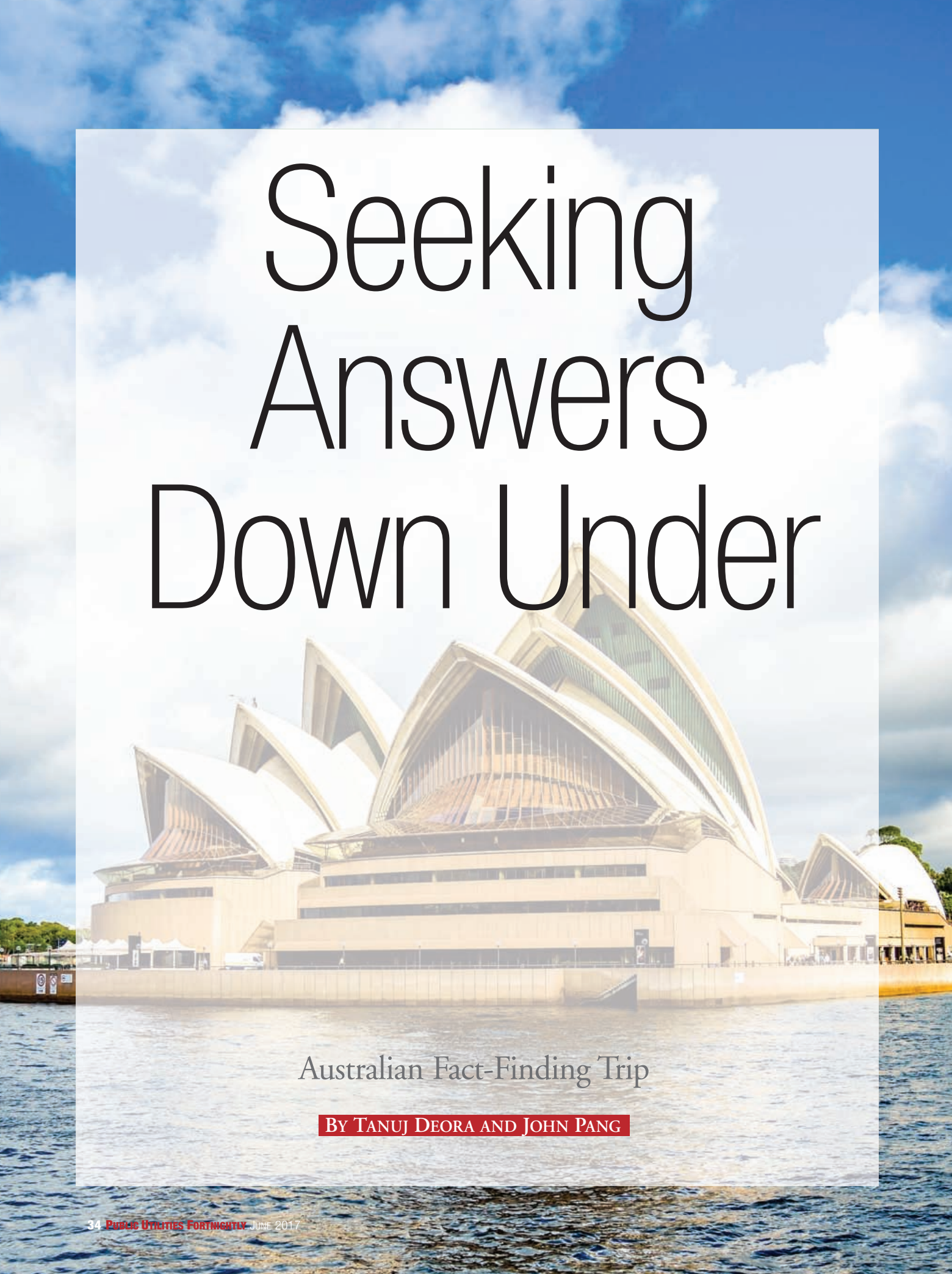


Seeking Answers Down Under

Australian Fact-Finding Trip

By Tanuj Deora and John Pang

Getting off the plane in Brisbane, the heat hits you like walking into a wall. It's a hundred degrees – in November.

