Wind Firming EnergyFarm

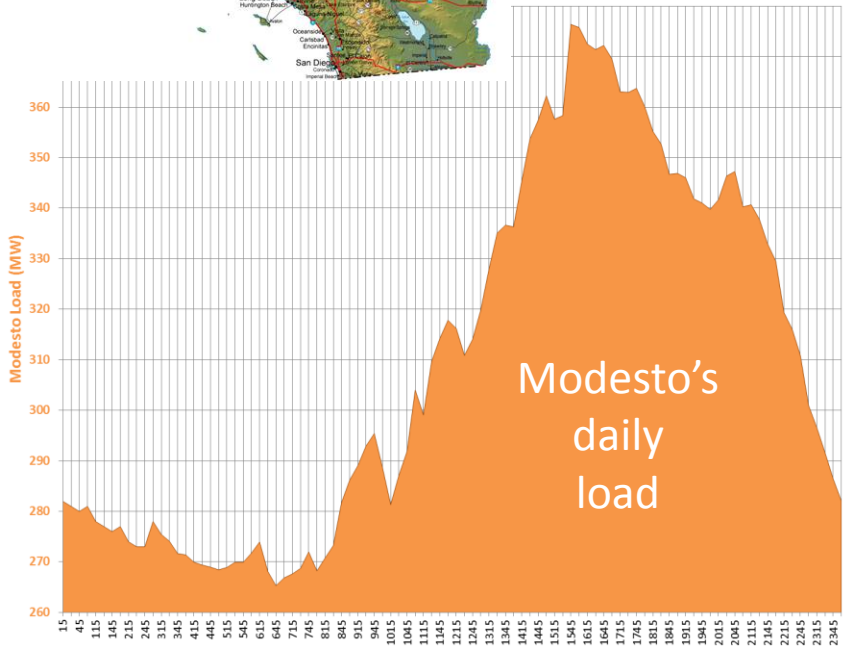
DOE Peer Review

September 26, 2012

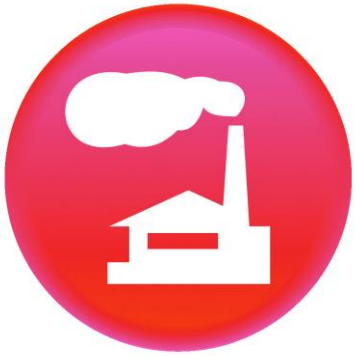
Primus Power is on track to deliver EnergyPods™ to California's Modesto Irrigation District starting 2014

PRIMUS POWER

How will storage integrate into Modesto's system?

