COMMISSIONER

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ORIGINAL

February 8, 2016



RE: Emerging Technologies in Energy, Docket No. E-00000J-13-0375; [redacted]

Dear Commissioners, Parties and Stakeholders:

As I mentioned at the February Open Meeting, strong consideration should be given to the water-energy nexus as we look at energy and resource planning and development in Arizona.

Given the possibility of a water shortage—a widely-discussed topic in Arizona and the western United States of late—a key question I have been examining is: what is the level of risk to the State of Arizona when it comes to the high potential of a shortage on the Colorado River?

The surface level of Lake Mead is the key factor in whether or not to declare a shortage. If a certain level is reached, the Secretary of Interior will declare a shortage. Lake Mead is currently very close to that level. If this occurs, Arizona is the first in line to reduce its withdrawal from the river.

There is good reason to believe Arizona will soon embark upon increased population growth which will put additional demands on our energy and water systems. Fortunately, we have benefitted from strong leadership from state and local officials when it comes to water conservation; we likely will, however, very soon find ourselves in a situation where *every drop counts.*

The production of energy and access to sufficient water are two key drivers to Arizona's economic future. The traditional thermal generation model we have used for the past century uses a tremendous amount of water. In our Commission-led workshops on Emerging Technologies in Energy in 2014 and 2015, we explored the topics of renewable energy, energy storage, combined heat and power and learned about new technologies that consume less water than traditional generation.

I believe it is time to further explore this issue. I think a good place to start is in our pending Value and Cost of Distributed Generation proceeding. Former Arizona Department of Water Director Herb Guenther and Amy Van Dyken recently wrote an article analyzing the amount of water that could be saved by rooftop solar (attached). A recent study analyzing the impact of state renewable energy standards by NREL and Lawrence Berkeley National Lab found that nationwide water consumption was reduced by 27 billion gallons and water withdrawal for generation was reduced by 830 billion gallons (http://www.nrel.gov/docs/fy16osti/65005.pdf at p. 9).

I would like to see testimony from the parties regarding the impact of rooftop solar and other distributed generation on water use. I would like to see this topic discussed in the context of developing a methodology for the value and cost of distributed generation. I look to the experts participating in this docket to analyze the best ways to quantify those savings. For example, if a person installs rooftop solar on his home which results in a decreased need for fuel from traditional generators, what level of water savings could result? I think this is an important question to explore in the context of this docket. I do, however, recognize that this docket does not cover utility-scale solar and other water-saving generation that would also be relevant to this discussion and, as such, plan to further explore this topic in the Emerging Technologies docket.

One model I have studied closely and believe should be considered for replication in our state is the combined heat and power biogas generators at Triple G and Stotz dairies in Buckeye, AZ. The Arizona Republic did a story on these projects in 2015 (attached). These systems capture the methane produced from cow manure at the dairies and use it to generate electricity. Not only do these systems not require water but the chemical process actually produces water that is used for irrigation. These systems also improve the quality of life in the area by almost entirely removing any smell of manure odor.

Arizona's agricultural sector is an incredibly important economic driver for our state and is also a large water user. If there was a way to expand this model to include other manure-producers, I believe there is a potential to see significant water savings for this sector. Fuel cells and wind turbines are another example of alternative generation with minimal water requirements. As an aside, I am looking forward to the development of statewide interconnection rules that will hopefully ease the cost and burden with which these technologies can be connected to the grid.

A water shortage in Arizona could also lead to the need for a very costly option: desalination. These facilities require significant power generation and are very expensive. Last October, we hosted the Idaho National Laboratory at one of our emerging technologies workshops, and learned about their study on small modular dual purpose nuclear generators. The lab is exploring how these systems could provide baseload power while also capturing heat and using that heat to operate a secondary process such as desalination.

These are just a few examples I have studied and I am sure there are many more out there and on the horizon. I look forward to continuing the dialogue on this topic in the aforementioned dockets and welcome your input on the issues I have raised.

Sincerely,

Robert L. Burns
Commissioner

ARIZONA CAPITOL TIMES
Your Inside Source for Arizona Politics, Government and Business

# Some good news about Arizona's looming water crisis

By: Guest Opinion December 3, 2015 , 4:59 pm

Not enough rain and snow. Dwindling reservoirs. Record heat. Our future water supply is in jeopardy. As Arizona struggles to find solutions, there is an obvious one right above our heads. The sun. Rooftop solar power currently saves the state 768 million gallons of water a year. The potential to save more water is amazing.

