



QER Public Stakeholder Meeting

Los Angeles

Takeaway Summary

Panel 1

- There is greater focus on natural gas as a fuel to facilitate grid integration for renewables while maintaining baseload services. Currently, the largest gas field west of the Mississippi is out of service. This changes the risk profile for large portions of Southern California.
- Cost reductions in solar energy have led to problems such as illustrated by the Duck Curve. One of the challenges is how to fill up the “belly of the duck.” Time-of-use rates at the retail level, as well as increased electric vehicle charging and other potential technologies, can help address this.

Panel 2

- As we get focused on the customer, all parties--utilities, DER providers, financial service providers, customers, stakeholders, environmental groups, and regulators--need to work together to find a way to operate in a competitive-bid situation to keep the costs as low as we can.
- The speakers were in general agreement that there is very strong interest in renewable energy. Customers are generally willing to pay more for electricity if it's green.

Panel 3

- New power generation and end use technologies are needed for continued greenhouse gas reductions. However the challenge is to seamlessly integrate them into the existing system.
- States need the flexibility to choose the best generation resources to meet Renewable Portfolio Standard (RPS).

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Opening Panel

Barbara Romero, Deputy Mayor for Los Angeles City Services

- LA's Department of Water and Power is the largest municipal utility in the country. It provides electricity to 1.5 million customers.
 - Thanks to the sustainability plan the mayor released over a year ago, we are on track to procure 33% of power from renewables by 2020, and on the way to being 50% renewable by 2030. Will be completely off coal by 2025, and replacing it with renewables and energy efficiency.
 - Every two years, they are upgrading their integrated resources plan.
- We are entering a new era in LA and beyond California where carbon-free energies are becoming the dominant energy form. Local solar installations grew by 20 percent last year alone, in part propelled by streamlining our permitting and interconnection process.
- The QER can help us address how we marry our policy goals with our clean energy and greenhouse gas (GHG) reductions, while meeting customers' energy needs in a cost-effective way.
- Key issues include new questions on the role of the utilities, different resources, different pricing structures, role of the consumer, and the role of companies developing technologies and strategies.

Elizabeth Sherwood-Randall, Deputy Secretary of Energy

- The QER was a result of two reports to the President by his Council of Advisors on Science and Technology. The QER is a White House document. DOE is responsible for technical analysis.
- How the first installment of the QER is informing policy: The focus was on transmission, storage, and distribution infrastructure. It produced 63 recommendations, 14 of which have informed Federal laws.
 - One of the most significant QER-related pieces of legislation relates to the modernization of the Strategic Petroleum Reserve, which is at the end of its design life.
 - All critical infrastructure is heavily dependent on electricity, and infrastructure is aging.
- Second installment is on electricity from generation to end use. Each region has its own electricity ecosystem, and each region has its own approach. We designed seven regional meetings to look at a wide range of models.
 - Developing findings and policy recommendations to guide the modernization of our electric grid, which will ensure continued reliability, safety, security, affordability, and environmental performance through 2040.
- California has a unique energy ecosystem. As a result of strong state and local policies to improve energy efficiency (EE), California has one of the lowest per capital energy usage levels and some of the lowest costs.
 - California has transformed its market with policies like decoupling, targeted renewable goals, storage goals, and efficiency options.
 - Impact of Efficiency Standards: California's innovation in refrigerator standards and clean car laws paved the way for national vehicle fuel efficiency standards. Similarly, California's efficiency standards for battery chargers led DOE to develop similar efficiency standards.
 - The state's recent mandates for utilities to expand storage by 1.3 gigawatts may have national implications for driving down the cost of storage and showing how it can substitute for new transmission and help with smoothing out the duck curve called by variable renewables.
 - California is ahead of the curve in deployment and integration of new generation sources, and your experience can serve as an example for other regions.

- Clean energy innovation is required to meet climate goals. President Obama and other leaders launched Mission Innovation and committed to doubling investments in clean energy R&D over the next five years.
 - It will be an all-of-the-above approach (renewable, fossil fuels, nuclear, and EE).
 - It will include system solutions such as IT management of energy. Innovators, like the LA Clean Tech Incubator, will be creating a range of technologies to help us reduce emissions, grow our economy, and combat effects of climate change. QER 1.2 will help us in part understand how to apply these innovations.
- Framing questions for panelists to consider:
 - How the changing generation mix affects grid operations and planning, reliability, and system requirements including ability to provide affordable electricity.
 - How should we address cyber and physical security concerns?
 - Do market structures allow for adequate investment in grid modernization?
 - Do new technologies create challenges to the increasingly blurry line between Federal and State jurisdiction?
 - What are the implications of increasing consumer connectedness to the grid?

