



## **Global Lecture Series II: How the Grid is Changing and Why You Should Care**

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Trinity University

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A Fireside Chat featuring  
Tanuj Deora (photo right),  
Chief Strategy Officer, Smart  
Electric Power Alliance  
and  
Cris Eugster (left), Chief  
Operating Officer, CPS Energy

*The 41 audience questions on the following pages were submitted over the sli.do app the night of the lecture.*

*EPIcenter CEO Kimberly Britton posed as many of the questions as possible to Mr. Deora and Dr. Eugster on stage during the Q&A portion of the lecture.*

*[The entire lecture, including the Q&A, can be viewed on EPIcenter's YouTube channel.](#)*

***When the time allotted for the program came to an end, audience member Paula Gold-Williams, CEO of CPS Energy, offered to answer these questions from the CPS Energy perspective. These answers are presented here.***



local partners to develop their business-oriented solutions. Another novel example is a concept that is under review and assessment that would create a network of connected energy efficient buildings to manage distributed energy production with thermal and energy storage technologies; this allows us to creatively leverage our existing network of building conduits and communications infrastructure to operate more reliably and effectively through a collective network of systems.

**4. What do you think of time-of-use (“TOU”) rates, such as those employed by PG&E?**

It is extremely important to understand customer impacts of any new pricing structures. The underlying basis for TOU rates are generally rooted in reliability and/or air quality concerns. We are the nation's largest combined electric and natural gas utility and one of the most affordable. Our diversity of energy sources, specifically the location and capacity of our wind and solar energy, ensures we are providing our customers clean energy during both peak and off-peak hours. Having said that, we are always looking to provide our customers more options and we're evaluating TOU as electric vehicle growth ramps up in our area and we develop energy storage options.

**5. What is your take on alternative storage systems like compressed air as opposed to battery tech which relies on rare elements?**

Energy storage will be important to the future of renewable energy, and all forms of storage should be investigated. Battery technology is currently capable of being utilized for multiple use cases and installation locations are less limited as some other technologies at this time. Efficiency is also greater with batteries versus compressed or liquified air systems. Cost and return on investment are also factors to consider. Currently, our partners in energy storage are using batteries, but we always have an eye out on alternative storage systems to provide our customers greater value in everything we do.

**6. To what extent does increased digitalization demand [mean] increased energy use (and increased heat generated by servers)? When is it counter prod? -Adam the Architect**

For consumer products, we are seeing manufacturers using smart- energy design, technology advancements and use of energy-saving devices such as smart thermostats, which is helping to offset an increase in load. As utilities become more digitized, we are seeing the architecture shifts from centralized processing within data centers to a distributed edge computing model, which is actually more energy efficient. Digitized architecture is a low power option and can be more targeted to a specific use; this will reduce excess devices that are not fully utilized and using energy.

**7. Please comment on the tensions that you see between ‘enabling ‘(free markets for distributed generation) and reliability/safety.**

There is a healthy tension and balance between the enabling of distributed generation and maintaining a high level of reliability while also prioritizing safety for our customers, crews, and first responders. With increased innovation in the energy space, we expect and allow for more distributed generation by implementing processes and modeling to ensure no impact to our distribution grid.

**8. Do you have a prediction for which energy storage technology will carry the day?**

Rather than building the next new big generation plant we want to be flexible and think about new technologies and how they work with renewables. We currently do not have a definitive technology solution for energy storage. The *Flexible Path* allows us to utilize our current generation assets while testing new technology solutions for economical and reliability purposes for our future power needs.

**9. Hackers have targeted utility, power grids. How vulnerable is the U.S. to a cyberattack on its critical infrastructure?**

Threat actors continue to increase the frequency and complexity of their attacks on critical infrastructure. Overall, utilities are aware and taking these threats seriously. We know that vulnerabilities can lie in systems and people. In particular, entities like NERC and the American Public Power Association are keeping the cybersecurity conversation and preventive strategies on the front burner at the national level. A never-ending, 24/7/365 vigilant stand is needed to decrease vulnerability risks, and many industry and non-industry entities are working towards that daily goal.

Locally, cybersecurity is strong and still growing in San Antonio with the military's presence and an intense focus among our institutions of higher education, one of which will be building a cybersecurity campus downtown. CPS Energy strategically partners with these create a proactive and resilient cybersecurity web. We take a number of measures to mitigate the risk of cyberattacks that include a layered security approach, audits and consistent training and testing of our systems.

**10. While solar and wind are discussed a lot, what consideration is being included in the short and long-term plans for waste heat to power from industrial sources?**

San Antonio does not have the large industrial loads that can make the economies of scale work for these systems. However, CPS Energy does use combined-cycle gas generation that uses waste heat to make steam and produce electricity from that source.

