers;
>
> -for PTR, total energy usage decreased by 0.2% for residential customers and there was no change for C&I customers; and
>
> -for TOU, total energy usage decreased by 0.1% for residential customers and there was no change for C&I customers.

Pilot Report, 4.

With regard to the time of usage and savings in the pilot, according to CL&P's Pilot Report, residential customers on the CPP and PTR pilots reduced peak usage by modest amounts; 11% to 16% without controlling technologies and 18% to 23% with controlling technologies. Id. The savings associated with these reductions, however, were limited to certain classes of customers. While residential customers in the pilot saved an average of $15.21 and low and limited income residential customers saved $8.07, C&I customers' costs actually *increased* $15.45. Id.

Even these modest savings, however, are vastly overstated. When calculating these "savings" in the pilot, CL&P did not reflect any of the costs associated with purchasing and installing the new AMI meters themselves. The Company also did not include the stranded costs

that would result from replacing the existing AMR meters before they had reached the end of their "useful lives." Tr. 2043-2044. The Company's "base case" scenario projects the cost of the new AMI meters and the attendant technology to be $493 million and the stranded costs could add an additional cost of more than $40 million. Tr. 2049-50.

Third, the pilot took place during an unusually cool summer. Pilot Report, 4; Tr. 1887. These moderate weather conditions likely skewed the results of the pilot by making participation in the pilot much less burdensome on its participants and leaving them with a far more positive impression of the program than they would have had under more typical weather conditions. Pilot participants never confronted the sometimes difficult choices that must be faced customers on dynamic rates, such as whether to use their air conditioners during extended periods of hot and humid weather. Tr. 2038-2040. See also EL-73. The mild weather, coupled with the fact that customers were paid for their participation in the pilot and were therefore finically insulated from any penalties that may have resulted from their failure to shift the times of their electricity usage, likely explains the positive reaction from those pilot participants that responded to the post-pilot survey.

Fourth, the costs associated with the full deployment of AMI meters are huge and cannot be justified by energy savings achieved. The Company's deployment plan calls for the replacement of fully functioning AMR meters with new AMI meters. Many customers do not want or cannot use the new AMI meters. Under the Company's plan, however, these customers will nonetheless be forced to subsidize the cost of the meters for the few customers who will use them.

The Company's base case scenario carries an estimated cost of just under $500 million for these new meters, on a net present value basis. When spread over the Company's 1.2 million customers, this price tag comes to roughly $411 per meter/customer. Tr. 2083. Moreover, as noted herein, this estimate is understated in that it does not include the more than $40 million in stranded costs associated with replacing the existing AMR meters before they reach the ends of their useful lives. This staggering cost produced savings of just $11 for residential customers over a twenty-year period, tr. 1965; 2060-2061, and the total energy usage in the pilot did not change for residential or C&I customers. Pilot Report, 4. In light of the State's high cost of electricity and lagging economy, CL&P's consumers simply cannot afford this experiment at the present time.

In addition, the cost of these new meters has increased by a staggering amount just since this case began. CL&P's initial meter proposal in this proceeding, presented in 2007, carried a projected cost of $264 million to $274 million for full deployment. Docket No. 05-10-03RE01, 9. That cost has since doubled.

Fifth, it is important to bear in mind that CL&P currently offers voluntary time-based rates, and these rates have attracted very few participants. While the Company argued that the low level of current participation indicates that the DPUC should increase the rate differentials between the peak and non-peak times in these rates, tr. 2113, the Department should remain skeptical. The DPUC should not force customers to purchase expensive AMI meters to facilitate rates that many customers have shown they do not want and are not likely to use, especially when it is those customers who do not or cannot take advantage of the dynamic rates (because the full benefit of AMI meters can only be achieved if the customers use them in conjunction

with other "smart" technology in their homes) will likely be forced to subsidize the savings of the few customers that can afford to use them. Tr. 1968-1970.[5]

C. CL&P's Cost-Benefit Analysis Fails to Support Full AMI Deployment

After the conclusion of CL&P's pilot program, the Company performed a cost benefit analysis by extrapolating the results of the pilot across its entire customer base. (Deployment Cost Benefit Analysis, submitted in Docket No. 05-10-03RE01, Order No. 4 ("Deployment CBA")). CL&P's cost-benefit analysis, however, is severely flawed, rendering the results inherently unreliable. A dispassionate analysis of the pilot results shows that the costs of CL&P's smart metering plan far outweigh the benefits. The facts simply do not justify full deployment at the present time.