USDA Rural Development Rural Business-Cooperative Service Administrator Sam Rikers

- USDA's Rural Development has an 80-year legacy of rural development, which began as the Rural Electrification Administration (REA).
 - Its mission is to expand member-owned electric coops provide electricity to rural America.
 - REA became the Rural Utility Service: It finances all aspects of the rural energy system and provides high-energy grants for very low-income communities that cannot afford loans.
 - There is a total of \$120 billion invested through REA, now RUS, in rural America's electric system.
 - Current portfolio is \$46 billion in loans, 600 borrowers, and a tiny [0.04%] delinquency rate.
 - The Rural Energy for America Program (REAP) contributes to the vibrancy of small towns in America, investing in businesses to create environments for rural communities to grow.
 - Creates areas for businesses to invest in such as renewables, energy efficiency, and new bio-based product manufacturing facilities.
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Panel 1: Bulk Power Generation and Transmission: How Can We Plan, Build, and Operate the Appropriate Amount for Future Needs?

Panelists

- Dr. Keith Casey, Vice President of Market and Infrastructure Development, California Independent System Operator (CAISO)
- Jan Smutny-Jones, Executive Director, Independent Energy Producers Association
- Marcie Edwards, General Manager, Los Angeles Department of Water and Power
- Rodney Cobos, Assistant Business Manager, Southern California Pipe Trades
- Mike Florio, Commissioner, California Public Utilities Commission

Changing Generation Mix and the Importance of Diversity

- Increasingly Diverse Resource Mix – There has been 16,000 megawatts of new generation added since 2000. This is primarily combined cycle gas turbine technology and it's been very successful and efficient. It's increased the efficiency of the gas fleet in California by 23% and had a significant reduction in GHG emissions from gas facilities in the state. Gas plants need to be modernized and kept available to support the clean energy issue, to help address the duck curve. There also has been significant growth in solar and wind, particularly rooftop solar and there is a policy encouraging 1,325 megawatts of energy storage. A challenge, however, is managing carbon emissions while maintaining reliability and affordability. (Jan Smutny-Jones)
- Balanced Portfolio - Biomass and geothermal are higher cost technologies than the intermittent lower cost technologies that have seen a recent surge in growth. But biomass and geothermal are baseload technologies, and have a potential to displace coal and nuclear power. In addition, they produce local economic benefits. (Jan Smutny-Jones)
- Diversity is critical in maintaining system reliability – California was becoming increasingly gas dependent as a means of reducing coal use. The growth of renewables has created an even greater focus on natural gas as a baseload fuel to facilitate integration of renewables into the grid. This impacts diversity. Currently, the largest gas field west of the Mississippi is out of service. This changes the risk profile for large portions of Southern California. (Marcie Edwards)

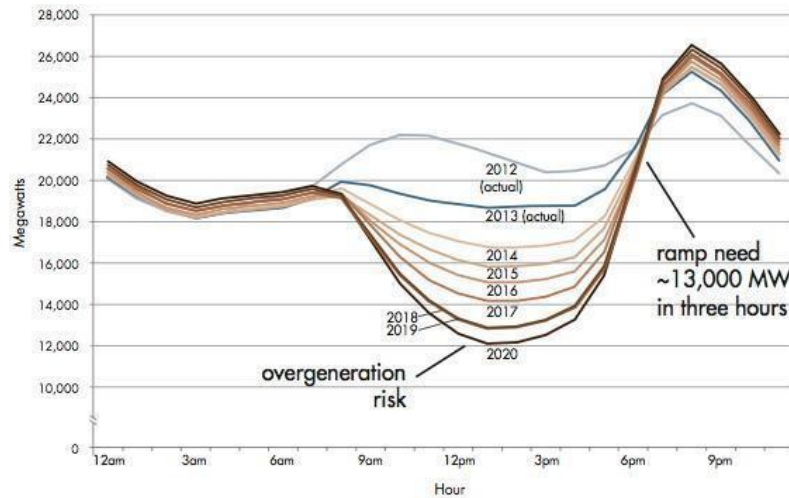
The California Duck Curve

- Revolution in Distributed Energy/Duck Curve - Rooftop solar is being added in communities throughout the state at record levels.