**11. What is a legitimate reason that a utility today wouldn't wholeheartedly support the consumer choice of distributed power?**

A utility is responsible for the stable and reliable power distribution to every customer in their service territory. If the interconnection of distributed power is not done with planned regulations, processes and procedures, this can pose risk to the power quality and reliability. We have addressed these issues successfully at CPS Energy for our customers because providing them options is among our highest priorities. Currently, we have more than 14,600 residential and commercial customers with distributed generation systems.

**12. What creative solutions or innovations are being talked about in San Antonio currently?**

CPS Energy is investigating new potential products and services, some of which were locally discovered through our C3 (a CPS Energy innovation competition that challenges employees to

develop new methods or products that can benefit our customers), our new energy economy partners and through EPIcenter (an energy innovation hub building capacity for entrepreneurship, innovation, and market expansion). The innovations range from more accurate building efficiency modeling tools, combined solar and storage technology, solar security lights and our grid-scale battery storage project at Southwest Research Institute.

**13. Will you elaborate on some of the energy storage solutions on the horizon that may help to make renewable energy more easily dispatchable?**

CPS Energy is investigating both dispatchable customer owned and grid-scale methods of energy storage. Having the capability to dispatch a network of distributed resources to increase the reliability of the grid, balance short-term congestion, address temporal power quality issues, and positively contribute to our ability to continue to provide affordable power to our customers is a crucial enabler in meeting our future grid demands.

**14. With the expensive havoc wrought by storms, earthquakes, fires, etc. on power poles and lines, why isn't burying power lines more common?**

The cost of underground infrastructure in comparison to overhead infrastructure is considerably higher, not only from an initial installation cost, but also long-term maintenance requirements. We are evaluating alternative design standards to reduce the cost and strategically apply these methods in our service territory.

Conversions from overhead to underground can also be difficult to accomplish because of other existing utilities that may prevent installation of underground infrastructure or challenges with securing easements.

entities, as well as law enforcement and others at the state and federal level, to

**15. What are the prospects for a migration to DC power applications/codes for buildings, particularly in light of the native DC nature of renewables?**

There may be benefits of a hybrid system, AC from the utility (for longer distance transmission) then conversion to building or site specific DC provisioning. It would depend on the proximity of the load to the generation. Most large-scale renewables are usually located long distances from load centers.

**16. What is your view of self-grid that coexists with centralized grid such as CPS?**

It's unlikely there will truly be a self-grid. Even with energy storage, customers will need a backup to the backup especially in cases of prolonged severe weather conditions and other factors. As an example, you can't store the solar energy that you're not receiving if there are extended days of cloudy or rainy weather. The utility grid will continue to be serve as a backbone to providing stable, reliable power to consumers and prosumers for the near future.

**17. What transmission and distribution infrastructure impacts can we anticipate with a decentralized model?**

System modeling, planning and system protection schemes would be impacted with

decentralization. Also, both the transmission and distribution infrastructure need to have the ability to handle dual power flow traffic as power production becomes distributed. CPS Energy continues to provide service options that allow customers to innovate while continuing to find value in the reliable and affordable service we provide.

**18. Have models taken into account consequences of irregular but reoccurring violent volcanic activity blocking solar energy from surface for months/years?**

Having a diverse power fleet can help to mitigate the effect of extreme events. Portfolio diversity is key to affordable and reliable service. CPS Energy learned that lesson during the gas crisis of the 70s and began to diversify shortly thereafter. We are now committed to our *Flexible Path* strategy that ensures diversity while researching and implementing new technologies that make sense for our customers and community.

**19. How important is it to aggregate and measure the collective energy production of DGs within a utility? Is there a potential solution?**

The penetration in terms of percentage of system load that is served by DGs within a utility is very important. It can bring greater challenge to maintain system and network stability. As higher levels of DG penetration begin to impact the power grid, the need for DGs to provide reactive power and improved response to disturbances and faults on the electrical system will become important. From a bulk electric perspective in Texas, the agency that manages our state grid, ERCOT, is working to gain insight into the DG infrastructure across the state. As individual DG systems are installed, the aggregate capacity has the potential to impact the bulk electric system. ERCOT has begun the process to map the DG systems to the transmission models it uses in its daily and planning operations. This mapping is expected to give ERCOT visibility into the DG systems and increase grid reliability.

