



The “Other” DER

Opportunities for natural gas growth in US distributed generation

2017 Electric/Gas Partnership
February 8, 2017

Enovation Partners and Cleantech Group

Launched in July 2013. Investors including Gas Technology Institute and West River Group (LPs include Kaiser Foundation, Tudor Investments, 2σ)

Focused on driving innovation to resources and infrastructure sectors

Advisory services delivery model

- Differentiated market insight, strategy, deal origination
- Experienced team, senior industry relationships
- Deep sector knowledge
- Rapid value capture
- Fees aligned with value creation

Acquired **Cleantech Group** in Jan. '16 to serve corporate, investor communities

- Cleantech Forum, Roundtables
- I3 – online cleantech networking platform
- Proprietary, in-depth market insight and analysis



EP named one of "7 to Watch" in Feb '16 issue

EP's capabilities and innovative model featured in Aug '15 cover story



We're very active in natural gas and DER

Natural Gas

- LNG value chain market entry strategy and investment support
- LDC corporate strategy – M&A, virtual pipeline, DER
- Midstream – building a growth platform to benefit from price dislocation
- LNG for transport and electric generation – project development and M&A
- Risk-based analytics for gas pipeline inspection

Distributed Generation

- DER “heatmap” for utilities and energy retailers
- Post-DER business model for wires utility – multiple efforts
- DR – growth strategy under new regs
- DER – growth strategy for gas LDCs
- Storage/PV development plan for IPP portfolio

Other Green Energy

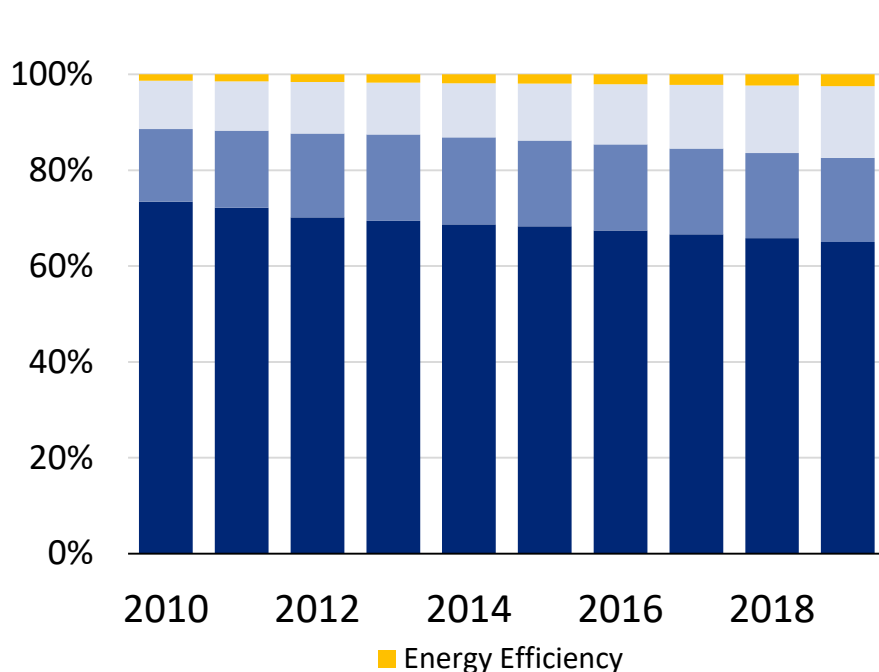
- Energy storage project assessments – multiple efforts
- Energy storage – Lazard LCOS cost survey
- Energy technology commercialization, turnaround, refinancing
- EV – turnaround for leading player, V2G strategy, growth strategy
- EV charging & battery storage market assessment and business plan

Growth Strategy

- Energy services and retail growth strategies – multiple efforts
- Utility M&A – multiple efforts
- Non-reg growth IOU – standing up a new venture equity group
- Energy technology/service venture investing at the utility holding company level

DER is playing a growing role in US electricity supply...

