Distribution or Retail Electricity Markets

OVERVIEW

Wholesale market participation contributes to and is in response to system (overall grid) needs which at times might not align with local needs of the distribution system. Furthermore, process of qualifying for CAISO market participation is complicated, time-consuming and has financial risks associated with it. As the penetration of DERs increases, the grid will experience a paradigm shift from a more centralized generation to a distributed one, in which load and generation are located close to one another and some resources are owned by the customer and located behind the meter.

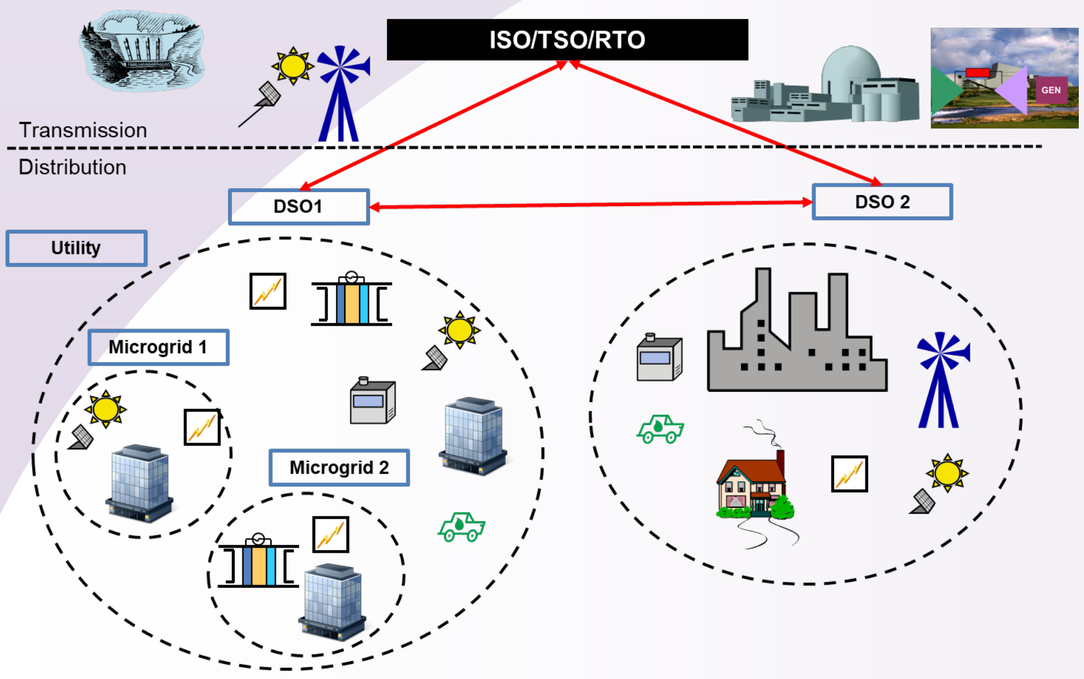
With increased DER penetration, ISO requires more distribution grid real-time visibility, forecasting of DER impacts at the transmission interface, and coordination between the ISO, utility, and DER aggregators in order to ensure a reliable and economic grid. With this added complexity, there has been renewed interest in distribution markets and concept of Distribution System Operator or DSO, as well as retail electricity markets.