In its Deployment CBA, CL&P developed three cost scenarios, a best case, worst case and base case, for its full meter deployment strategy, with the Company asserting that the base case was the most likely to occur. Tr. 2006-2008. Each of these scenarios applied different inputs for the following variables:

-AMI meter costs;

-average lives of the AMI meters;

-forward capacity market prices through 2020;

-percentage of conservation achieved; and

---

[5] After the completion of the pilot test period, CL&P conducted a survey to measure the participants' satisfaction with the pilot. Although the survey results were favorable, they cannot be relied upon to predict customer satisfaction with CL&P's metering plan across the Company's entire customer base. According to CL&P's survey, 92% of the residential participants and 74% of C&I participants said they would participate again. Pilot Rpt 4. The survey, however, was completed by a small subset of the rather small number of customers that volunteered for the pilot. Just 205 residential and 55 C&I customers actually responded to the survey. EL-79; Tr. 2037. Their views are not likely reflective of the views of the vast majority of CL&P customers who had no interest in the pilot program (despite the chance to be paid for participation), or may have participated in the program but declined to complete the survey.

-percentage of customer participation in dynamic pricing.

Deployment CBA, 3.

According to CL&P's conclusions, the best case scenario produced a positive net present value (measured over a twenty-year period) of $791 million and the worst case scenario produced a negative net present value of $392 million. The Company's base case scenario initially produced a positive net present value of $87 million, which the Company revised upward during the hearing to $154 million, again on a net present value basis. EL-15; LF-1.

Review of the Company's analysis shows that it has consistently understated the costs associated with AMI deployment. For example, CL&P did not include "stranded" costs that it would seek to collect from ratepayers associated with the existing AMR meters which would be replaced long before they reached the end of their useful lives. EL-37. The existing AMR meters were deployed by CL&P between 1994 and 2005 and have a useful life of twenty years. EL-38. The average remaining life of the existing AMR meters is 14 years. LF-17; Tr. 2140. In other words, many are just five or six years old.[6]

As of September 30, 2010, the net book value of the existing AMR meters was $58.9 million. Tr. 2142, 2149. Thus, if the DPUC approved CL&P's full deployment AMI proposal, the stranded costs associated with the existing AMR meters would be $41 to $44 million. EL-38; Tr. 2042. These stranded costs, however, could be reduced substantially if the DPUC approved a surgical deployment of AMI or approved a strategy in which AMI meters were

[6] Moreover, it does not appear that CL&P replaces its existing AMR meters immediately after they have been in service 20 years. In 2009, for example, the Company replaced only 646 meters because of their age or because they had exceeded their useful lives. LF-3.

installed only after an AMR meter reached the end of its useful life, or a combination of the two. Tr. 2142.

Other factors not appropriately considered in CL&P's analysis include the costs inherent in the roll-out of new advanced technology on a wide-spread basis and the related increase in customer inquiries and problems with the new meters and their functionality. EL-22. Note that these costs will be imposed on all of CL&P's customers under the Company's plan, including those who do not want and cannot use the AMI meters' capabilities.

While the costs that CL&P applied in its analysis were relatively known, the benefits were much more speculative because they depended on assumptions concerning a variety of critical external variables, such as future electric prices, the elasticity of demand for electricity and calculating the benefits of peak-time energy usage reductions. Deployment CBA, 8-9. For example, CL&P assumed that the level of participation across its entire customer base would match the levels of participation experienced in its rate pilot. This assumption, however, is unreasonably optimistic. As discussed herein, the pilot consisted exclusively of customers who chose to participate, and those customers were paid for their participation. In addition, CL&P will be unable to recreate the conditions of the pilot for all of its 1.2 million customers across the State. For instance, customers who participated in the rate pilot were given a high level of direct care and attention by Company employees to guide them through the process. It is highly unlikely, if not impossible, that CL&P could give the same sort of cash incentive payments and direct customer care to every one of their customers. See OCC PFT, 26-27.