The “Duck Curve” highlights two integration challenges:

- Oversupply challenge – The Duck Curve illustrates the total load on the system, subtracts wind and solar output, and illustrates what is essentially the net load profile which the grid operator must manage against. More PV is being installed between now and 2020. With PV output being concentrated in the middle of the day and ramping down quickly at the end of the day, there will

be a challenge of a daily spike in oversupply. This means that power must be curtailed to keep the system in balance. In many cases this is renewable power.



Source: California ISO

- **Ramping Challenge** - The neck of the “Duck” illustrates the ramping challenge. Solar drops off dramatically at the end of the day which coincides with evening load increases when residential energy use increases. This represents a huge ramping challenge which requires the right resource mix to match the sharp increase in demand over a very short period of time, three hours. (Keith Casey)
- **Intermittent Resources** –There are tools to address the problems illustrated by the Duck Curve with regionalization being one. In addition, the storage mandate is progressing and so far initial results are favorable. The solicitations to date have produced a variety of types of storage at surprisingly low cost. There is also expansion in demand response capabilities, not only the traditional, interruptible load programs, but also into integrating distributed resources into the ISO market, so they are used when and where needed. One of the challenges is how to fill up the “belly of the duck”, which occurs particularly in the springtime. Time-of-use rates at the retail level, as well as increased electric vehicle charging and other potential technologies can help address this. There has been success in developing fast start gas fired resources that can provide flexibility to the system. Investments may be needed to upgrade some of the combined cycle plants that are not running at the high capacity factors originally anticipated. (Mike Florio)

Regional Markets Provide Benefits

- There are various solutions to the “Duck Curve” with one being deeper regional coordination. Currently, California is involved in a regional market, which is proving to be beneficial. Instead of just optimizing the resources on the California ISO footprint, it is co-optimizing, as one system, the resources in both its footprint and the PacifiCorp footprint in the Pacific Northwest. This presents synergies including the ability to mitigate some of the variability in the system by operating it over a larger footprint. Last year it avoided roughly 18,000 megawatt hours of renewable curtailment. In the current quarter, it avoided over 113,000 megawatt hours of renewable energy curtailment, which translates to about 50,000 metric tons of CO₂ savings. (Keith Casey)

- There are extensive resources in the West which can benefit the Western grid regionally. For example, wind energy produced in the Columbia Gorge could be sold in California at a relatively low cost. Solar developers want to export power within the region. A broader regional market will have benefits. (Jan Smutny-Jones)
- There is initial exploration with PacifiCorp on full participation in California ISO. It would essentially become a regional ISO and have the benefit of a day-ahead market and the benefit of a consolidated balancing area. There are 38 balancing areas over the entire Western region, ranging from very small to very large. It creates inefficiencies and seams issues. The benefit of full participation is that it consolidates the balancing area function, allows for management of reserves and resource commitments more efficiently, and consolidates transmission planning and resource planning. (Keith Casey)
- A challenge to regionalization is that each state is different, with different cultures, politics and circumstances regarding their energy sector. For example, California, Oregon and Washington largely embrace the Clean Power Plan and are moving in the same direction. Some Rocky Mountain States are suing to overturn the Clean Power Plan.

Regulations and Policies

- Jurisdictional Issues – There are regulation issues with rooftop solar and other distributed resources. For example, could sales from distributed resources be considered “sale for resale” which could involve Federal jurisdiction? In addition, if owners for rooftop solar who are net energy metering start to become bundled with ancillary services then sold, regulation and jurisdiction becomes further complicated. Also, the state versus Federal jurisdictional boundary and boundaries between distribution and wholesale could become more blurry. These and other jurisdiction issues need to be thought through. (Jan Smutny-Jones)
- State policies helping to promote cleaner energy technologies – Clean energy policies include reducing greenhouse gas emissions to 1990 levels by 2020; the 33% RPS goal; a goal by the Governor to promote 12,000 megawatts of distributed generation; and a ban on the use of once-through cooling in coastal power plants. The latter impacts a little over 12,000 megawatts of gas fired generation, predominantly along the coast, and another 5,000 megawatts of nuclear power. Promotion of renewables is causing a significant reduction in the gas fleet. The Governor also issued an Executive Order to further reduce greenhouse gas levels, a goal of 40% below 1990 levels by 2030. (Keith Casey)
- Flexibility in Federal Policy - Federal involvement should empower local interests. They're one of the best reflections of the specific needs and interests of a particular community. Federal policies can also have unintended consequence. Policies should communicate a clear policy objective without being overly prescriptive. They should include off-ramps or other means to address unexpected circumstances or unintended consequences. (Marcie Edwards)
- Wide Range of Stakeholders Increases Uncertainty in Planning - Planning models, cost allocation models, and utility operation models in California are all subject to shifting financial, regulatory, technological, market, legislative direction. These shifts in direction involve many stakeholders advocating specific policy platforms. Combine this with rapid advances in technology results in a lack of predictability which can lead to an underinvestment in bulk power right when it is needed to maintain stability. (Marcie Edwards)