Share of “customer wallet” – one client’s view



CAGR %
(2015-19)

10.6

10.4

3.6

3.0

Observations

Demand erosion for central station generation over time...

- DER gains share of additions over next decade (~50% to ~90%)
- Absolute growth in DER over 9%
- Diesel and gas reciprocating engines are dominant forms; Solar PV grows from 5% to 20%

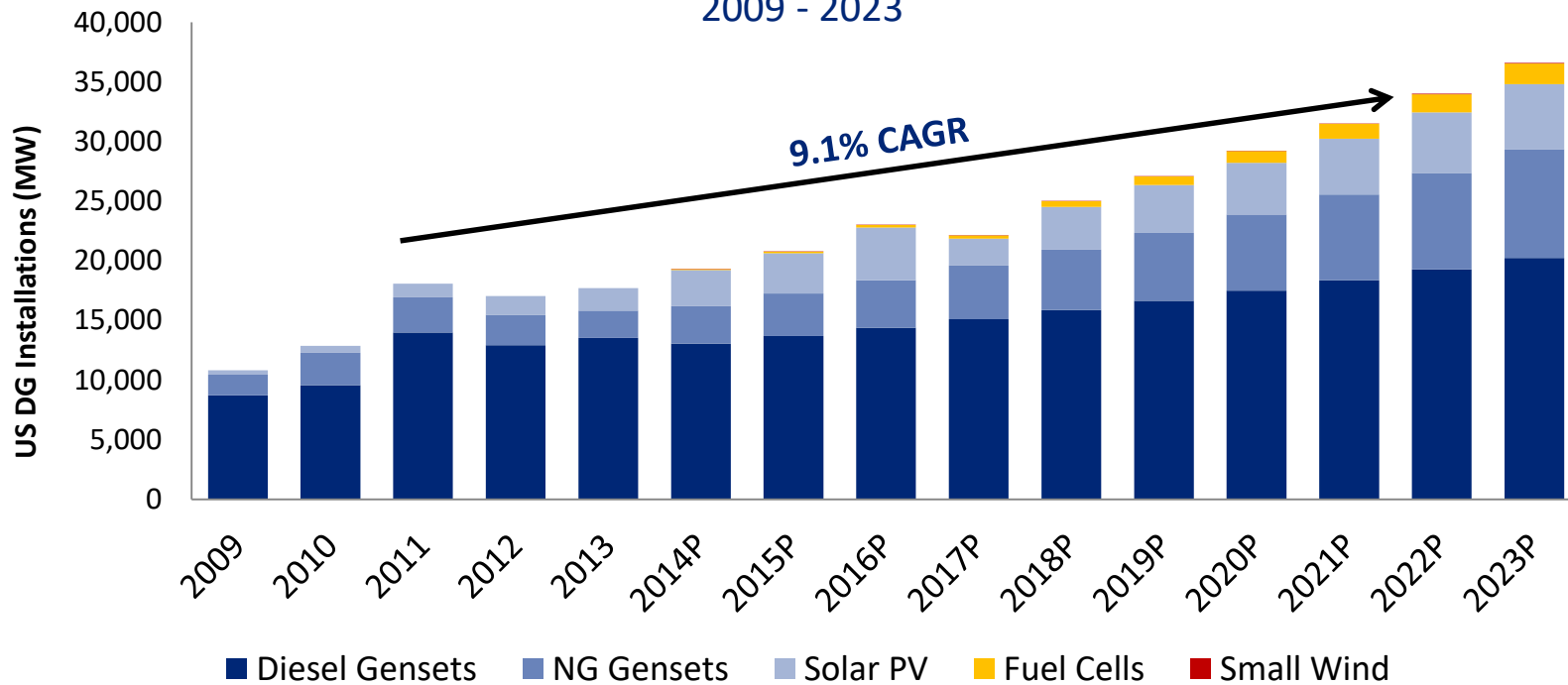
Increasing dis-intermediation of customers from utilities