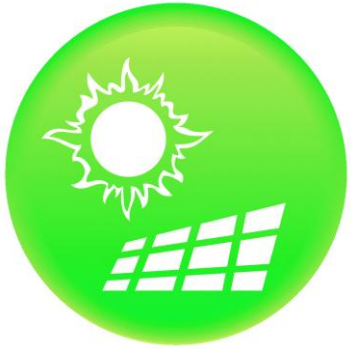


Hydro



Coal & Gas

Wind



Solar

Storage

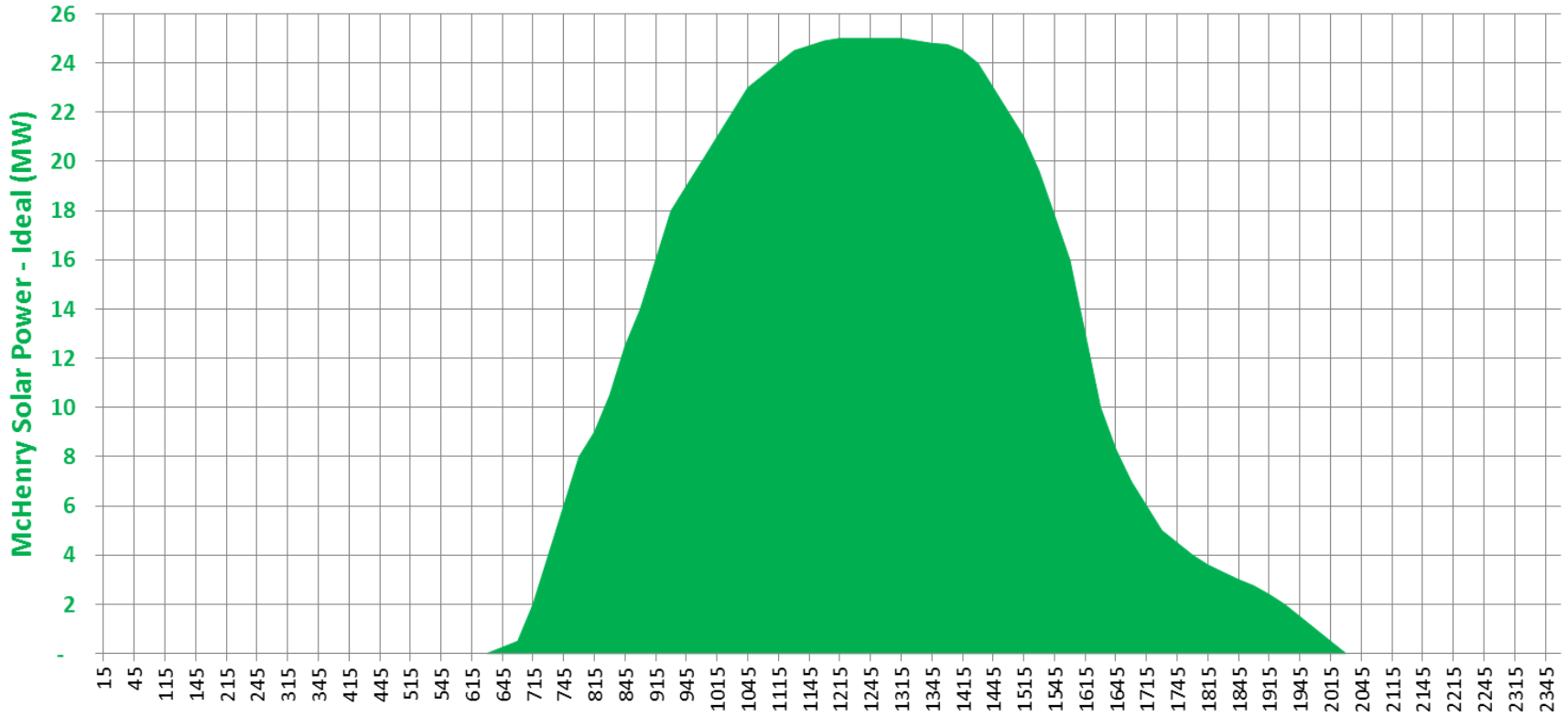
?