Importance of Bulk Power

- Importance of Bulk Power - Bulk power facilities act as a hedge. Many are fully depreciated. In addition, due to economies of scale, they help hold down costs to consumers in an era where new, but sometimes more expensive, technologies are being deployed rapidly. Bulk power can help manage the cost-equation. It is the backbone in this country for keeping the lights on. Developing new bulk power facilities can be costly. They also rely on long-term predictable revenue streams in order to gain financing, and there's a notable lack of predictability in the industry at present. (Marcie Edwards)
- Research and Development - More should be done in the area of research and development. Don't select specific technologies, companies, or fields but rather facilitate the development of new technologies through independent institutes. (Marcie Edwards)

Renewables and Job Creation

- Jobs - Growth in renewables is also increasing the number of clean energy jobs in the state. (Rodney Cobos)

Grid Operations and Planning

- Long Term Planning Processes – California has a robust, long-term planning process that involves resource procurement proceedings at the California Public Utilities Commission, and the municipal utilities, as well as a sophisticated transmission-planning process at the California ISO. Those processes have evolved to the point where now all of the processes use a common set of assumptions and a uniform set of planning data. It has served the state well. For example, the retirement of the once-through cooling plants along the coast was anticipated well in advance. Utilities were guided to procure replacement capacity ahead of time and it was quite successful. (Mike Florio)
- Aliso Canyon – This was an unexpected issue that has the potential to cause a significant impact. Until Aliso Canyon can come back online, there are real risks this summer. (Mike Florio)
- Moving toward a world where, instead of the traditional model of supply-following load, load will need to follow supply, because the supply is intermittent. It's abundant at times and nonexistent at others. This can occur through rate setting, moving away from time-sensitive retail rates to rates that are reflective of conditions on the system. (Mike Florio)

Stranded Costs

- Stranded Costs – An area of some concern is there may be growing stranded costs. It is not with older resources that for the most part are well depreciated, but rather it is the early era renewable contracts that were more expensive (i.e. ten to fifteen cents/kwh). These can't compete with current solar and wind prices. It is very easy to start a new procurement entity and get cheap renewables. Who will pay for those more expensive legacy resources that the utilities invested in to get the renewables market moving in its early years? This leads to cost allocation debates at the Public Utilities Commission. It is not unlike the early 1990's when combined cycle gas generation could undercut the prices of the existing resources, which created a push for industry restructuring. In the end, stranded costs don't go away. It's just a matter of who pays them. (Mike Florio)

Q&A

Managing the move to increase distributed energy resources

- With the rapid increase in intermittent generation such as solar a predictable fuel, such as gas, is needed for successful integration. In talking about grid integration services for renewables, it is typically gas plants. The restrictions imposed by Aliso Canyon complicate this. The gap can't be replaced with renewables or energy efficiency or demand response solely. Gas generators are creating other elements that keep the power grid stable. They're providing voltage support and they're providing something called rotating mass. Those two things are very critical to keeping a power grid stabilized.
- Forecasting tools need to be improved to provide better information of what is actually behind the meter.
- There are voltage swings during certain parts of the day and certain times of the year. The question is, who's going to manage that voltage? Is it the transmission operator, the distribution operator, or both?

Workforce

- The development of a well-trained workforce is not moving quickly enough in some areas. In Los Angeles, there is an established Civil Service system. So there is a complex set of exams and processes on how people move upward within an organization. More flexibility is needed. More training is needed. One option being evaluated in conjunction with labor partners, IBEW, Local 18, is the Utility Pre-craft Training Program, where people are trained on the basics. There's probably 1,000 people on the wait list.

Do you have a sense of what this new mix might look like? Do you see a role for DOE in the R&D space for specific technologies or areas?