- Reduced demand
- Aggressive non-utility players offering an array of behind the meter products and services
- ...but opportunity for utility investment and creating stickier customers by bundling a new array of products and services that address reliability, power quality, environmental footprint and cyber security
- New business models to drive growth

Distributed Generation includes: Boiler / steam turbines, Combined cycle, Combustion turbines, fuel cells, NG gensets, microturbines, solar PV, storage and NG reciprocating engines
Source: EIA, KEMA, SEIA, Lawrence Berkeley National Lab, NETL, Lazard, ICF, EGSA, EP analysis

... and is not just – or even primarily – about PV

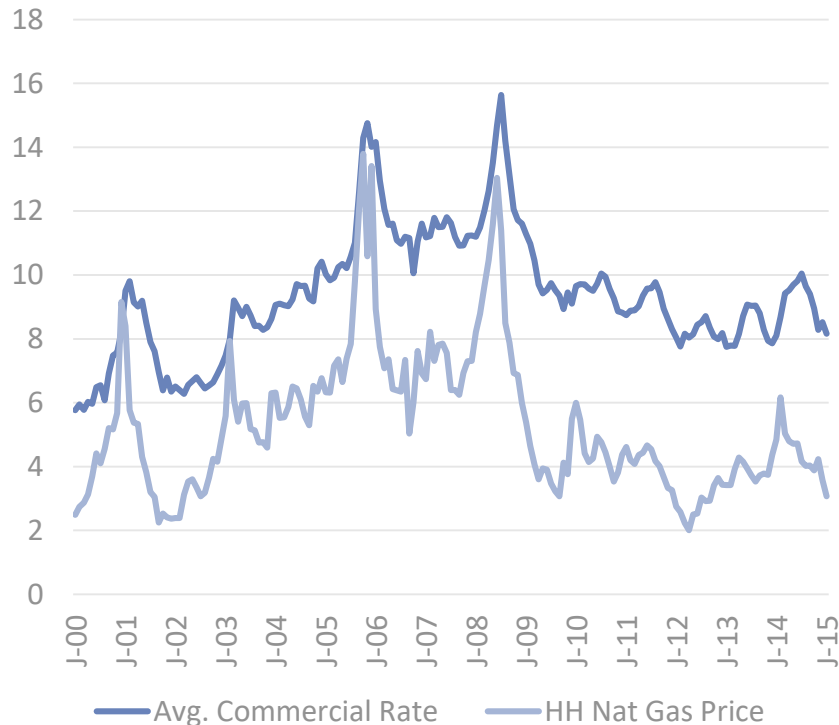
US Distributed Generation Capacity Additions 2009 - 2023



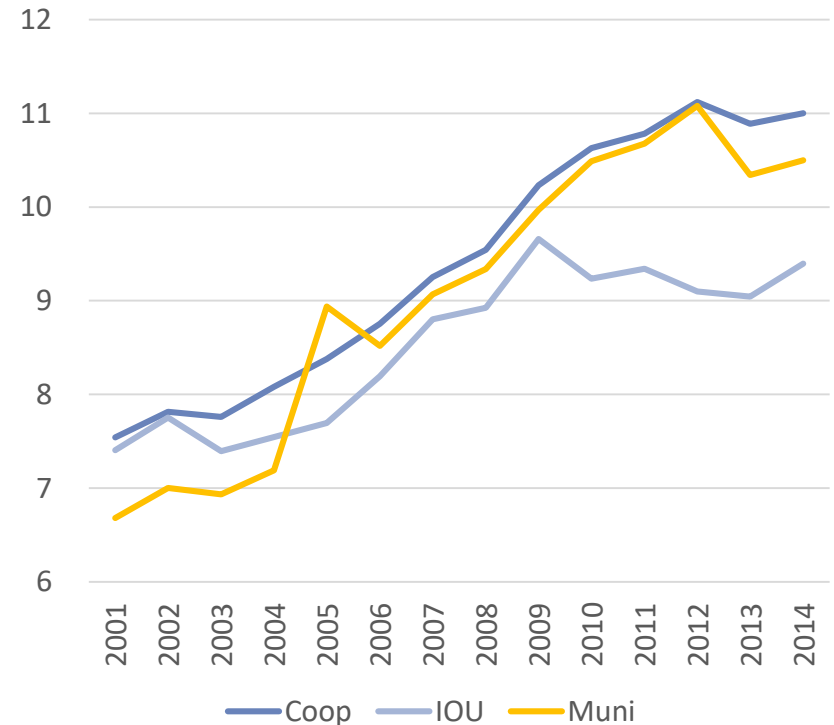
Note: 2014 – 2023 are projected (P) values Source: Power Systems Research, SEIA, EGSA, Navigant, Enovation Partners

