

# Opportunities & Challenges for Microgrids and Distributed Energy Resources as a Grid Asset

**Dispatchable Distributed Generation: Manufacturing's  
Role in Support of Grid Modernization**

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***CA's future electricity system will consist of near zero net energy buildings, highly efficient businesses, low-carbon generation, sustainable bioenergy systems, more localized generation, and electrification of transportation, supported by a highly flexible and robust distribution and transmission infrastructure. – CA Energy Commission, EPIC Funding Vision***

# The Four Cornerstones

Reliability

Survivability

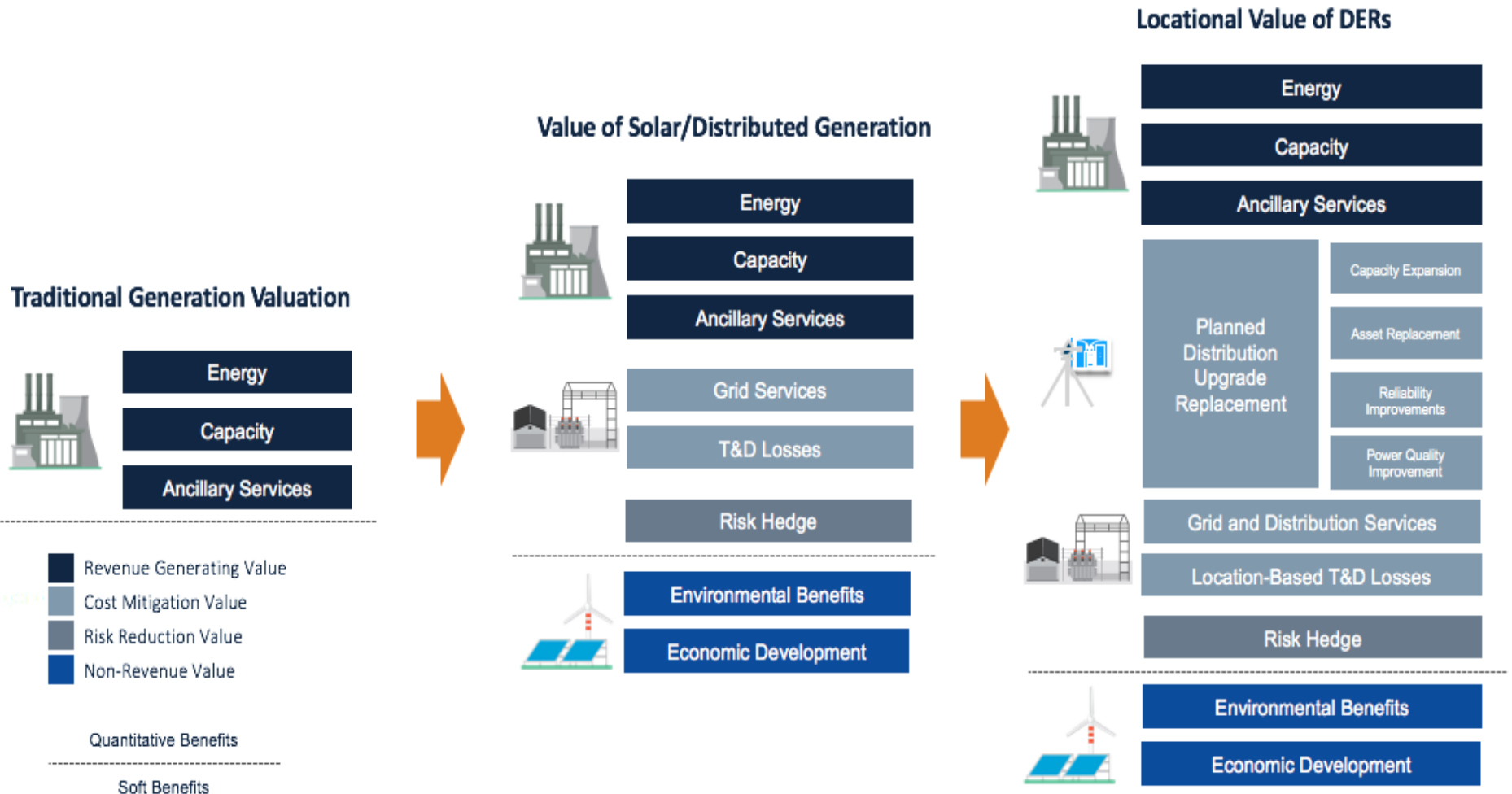
Resiliency

Intelligence

UCSD's Energy Research Park  
EV DC Fast Charging & Energy Storage, 5 MWH Energy  
Storage, 2.8 MW CHP Fuel Cell with 350 Ton Absorption  
Chiller, 2.4 mgal TES, Smart EV Charging