- Continued R&D investment is very important. For example, new fast-acting gas turbines are being installed in California which come with a clutch. There are only four in the United States. When the clutch is pulled, the unit continues to create elements that support the grid, but it's doing it without using gas. That's the kind of technology that is needed on a more macro scale. Another example is autonomously operated battery systems, control systems, and other computerized systems. There are other technologies that have not even been envisioned yet.

Panel 2: Electricity Distribution and End-Use: How Do We Manage Challenges and Opportunities?

Panelists

- Susan Kennedy, Founder and Chief Executive Officer, Advanced Microgrid Solutions
- Michelle Bertolino, Electric Utility Director, City of Roseville, and President, California Municipal Utilities Association (CMUA)
- Lars Lee-Potreck, Vice President, Product Management and Product Marketing, Energy Management, Smart Grid Solutions & Services, Siemens AG
- Ronald O. (R.O.) Nichols, Senior Vice President for Regulatory Affairs and Nuclear, Southern California Edison
- Michael Yaki, Senior Counsel for Market Expansion and Policy, Renovate America
- David Geier, Vice President, Electric Transmission & System Engineering, San Diego Gas & Electric

Harnessing Innovation and Smart Grid Technology

- Customers are embracing technology. Rooftop solar has become more popular, as have electric vehicles and energy storage. We need to modernize the distribution system and look at new technologies for managing it. Customer education and outreach is very important as our customers make decisions to invest in new technology. (Michelle Bertolino)
- We need better data analytics. We have smart meter data, but we need help to figure out analysis that can be done with that data. To the extent DOE can help disseminate the information of what is working and what's not working, that would be incredibly valuable. (Michelle Bertolino)
- Advanced Microgrid Solutions is a project developer of behind-the-meter-energy-resources. We design our projects for grid support and choose technologies and host customers based on what the utility needs in a particular targeted area of the grid. We procure energy storage systems from leading technology providers and capture economies of scale by procuring energy storage systems in large volumes. (Susan Kennedy)

Importance of Customer Engagement and End Use

- Our focus is all about the consumer. Municipal utilities are responsive to the community's needs through our local regulatory bodies, whether a City Council or a commission or a board. For the consumers, this provides a venue of direct interaction. I speak to customers every week about their concerns, which allows the decisions to be made at a local level. (Michelle Bertolino)

Grid Operations

- The future of the energy business and the consumer-centric model is part of what we call a transactional grid, where the industry needs to collaborate and integrate an increasing level of DERs. (Lars Lee-Potreck)
- These [ITCs] created California's most famous duck. California ISO has between 13,000 and 15,000 MW of renewables with the peak load of 50,000, which is 40% or more of its power coming from renewable

resources. The problem is that most generation happens during the day where the peak demand is in the evening. Energy storage is the most promising technology and the only technology that is able to perform multiple fast, flexible ramping functions in order to meet these challenges. (Susan Kennedy)

- I see a huge shift. We had a utility system predicated on large-scale generation, high voltage transmission, coming to serve customers and then distributing the power. We are on the road to have that actually going in reverse. (Ron Nichols)

On Affordability and Equity

- We are looking for the lowest cost to provide service that is reliable. We do not have a financial incentive to build profit. (Michelle Bertolino)
- As we get focused on the customer, all parties--utilities, DER providers, financial service providers, customers, stakeholders, environmental groups, and regulators--need to work together to find a way to operate in a competitive-bid situation to keep the costs as low as we can. (Ron Nichols)

Cost-Allocation and Rate Design

- We need to look at business model changes and rate structures that best reflect how our customers are using the grid and the electric distribution system in the future. We need fair and equitable rates. (Michelle Bertolino)
- Who pays for storage? Storage doesn't benefit from the ITC and it doesn't benefit from net metering. It is never going to be cost effective to put a battery behind solar at a customer site without subsidies. On the utility side, mandates do not help when you put in storage because it is a very expensive CapEx system. The trick is how utilities can find distribution level benefits from storage. (Susan Kennedy)