Most people are not aware that it can take lots of water to generate electricity. Thermal generation, where nuclear energy, natural gas or coal are used to heat water and drive turbines, is second only to irrigation in terms of water withdrawals.

That's hardly the case with rooftop solar panels which harvest electricity directly from the sun without the use of turbines.

Thermal power plants on average use 685 gallons of water to create one megawatt-hour (MWh) of electricity. Rooftop solar uses almost no water, save a minimal amount to keep panels free of dust and dirt.

There's plenty of room for growth. Rooftop solar currently accounts for less than 1 percent of Arizona's energy supply. Increase that number to 20 percent, and Arizona could save 15 billion gallons of water a year. That's the equivalent of 1.6 million swimming pools (at 9,000 gallons each). It's enough water to supply more than 90,000 homes or the entire population of the city of Chandler for one year.

As a former director for the Arizona Department of Water Resources, I can tell you that there is no one magic solution to avoid an Arizona water crisis. However, we can start with water saving measures that reduce our current water use to help meet the challenge.

As an Olympic swimmer striving to overcome a severe spinal cord injury, I can tell you that our great state can overcome any challenge.

That's why we teamed up to deliver this message.

You don't have to be an expert on water usage or an Olympic swimmer to appreciate the need to conserve water, especially in the desert. It is ironic that our desert provides both the problem, a constant shortage of water, and a solution, an unyielding sun.

It's encouraging to know that every time someone installs solar panels on their roof, our state saves water. Adding more rooftop solar to Arizona's energy equation doesn't require drastic changes to our way of life. All that's required is to let consumers make use of this emerging technology through the private sector.

Sometimes the answer to a challenging problem is found right under our nose. In this case, the answer may be right above our heads.

*Herb Guenther is a former director of the Arizona Department of Water Resources and Amy Van Dyken is a former Olympic*
*swimmer and six time Olympic gold medalist.*



