

Demand Response at the Grid Edge

An Update on Wholesale Market Prospects

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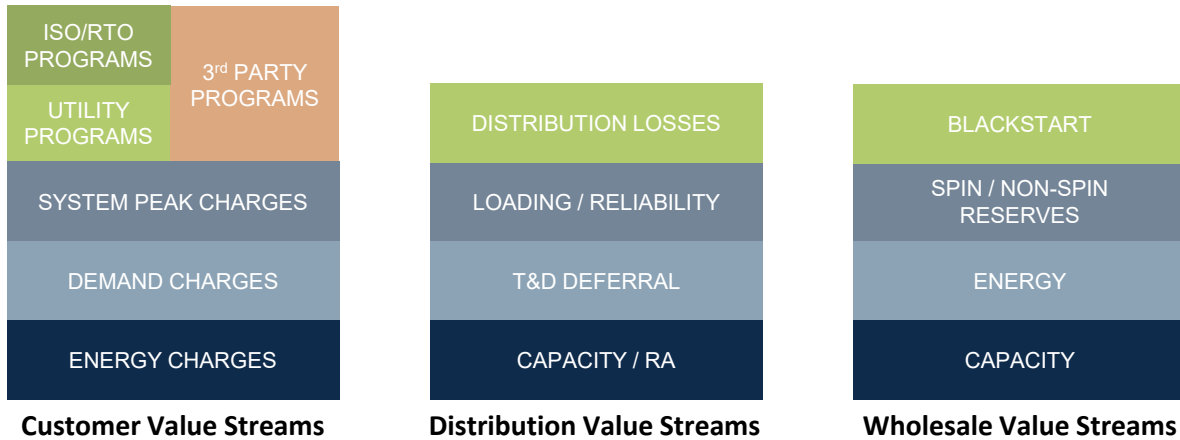
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HIGHLIGHTS