Regulations and Policies

- Federal policies should encourage diversity of resources and technology to address distribution system modernization. Federal policies should avoid being overly prescriptive and should not attempt to create winners and losers in technology and resource types. (Michelle Bertolino)
- The investment tax credit is the most impactful measure that has driven growth of distributed resources in the United States. Annular solar installations grew by over 6500% since the ITC was implemented in 2006. The growth is tied to the push and pull of market incentives that have been put in place. The pull side of it is the ITC and net energy metering, and the push side is readable portfolio standards and carbon reduction policies. (Susan Kennedy)
- The goal is not to rely totally on incentives for integrating DERs, even though they have been important to get resources and technologies moving. The idea is not to be selective in picking winners and losers but to get performance oriented to promote reliability, GHG reductions, and growth. (Ron Nichols)
- We are involved in Property Assessment Clean Energy financing, PACE. It is a government form of using tax power to create financing for homeowners who will get 100% financing to buy EE products and repay it through their property tax bill. It is secured by a lien on the property. If PACE is adopted in a community, it enables someone to make an energy efficient decision and finance something that will save energy, save them money, create jobs, and help the environment. It requires cooperation with local

and state government. (Michael Yaki)

Markets

- California ISO is looking at a way to get DERs on the distribution system to replace the wholesale market. The key will be how to meet the price signals necessary at the wholesale level to start displacing them with large-scale renewables we might need and make sure those same resources on the distribution system are providing reliability. (Ron Nichols)

Question: To what extent have you seen customers in the region paying more attention to their electricity consumption? Do you see behavioral changes at the customer level?

- The speakers were in general agreement that there is very strong interest in renewable energy. Folks are generally willing to pay more for electricity if it's green--if it's solar. It is important to have the ability of the company to advise on these issues. Multiple speakers spoke about the need--and challenge--in getting residential customers to view utilities as a trusted energy advisor. People want to make sure they feel good about their decisions.

Question on cyber and physical Security given all the new technologies and systems being placed on the grid:

- The speakers agreed that the cybersecurity challenges increase as you add more services and access points for smaller devices. There is a lot to be learned from the CIP model on the transmission system.
- Mr. Nichols and Mr. Geier agreed that it is important to develop protocols, communication, as well as ways to test systems for their security.
- Mr. Geier and Ms. Bertolino agreed that while cybersecurity and physical security are top priorities, they add cost that vendors of rooftop PV are not going to want to pick up.

Question: With the added cost associated with these new systems and technologies, do you feel that this will change affordability for customers?

- Not everything will go down the path of solar, but all the costs are going to come down as we get to scale and gain more experience and innovation. The important thing is to have broad access from customers and not pick winners and losers. (Ron Nichols)
- Utilities still want batteries, but they are really expensive and it will not be cost effective. Rather than asking for solution in a box, they did not understand how [AMG] could provide storage in a different way.
- Mr. Yaki explained how they leverage private capital to create a closed-loop system using a bonding authority. We can keep things affordable because we can securitize that into what we have now, which is the largest green bond platform in the United States. It is all about how you can competitively finance for people who otherwise would not make the decision to buy the EE product.
- Ms. Bertolino said it is not uncommon to have a \$600 electric bill. We get some complaints, but people are not marching in protest in Sacramento to the Governor's office.

Closing Remarks

- Need to define the ultimate outcome and agree that it is GHG reduction, and then allow states and utilities to chart the best path forward for a financial sustainability standpoint, etc. (Arlen Orchard)
- The single most important tool is tax incentives. If you want storage, then you need incentives. (Susan Kennedy)
- Remember the grid is the backbone of what we do. Affordability is important, but it may not be the most important. Need diverse resources, not picking winners and losers. (Michelle Bertolino)
- We propose to form new markets for DERs to allow investments to come in, but have non-discriminatory access to the grid. Build a competitive landscape, which will contribute to affordability. (Lars Lee Potreck)
- The Federal government can create a level playing field among states and can help expand California to other states. CPP is one way. Federal government can share results with other states. Smart grid program was one way. (Ron Nichols)
- Funding of pilots are key. (David Geier)
- Uncertainty about PACE due to two Federal agencies. Wants help from the government to expand PACE. (Michael Yaki)

Panel 3: Generating and Delivering Electricity to Meet Greenhouse Gas Targets

Panelists

- Susan Kennedy, Founder and Chief Executive Officer, Advanced Microgrid Solutions
- Michelle Bertolino, Electric Utility Director, City of Roseville, and President, California Municipal Utilities Association (CMUA)
- Lars Lee-Potreck, Vice President, Product Management and Product Marketing, Energy Management, Smart Grid Solutions & Services, Siemens AG
- Ronald O. (R.O.) Nichols, Senior Vice President for Regulatory Affairs and Nuclear, Southern California Edison
- Michael Yaki, Senior Counsel for Market Expansion and Policy, Renovate America
- David Geier, Vice President, Electric Transmission & System Engineering, San Diego Gas & Electric