Even with all of its flaws, CL&P's own overly optimistic cost-benefit analysis showed that the financial benefits associated with CL&P's proposed full AMI deployment are small.

According to the Company, residential customers would save just $11 over a twenty-year period with the new AMI meters, while C&I customers would save $96.35. EL-64; Deployment CBA 10. For residential customers, those savings come to roughly 55 cents per year.

Finally, CL&P's remaining arguments simply do not support full AMI deployment. CL&P claimed that the use of AMI meters would provide other system benefits, such as a reduction in transmission and distribution capital costs. EL-27. The Company, however, based this assumption on an existing energy conservation study and did not adequately explain why the results of that conservation study would apply in the present case. Id. The Company further asserted that the use of AMI meters will reduce uncollectibles by facilitating more and more timely shut-offs because the new meters would allow CL&P to could shut-off remotely. EL-55. CL&P, however, has already begun remote shut-offs using its existing AMR meter technology. Tr. 2157-2158; CL&P Notice to DPUC dated November 18, 2010 in DPUC Docket No. 98-01-02 (in which the Company announced the beginning of its remote shut-off program). Clearly, any benefits associated with remote shut-offs cannot be attributed solely to AMI technology.

Similarly, CL&P claimed that AMI meters will produce customer benefits because they will help detect service outages. But, existing AMR meters can also detect outages. Tr. 2136-2137. CL&P further stated that the new AMI meters would assist in theft protection. Again, however, the existing AMR meters already have tamper flags that serve that very purpose. Tr. 2098. Moreover, the Company did not produce any studies to indicate or support the correlation between AMR meters and theft of service. LF-10. Finally, CL&P could not provide examples of other companies that have saved money or reduced rates by installing these new meters. EL-61.

D. Dynamic Rates Are Punitive to Certain Types of Customers

Certain types of customers, due to no fault of their own, simply cannot shift their electricity usage to off peak times. These customers include many elderly, those with sick or young children at home, as well as those customers who work second or third shifts. OCC PFT, 17-18. Also, many businesses simply cannot change the times that they use electricity. Forcing these customers to purchase AMI meters is punitive. First, theses customers cannot take advantage of the time-based rates that the AMI meters are intended to facilitate. Second, these customers will not only be forced to pay for their own meters, but they will also be required to subsidize any savings achieved by those customers that can benefit from time-of-use rates. Third, even if they could shift the times of their electric usage, many of these customers cannot afford the associated controlling technologies that are required to make the AMI meters truly effective. While time-based rates should remain an option for electric customers, they should not be forced on customers to their economic detriment.

Further, designing rate differentials in dynamic rates will prove to be a very difficult task that could, in the end, ultimately defeat the purpose of installing AMI meters altogether. CL&P asserted that the rate differentials in the dynamic rates offered with AMI meters must be significant enough to encourage customers to shift their usage to off-peak periods. Participation in dynamic rates, however, will be entirely voluntary. CL&P's customers will not be required to use the Company's dynamic rates, and indeed can switch to alternate generation providers who tend to offer flat rates. EL-76. As a result, the majority of any savings achieved by those customers who do switch their usage will likely be subsidized by those customers who do not shift their usage and do not switch from the standard offer.

E. Expected Advances in Technology Could Eliminate Some of the Costs Associated with CL&P's Proposal

As CL&P acknowledged during these proceedings, AMI technology is still maturing. Tr. 1903. Indeed, the Company is "monitoring" new technology that would allow compatibility to read AMI and AMR meters. EL-38. Tr. 1973; 2154-2155. This technology, which CL&P is now testing and should be commercially available by the end of 2011, would allow the deployment of AMI meters along side of existing AMR meters, thereby eliminating the need to replace AMR meters before they reach the end of their useful lives and the associated $40 million in stranded costs of doing so. EL-38; LF-19; Tr. 2155. Other advances in technology could produce more profound results and may address the privacy and cyber-security issues presented by smart meter technology. See OCC PFT 14.