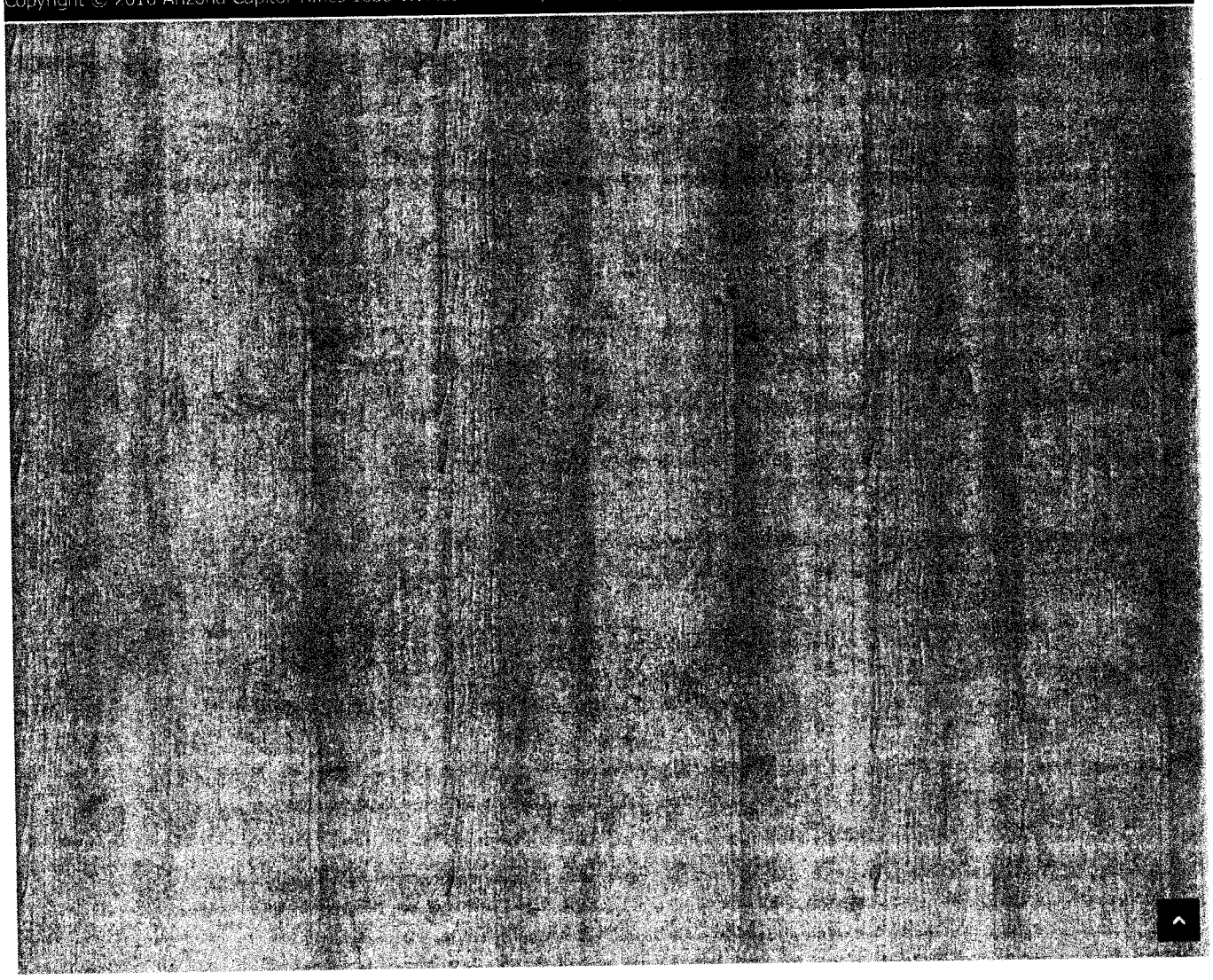
## ONE COMMENT

*GaryGary*
December 16, 2015 , 7:09 am at 7:09 am

The problem with solar panels is their 36 year pay back and their 10 year life span. Now due the math.

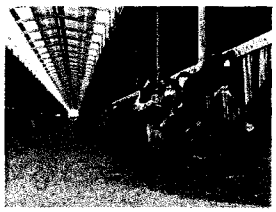






# Two Arizona dairies produce methane power

Laurie Merrill, The Republic | azcentral.com *2 p.m. MST February 13, 2015*



*(Photo: John Samora/ The Republic)*

Thousands of cows at the Triple G Dairy in Buckeye lazily chew their grains and hay, unknowingly providing renewable energy every time they contribute to the farm's manure lagoon.

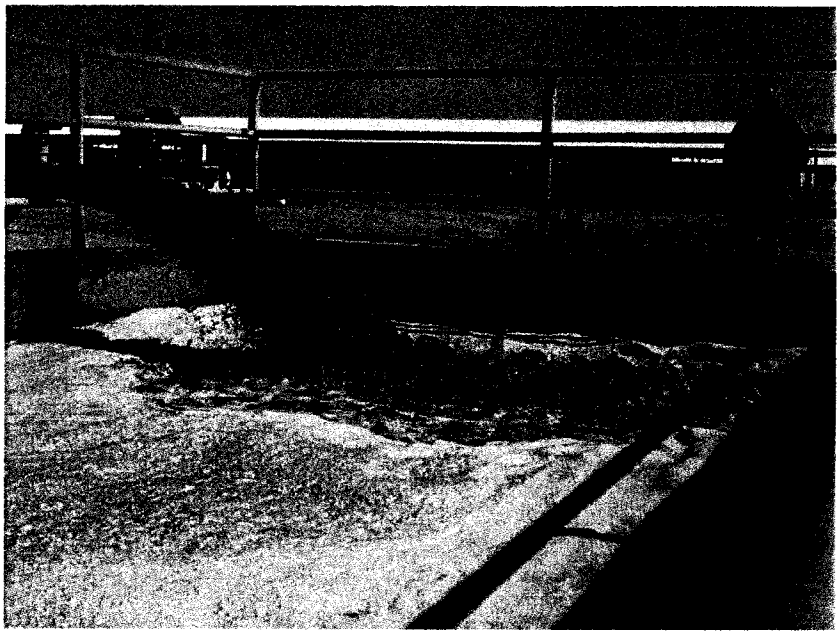
"As long as the cows are pooping, we are producing power," Curt Kaminer, director/manager of Chaple Street Environmental, said as he gazed at the cows that were contentedly eating under a massive shade structure.

On the Triple G and Stotz dairies, two neighboring Buckeye farms, a combined 20,000 head of cattle produce more than milk.

Their manure also produces methane, a greenhouse gas that Kaminer's company has turned into a profitable cow byproduct.

The company has built systems at each farm that capture the methane and convert it into power, which goes back onto the Arizona Public Service Co. energy grid, he said.

In addition to producing energy, the systems reduce the odor from manure lagoons.