It's not surprising; gas rates have remained stable, while electric rates have increased 30-60%

Monthly US Avg. Commercial Gas Rate & Henry Hub Spot Price (\$/mcf)



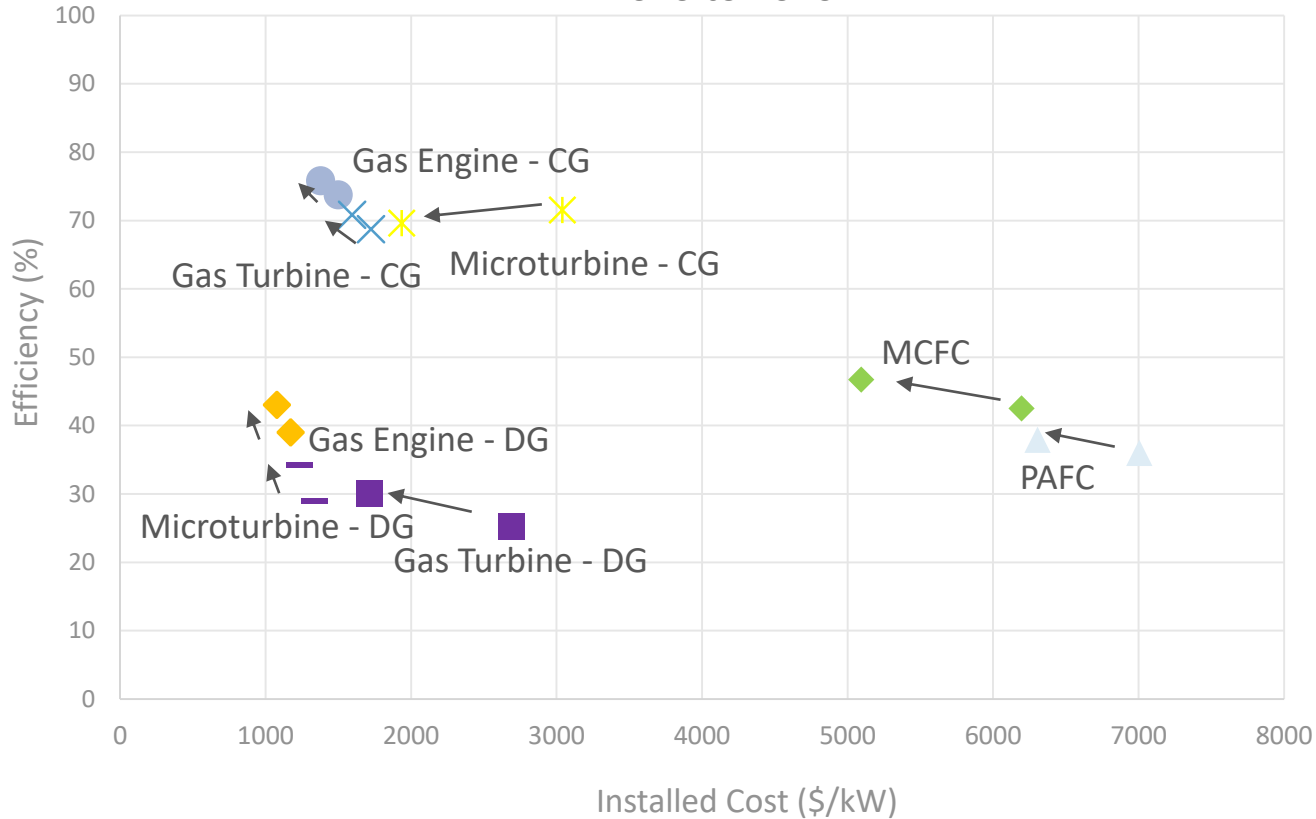
Commercial Electric Rates by Utility type (cents/kwh)