Our latest report, **The Impact of**

Dispatchable Demand Response Can Provide Value Across All Levels of the Grid

Representative Value Streams for Demand Response



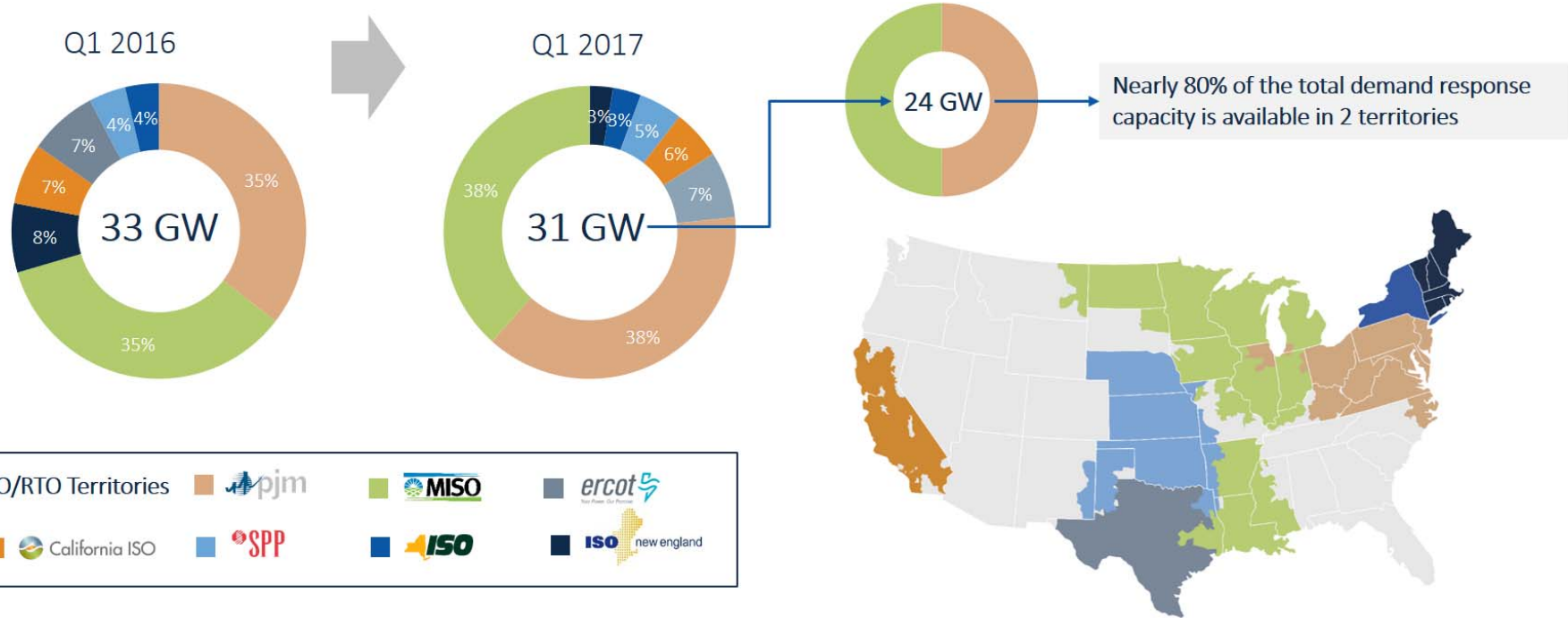
Value Drivers

- Retail electricity prices
- Retail demand charges
- Demand growth
- Wholesale capacity prices
- Wholesale energy prices
- Wholesale ancillary services prices
- Reformed markets for wholesale-level value streams
- Emerging markets for distribution-level value streams

Source: GTM Research

Note: Value streams may not be readily accessible due to regulations and traditional business processes.

Demand Response Availability in ISO/RTO Territories*



Source: GTM Research U.S. Wholesale DER Aggregation

*Estimated Results

Resource Procurement

FERC Approves CAISO's Revisions to Open Access Transmission Tariff

DR procurement through the Demand Response Auction Mechanism (DRAM)

Electric Storage Participation in Markets Operated by ISOs/RTOs

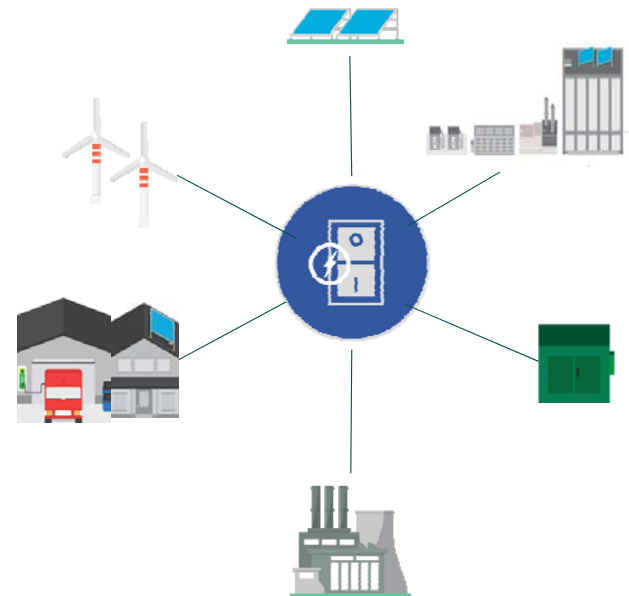
Resource Availability

FERC Order 745 is Upheld by the Supreme Court

Expiration of RICE generator participation in emergency DR programs

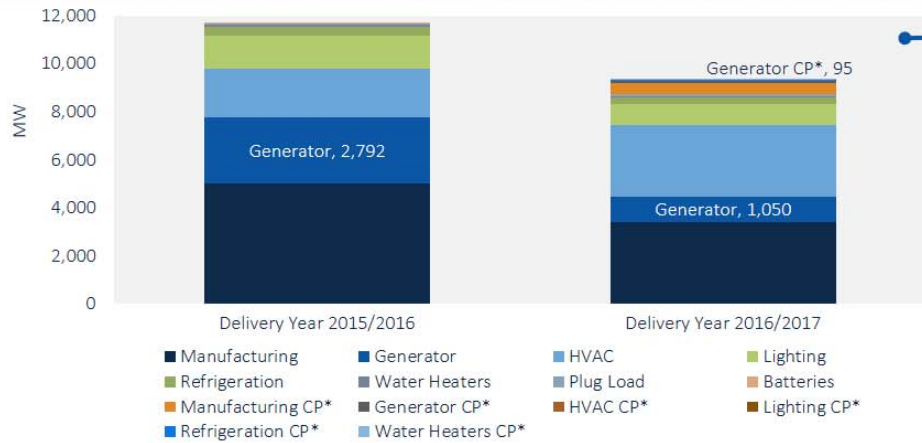
Starting in 2018 fossil fuel back-up generators for DR are prohibited in California