**20. How can homeowners / communities understand their optimal role on the grid as the grid and renewable energy collection evolves?**

Our objective is to collaborate with customers to advance rules related to distributed generation (DG) activity before reliability challenges to the power grid emerge. This dialogue should seek to identify appropriate standards for interconnected equipment and resources, and provide us with visibility to assure safety and that system planning and load forecasting are sufficient to manage the benefits and risks of large scale DG deployment. In addition, CPS Energy continues to evaluate opportunities for continued expansion of Distributed Energy Resources (DERs) within our customer service area.

**21. How can utilities adapt their business models to help enable the decentralization of the grid?**

There will be multiple stages to this transformation of the utility industry. Today, most utilities are actively engaged in rebating energy efficiency technologies designed to incent new behaviors and to gain knowledge to shape future products and services. More recently, the industry is starting to deploy larger scale pilots in applications where economic viability is favorable. In the future, we anticipate seeing a more general adoption of technology that will interface customer and utility deployed assets to jointly balance the needs of our community in a more

collaborative business model.

**22. We've talked about regulatory challenges. Are there any specific examples of unequivocally "good" public policies that would facilitate innovation?**

Good public policies are typically technology neutral and align public interest with market forces. Instead of creating separate wind, solar, thermal, or a new tech policy, an overarching energy policy, like our *Flexible Path*, which incorporates renewables, storage, thermal and other flexible technologies will allow for the most innovative solutions to the challenges facing the grid. Regulators find that the best policies are created when a problem is posed and the unrestrained market innovates and creates a solution. Once a solution is presented, regulators weigh public good and add safeguards to achieve a balanced policy.

**23. How do we keep the grid safe from enemy attacks to create chaos or do harm? Does smart technology make the grid more or less secure?**

Utilities that focus beyond their enterprise networks and include their operational networks in their security strategies will be able to take advantage of new technologies that help utilities operate the grid. Securing enterprise networks is very different than the approach needed for securing operational networks as the threat actors on the grid are vast and not easily detected. Utilities must adapt their security strategy before bringing smart technologies onto the grid or otherwise face the risk of being compromised and not having any situational awareness. To meet customer expectations, we must continue to focus on this additional security dimension.

**24. How will consumer behaviors dictate the future of energy?**

Customer preferences are driving enormous change in our industry. Customer behaviors such as using more smart technology and applications or adding distributed resources like solar to their homes are driving us to expand our program offerings and rethink the future of the grid.

**25. Does the grid become inherently less secure as distributed generation and democratization become more prevalent?**

Not necessarily. While the architecture of the grid might be different, the same cybersecurity framework is applied to secure the grid.

**26. I'm thinking about investing in solar. What assurance can you provide that rooftop solar will be a good long-term investment financially?**

We can't provide an assurance for any product from a private company. But we find customers are generally pleased with their investment in rooftop solar and seeing paybacks in the 10-15 year range. Our first recorded CPS Energy customer install was in 2007, and that system is still producing.

The most important advice we can give any potential solar customer is to do their research for a solid and reputable solar provider and to be well versed on the product, its cost and any available utility rebates, their energy needs, as well as any installation and maintenance agreements.

**27. Tech primary driver of recent increases in inequalities specifically job displacement. How does energy industry plan to address retraining future workforce?**

The energy sector has been in transition for decades and has a history of evolving workers' skills as technology changes. Given deregulation and market changes, the modernization of infrastructure, and the automation of grid technology, our tools and work continue to change. The people who perform this work are re-skilling and/or changing roles. With about one-third of utility sector employees eligible for retirement across the country, the industry is uniquely positioned to adopt new technology, re-skill current staff and onboard new workers with relevant skills. In the coming years, demand is expected to skyrocket for workers who can review and evaluate data from automated systems, then troubleshoot and repair those systems. The ranks of skilled technicians in the utility workforce will swell with automation in spite of the use of artificial intelligence to manage rote tasks.

**28. What about Microgrids?**

Microgrids are another tool for a targeted approach to provide increased performance levels to critical service locations. They involve the application of newer automation technology applied to traditional infrastructure and distributed energy resources. Although, these new technologies provide benefits to targeted services, they also provide visibility challenges for operational teams such as system operators and utility crews that are tasked to maintain the safe operation and overall integrity of the system.

**29. Is there consumer acceptance or push back from the utility knowing or possibly mandating how much my refrigerator or other appliances get used?**

We are not looking to mandate how much energy appliances use. We are looking to provide usage patterns and data analytics to customers so they can make informed decisions to better manage their use and their bills. Giving customers the power to make cost-effective decisions for their households drives value and brings them greater satisfaction.