These macro trends are having a significant impact across the US and are driving penetration of gas-fired DER

And gas-fired technology cost and performance continues to improve steadily

Expected Evolution in Selected DG Technology Economics
2010 to 2020

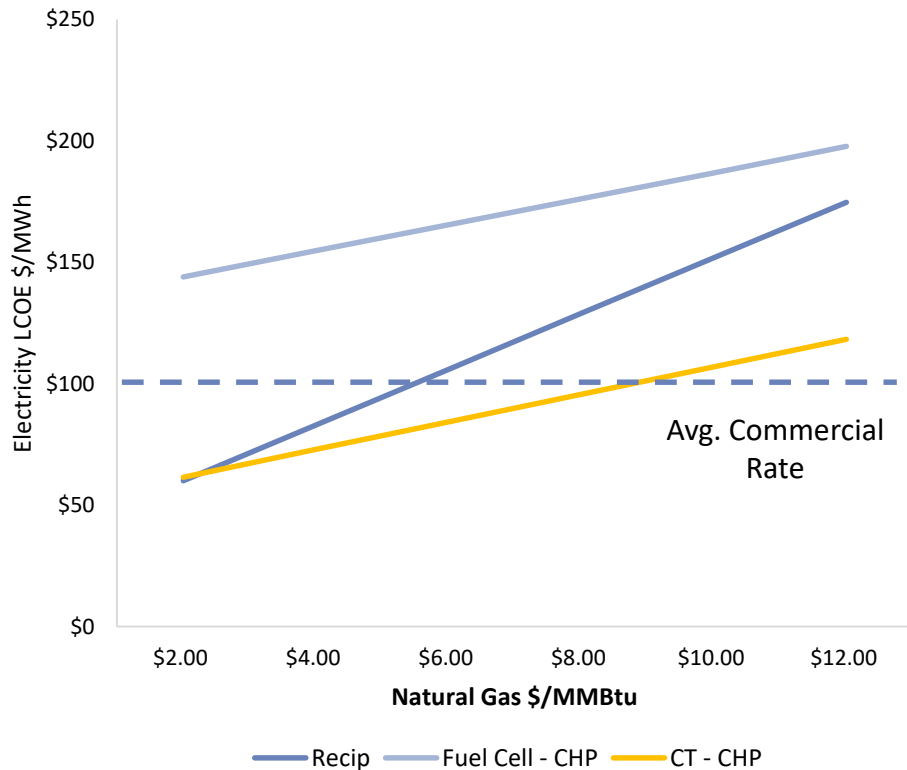


Assumed capacity: Gas engines 3 -5 MW; Gas turbines 5 – 20 MW; Micro turbines 65 – 200 WW; Phosphoric Acid Fuel Cell 400 kW; Molten Carbonate Fuel Cell 300 kW