# CA Initiatives to Monetize the Value of DER Using Locational Marginal Pricing (GTMResearch)



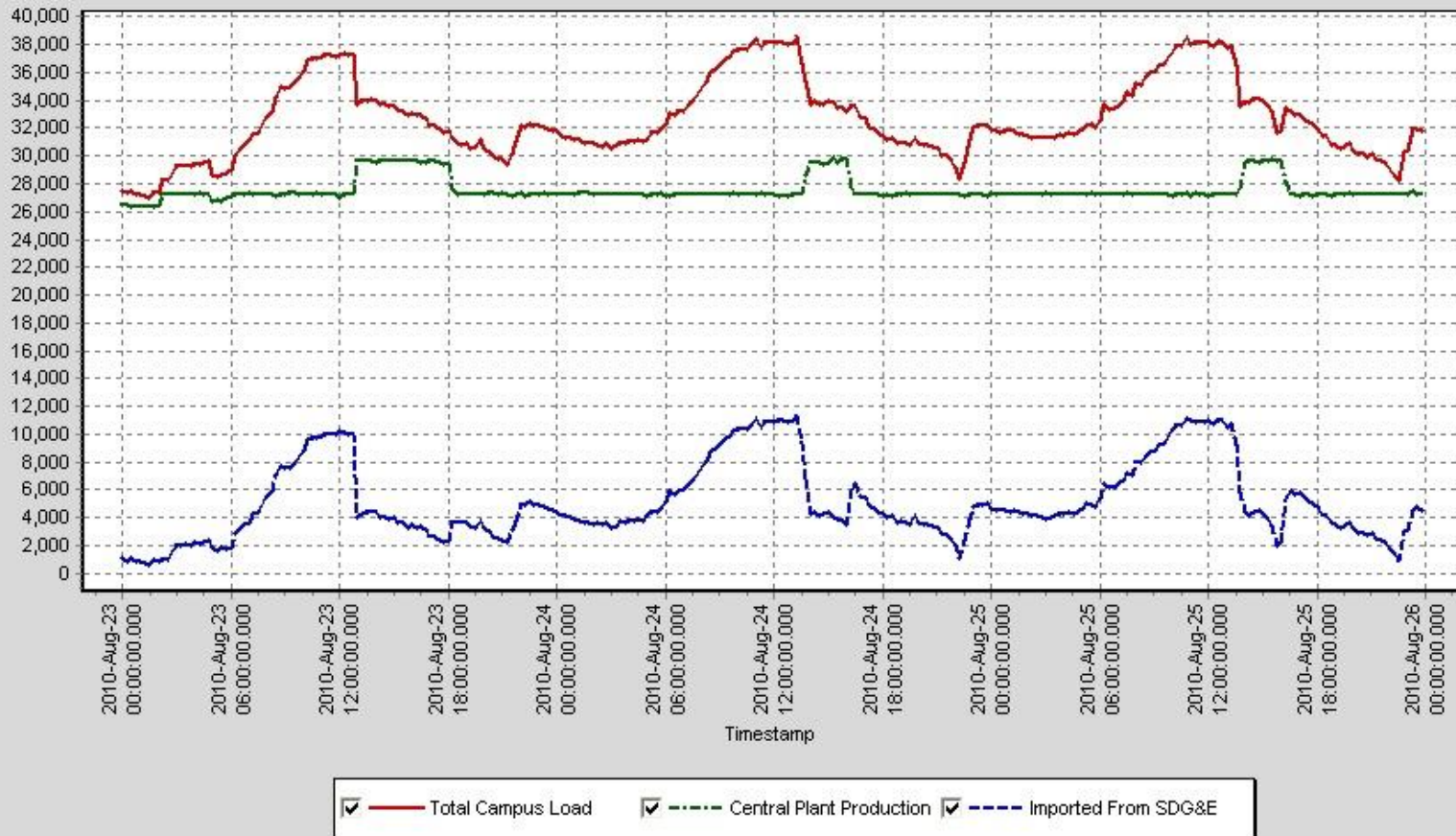
- Revenue Generating Value
- Cost Mitigation Value
- Risk Reduction Value
- Non-Revenue Value

