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Arizona Corporation Commission
1200 W. Washington
Phoenix, AZ 85007

RE: Innovation and Technological Developments
Docket No. E-00000J-13-0375

During Innovation and Technological Developments workshops held earlier this year, Tucson Electric Power gave a presentation entitled "TEP's Distribution Automation Strategy." One of the slides in that presentation included a diagram developed by the Electric Power Research Institute (EPRI) that depicted the many new technologies that are available and/or being developed for the distribution grid. Commissioner Bob Burns requested that Arizona Public Service Company file to this docket a short discussion of APS's experiences with each of the technologies shown in that diagram.

Attached is APS's discussion of these technologies and, for the Commission's convenience, a copy of the original slide from the TEP presentation.

If you have any questions regarding this information, please contact Greg Bernosky at (602)250-4849.

Sincerely,

Lisa Malagon

LM/bgs

APS Response to EPRI Technological Advancements Diagram

Summary

The EPRI view of emerging technological advances for the grid is broad and diverse. They describe advances in Smart Generation, Smart End Use, Smart Substations, Smart Distribution, and Smart Buildings. APS has already installed or is actively looking at many of these technologies. In order to best serve our customers and the State of Arizona in the future, APS understands it is paramount that we modernize the grid in order to ensure flexibility and enable choice. Many of the technologies shown on the diagram make this possible. APS is committed to working with its regulators, customers, and other stakeholders in order to ensure Arizona's energy future through the active assessment, piloting, and implementation of these and other technologies as they develop and prove valuable.

Smart Generation

- **Demand Response:** APS is currently piloting a Home Energy Information program which is a two year demand response and energy efficiency study of in-home enabling technologies with approximately 400 APS residential participants. The program consists of three distinct studies consisting of peak event pricing with smart thermostats, price and direct load control signals with smart thermostats, and real-time consumption information via a smart phone app for both energy usage and cost information.
- **Electric Storage:** APS has already invested in a pilot of energy storage in the form of batteries. While the first trial of this technology was not successful, APS will continue to pursue battery storage opportunities in 2015.
- **Solar:** APS is a large proponent of solar with approximately 500 MW of installed utility-scale solar capacity. APS will continue to advance solar power in the State of Arizona as demonstrated by its AZ Sun DG proposal to install and own (at no additional cost to participating customers) 20MW of rooftop solar.
- **Biofuel:** APS currently has an aggregated total of 30 MW of purchased capacity from biogas, biomass and geothermal sources. APS continues to explore the further use of these types of dispatchable, renewable resources. APS also integrates 289 MW of wind capacity into its grid from several utility scale projects.
- **Voltage/ Var Management:** APS has installed an Integrated Volt/ Var Control solution on four distribution feeders out of Pioneer Substation and two distribution feeders out of Mazatzal Substation. This integrated system automates selected regulators and capacitor banks resulting in improved feeder voltage profiles and power factor correction. APS has plans to expand this technology in 2015 and 2016.

Smart Substation

- APS is currently installing transformer monitors on 69/12kv distribution substations and bushing monitors on transmission substations as part of its Substation Health Program. In addition, APS will be adding breaker monitors and integrating the substation health information into the

existing Transformer Oil Analysis & Notification (TOAN) software application, for which APS has received an industry award and patent.

Smart Distribution

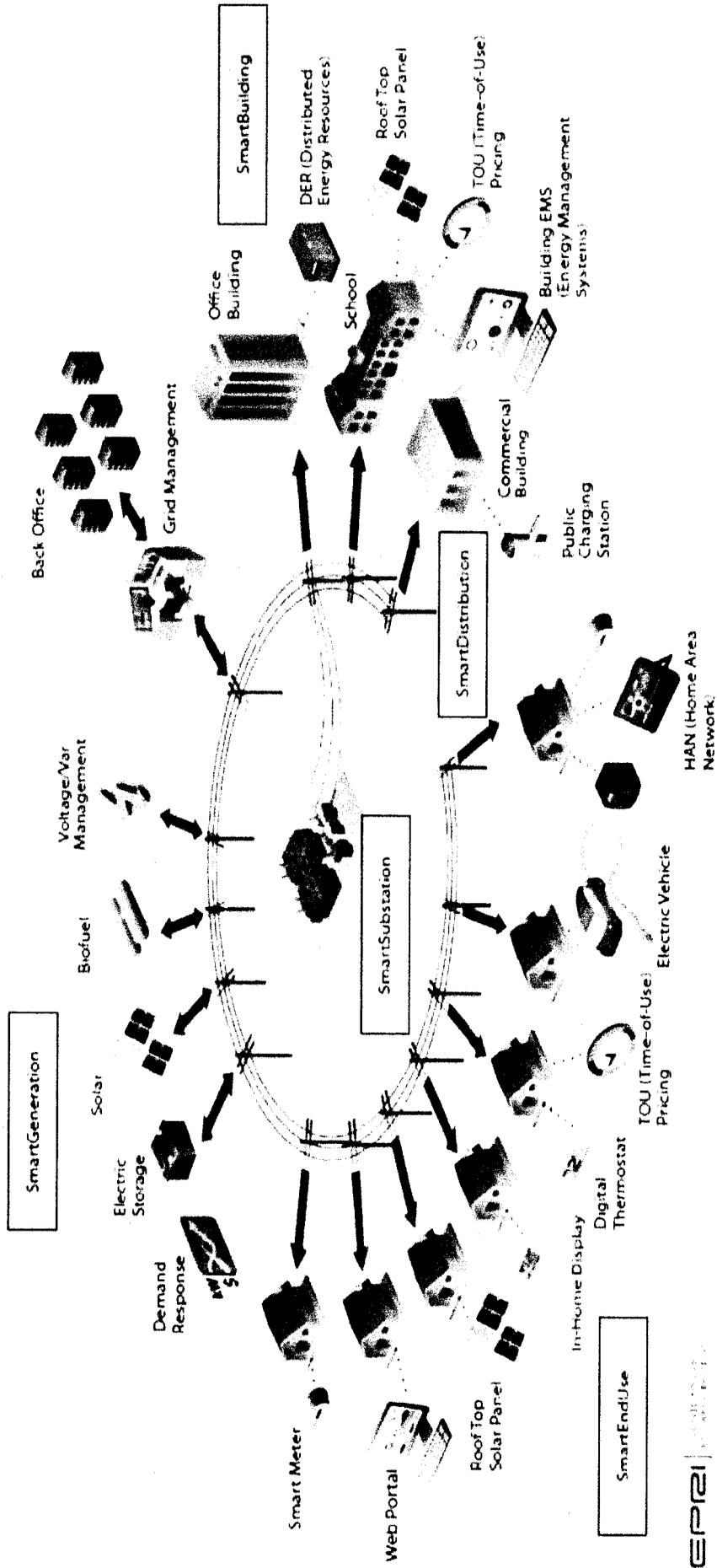
- APS's 5-year Smart Grid plan is aimed at modernizing its distribution grid (including increasing efficiency, facilitating data collection and remote control, and enhancing flexibility) by installing over 5,000 smart circuit devices over the period 2014-2018. These smart distribution technologies include Fire Mitigation, Communicating Fault Indicators, Supervisory Controlled Switches, SCADA-enabled Network Protectors, Integrated Volt-Var Control and Substation Health Monitoring.