PRIMUS POWER

Modesto’s 25 MW McHenry solar farm

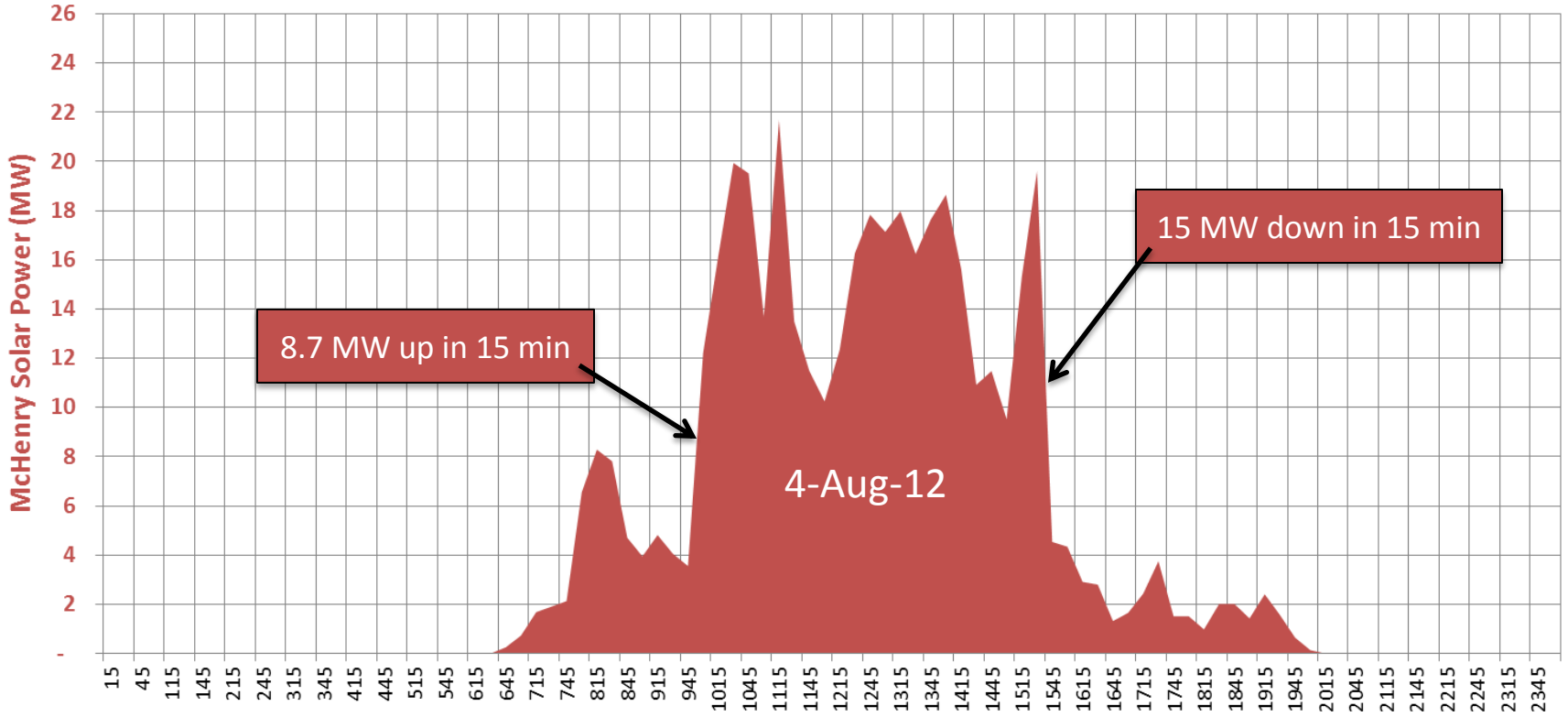
PRIMUS POWER

Modesto will use EnergyPods to integrate renewable wind and solar energy



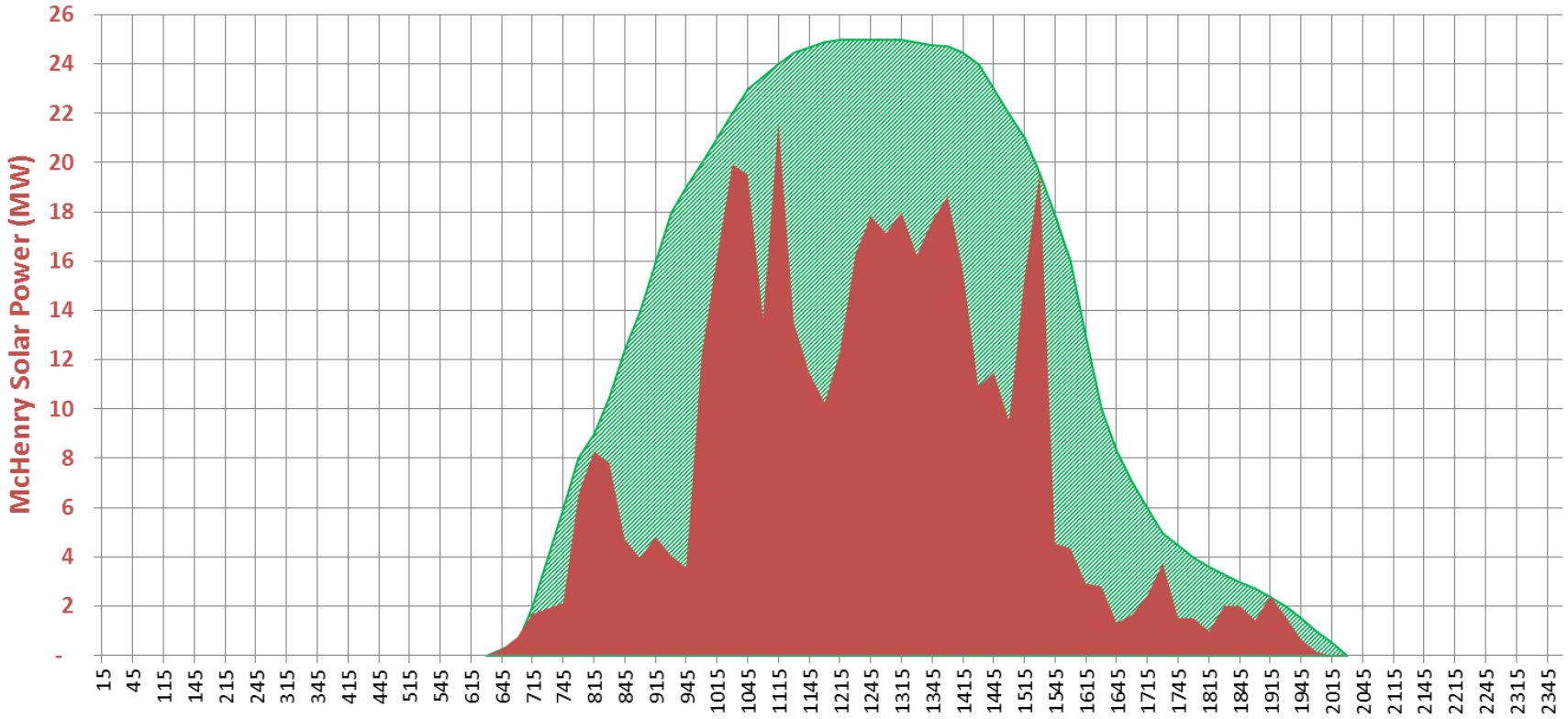
PRIMUS POWER