We are in Australia as part of a group of about twenty-five U.S. energy industry executives from large and small utilities and innovative cleantech firms. We have travelled halfway around the world for a weeklong, intensive look at Australia's booming solar market and the energy market transition it has spawned.

Australia not only has more sheep than people, it has more solar panels than air conditioners. That fact and Brisbane's triple-digit heat are the first clues that our perspectives are about to be disrupted; not only about appropriate autumn weather, but also about what happens when levels of residential solar on utility distribution systems literally go through the roof.

See Figure 1 – Transmission and distribution networks in the National Electricity Market

In the coming days, we will learn that Australia's distribution, or network, utilities have been extremely successful in integrating rooftop solar onto their systems. For many utilities, a twenty-five percent solar penetration rate is now business as usual. In some cases, customers may be eligible for close to plug-and-play solar interconnection, while also enjoying traditional reliability.

But utilities have also missed opportunities to shape policy on key grid modernization initiatives, such as the rollout of smart or advanced meters. A recent regulatory decision has opened meter installation and ownership to third-party retail providers, foreshadowing a further disruption of utility business models.

"With American utilities' intense focus on reliability and safety, keeping the lights on, we often lose sight of the innovation going on in other markets, such as Australia," said Julia Hamm, President and CEO of the Smart Electric Power Alliance, one of the trip leaders.

"Seeing different approaches to the same problems we are facing in the U.S. with the integration of solar and other distributed energy resources really breaks down silos."

Sponsored by SEPA and industry consultant ScottMadden, the executive fact-finding mission included some of the obligatory Aussie experiences. Our first night, the group enjoyed a real Australian barbecue, with Aboriginal dancers and didgeridoo players. We also spent an afternoon at a koala sanctuary, where each of us got a chance to have our pictures taken holding one of the cuddly looking critters. (Key takeaway: holding koalas just automatically makes you feel happy.)

Australia not only has more sheep than people, but more solar panels than air conditioners.

But the core of the trip was a series of meetings in Brisbane and Melbourne with our Australian counterparts. There were utility executives, researchers, policy experts and tech innovators. With them, we could dig into the differences and similarities of our respective energy markets. The group quickly adapted to Australian tech talk, slang and accents, and the sessions were lively and challenging, with a two-way flow of experiences shared and lessons learned.

That said, the Australians were somewhat bemused by our interest in their operations. They seemed to have assumed that the U.S. had already figured out solutions to all the problems of solar integration and grid modernization.

They are vastly impressed with our advanced metering infrastructure, evolving utility business models, and distribution system planning tools. That's perhaps part of the reason why Audrey Zibelman, former chair of the New York Public Service Commission, was recently hired as chief executive of the Australian Energy Market Operator.

Certainly, many of the technologies Australians are deploying on their grid come from U.S.-based companies or global companies with American engineers. But our Australian hosts sometimes didn't seem to appreciate that they are innovating in very profound ways themselves.

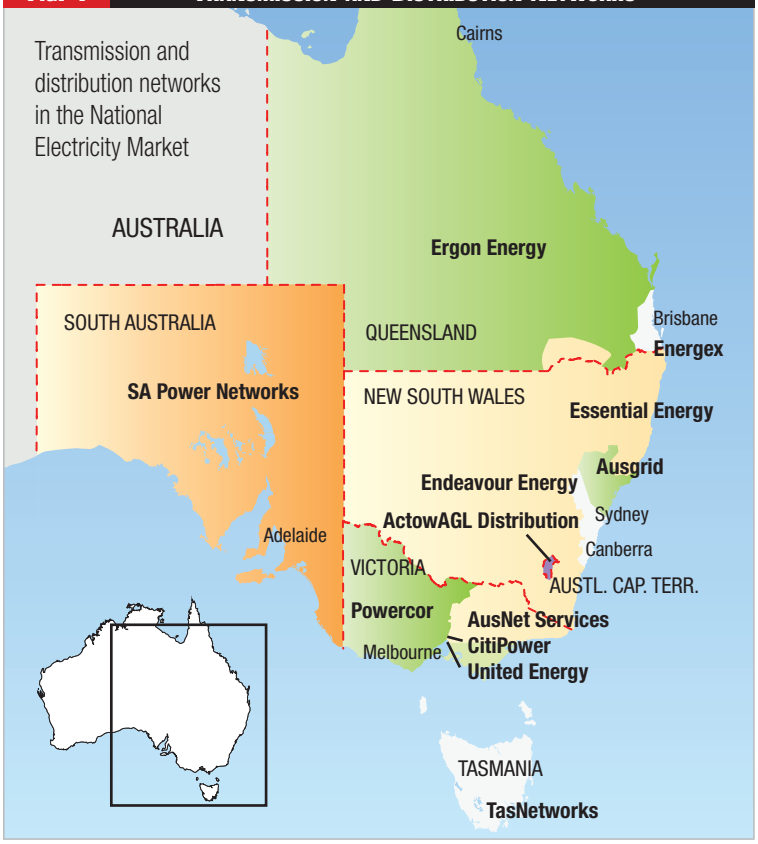
Brad Punu, Manager of Strategic Partnerships at the Energy Incubator in Honolulu, was blown away to discover one Australian utility that was funding its own in-house high-tech startups.