The Department has the time to be patient and see if new technology or innovative approaches provide a superior and more cost-effective alternative to the Company's AMI deployment proposal. CL&P's existing AMR meters have plenty of life remaining. The average remaining life of the existing AMR meters is 14 years. Moreover, CL&P tends to replace only three percent of its AMR meters per year. For example, from July 2009 to June 2010, CL&P replaced just 6,464 of its 1.2 million AMR meters, and of that amount replaced only 646 were replaced because their age exceeded their expected lives. LF-3.[7]

A wait-and-see approach is also supported by the Company's one year pilot "Home Energy Reporting Program," which began this month. The 24,000 CL&P customers that participate in this program will receive customized detailed information about their electricity

[7] CL&P testified during the late file hearings that these numbers are typical and fairly represent its meter replacements over recent years.

use, along with an anonymous comparison to similarly situated customers and personalized tips concerning how to increase the efficiency of their energy usage. The Company believes that this program, which does not require new meters or time-of-use rates, could save customers as much as three percent on their monthly electric bills. The Department should evaluate the results of this program before requiring customers to pay more than $500 million on new meters and rates that are basically intended to serve the same purpose.

F. <u>At Most, the DPUC Should Approve a Surgical Deployment</u>

If the Department determines that it should approve the deployment of AMI meters in this case, it should authorize only a surgical deployment. That is, it should allow any CL&P customer that wants an AMI meter to receive one upon request, so long as the costs of those meters are assigned only to the customers who ask for them. Such a deployment strategy has been used in New York and protects customers who do not want or cannot afford to use AMI meters from subsidizing meters and rates that benefit other customers. LF-21. In the alternative, the Department could couple a surgical AMI deployment with a meter replacement strategy whereby the Company would replace obsolete AMR meters with new AMI technology. This would allow for a more gradual roll-out of AMI meters system-wide, which not only eliminates stranded costs but also allows time to work out problems or flaws with the new system and incorporate advances in technology. As CL&P testified, new meter reading technology has emerged that allows it to read AMR and AMI systems at the same time, which would allow the two metering systems to be deployed simultaneously. LF-19.

G. The DPUC Must Reject CL&P's Proposed "Conditional Approval"

In the event that the DPUC approves any sort of deployment of AMI meters in this case, it must reject the Company's proposal of assured cost recovery up-front. Instead, the Department should only approve cost recovery for the new meters in a full rate case proceeding after the meters are installed and considered "used and useful." In such a rate proceeding, the DPUC could properly review the prudence of the costs associated with this program, rather than writing the Company a blank check, paid for by customers, up front as CL&P has proposed. See OCC PFT, 30. As noted by the OCC in its testimony, there is a reason that the Company wants to be assured of full cost recovery in advance and place all of the risk of this investment on its customers -- because the Company is not willing to assume this risk itself. OCC PFT, 38-39. If the Company is unwilling to assume this risk, the DPUC should not place it on CL&P's customers, especially when the total projected residential savings associated with the project is just $11 for residential customers over twenty years.

WHEREFORE, the Attorney General respectfully submits this brief in this proceeding.

Respectfully Submitted,

GEORGE JEPSEN
ATTORNEY GENERAL
STATE OF CONNECTICUT

BY: _____

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Service is certified to all parties and interveners on this agency's service list.

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EXHIBIT AA

STATE OF MICHIGAN
DEPARTMENT OF ATTORNEY GENERAL

P.O. Box 30755
LANSING, MICHIGAN 48909

BILL SCHUETTE
ATTORNEY GENERAL

April 16, 2012

Ms. Mary Jo Kunkle
Executive Secretary
Michigan Public Service Commission
6545 Mercantile Way
Lansing, MI 48911

Dear Ms. Kunkle:

RE: MPSC Case No. U-17000

Pursuant to the Commission's E-Dockets User Manual, I am attaching the Attorney General's Comments Pursuant to the MPSC Order Dated January 12, 2012.