Modesto will use EnergyPods to integrate renewable wind and solar energy



PRIMUS POWER

Modesto will use EnergyPods to integrate renewable wind and solar energy



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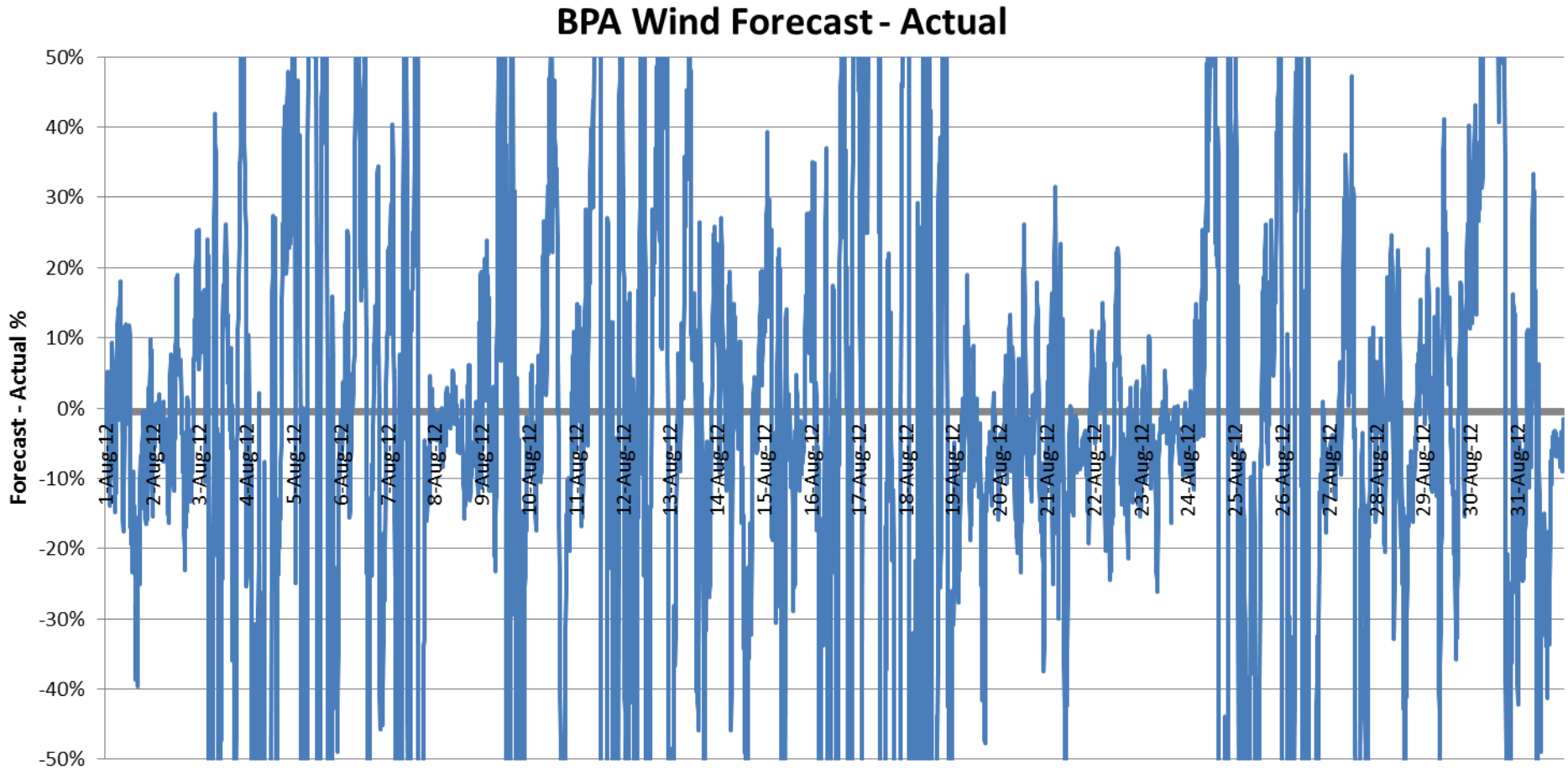
Modesto receives wind from the Bonneville Power Administration area. Forecasting wind is tricky.



 Plot shows: (forecast – actual)/forecast. 5 sec data shown.

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Modesto currently integrates intermittent renewable solar and wind energy with thermal generators