"In the U.S., innovators may work at utilities for a while, but to develop new technology, they have to leave," he said. "This was a startup that started on the inside – a living, breathing example."

Tanuj Deora is Executive Vice President & Chief Strategy Officer at the Smart Electric Power Alliance. He joined SEPA in January 2015 to lead SEPA's research, advisory, communications, and programs teams. His previous experience includes leading the Colorado Energy Office, developing wind energy projects in New England and the Rockies, and consulting in the McKinsey electric power practice.

John Pang is a Partner in ScottMadden's Energy and Clean Tech Practices. John has consulted with utilities around the world. His focus is on clean sources of energy, sustainable utility best practices, strategic planning and cost management.

FIG. 1 TRANSMISSION AND DISTRIBUTION NETWORKS



Integrating Renewables Low-Tech

The Australian consumers' voracious appetite for solar required the country's distribution utilities to quickly integrate large amounts of distributed variable generation. While some U.S. utilities have responded to even modest levels of solar with concerns about impacts on system reliability, the distribution utilities in Australia found the grid could handle higher penetrations of renewables than they had initially thought possible.

Previous SEPA fact-finding missions found similar results in Germany and Hawaii, two additional regions with high penetrations of renewables. What sets Australia apart is the utilities' creative use of low-tech solutions to facilitate the integration of distributed renewables.

For example, Energex, a distribution utility in Queensland, has turned to hot water load control as a low-cost option to integrate solar PV. Using distribution management software, the utility shifts hot water heating demand from early morning and late evening to mid-day. This load-shifting strategy, involving hundreds of thousands of water heaters, functions as what the Australians call a "solar sponge."

See Figure 2 - Solar Sponge Illustrated

That is, the water heaters preheat water at mid-day, to absorb excess solar generation. That improves network efficiency and power quality.

"It changed my outlook for DERs," said Seth Frader-Thompson, CEO of EnergySage. "I spend a lot of time thinking about them, to see what certain tipping points might look like. Water heaters have been a demand response resource for a long time. Now they can be incredibly valuable distributed resources. That shows how close we might be to dramatic technological shifts in parts of the U.S."

David Grant, Senior Vice President of Sales and Marketing for Tendril, was also taken with the solar sponge idea, seeing opportunities for electric vehicles and the need for what he called "incredibly sophisticated software to manage all this."