**30. How do you deal with the debt to equity ratio when we must shut down coal plants in just a few years in a public company? A private company can just bankrupt it.**

The prudent recovery of asset costs and the repayment of debt associated with these assets are important considerations for utilities. As a municipally owned utility, our credit rating is important to help maintain access to capital and ultimately keep costs lower. Our *Flexible Path* takes these financial impacts into consideration so over time we can maintain affordability for our customers.

**31. What is the potential for car-top solar panels, to recharge batteries and reduce the need to charge from the grid?**

CPS Energy is not currently studying or investigating car-top solar panels as an option. An National Renewable Energy Laboratory (NREL) study found that the system provided minimum gain and that parking lot solar provided greater value. We are moving in the direction of the latter through a public-private partnership that we expect to announce in the near future.

**32. What other types of energy storage are being explored aside from battery storage?**

The main areas of focus today are lithium-based battery storage technologies due to their broad application potential and rapid economic advancements related to the technology in adjacent industries. We are also following the adoption of vehicle-to-grid technology as a potential method of using electric vehicle battery packs in peak-shaving activities. We are also monitoring Flow Battery research for large-scale and extended duration storage capabilities which are not strong characteristics of today's lithium batteries. Another potential opportunity in the research stage includes thermal energy storage, particularly in the advanced building application discussed in question 3 above.

**33. Do you see a future for price driven demand response?**

Yes. In fact, DR already is mostly price-driven. We currently have 200+ MW's of demand response in our portfolio, and the vast majority involves customers reducing load at peak times in response to some type of incentive payment.

**34. How does a utility maximize efficiency while maintaining its revenues?**

Utilities will need to continue to find ways to be more efficient, utilize automation to lower costs, creatively manage its generation and distribution assets and look for new revenue opportunities as the industry evolves.

**35. What are the challenges CPSE is trying to solve using AMI data?**

There are many benefits associated with AMI. One area we are looking at utilizing AMI data to help forecast solar production at the residential level to improve our day ahead load forecast. Other applications are around new creative rates based on time of consumption and improving engineering planning, outage response and advanced automated service restoration.

**36. Coal: high carbon impacts; nuclear generation: long-term radioactive waste. What are the negative impacts of solar and do models address all negative costs?** Decommissioning of solar projects involves recycling and landfilling solar modules, which contain some environmentally sensitive materials. The costs of proper disposal and decommissioning at the end of life are included in project models. As grid generation capacity becomes more carbon neutral, so does the production of solar equipment and therefore solar projects become more carbon friendly as the cycle continues. Land use for a solar site is also a negative impact, as it is not possible to utilize the land for other purposes. This is especially important the closer the facility is to urban centers.

**37. Can renewable energy survive in a world without having any subsidies?**

Yes. Market demand produces supply and drives the economic viability of businesses. That law is true for renewable energy, as well.

**38. Current payback for solar is quoted as being a 10-15 year payback. When will the cost come down to a more reasonable price like say a 5 year payback?**

Solar costs continue to decline. But it's hard to say when, or if, it will reach a 5-year payback. The market will determine when specific payback periods are reached driven by the cost of solar

and the cost of energy from the utility.

**39. Climate change presents serious, immediate challenges. If mitigating it were regarded as a “war”, how would “What are we designing for?” criteria be reordered?**

As a utility, we are exploring the benefits of a consequence-based model of system planning that could transform from designing for an overall, system hardening to use case specific design requirements. This design method will place priority to designs that mitigate the impacts of climate related events and can be area specific. CPS Energy also continues to evaluate reducing carbon emissions in our generation mix.

**40. What are the limits of battery-stored energy at the regional scale? How doesn't this change our day to day use & consumption? Does it improve resiliency?**

At a regional level, the only real "limits" of battery storage would be the transmission system, which is sized to handle the generation connected to it; however, there are times when there is a generation/load mismatch due to high wind production, especially at night when loads are light. This can cause constraints on the transmission system, and sometimes wind generation must be curtailed. Having large-scale storage in place would allow this production curve to be much more predictable; so, during times of high wind production/light loads, storage could be charged up and that energy could then be discharged during light wind/high load times. "Firming" up the capacity of renewables makes them a dispatchable unit.

**41. What is the biggest obstacle to "enabling" the new energy future?**

Utility business models are the biggest obstacle and will have to move to a more flexible model. The faster the business model can change to meet the desires, but more importantly the needs of users, the better. Things like customer costs, how to build and plan the system and pay for it, will have to change. We can't build a system that nobody wants to use and then expect them to pay for it. It will take a collaborative effort with clear communication in the community to shift the business model to align with the community owners.

To ensure that we have the ability to adjust to new energy future, CPS Energy has adopted the ***Flexible Path*** strategy, enabling us to adapt to changing energy conditions.