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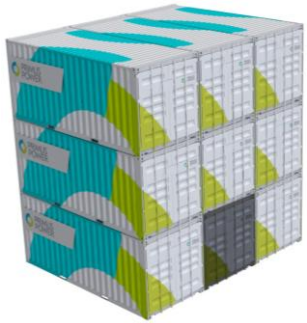
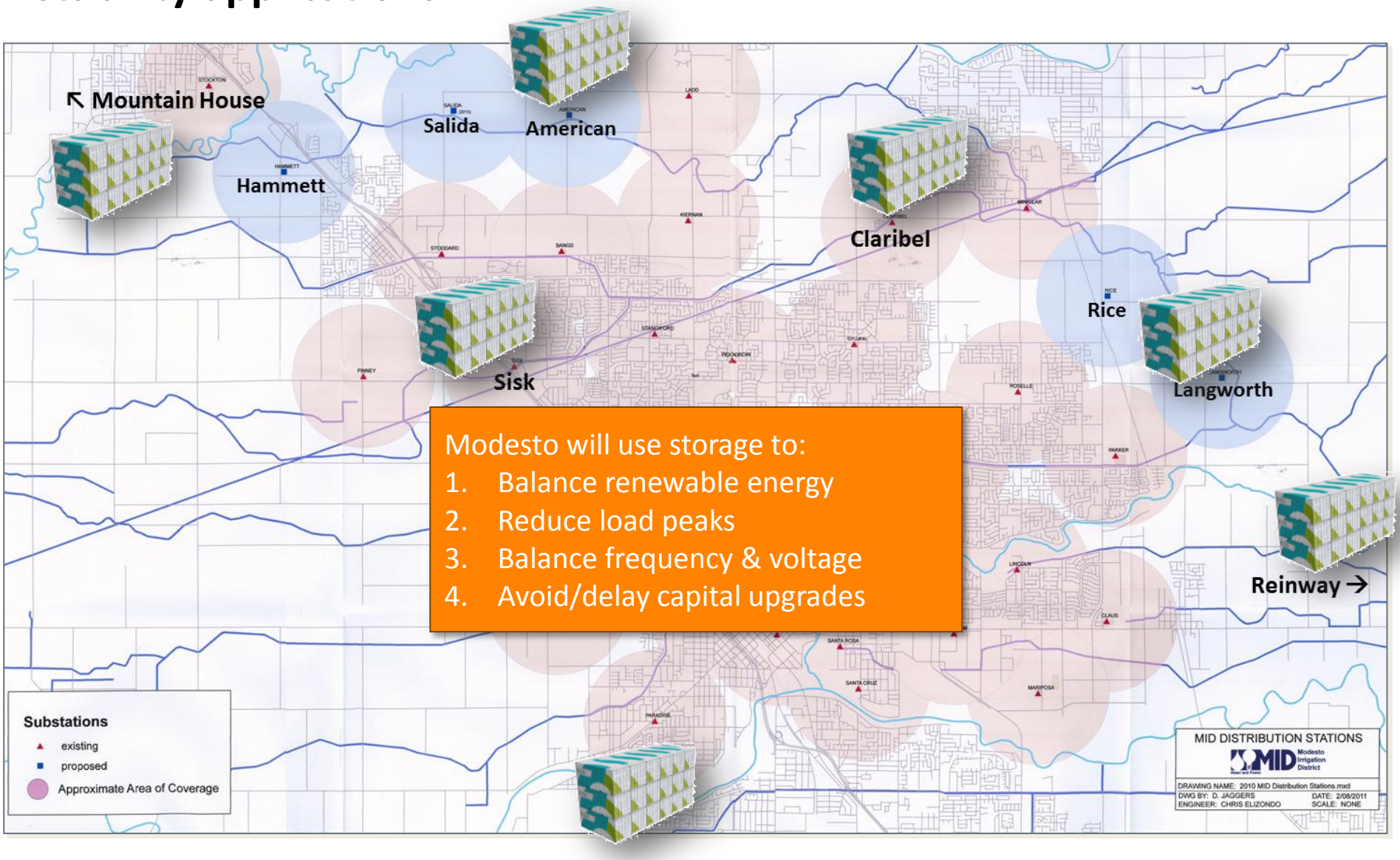
EnergyPods vs. thermal generators for flexibility and balancing

	Natural Gas Reciprocating Engines	Primus Power EnergyPods™
		
Firming range (MW)	4 to 50	-25 to 25
Cost	$73M	<<$73M
Time to full power (sec)	300	5
Water use (liters)	66,000	0
Natural gas (mmBTU)	2,900,000	0
Pollutants (metric tons)	20 NOx, 72 CO, 72 VOC	0
CO_2 emissions (metric tons)	66,000	0
Sound (dB)	95 (jackhammer)	30 (whisper)
Installation time (months)	36 to 54	3 to 6
Area (acre)	1	¼

10 Annual data, based on 35 MW average use. EnergyPods are charged with renewable solar and wind energy.

PRIMUS POWER

Modesto will use EnergyPods™ for energy balancing and local area stability applications