GOALS

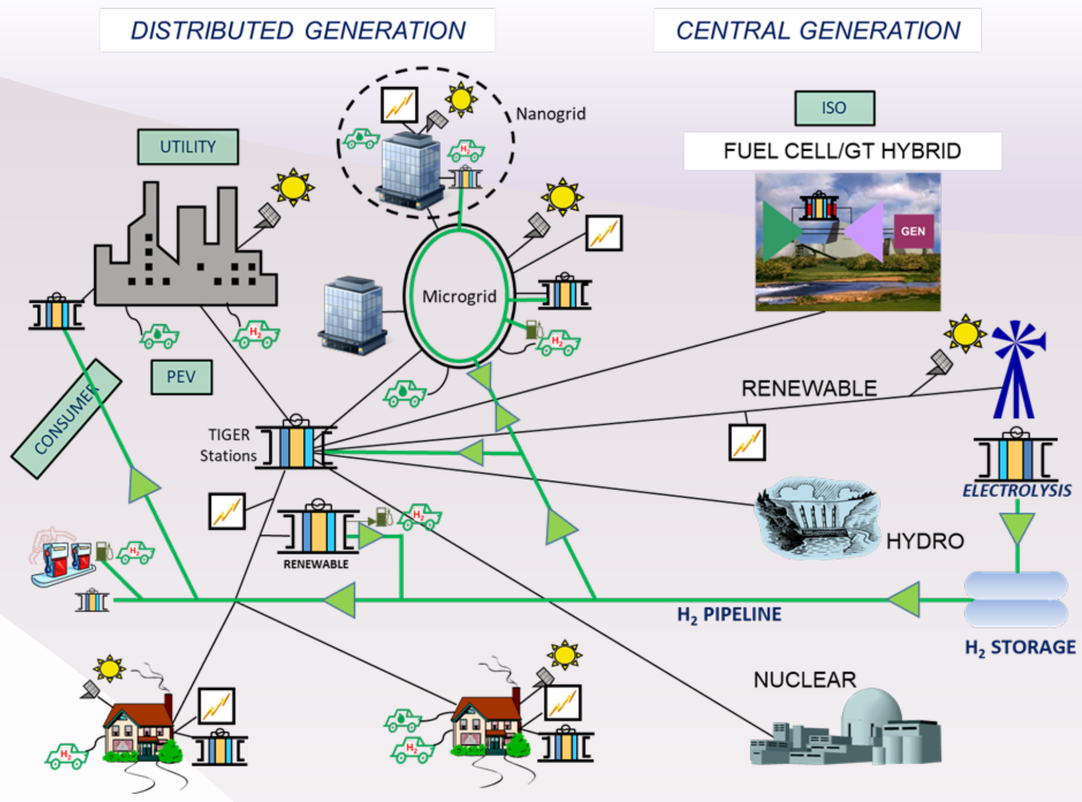
- Assess various DER market participation opportunities
- Determine if retail market participation benefits the customers
- Assess DSO-TSO designs

RESULTS

To facilitate participation of DERs in the market, one option is to basically expand the ISO to include the distribution system and its resources. In addition to requiring a complete model of the distribution system, this approach requires real-time monitoring of all DERs by the ISO, as well as communication and telemetry. Another option is to set up a market in the distribution system which is similar to the ISO wholesale market. This market will be run and operated by the DSO and DERs will have the option to participate in this market. In addition to T-D interface reliability, energy transaction at the T-D interface will be the responsibility of the DSO as well as scheduling and dispatch of resources in the distribution system.



Distribution Market (Total or Full DSO)

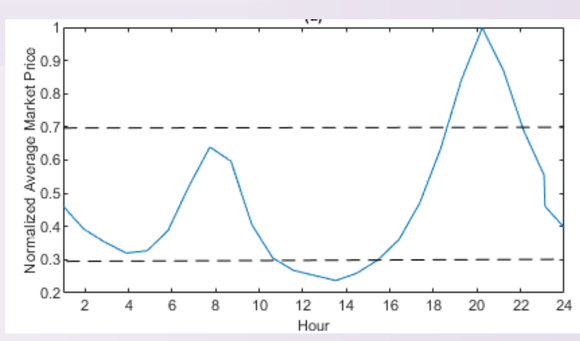


Future smart grid

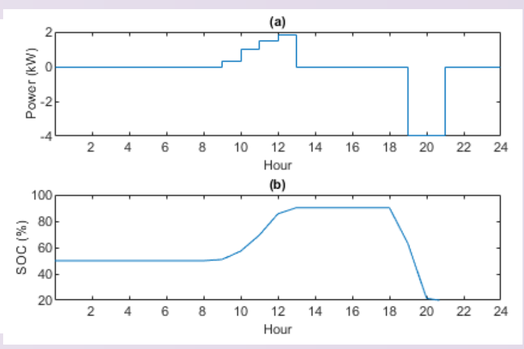
RESULTS (continued)

Cost/benefit analysis performed in this project showed that overall market participation increases the benefit to cost ratio of DERs making them more attractive to investors. The extent of the benefits and most lucrative markets for DERs depends on the size of the resource, its location, and its ownership.

Direct participation of retail customers is referred to as retail market. It is widely believed that participation of retail customers in the market will result in flexibility of the demand side. Results indicate that a particular customer (with PV, battery, and PEV) can benefit from retail market participation which has the potential to reduce energy costs by 61%. However, this requires the customers to invest in DERs including PV and battery with relatively high capital costs as well a home energy management system to operate the DERs and optimize the market participation, and smart appliances capable of demand response. Retail markets also benefit the grid by providing demand flexibility.



Retail price signal



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G. Razeghi, J.J. Lee, S. Samuelsen (2019). Station Automation and Optimization of Distribution Circuit Operations. Final Report to CEC

PERSONNEL

Graduate Students: Jennifer Lee
Staff: Ghazal Razeghi
Principal Investigator: Scott Samuelsen

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