Leveraging Technologies for Reducing GHG Emissions

- Need to expand electrification of vehicles and building stock for greater reductions in GHG emissions. (Arlen Orchard)
- Need more storage to deal with over generation. Cost effective battery storage will allow:
 - Customers to access storage to charge electric vehicles during peak utility hours.
 - Customers to use the storage to better manage their overall peak energy cost or demand charges.
 - Provide customers with a backup during utility outages.
 - Provide SMUD with assistance in reducing overall peak load. (Arlen Orchard)
- The technology to reach GHG targets already exists today. The challenge is in integrating technologies such as distributed generation. (Jana Ganion)

Grid Operations

- Increasing levels of intermittent renewable generation requires more system flexibility to balance both the electric supply and demand. (Melissa Lavinson)

Regulation and Policies

- Investments by utilities to reduce GHG emission have real financial implications to customers. DOE is encouraged to not ignore such costs to consumers and businesses as climate policy is advanced. (Arlen Orchard)
- An emphasis on regional flexibility with local decision-making and accountability, will allow the most appropriate cost effective solutions to emerge based on the diversity of resources and tools available in each region. Federal action should not preempt or complicate existing state or regional emission reduction programs that provide compatible alternatives. (Arlen Orchard)
- Policies are needed to give consumers the ability to choose clean energy sources. (Jana Ganion)

- To achieve policy goals, it will be important for States and Federal agencies to make the permitting process for new generation facilities cost effective and expeditious. (Melissa Lavinson)
- It is important for both State and Federal Government and the private sector to provide the resources necessary to train the workforce of the 21st century. (Melissa Lavinson)
- Moving to performance-based regulation can harness the utility business model to deliver outcomes needed from the electricity system such as resilience, affordability, environmental performance, safety and security. (Sonia Aggarwal)

Valuation and Rate-Making

- Wholesale markets must appropriately value flexibility and create a level playing field for all resources to provide the ability to adjust supply and demand resources up and down, ramping in real time to keep the electric system in balance at least cost. (Sonia Aggarwal)
- Customer-facing rates need to be aligned with the pursuit of technologies and services that lower cost for everyone. (Sonia Aggarwal)

California customers desire carbon reduction technologies potentially even if there is increased cost associated with that. Is this true for all customers for industrial and commercial customers and agricultural customers as well as residential customers?

- There has been a lot of interest in green pricing programs and an uptick in interest from businesses because their customers expect them to have a more sustainable business practice. But there are a lot of customers who are very concerned first and foremost about the lowest cost. (Arlen Orchard)
- It's difficult to generalize across all customer classes and customer types. That said, focus groups have shown a willingness to pay more to get a cleaner product. But at the end of the day, customers still are very price sensitive with regard to both electricity and natural gas. (Melissa Lavinson)
- Because of energy efficiency, rates on average in California may be higher than elsewhere, but bills tend to be below the national average. (Melissa Lavinson)
- Businesses and residents want the ability to choose a greener mix, but there is still pricing sensitivity. (Jana Ganion)

Consider and then expand on where you see R&D or policy innovations and any support needs you might have in those spaces as it relates to GHG reductions?

- The merger of innovation of energy technologies with information technologies has enabled more automated and a more digitized system to facilitate de-carbonization. (Melissa Lavinson)
- For innovations to take root the following will need to be further considered:
 - The utility business model
 - Utility and community partnerships.
 - Which customers want more control of their energy future vs which customers just want energy when they need it? (Melissa Lavinson)

- Cooperative Research and Development Agreements between private companies and often National Labs to test out some new technologies are really important tools and making them as easy to enter into as possible and with as many protections as are feasible, can really help move technologies through the labs and out into the field. (Sonia Aggarwal)
- Utilities are currently challenged in managing the IT platforms required to optimize distributed energy resources. (Arlen Orchard)
- Deployment and demonstration of technology provide valuable lessons that either lead to replication or into a more knowledgeable direction. (Jana Ganion)

Talk a little bit about whether you see meeting greenhouse gas targets and being able to do that. Is the focus more on generation, energy efficiency, or a combination of the two?