Sincerely,

Donald E. Erickson (P 13212)
Robert P. Reichel (P31878)
Assistant Attorney General
Environment, Natural Resources &
Agriculture Division
(517) 373-7540

c: All parties

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

In the matter, on the Commission's own motion, to review issues bearing on the deployment of smart meters by regulated electric utilities in Michigan. MPSC No. U-17000

/

ATTORNEY GENERAL'S COMMENTS
PURSUANT TO THE MPSC ORDER
DATED JANUARY 12, 2012

In its January 23, 2012 Order, the Michigan Public Service Commission (MPSC or Commission) directed all regulated electric utilities to submit information regarding several topics involving the deployment of "smart meters" Those topics include, but are not limited to: [1]

- The estimated cost of deploying smart meters and any sources of funding.
- An estimate of the savings to be achieved by the deployment of smart meters
- Whether the electric utility intends to allow customers to opt out of having a smart meter; and
- How the electric utility intends to recover the cost of an opt out program if one will exist.

[1] Other topics listed in the Commission's Order including scientific information that bears on the safety of smart meters, and steps each utility intends to take to safeguard the privacy of customer information gathered through smart meters, are the subject of extensive comments filed by other parties in this case, and will not be addressed here. We urge the Commission to carefully consider those comments.

In response to the Order, comments were submitted by several electric utilities. Among those, Detroit Edison Company (Document No.0146) and Consumers Energy Company (Document No. 0148) disclosed the most extensive plans to install smart meters.

The Attorney General respectfully submits that, notwithstanding the comments submitted by Detroit Edison Company (Detroit Edison) and Consumers Energy Company (Consumers), at least two very substantial issues remain that must be further addressed before the MPSC authorizes or approves any further deployment of smart meters by Michigan electric utilities and the recovery from ratepayers of the costs of smart meter deployment. First, there must be a sufficient demonstration that implementation of the smart meter programs will actually produce a net economic benefit to customers. Second, customers must be afforded a meaningful and fair opportunity to opt out of smart meter installation without being penalized by unwarranted and excessive costs.

Inadequate Demonstration of Economic Benefit to Ratepayers

A net economic benefit to electric utility ratepayers from Detroit Edison's and Consumers smart meter programs has yet to be established. In the absence of such demonstrated benefit, the Attorney General has opposed, and will oppose any Commission action that unjustly and unreasonably imposes the costs of such programs upon ratepayers. To a significant extent, the asserted potential benefits to utility customers depend upon assumptions that a customer will consider additional "real time" data on electricity usage provided by smart meters, and

adjust their electrical consumption to achieve cost savings under variable pricing programs that do not yet exist. (See Edison, Document No. 0146, p 5; and Consumers, Document No. 0148, pp. 6-7). Any assumption that large numbers of residential customers will have the time, ability and motivation to attend to, and act upon daily or even hourly changes in their electrical is questionable.

The absence of sufficient economic justification for Detroit Edison's smart meter program was emphatically recognized by the Court of Appeals in the consolidated appeals by the Attorney General and the Association of Businesses Advocating Tariff Equity from the Commission's January 11, 2010 Order in Case No. U-15768, In re Application of Det Edison Co (Michigan Court of Appeals Nos. 296374, 296379, slip opinion, pp. 7-9, April 10, 2012):

> We agree with appellants that the PSC erred in approving funding for Detroit Edison's advanced metering infrastructure (AMI) program. The PSC describes AMI as "an information gathering technology that allows Detroit Edison to collect real-time energy consumption data from its customers." As ABATE explains, "[t]he so-called 'smart meters' allow the utility to remotely monitor and shut-off electricity to customers that have these meters installed." According to ABATE, the intention appears to be to "allow customers to access real time energy consumption data and make alterations in their energy consumption patterns in order to reduce their own costs and to reduce the demands placed upon the system at time of system peak." However, appellants have established that the PSC's decision to approve the nearly $37 million rate increase to fund the program was unreasonable because it was not supported by "competent, material and substantial evidence on the whole record." In re Consumers Energy Co, 279 Mich App at 188; MCL 24.306.
>
> What the record does reveal is that AMI is a pilot program that even Robert Ozar, Manager of the Energy Efficiency Section in the Electric Reliability Division of the PSC, concedes "is as yet commercially untested and highly capital intensive, resulting in the potential for significant economic risk and substantial rate impact." At best, the

actual evidence presented by Detroit Edison to support the rate increase was aspirational testimony describing the AMI program in optimistic, but speculative terms. What the record sadly lacks is a discussion of competing considerations regarding the program or the necessity of the program and its costs as related to any net benefit to customers.