Aggregation for Innovation in Market—Based Deployments of DERs

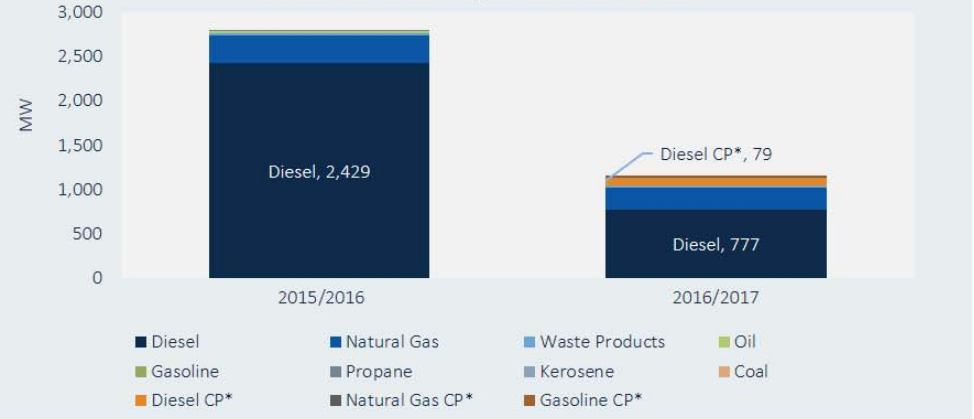


Estimated Changes in DR Resource Mix Resulting from BTMG

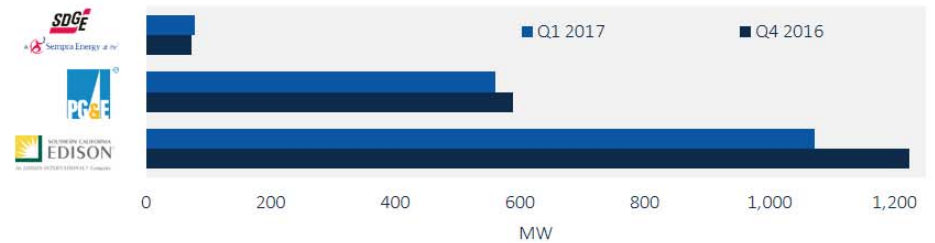
pjm Estimated Load Management Customer Load Reduction Methods



Estimated Load Management BTMG Fuel Mix



Estimated Change in Capacity Available by the California IOUs Starting Q1 2017



Prohibition of specific BTM technologies to provide DR, effective 1/1/2018¹

Distributed generation technologies using diesel, natural gas, gasoline, propane, or liquefied petroleum gas, in CHP or non-CHP configuration.

Source: PJM, GTM Research U.S. Wholesale DER Aggregation *CP: Capacity Performance ¹Decision 16-09-056,

Bringing the Grid Edge to Wholesale Markets: California's DRAM Participants



Source: CPUC, SCE, PGE, SDGE





Distribution-Connected DER Aggregation Providers' Market Participation



Revisions to Open Access Transmission Tariff Approved by FERC Effective June 3, 2016¹

The approved tariff revisions enable the participation of aggregations of distribution-connected resources within CAISO's balancing authority area to form aggregations of 0.5 MW or more for participation in energy and ancillary services markets. In line with the tariff revisions, the CAISO has to recognize distributed energy resource providers (DERPs) as market participants "similar to participating generators."

As of late 2016 the following entities have executed agreements with the CAISO to become DERPs:

DERP	Aggregations proposed for approval	Commercial operation of DER aggregation(s)
	Two aggregations within PG&E territory.	Q1 2017
	In discussions with several entities seeking to aggregate renewables and small-scale storage.	Unknown
 <small>A Sempra Energy company</small>	Envisions its aggregation would involve energy storage systems across five separate sites in the northern, northeastern, and central portions of its service territory.	2018
	Looking for storage and EV assets.	Unknown

Source: FERC, CAISO ¹Docket No. ER16-1085-000 ²Docket No. ER16-1085

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