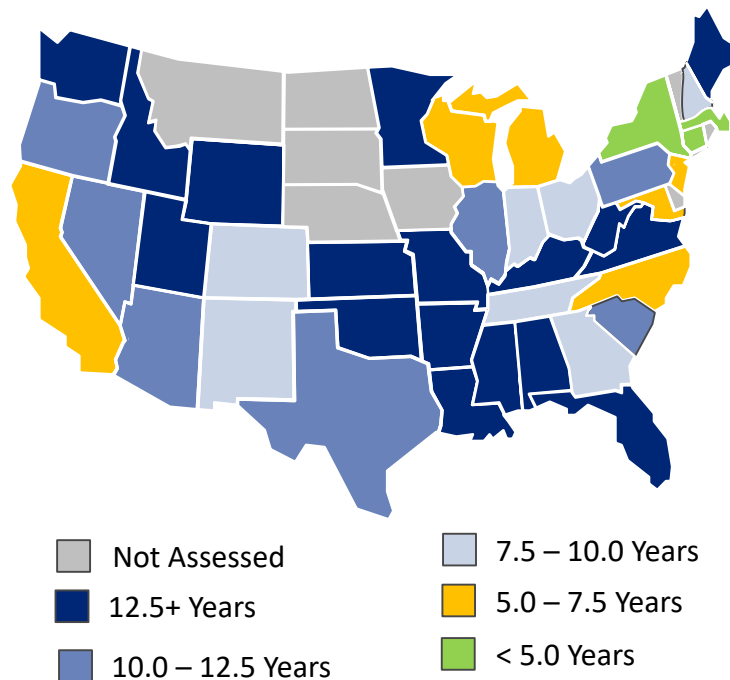
Source: GTI, Enovation Partners

Consequently gas-fired DER has become highly competitive with electricity in many regions

LCOE vs Gas Price



Commercial Gas DG Heat Map - 2016



Sustained low natural gas prices is creating a large market for behind the meter gas-fired DG at the commercial level

Source: NREL, SNL Energy, Enovation DER Heatmap Analysis

However, opportunities for gas-fired DER are sensitive to difference in load, and tariff design

IRR for Demand Management Using Natural Gas Recip. Engines – Minnesota Examples

Building Type	Load Factor	New Ulm, MN 2026		Willmar, MN 2026		Virginia (city of), MN 2026	
		Small Comm. Service	Large Comm. Service	Small Comm. Service	Large Comm. Service	Small Comm. Service	Large Comm. Service
S School/L Office	36%	9%	4%	10%	0%	6%	6%
QSR/FSR	52%	12%	5%	13%	0%	6%	6%
Supermarket/L Hotel	60%	12%	4%	12%	0%	5%	5%
M Office/P School	36%	10%	5%	10%	0%	7%	7%
Strip Mall/Warehouse	32%	10%	6%	10%	2%	9%	9%
S Office/Midrise Apt	40%	12%	4%	12%	0%	5%	5%
Standalone Retail	33%	11%	6%	11%	0%	8%	8%
Small Hotel	50%	12%	4%	12%	0%	5%	5%
Out Patient	47%	11%	5%	11%	0%	6%	6%
Hospital	67%	13%	5%	13%	0%	6%	6%