* * *

Moreover, we will not rubber stamp a decision permitting such a substantial expenditure—a cost to be borne by the citizens of this state—that is not properly supported. Were we to do so, we would abdicate our judicial review obligations. Again, the PSC may allow recovery of a utility's costs only when the utility proves recovery of costs is just and reasonable. On the record before the PSC and, perforce, before us, the PSC's decision was erroneous. Accordingly, we remand this matter for the PSC to conduct a full hearing on the AMI program, during which it shall consider, among other relevant matters, evidence related to the benefits, usefulness, and potential burdens of the AMI, specific information gleaned from pilot phases of the program regarding costs, operations, and customer response and impact, an assessment of similar programs initiated here or in other states, risks associated with AMI, and projected effects on rates. In other words, a real record, with solid evidence, should support whatever decision the PSC makes upon remand.
[Slip Op. pp. 7-9, (Emphasis added, footnote omitted)]

Opt-Out Provisions

Given the questionable benefit of smart meter program to customers, as well as the extensive public concern about the effect and potential intrusiveness of smart meter infrastructure acknowledged in the Commission's January 12, 2012 Order in this matter, the Commission appropriately directed Michigan's electrical utilities deploying or proposing to deploy smart meters to provide information about their plans for allowing customers to opt out of having a smart meter, and how they intend to recover the cost of such an opt-out program.

The Attorney General respectfully submits that utility customers should be given a meaningful choice of whether to have smart meters installed and operated on their property. An "opt-out" program that requires those customers who opt out to pay an unwarranted economic penalty for doing so does not afford customers such a meaningful choice.

The information provided by Detroit Edison, and Consumers in response to the Commission's Order does not sufficiently establish that they intend to offer customers a fair choice of whether to accept smart meters on their property. Detroit Edison's response on this subject is based upon the assertion that "Edison's AMI [Advanced Meter Infrastructure] program is beneficial for all customers." (Document No. 0148, p. 7). Proceeding from the unsubstantiated assertion, Detroit Edison apparently proposes to impose what it broadly describes as "all incremental costs" solely upon customers who choose not to accept installation of smart meters. (Document 0148, pp. 8-9). Consumers' submission similarly states that while it proposes to provide customers with the option to retain their existing meter equipment, it apparently intends to subject customers making such a choice to additional charges, including charges for "maintaining ready testing and billing traditional meters". (Document No. 0146, pp. 16-17). While neither Detroit Edison nor Consumers provide details regarding their opt-out proposals and associated charges, both of their comments suggest that they intend to effectively penalize customers who choose to opt-out of smart meters. Presumably, under the utilities proposals, customers who opt-out of smart meters would be required to pay rates

covering both the costs of the smart meter program, and expansively defined incremental costs "of retaining traditional meters. These proposals raise substantial questions as to whether their respective customers would, in fact, be afforded a fair and meaningful choice to "opt-out".

Another argument which may be important for the Commission to consider is whether a financial incentive to homeowners who allow smart meters to be installed in their home might be an alternative approach to a rate increase if a homeowner refuses to permit a smart meter to be installed.

Respectively submitted,

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Dated: April 16, 2012

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PAGE # 329

EXHIBIT BB

Germany Rejects EU Smart-Meter Recommendations on Cost Concerns

Stefan Nicola
August 1, 2013, 2:18 AM MST

Germany said it probably won't follow smart-meter guidance from the European Union -- which has recommended that 80 percent of homes install the devices by 2020 -- because such a move would be too costly for consumers.

