

**Quadrennial Energy Review
Second Installment
Electricity: Generation to End Use
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**Panel 2
Electricity Distribution and End Use: How Do We Manage Challenges and Opportunities?**

Southern California Edison (SCE) appreciates the opportunity to participate in the US Department of Energy's discussions today on the topic of "Electricity Distribution and End-Use: How Do We Manage Challenges and Opportunities?" The Distribution System and the growing role of distributed energy resources (DER) is the focus of the future for Southern California Edison as we plan for the needs of our 5 million customers and population of nearly 15 million people in our 50,000 square mile service territory. Today I would like to address, at a high level, the scope, pace, opportunities and challenges of the expected evolution of an electric utility system with high levels of DER penetration.

Key Drivers of Distribution Changes

The key drivers to this focus on the distribution system are advancing DER technologies with decreasing costs, customer desire for more choices in how they meet their energy needs, and the need to further reduce greenhouse gas (GHG) emissions. The initial driver to the expansion of DERs has been customer-installed solar. SCE has worked with over 130,000 customers to connect their solar to the distribution system and over 5,000 customers per month are adding to those numbers.

Battery storage is fast on the heels of private solar adoption. While costs still need to come down to achieve wide-scale penetration, reductions in cost are expected. SCE has been a leader in energy storage expansion both at customer locations behind the meter and at "in front of the meter" installations on our distribution system. SCE awarded contracts over 260 megawatts of battery and thermal storage in a competitive solicitation with 160 MW of that total in behind the meter applications at customer locations. This is the largest competitively bid energy storage program in North America, if not the world.

Electric vehicle (EV) charging is an important part of the suite of DER. With the major expansion of large scale renewable energy, private customer solar, and continued growth of energy efficiency, the transportation sector in California produces more than twice the GHG emissions of the electric generation sector. If we are to achieve the state goal of 80% below 1990 levels of carbon emissions, California will

need to make bold and ever increasing conversions to emission-free vehicles. EV charging is also a strategic load to use renewable energy to charge EVs as our combined wholesale renewable energy resources and private customer-installed solar supply increases to create periods where there is excess energy above otherwise traditional customer electric needs. Dynamic pricing and real-time customer communication methods will create further value for EVs in this manner.

SCE has been a leader in EV charging through our Charge Ready program approved by the California Public Utilities Commission (CPUC) earlier this year. Charge Ready provides the electric infrastructure up to the EV charger at businesses, public facilities, multi-family residences and other long-dwell locations, as well as a rebate to help customers select and purchase EV chargers at significantly reduced costs. This program is expected to accelerate EV adoption with its associated GHG reductions.

California will continue to expand its already strong energy efficiency achievements as the state's utilities implement measures to meet the 2015 state Senate Bill 350 provisions for undertaking a 50% improvement to existing energy efficiency in California. In addition to efficiency, demand response programs will continue to expand as a measure to reduce peak power requirements, as yet another distributed resource method to reduce the need for incremental large scale generation.

The Challenge of Optimizing DER Integration

Individually, all of these technology advances and policy adoptions continue an important path to carbon emission reductions in California while providing utility customers with choice in meeting their energy needs. One of the challenges is the optimal integration of these many distributed resources on the utility distribution system in a manner that fosters accelerated DER penetration to not only provide choices and value for the customers who select DER adoption, but also provides long-term cost and reliability benefits for all customers. The CPUC proceedings for Distribution Resources Plans and Integrated Distributed Energy Resources (DRP and IDER), create such an opportunity if implemented properly. These proceedings contemplate a regulatory structure and market for DER that recognizes the value of energy, GHG reductions and distribution system services such as voltage control and contribution to reliability, in some circumstances enabling deferral of traditional utility distribution infrastructure additions. Proper planning and competitive sourcing of DER for such purposes will be important to create the best opportunities for all customers.

The California Independent System Operator (CAISO) has "jump-started" the DER market at the wholesale level with its recent Distributed Energy Resources Program (DERP) filing at the Federal Energy Regulatory Commission. This program will create a market at the wholesale level for energy for DER installed at the distribution level to the extent it can offset the need for wholesale power supply. The DERP is expected to provide wholesale power market value as another revenue stream to financially support DER penetration. SCE is supportive of this concept provided there is coordination of wholesale market signals for operation of DER and distribution system needs for DER performance to provide distribution circuit reliability. The details will be important. The CPUC and CAISO will need to work together to achieve the proper regulatory structure and utilities will need input to the operational protocols.

The CPUC DER proceedings propose a set of demonstration pilots to prove the performance of DER and associated DER markets to support them. SCE and the other two investor-owned utilities are developing additional ideas for demonstration pilots to enable DER and supporting markets to evolve to the benefit of all customers prior to development of final regulations, markets and operational protocols.

Fundamental Shift to a Distribution-Centric Utility Model

All of these technology advances, market developments and regulatory changes portend a sea change for the electric utility sector. For well over a century, the electric utility system has centered around large scale generation and an expanding high voltage transmission system to meet the electric load needs of customers on the electric utility distribution systems. At SCE, we believe the evolution of DER will result in a fundamental change where the high penetration of DER on the distribution system will be the center of the utility system, supported as needed by the large-scale wholesale generation and high-voltage transmission system- a reversal of the way the system is planned today. The timeline for this change is not perfectly clear, and many details need to be worked out, but the direction seems inevitable.

Modernizing and Reinforcing the Distribution System

The modernization and reinforcement of the distribution grid to enable DER to benefit customers on all circuits and at wide ranges of economic means will be a cornerstone of this sea change. This will require proper planning and investment in the distribution system to enable wide-spread DER penetration. Absent some completely unknown future technology, the distribution system will continue to be key to enabling DER penetration while providing reliable, clean and affordable service to all customers. Electric utilities, customers, third party DER equipment and service providers, regulators and financial service providers will need to work together to implement this major change to benefit all electric customers, as we reduce carbon emissions and provide customers with more options in meeting their energy requirements.