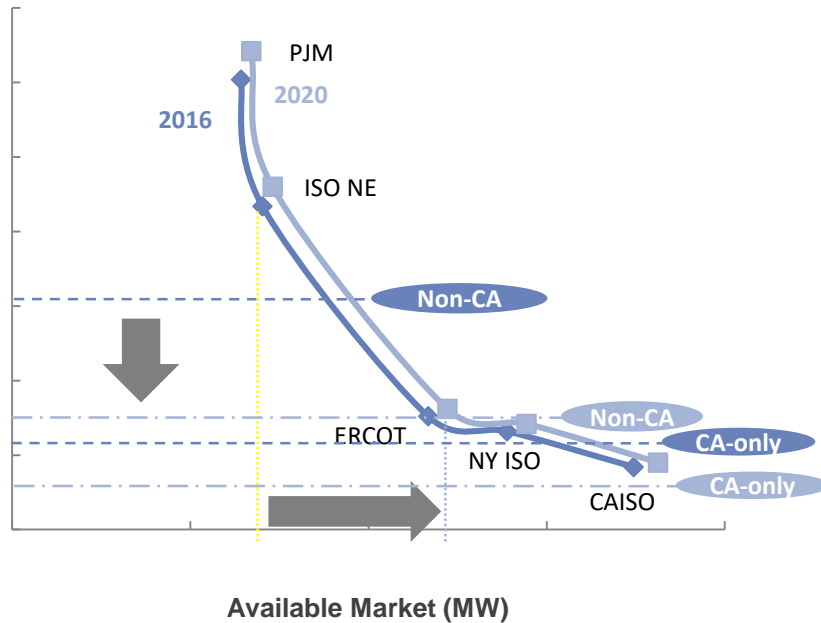
< 6%
 6-8%
 8-10%
 10-12%
 12%+

Assumptions: Power price escalation: 3.7%, NG price escalation: 2.2%, 2026 gas price: \$6.77/MMBtu, Dispatch case: super peak trimming, O&M inflation: 2.0%

Longer term, while batteries will increasingly challenge the role of natural gas in providing flexibility and reliability...

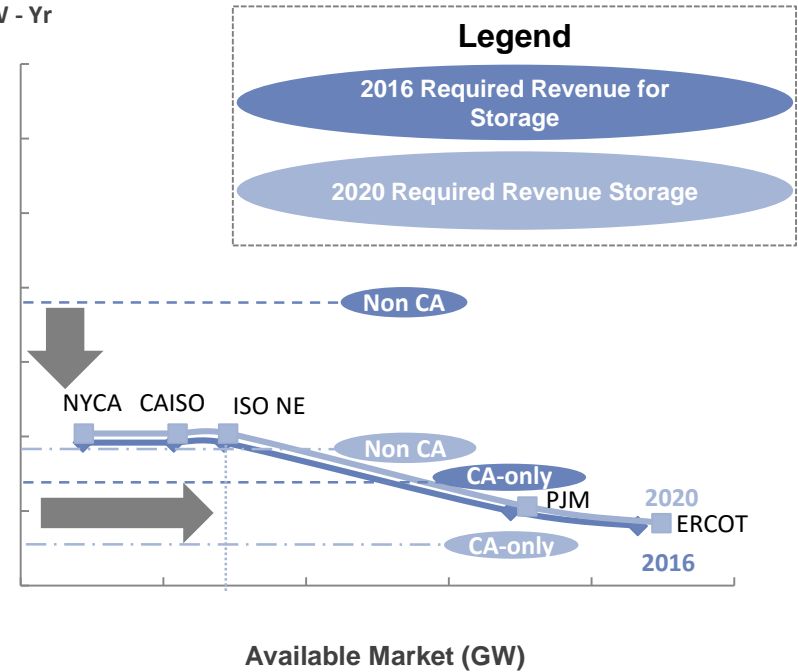
Frequency Regulation for Storage

'000 \$/MW - Yr



Demand Management for Storage*

'000 \$/MW - Yr

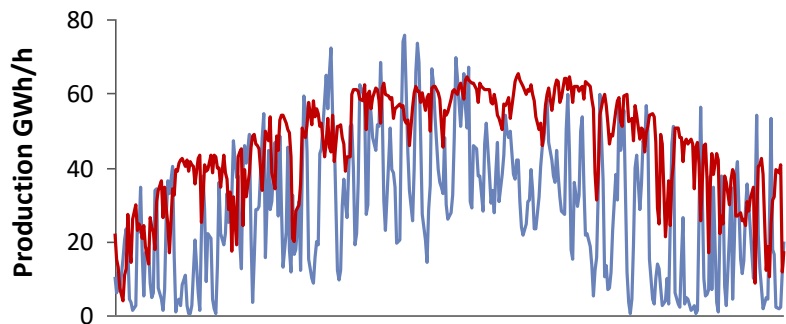


*Available market for demand management BTM offerings are dependent on tariff-specific demand charges and terms. Volume (GW) in horizontal axis of graph is based on assumed C&I contribution to peak ISO capacity, NOT likely BTM storage market size
 See Appendix pages for assumptions behind regional revenues and storage costs by use case
 Source: Enovation Partners analysis