The EU proposal is "inadvisable" for Germany, the Economy Ministry said in a statement <http://www.bmwi.de/DE/Presse/pressemitteilungen,did=586954.html> , citing a study <http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/Studien/kosten-nutzen-analyse-fuer-flaechendeckenden-einsatz-intelligenterzaehler,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf> it commissioned from consultants Ernst & Young. For users with low power consumption, the installation cost would be greater than the achievable energy savings, it said.

"The results show that we in Germany have to expand smart measuring systems

PAGE # 331

and meters selectively and in line with the energy switch," Deputy Economy Minister Stefan Kapferer said, referring to the country's shift away from nuclear generation and toward renewable power.

Smart meters allow consumers to monitor energy use and costs, and relay the data to suppliers to help them manage demand. Germany, which seeks to more than triple the share of renewables to 80 percent of consumption by 2050, has yet to adopt a firm policy on the devices.

The study on Germany, which has about 48 million traditional meters, "disappointed some in the industry, who had hoped for a stronger recommendation for a mass-market rollout," Albert Cheung, an analyst at Bloomberg New Energy Finance, said today by e-mail. "This is still a positive development as it clarifies the roles and responsibilities for smart metering, where uncertainty had previously stymied development."

EXHIBIT CC

Theresa May threatens to intervene over Npower gas and electricity price hike

1.4 million energy customers will face a £109 price hike from next month

By Katie Morley, CONSUMER AFFAIRS EDITOR and Jillian Ambrose
3 FEBRUARY 2017 • 10:16AM

Theresa May has threatened to intervene over NPower's "shocking" price hikes, which will push up 1.4 million households' energy bills by over £100 a year.

The energy giant is putting up the cost of standard tariffs by 10.4pc from March in a move which represents the biggest rise in energy costs for consumers since 2013.

NPower is blaming costs attached to the Government's own "smart meter" policy and higher wholesale energy prices as key factors in its "hugely difficult" decision to make loyal customers pay more for gas and electric.

Similar price rises from other "Big Six" energy providers are expected to follow, with experts predicting that by the end of April all six will have raised prices by between 5pc and 10pc.

A spokesman for the Prime Minister said: "We are concerned by Npower's planned increases – we are committed to getting the best for households.

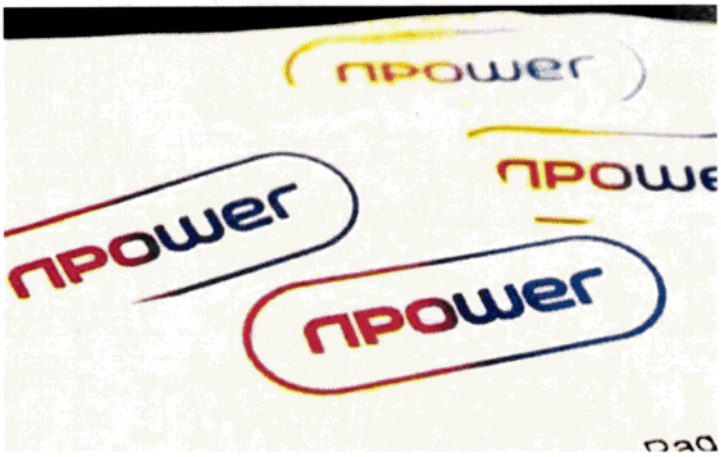
"Suppliers are protected from recent fluctuations in wholesale energy prices which are set two years in advance so we expect them to treat customers fairly and clearly where markets are not working we are prepared to act."

It comes as the Department for Business, Energy and Industrial Strategy is preparing to publish a green paper on the energy market, in which a range of measures including a price cap and action against individual firms are not being ruled out as possible changes to current policy.

Npower will raise standard tariff electricity prices by 15pc from 16 March, and gas prices by 4.8pc. A typical dual fuel annual bill will rise by an average of 9.8pc, or £109.

Last night Business Secretary Greg Clark slammed Npower's price rise, saying: "Loyal customers are being taken for granted by the big energy firms."

PAGE # 334



Npower is one of the UK's big six energy companies

But NPower defended the move, claiming the rising cost of Government energy policies now meant they accounted for nearly a quarter of its internal operating costs.