**Curt Kaminer, managing director of ECM, stands near a slurry pumping station at Triple G Dairies. Cow waste is converted to methane gas and used by ECM to fuel a generator that is uploading power to the electrical grid via APS as seen in Buckeye on Feb., 10, 2015** *(Photo: John Samora/ The Republic)*

They also separate and cleans the water, which is used for irrigation, and creates fertilizer-grade manure, which is spread onto feed crops.

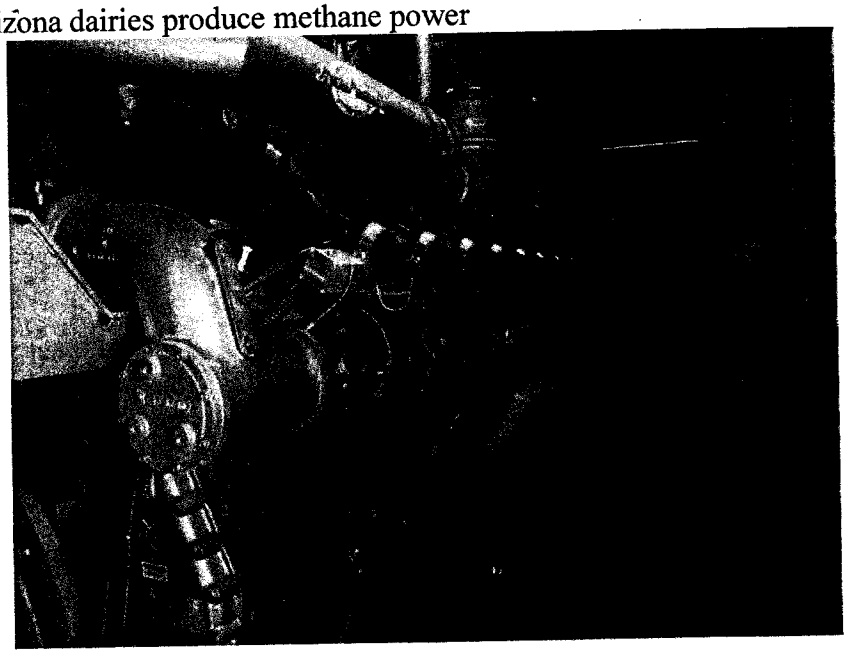
"What has happened here is really pretty cool," said Chaple Street's attorney, Donald Gilbert of Fennemore Craig in Phoenix.

The process converts methane to energy, which the company sells to APS. The company earns energy credits, which it also sells, company consultant Mons Ellingson said. .

The company burns some of the methane, rendering it harmless. For this, it earns carbon credits that it sells mostly to California companies, Ellingson

The profits are shared with the farms, which provide the manure and the space for the methane digesters, he said.

"There are three different income streams," Ellingson said. "It's really a pretty good deal for the dairies."



**Mons Ellingson, project manager of ECM, points out the features of the heart of his company's power plant, and 16 cylinder, 1000HP engine that is fueled by methane gas which powers a generator that is uploading power to the electrical grid via APS as seen in Buckeye on Feb., 10, 2015** *(Photo: John Samora/ The Republic)*

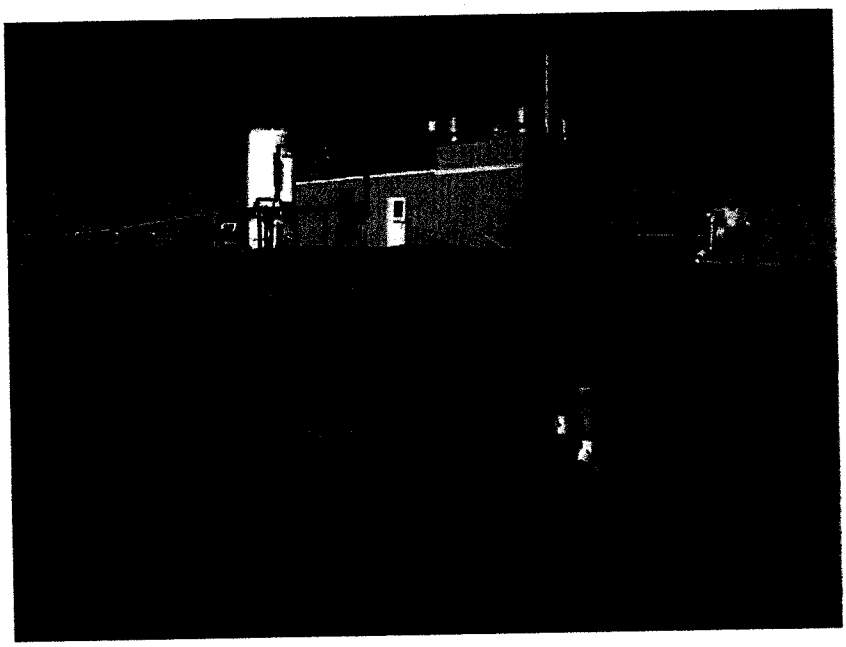
Ben Gingg, whose family owns the 2,000-acre Triple G Dairy, agrees. The Ginggs have been farming in Arizona since 1957. The farm was once near 99th Avenue in Glendale, just west of the University of Phoenix Stadium and Jobing.com Arena, before development pushed it to the outskirts.