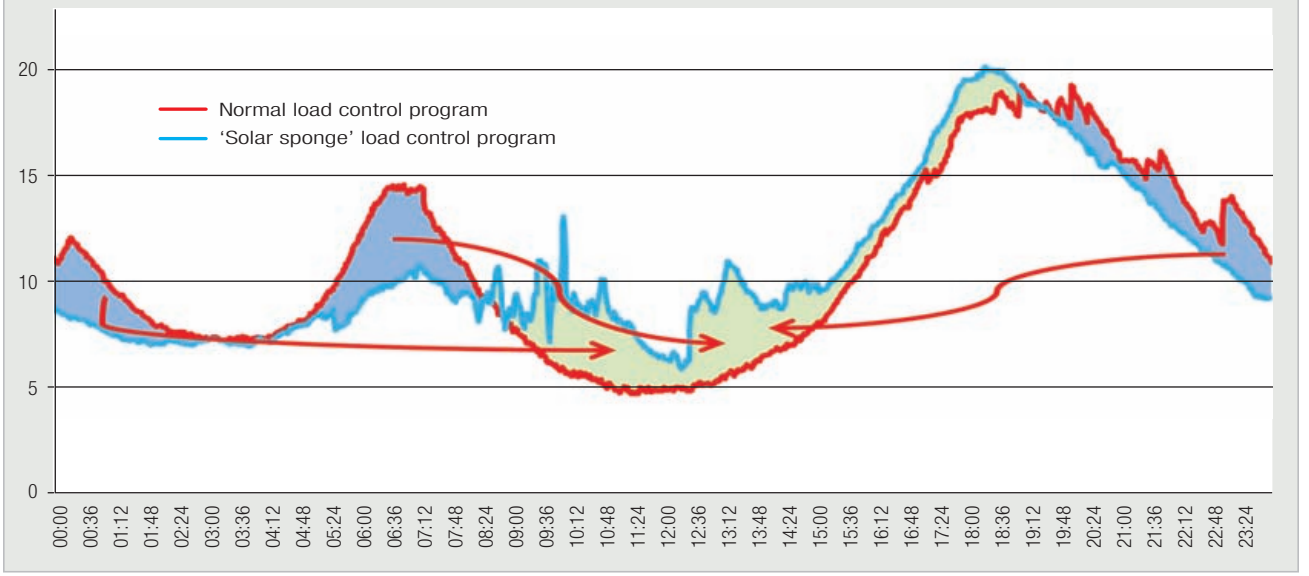
"We look at it as balancing rooftop solar with electric vehicles with hot water heaters," he said. "But you need to do that on a grid basis, as DERs get out there, to have the analytics and the algorithms. It's all coming."

In addition to such solutions, distribution utilities are also revising operating standards to accommodate high penetration of distributed generation. For example, the increase in solar has occasionally pushed operations outside traditional voltage standards.

Despite these anomalies, the utilities have not received any customer complaints. Voltage standards are being reviewed and are likely to be widened, to allow more flexible operating parameters.

The Australian utilities have focused on re-balancing the load, which has lessened the impact on the system. In all, the consensus view among the Australian utility executives we talked with was that the current state of available technology was not a barrier to high penetrations of solar.

Fig. 2 **Solar Sponge Illustrated**



A twenty-five percent solar penetration would require little action, they said, and even up to fifty percent penetration could be handled with traditional technology.

Despite the success of these strategies, the impact of renewables on grid operations remains a topic of debate in Australia. Questions were quickly raised about renewable generation following an extensive blackout in South Australia in September 2016.

The Australian Energy Market Operator has determined the loss of power was due to damage to electrical transmission lines and other infrastructure during a violent storm.

Metering Market Disruption

Somewhat paradoxically, the distribution utilities' can-do approach to integrating distributed solar has not carried over to the regulatory sphere. Specifically, the rollout of advanced metering in Australia has sparked reforms that could soon trigger a radical disruption to the distribution utility business model.

As in the U.S., Australian utilities have historically owned, installed and processed usage data from meters. But in an effort to encourage smart meter deployment, the Australian Energy Market Commission finalized a rule in November 2015 that allows competition in metering and related services.

When the rule goes into effect in December of this year, distribution utilities will have to compete with third parties to retain metering services for their customers.

The metering provisions are part of a larger package, called the "Power of Choice" reforms. They are designed to make Australia's energy networks more efficient and offer customers more choice and control of energy services.

The changes are broadly focused on metering, network pricing, and distributed generation. Corresponding changes in the U.S. market include the introduction of time-of-use rates and the development of industry wide technical standards for distributed technologies.

When the metering regulations were first mentioned, "there was this gasp," recalled Punu. "Until that moment, people in the room had not considered meters that were not controlled by utilities. You could tell there was a pressure point there."

Punu and other U.S. utility executives on the trip questioned their Australian counterparts closely on how the distribution utilities lost out on the metering services issue. Basically, faced with smart, aggressive lobbying by third parties, the Australian utilities took a passive approach to communicating with their customers and regulators.