Quantitative Benefits

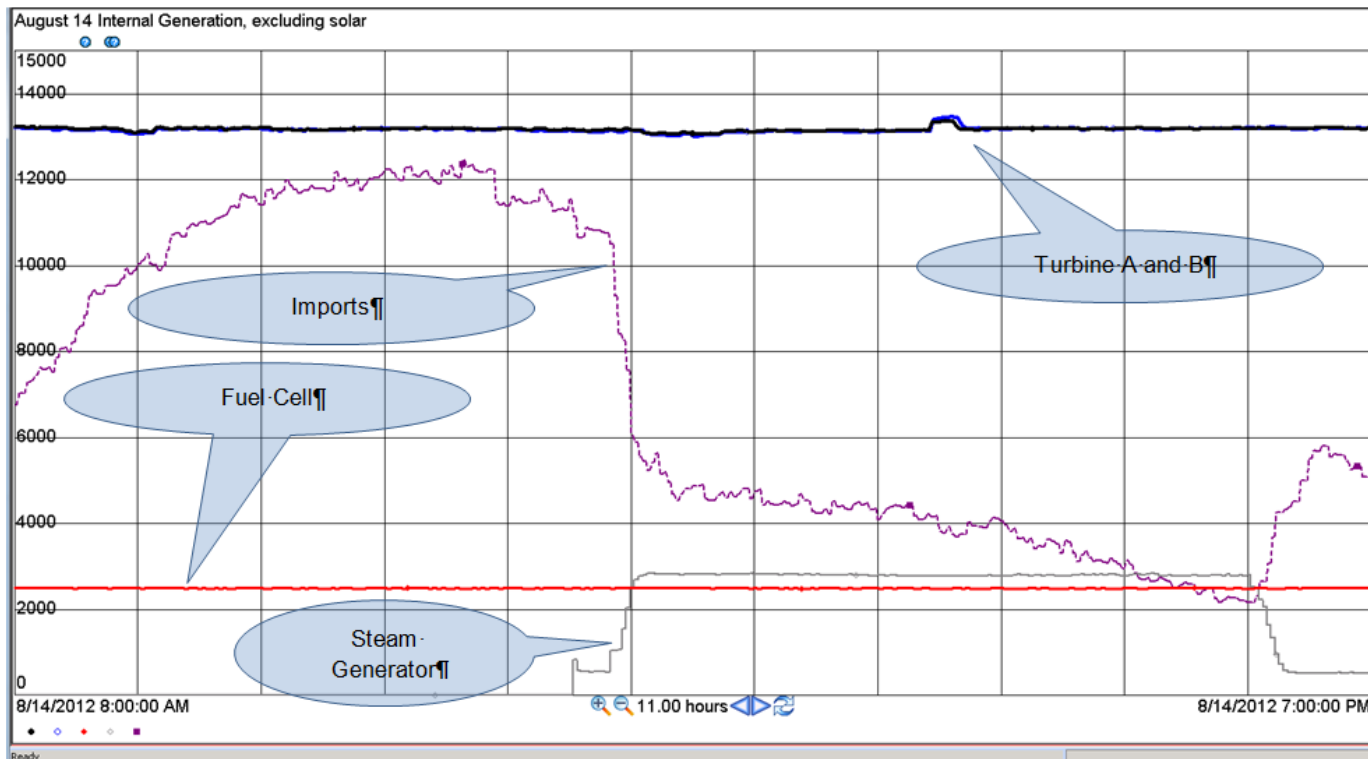
Soft Benefits

# Demand Responses Week of Aug 23 2010

UCSD Demand Response Aug 23-25, 2010



# Zoomed In View from 8/14/2014





# Islanding Protocol will be Key to Reliability, Survivability & Resiliency





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# Islanding Protocol will be Key to Reliability, Survivability & Resiliency



# The Microgrid Saves the UCSD Campus

**\$850,000 Per Month!**

**Yes, \$850,000 Per Month!**

And Produces GHG  
Emissions (g-CO<sub>2</sub>/kWh)

27% Below the Average  
CA Generation Mix

Yes, 27% Below







## 2.8 MW Fuel Cell supplies 8% of baseload power with directed biogas renewable fuel



Capturing the Waste Heat with a 350  
Ton Absorption Chiller to Have an  
Overall Efficiency > 66%





# World's First Absorption Chiller with a Fuel Cell



# Thermal Energy Storage is Being Installed to Optimize the Efficiencies









# Placeholder for Doubling Our TES