Smart End Use (Includes Smart Buildings)

- **Smart Meter:** APS has completed its installation of approximately 1.2 million advanced meters throughout its service territory. This has resulted in increased energy usage information for our customers as well as increasing utility efficiencies. In addition, APS's Advanced Meter Infrastructure has enabled quicker customer response for pricing program changes, connects, and disconnects; and increased safety and reduced carbon emissions through reduced drive time.
- **Web Portal:** APS introduced its customers to APS.com in 2000. Over the past years it has continually invested in the web site in order to offer customers additional information on their energy use, the ability to access and administer their accounts, and additional payment and program opportunities.
- **Roof Top Solar Panels:** APS has been, and is, a proponent of roof top solar. In 2010 APS installed 600kW of roof top solar at no up-front cost to its customers in the Doney Park area of Flagstaff in order to study the effects of high levels of distributed generation. APS has also installed over 15 MWdc of PV at rural and economically challenged schools throughout Arizona through its innovative Schools & Government program. APS seeks to continue this practice with its AZ Sun DG proposal currently before the commission. In addition, with almost 450 MWdc of distributed solar capacity installed at approximately 28,000 customer locations, APS has been at the forefront of advocating for fair and equitable rate structures that make solar affordable while preserving the underlying security of the distribution grid and avoiding unfair cost shifts.
- **In-Home Display:** APS does not currently have in-home display technology installed at any customer premises, but does provide real-time usage data to a select set of customers who volunteered for the Home Energy Information pilot program. APS believes there is a future for devices such as this; however, the product market is currently immature. APS will continue to monitor this space and may potentially offer services in this area at a future time.
- **Digital Thermostat:** The APS Home Energy Information pilot is a program (2013-2014) aimed at developing, testing, and deploying a group of in-home technologies designed to provide transparent energy information to customers. As part of the program, smart thermostats are being used for peak event pricing and direct load control signals.

- **TOU Pricing:** APS is, and will continue to be, a leader in Time of Use (TOU) pricing. A variety of TOU rates are currently offered to customers and this set of programs has been bolstered by the implementation of APS's Advanced Meter Infrastructure.
- **Electric Vehicles:** APS supports the adoption of electric vehicles in order to reduce carbon emissions and increase customer choice. The company has recently embarked on a fleet-electrification initiative in an effort to convert a portion of its own vehicles to electric. Additional investment will need to be put into Arizona's electric vehicle infrastructure (e.g. charging stations) in the future in order to spur the adoption of this mode of transportation.
- **Home Area Network:** As part of APS's Home Energy Information pilot program, approximately 200 AMI meters with Home Area Network capabilities (via Zigbee wireless) have been installed at customer residences. These are used to provide real-time usage data to customers in the program. APS continues to research available and up and coming Home Area Network technologies that may be used to provide enhanced services to customers who are interested. The security of such networks is a critical factor in determining their appropriateness for use and the industry has been maturing its security controls and architecture in this space.
- **Public Charging Stations:** APS installed three charging stations at Chase field (owned by the City of Phoenix) as a living laboratory to test solar powered EV charging. They are located across from the APS Solar Pavilion and are powered using solar panels from the Chase Field Solar Pavilion with grid backup. The stations include a data acquisition system that monitors use and regulates the chargers. APS also has several electric vehicle chargers located at its facilities for use by its current fleet. The State of Arizona will need to add a substantial number of public charging stations in the coming years in order to encourage adoption of electric vehicles.

Technological Advancements



EPRI
Electric Power Research Institute

New technologies are available and are being developed for all facets of the electrical grid