They did not convincingly lay out the value of the advanced metering services they would provide that would, in turn, justify

Australian Energy Market: A Closer Look

Solar Makes Sense to Consumers

Australia is a ready-made solar market, with mind-boggling natural resources – both in terms of sun and wide open, mostly flat land. The country also combines dense urban centers with high power demand, and remote outback communities where off-grid solar is already taking root. But even taking these factors into account, the speed and extent of the country's solar explosion has been dramatic.

Ten years ago, Australia had slightly more than thirty-five hundred residential and commercial photovoltaic solar systems, most of them small scale, up to a hundred kilowatts. Four years later, in 2011, the country installed more than 360,700 small-scale PV systems in a single year.

By the end of 2015, more than four gigawatts of small-scale solar had been installed across Australia.

See Figure 3 – Annual Installed Small Solar Capacity (MW)

Over ninety percent of that capacity exists on the NEM transmission system, where penetration rates can be staggering. In the state of South Australia for example, twenty-five percent of households have installed solar PV. In some neighborhoods, penetration levels can hit sixty-five percent, according to figures from the Australian Energy Council.

This booming distributed solar market is no anomalous black swan in the energy landscape. It is the result of a convergence of three strong drivers that are by no means unique to Australia: a rapid increase in retail electricity prices, the introduction of generous solar incentives, and a precipitous decline in the installation cost of solar.

Little utility-scale solar being developed here, despite Australia's sun and open spaces.

Retail rates: Australia's rapid increase in retail electricity rates can be traced back to a major increase in investments in the country's transmission and distribution networks from 2009-2011.

See Figure 4 – Retail Electricity Price Index for Australian Capital Cities (Inflation Adjusted)

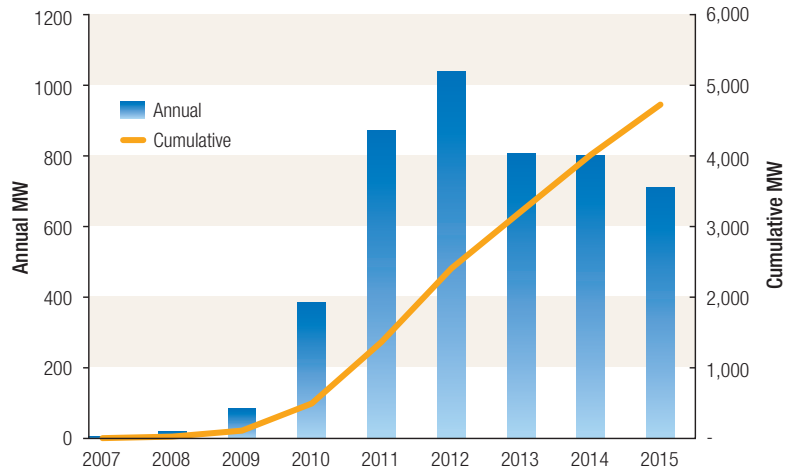
At that time, the industry was responding to the need to update the system and improve reliability, in the face of an expected upturn in peak demand. The global recession also exacerbated rate increases as the cost of capital rose, eventually peaking at ten percent in 2010.

The impact on electricity bills left many consumers stunned – residential electricity prices have increased sharply in recent years, with household electricity prices rising by around fifty percent nationally from 2010 to 2013.

The parallels for U.S. utilities are obvious. The attractive regulated investments and associated earnings growth notwithstanding,

Fig. 3 Annual Installed Small Solar Capacity (MW)

"Small solar" includes up to 100 kW; 2007 includes pre-2007 installations



Source: ScottMadden, Clean Energy Council

the major infrastructure investments required. Nor did they lay out the benefits for customers.

As a consequence, the distribution utilities will be expected to continue operating the distribution grid, but may not have access to real-time meter data if a customer selects a competitor for metering services.

The most memorable example of this shift came one night during dinner on the twenty-fifth floor of a Melbourne high-rise. The conversation among the Australian network operators, Australian energy retailers, and the delegation had moved to "meter contestability." That means the retailer can remove the network operator meter and put their own in.