Its statement read: "Since Npower last raised its prices three years ago, there have been increases in wholesale energy costs and rises in the cost of delivering Government policies, such as smart metering, renewables obligation and the capacity market. This trend is set to continue, with network and policy costs representing an increasing share of domestic electricity bills."

It is the first time an energy company has blamed a price rise on the Government's smart meter policy.

Experts said the admission is the first hard evidence that smart meters, which are designed to help consumers save money, are actually flawed and will end up making people worse off.

The gadgets, which give consumers accurate meter readings, are being installed in UK homes under European Union legislation.

Installing the devices is estimated to cost energy providers £11bn, or £350 per customer, a cost which critics have long argued will end up being passed onto consumers.

- **Comment: 'We're paying £11bn for smart meters, but they won't stop the plague of billing errors'**

Ofgem boss Dermot Nolan said last month: "It's not obvious that there should be significant price increases across the market" CREDIT: EDDIE MULHOLLAND

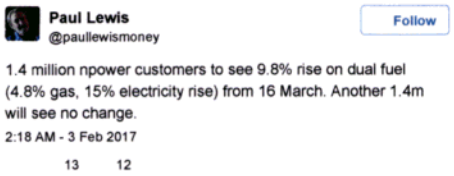
Doug Stewart, chief executive at Green Energy UK, said: "Smart meters have been sold on the basis that they will be be good for the consumer as they will get accurate bills, but nothing is free in businesses.

"When costs get loaded onto businesses they simply pass them onto the consumer, or else they would make less money. This appears to be what NPower are saying and I'd expect the rest of the 'Big Six' providers to do the same."

The hike is likely to be seen as a slap in the face to the energy regulator, which warned companies only a fortnight ago to keep a lid on prices.

Ofgem boss Dermot Nolan issued suppliers a stern caution against price hikes, saying the companies should be able to swallow a surge in energy costs to avoid passing on higher prices to consumers.

PAGE # 335



"It's not obvious that there should be significant price increases across the market and it would be up to suppliers to justify this to us and to their customers," said Mr Nolan.

Ofgem estimates that the cost of supplying energy has soared 15pc in a year due to price rises in wholesale energy markets as well as the increasing burden of the Government's renewable energy programme.

But it said that large suppliers were able to buy their energy from the market a year or two ahead of delivering it to customers, so they should still be able to benefit from historic low prices in energy markets last year.

The standard variable tariffs of the 'Big Six'

Supplier	Pay on receipt of bill	Monthly direct debit	Prepayment
British Gas	£1,102	£1,044	£1,102
EDF Energy	£1,139	£1,069	£1,139
E.On	£1,117	£1,047	£1,117
npower	£1,172	£1,077	£1,172
ScottishPower	£1,161	£1,081	£1,142
SSE	£1,136	£1,056	£1,148
Average	£1,138	£1,062	£1,137

Source: uSwitch

Ofgem is also putting pressure on companies to trial new ways to engage with so-called 'sticky customers' - people on standard variable tariffs (SVTs) who fail to switch to a better deal.

Mr Stacey said Npower would launch an exclusive four-year fixed term tariff for the standard customers who are facing the price hike and will waive the cost of switching fees.

Earlier this week Mr Stacey appeared before a select committee of MPs where he admitted that energy suppliers' business model means "the standard price is effectively subsidising the non-standard".

An investigation by the Competition and Markets Authority found that two-thirds of customers on standard tariffs are paying far more than they need to, meaning collectively energy customers are overpaying by £1.4bn a year.

PAGE # 336

EXHIBIT DD

Subject: Save by lowering your overall energy usage

From: APS (APSnews@aps.com)

To: w6345789@yahoo.com;

Date: Wednesday, September 28, 2016 1:03 PM

Save by lowering your overall energy usage

SAVE on your overall usage by taking advantage of some basic energy-efficiency programs, tips and tools, like:

- considering washing your clothes in cold water and avoid small loads
- taking our energy analyzer survey to get a customized energy savings report
- turning your AC up a few degrees during the summer and down during the winter

Learn more ways to lower your bill with Shift, Stagger and Save.

PAGE # 338