...the role for gas (or hydrogen?) in longer duration applications remains more assured

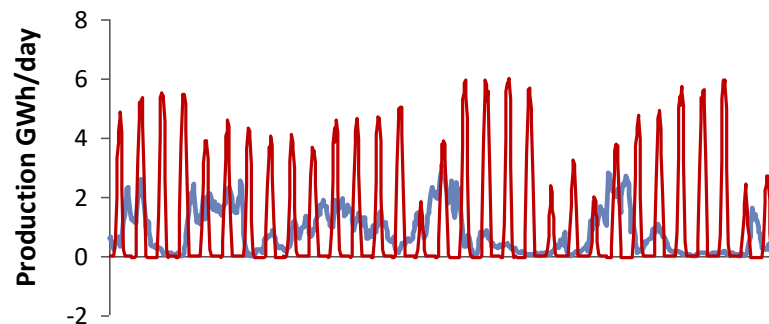
Hourly Load and Renewable Generation in CAISO

Wind and Solar Hourly Production (December 2016)

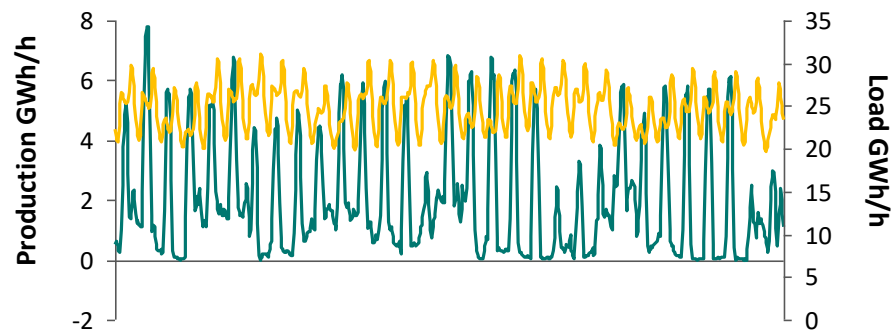


Daily Load and Renewable Generation in CAISO

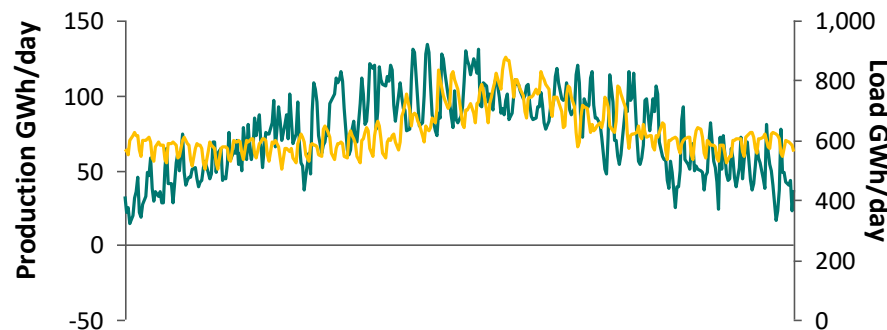
Wind and Solar Daily Production (Year 2016)



Wind+Solar Hourly Production vs. System Load (December 2016)



Wind+Solar Daily Production vs. System Load (Year 2016)



— Wind Production — Solar Production — Wind+Solar Production — System Load

	Wind/Solar	Wind/Load	Solar/Load	Wind+Solar/Load
Correlation	(0.15)	0.14	0.34	0.38
	Wind	Solar	Wind+Solar	Load
Volatility	0.76	1.25	0.78	0.18

	Wind/Solar	Wind/Load	Solar/Load	Wind+Solar/Load
Correlation	0.39	0.24	0.52	0.43
	Wind	Solar	Wind+Solar	Load
Volatility	0.64	0.31	0.37	0.13

Source: CA ISO