- A little bit of everything, but energy efficiency is the cheapest option. (Arlen Orchard)
- Bringing the existing housing and building stock up to the current Title 24 standard would have a large impact on reducing greenhouse gases. (Arlen Orchard)
- Current innovation on the demand side needs to be integrated into the system. (Melissa Lavinson)
- On the supply side utilities and states need the flexibility to optimize the generation sources needed to meet renewable portfolio standards. (Melissa Lavinson)

Closing Remarks

- Define what the ultimate outcome is and if that is greenhouse gas reduction, then provide the flexibility and the framework to allow states or utilities to chart the best path forward which provides financial stability and meets the needs of the consumer. (Arlen Orchard)
- Many of the technologies needed are available today but need to be effectively integrated. This is more of a systems challenge than a technology challenge. (Melissa Lavinson)
- DOE could assist in the following:
 - Research in IT platforms for integrating new resources and technologies.
 - Thinking about ways to demonstrate policies and programs and integration through institutions that have large systems that can test new innovative policies and technologies. (Sonia Aggarwal)

Public Comments

Will McLinn, Kumeyaay Tribe, Federally recognized tribe in East San Diego County

- Offered a couple of recommendations for the QER:
 - Cited DOE Indian report on developing clean energy projects on tribal lands, which found that 2% of land contains an estimated 5% of renewable energy, yet there has only been one significant commercial wind project on Indian lands.
 - There are 25 tribal renewable energy projects that could be completed within 5 years and could produce 2200 MW of power, but federal agencies that are stewards of federal public lands, specifically U.S. Forest Service and U.S. Wildlife Service, must reform their policies on renewable energy projects if U.S. is to adapt to climate change and GHG reduction targets.
 - U.S. Forest Service and NREL established a partnership for determining which national forest units and grassland units that have the greatest potential for private sector development of wind energy and solar energy resources. They found 169,000 MW of potential for CSP, solar sites, 429,000 MW for PV, and 171,000 MW for wind class 4 or better.
 - The current production total on national Forest Service units is zero.
 - Current megawatts in production is 12,000 MW.
 - Public land policies matters to tribes because most tribal lines dependent on transmission infrastructure connecting the project to the grid, which allows the project the ability to achieve the scale necessary that makes it financeable and financeable.
 - Permitting projects make renewable projects unfinanceable and unbankable. For instance, the permit does not grant exclusivity. A developer can spend many years collecting and analyzing data for the project, but they must hand over proprietary data to the Forest Service, which then makes the permit a competitive bid to any number of developers.
 - Our written remarks include a number of solutions on the Forest Service and Fish and Wildlife Service on its eagle permit. In addition to the standard on disturbing eagles, there is a regional impact regarding a standard that is too high for meeting Federal and State Energy Policy Standards.

Steve Zaretti, Brookfield, Renewable Energy Group

- Encourage considering on a national basis the role of hydropower and where this resource can be better leveraged and valued.
- Hydro is valuable among renewable resources—shaping intermittent resources—can be paired to create a baseload renewable energy product. Existing hydro can help reduce costs and limiting overbuild of renewables and eliminate overreliance on gas.
- Encourages QER process to include recommendations:
 - Define renewable energy to include existing hydro
 - Promote the use of hydro to pair intermittent resources
 - Affirm market value as an existing resource.
 - Established contracting mechanisms that align with the benefits and lifecycle and the asset
 - Ensure role for existing and new hydro resources in achieving of energy and climate goals.

Dave Bryant, Director of Technology at CTC Global Corporation

- Following Western energy crisis of 2000 and the major east coast blackout of 2003 that was caused by excessive conductor sag, my company developed the high-capacity, low-sag overhead conductor to double the capacity of existing transmission lines without the need to replace existing structures.
- Our initial goal was to increase line capacity, improve reliability mitigate congestion costs, and open existing corridors to cleaner generation, we--and more than 150 utilities--realized the technology could also be used to improve grid efficiency. EE is the least expensive way to reach our energy and environmental objectives.
- Higher-quality aluminum of the high-performance ACCC conductor serves to reduce line losses by as much as 40%. Can reduce fuel consumption and associated emissions, and can improve viability of renewable generation resources.
- To ignore the importance of transmission line efficiency is to turn our backs to the least expensive ways to reach our clean energy policies and environmental mandates.
- Please take a look at this, and I commend you to using the second installment to underscore the critical electrical infrastructure in meeting our policy goals. I believe this report should highlight the benefits of high-performance transmission conductors like ACCC with the aim to promote their broad deployment.