During the dessert course, we asked the provocative question, "How does this make sense? What is the logic of the retailer having the meter?"

A representative of the energy retailer answered with a sly grin, "It is because the government relations folks at the retailer were better than the government relations at the network operators."

The crowd chuckled.

A delegate said, "But you are going to provide the operational

the steep increase in Australian electricity rates appeared to provide few tangible benefits for consumers.

A regulatory backlash followed, with a rate structure that made alternatives such as rooftop solar competitive. More recently, a decline in network investments and the removal of carbon pricing have tempered electricity prices, without affecting the solar market.

Incentives: The second key driver was the introduction of generous feed-in-tariffs (FITs) during the first years of this decade by state governments interested in reducing carbon emissions. Under these tariffs, utilities were required to buy solar owners' excess power, often at above-market rates. Initial FIT schemes were as high as forty-six cents in U.S. dollars per kilowatt hour, or sixty cents in Australian dollars.

Further, some states offered a gross FIT, providing compensation for all renewable generation rather than limiting compensation to excess electricity provided to the grid.

This approach to market-building has resulted in very little utility-scale solar being developed here, thus far, despite Australia's sun and open spaces. That situation could be changing with some development in large-scale projects now just starting.

FITs also contributed to Australia's higher electricity rates and have created long-term liabilities on the books of some distribution utilities due to the long-term length of their contracts.

The final factor in Australia's solar boom was the nosedive in installation costs.

Installation costs: The final factor in Australia's solar boom was the nosedive in installation costs. While the global decline in panel prices has been a central part of cost declines, the Australian market was also able cut soft costs, including installation, permitting and interconnection. Using standardized installation practices, solar crews in Australia can install two new residential rooftop PV systems per day.

Australian utilities have also simplified the interconnection process. One distribution utility even has a "connect anytime anywhere" policy for small solar systems.

Riding on this trifecta of trends, the cost of rooftop solar has become so low – three to five thousand dollars – Australian customers no longer view solar as a unique or extraordinary investment. More than one U.S. executive was floored by just how inexpensive solar has become here.

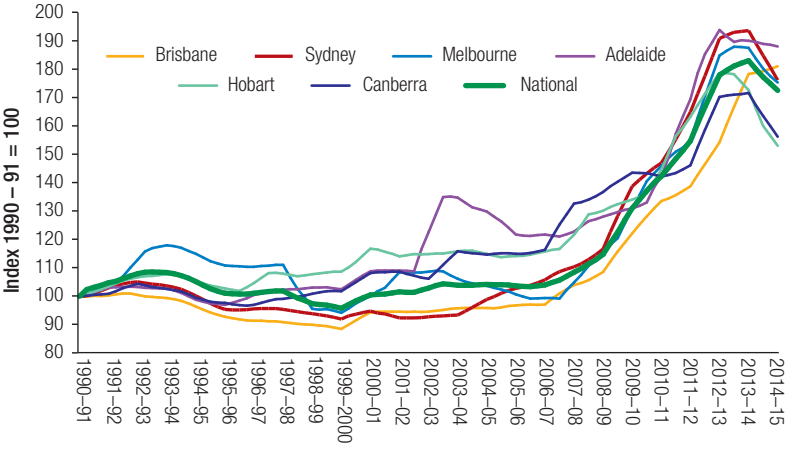
"I absolutely loved putting on the TV and seeing solar ads – 'Get your five-kilowatt system for five thousand dollars,'" Punu said.

"It's so cheap, it becomes a lifestyle decision, a discretionary purchase – like deciding whether you want the navigation system in a new car," said Seth Frader-Thompson, CEO of EnergySage.

"When you look at the U.S., where everyone is so obsessed with payback periods – the dollars and cents – that has an impact. When you have cheap solar, that allows you to make other decisions, for example, to get storage." ●

FIG. 4 RETAIL ELECTRICITY PRICE INDEX FOR AUSTRALIAN CAPITAL CITIES

Note: Consumer price index electricity and gas series, deflated by the consumer price index for all groups.



Source: ABS, Consumer price index, cat. no. 6401.0, various years

data to the network operator, right? How is the operator going to know there is an outage if they don't get a 'last gasp'?"