"On these big dairies, we all have these big waste water lagoons that make gas around the clock," Gingg said.

With a methane digester, "the natural gas coming off these ponds is no longer just emitted into the air."

This reduces the odor, a big reason farms are pushed out of concentrated areas.

"Dairy farms keep moving farther and farther out," said Gilbert. "Good people, but not good business in neighborhoods."



**Curt Kaminer, managing director of ECM, walks across the top of 6 acre rubber covered lake of cow waste slurry at Triple G Dairies. Cow waste is converted to methane gas and used by ECM to fuel a generator, housed in the building beyond, that is uploading power to the electrical grid via APS as seen in Buckeye on Feb., 10, 2015** *(Photo: John Samora/ The Republic)*

**How it works**

Both the Stotz and Triple G dairies use water to flush cow manure from barns. It then goes through a system that essentially operates like a screen, separating the liquids from the solids. The liquid goes into lagoons, Kaminer said.

Triple G's lagoon is six-acres and Stotz's is 11.5 acres, according to Ellingson.

"The manure lagoons naturally boil methane," he said. "We can see it going off into the atmosphere."

The company covered each lagoon with a geo-membrane tarp.

"It's like putting a lid on the cauldron," Gilbert said.

Triple G's blue-green tarp traps gases from the 25-foot deep lagoon. The methane goes into a pipe, then through a biological scrubber that cleans it, Ellingson said. The clean methane powers motors at each facility, which continuously generate electricity, Ellingson said.

They produce enough to continuously power 120 homes, he said.

Currently, neither farm uses the generators to power the dairies, he said.

The water and fertilizer byproducts of the manure go back onto feed crops, and the grain and hay the cattle eat then results in manure, which produces energy, he said.

"I think it's awesome," said Julie Murphree, Arizona Farm Bureau spokeswoman.

In November, the bureau awarded each dairy with an Environmental Stewardship Award.

Triple G was the first to embrace the technology, though Gingg stressed that the dairy's main business is milk.

**"Why not?"**

Gingg said that when he was approached about the methane digester, he thought, "Why not? Why not capture the gas coming off these lagoons?"

The Triple G and Stotz dairies have been producing energy since 2013, Kaminer said. Before securing a deal with APS, the company made money from burning the methane and earning carbon credits, Ellingson said.

Bob Burns, an Arizona Corporation Commissioner, is one of several people who has requested permission to view the operation.

"I thought the project was amazing," Burns said. "In fact, I went back down twice because I was so impressed."

When he learned that it took several years for the company to connect to APS, "it energized me to look into interconnection rules."

The commission once developed rules on connecting energy like that created by the farms to the grid, but the rules were never adopted, he said.

The commission needs to update and adopt interconnection rules, Burns said.

"There is a cluster of dairies in that area," Burns said. "If we could make it a little more user friendly to put up...there might be an opportunity for similar operations."

**Cattle produce 20 percent of U.S. methane**

•Globally, livestock produce about 80 million metric tons of methane annually, according to the epa.gov website.

•In the U.S., cattle emit about 5.5 million metric tons of methane per year into the atmosphere. This accounts for 20 percent of U.S. methane emissions.

•Methane is the second most prevalent greenhouse gas emitted in the U.S. from human activities, after carbon dioxide, which comprises 82 percent of U.S. greenhouse gas emissions.

2012, methane accounted for about 9 percent of all U.S. greenhouse gas emissions from human activities. Methane is emitted by natural sources such as wetlands, as well as human activities such as leakage from natural gas systems and the raising of livestock.

•Since humans raise cattle for food, the methane emitted by cattle is considered a human activity.

•Pound for pound, the comparative impact of methane on climate change is over 20 times greater than carbon dioxide over a 100-year period.

Source: Epa.gov

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