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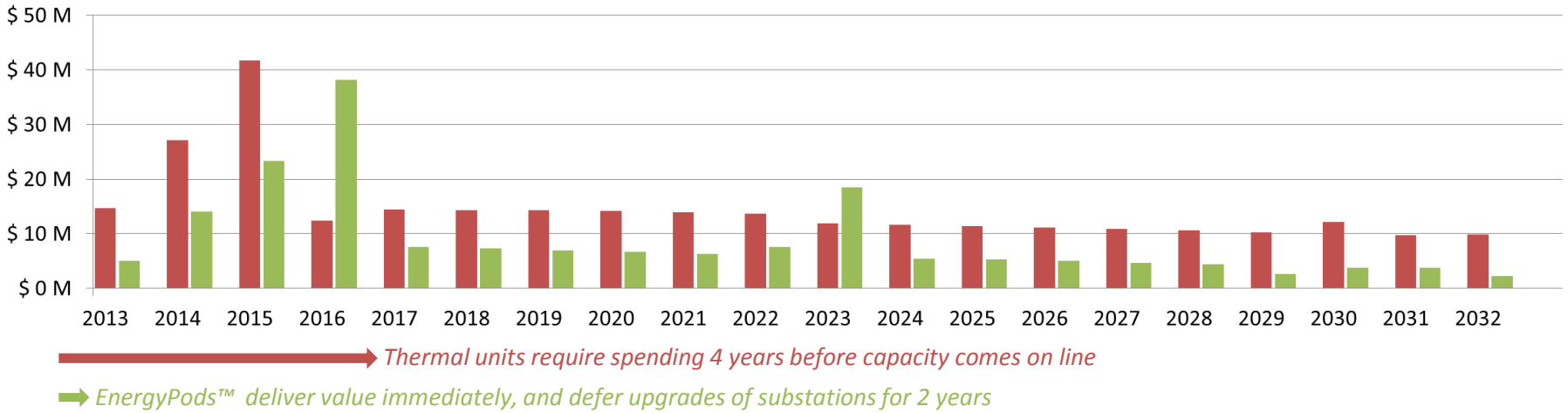
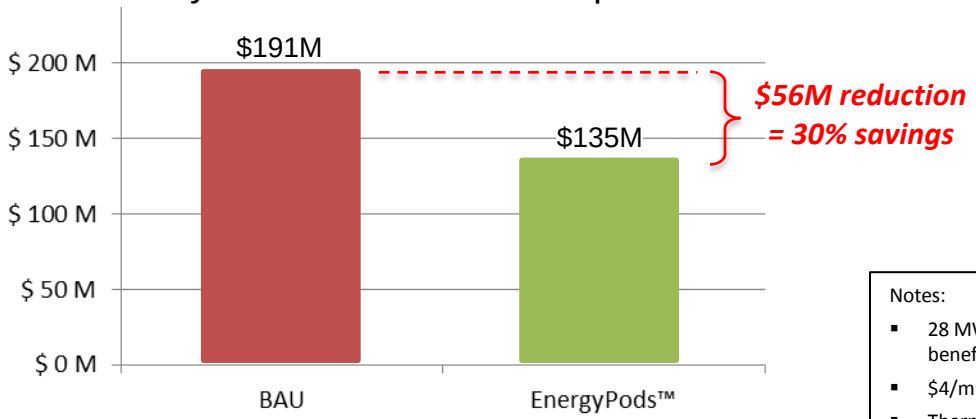
Modesto will save 30% by using EnergyPods™ instead of thermal generators

Centralized thermal units vs. distributed EnergyPods™ for 50 MW of flex capacity



20 year Present Value Comparison



Notes:

- 28 MW EnergyPods™ deliver the same load balancing benefit as a 50 MW thermal plant
- $4/mmBTU average natural gas price over 20 years.
- Thermal plant installation & commissioning: 4 years.
- 6% cost of capital.

Modesto Irrigation District

Several partners are assisting our Modesto deployment

Team

- Decades of flow battery expertise
- >80% graduate engineering degrees
- Proven system integration experience
- Deep understanding of energy storage economics

Grants

$14M Department of Energy • Energy Storage Demonstration Program

$2M Advanced Research Projects Agency • Energy

$1M California Energy Commission

Patents

- 8 granted
- 30 filed
- >350 claims
- US & International

Investors

Chrysalix Energy Venture Capital

KPCB Kleiner Perkins Caufield Byers

DBL Investors Double Bottom Line Venture Capital

I2BF

Partners

BOSCH

Integration & Control

Sandia National Laboratories

PG&E

EPRI Electric Power Research Institute

KEMA

3rd Party Testing

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Thank you

PRIMUS POWER™

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