The network operator asserted, "Oh, they'll give that to us, for sure."

The retailer replied, "Why would we do that? All the data is our data."

The takeaway for David Grant from these "unintended consequences" was just how important it is for utilities to "get into the market and experiment and get hands on. You have to be in constant learning mode, piloting new technology, never underestimating the role of consumers and the unpredictable nature of consumer behavior," he said.

As with previous SEPA fact-finding missions, our immersion in Australia's very dynamic energy transition pushed us to see new possibilities and gain a deeper understanding of the challenges ahead.

The utility of the future and the energy system it operates in will not be a uniquely American creation. Transition can and should be a hybrid force, integrating the best knowledge and most effective strategies from the global marketplace.

(Cont. on page 67)

Building Energy Workforce of the Future

(Cont. from p. 59)

has an impressive program called STEP – Shaping Tomorrow's Energy Professionals – that is designed to develop leadership qualities, transfer company and industry knowledge and help to groom replacements from within the company for employees who are likely to soon retire.

Much time and thought has been put into this curriculum and choice of employee participants from various parts of the company. I can say from personal experience, having presented twice to these groups, that there is a spirit of camaraderie among the participants. Given Santee Cooper's size, these folks might not have gotten to know each other very well but for this program.

Nurturing diversity: Diversity in the workforce is not easy to define. As Lisa Lewis, vice president of people and culture at CPS Energy in San Antonio says, "Being diverse means our workforce reflects the community in which we live and serve, through age, gender, ethnicity, race, education, etc. And it means valuing those differences when it comes to solving problems and getting work done."

> A workforce that reflects its diverse community ensures the utility is more in tune with customers.

A workforce that reflects the diversity of the community ensures that the utility is more in tune with customer needs and preferences.

Many companies also create employee resource groups, which bring together staff with similar backgrounds. "If you create a resource group for military veterans, for example, there's automatically a place where they feel comfortable asking questions or asking for help," says the Center's Ann Randazzo. "Having an organization you can go to where you feel welcome makes a huge difference."

The Omaha Public Power District has five employee resource groups – the Society of Engineers, Young Professionals Group, African American Network, Women's Network and Veterans Group – which help cultivate ideas from all types of employees.

Diversity of thoughts and ideas helps them drive good decision-making and better customer service.

Courtney Polk, chair of the Young Professionals Group, says, "We put together a team to create an innovation initiative, so employees have a voice in new ideas the district goes after. It's been exciting that we've gone from being just a social group to also figuring out how we can be a seat at the table and have a voice."

We in the energy industry need to have a strong voice when tomorrow's workforce makes career choices. We need to show our stuff, and get them energized about the vitally important work we do. Because without electricity, the quality of life for all of us, including the future workers we want to attract, would be radically different – and certainly worse. PUF

Seeking Answers Down Under

(Cont. from p. 39)

Takeaways

Our last day in Australia included an intensive closing session during which we tried to summarize a few key takeaways.

Simply put, high penetrations of solar are not a fundamental threat to grid reliability and security; integration of rooftop solar is a technical problem of the kind utilities are very good at solving, often with tools and programs already to hand.

Utilities, like other sectors of our economy, must focus on supporting innovation and becoming innovators themselves. The emerging grid of the future, by its very nature, will disrupt many givens of the U.S. electric system's hundred-year-old business model, and outcomes will not be predetermined.

Even in traditionally regulated markets, utilities must become more competitive. The term "customer-centric" has become an industry buzzword, easy to use but with no real quantifiable meaning. As utilities' historic regulatory compact comes under increasing pressure in markets around the world, taking our customers for granted is a risk we can ill afford. PUF

In January's *PUF*, Lawrence Jones, EEI's VP – International, said: "I have had the opportunity to sing in many choirs and groups, performed solos before large and small audiences in different countries, including singing a duet with my wife at our wedding. I also directed choirs. I believe that when you sing in or direct a choir, you develop a kind of listening skill that seeks to find harmony. I think having a conversation is like singing with another person. If you can't reach the point of harmony, then you're not communicating." June 12 is Lawrence's birthday. And when our new digital mag *PUF 2.0* debuts.