DER Support for a Reliable Electric Grid in a Competitive Market

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Consortium for Electric Reliability Technology Solutions

The 10-Year Vision

- *"Distributed Energy Resources achieve 20% of new electric capacity additions in the US..."*
- *"…and enhance electric system reliability."*
  - 26.5 GW of new DER capacity
  - Most will be 1-40 MW in size
  - If 25% are <100kW, 100,000 units will be required

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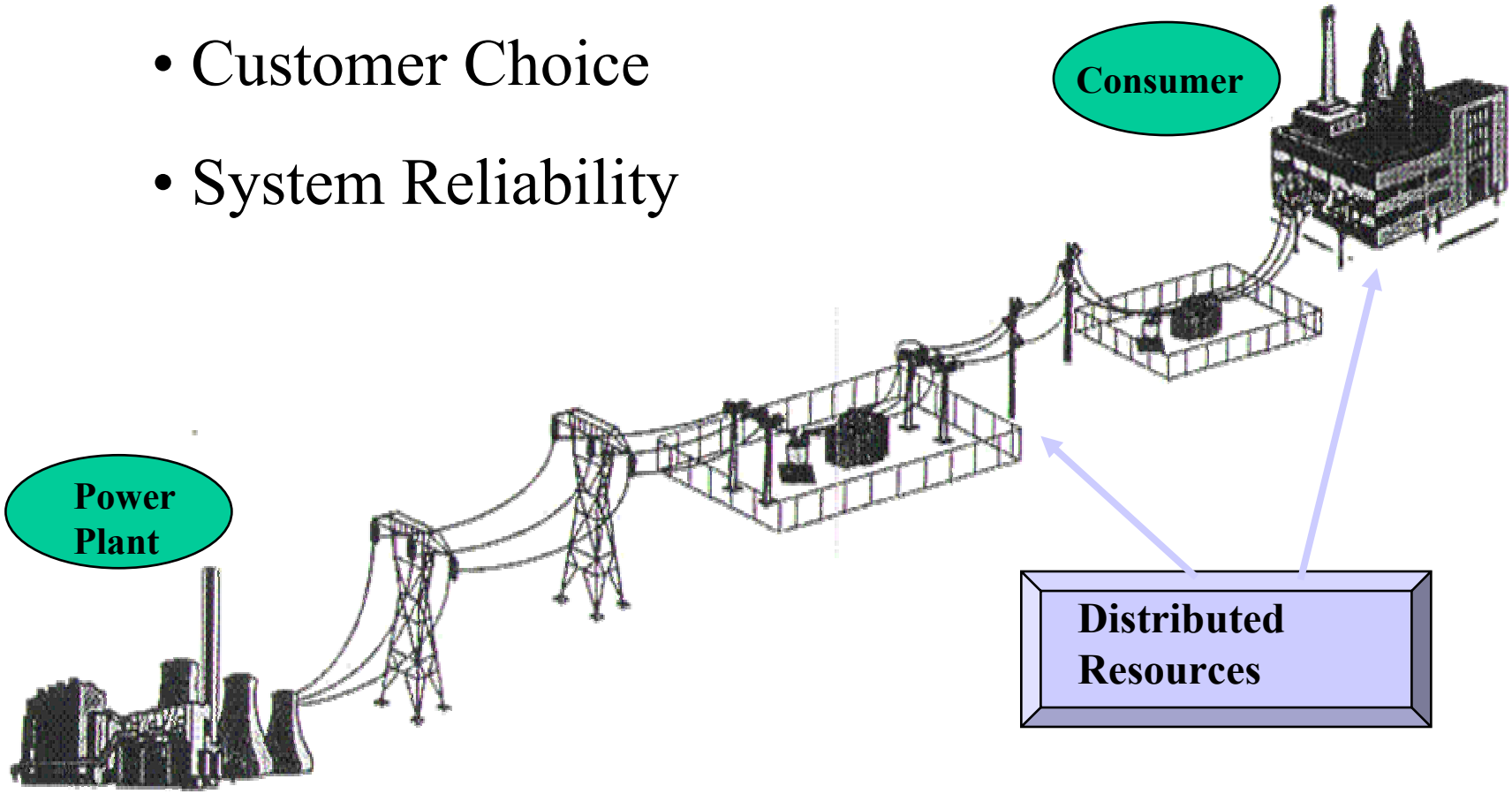
Distributed Resources Support…

- Customer Choice
- System Reliability



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The Research Goal is as Follows…

Identify and develop system integration tools and techniques

to permit reliability-enhancing operation of

large numbers of

small (< 1 MW) distributed energy resources

in the distribution system.

The μGrid is the conceptual solution.

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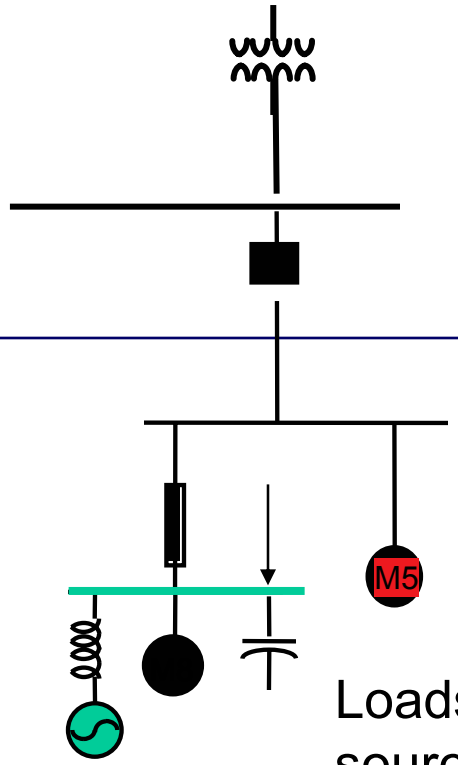
The μGrid Concept



Utility

- Dispatchable load without requiring individual control
- Self-controlled for voltage and frequency
- Responds to real-time pricing

Customer

Loads, micro-sources & storage

- Complementary devices
- Use of waste heat
- Local voltage control
- UPS functions
- Local redundancy
- Appropriate power quality
- Manages own faults

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Three Primary Projects are Underway

- Define and advance the μGrid concept
  - "Good" and "Model" citizen of the grid
  - Enables unlimited penetration by DER
- Develop tools, analyses, data collection for
  - Control, Protection and Economic Issues
- Plan for μGrid field demonstrations
  - CEC, AEP, Capstone and others

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Microturbine Tests Allow Exploration of Operating Parameters

Partnership between Southern California Edison, University of California Irvine and CERTS

- 5 microturbines (more planned), 28-100kW
- Grid-connected and stand-alone
- Single units and multiple units in parallel modes
- Results useful for
  - model development and validation
  - understanding operation of multiple units
  - power electronics implications

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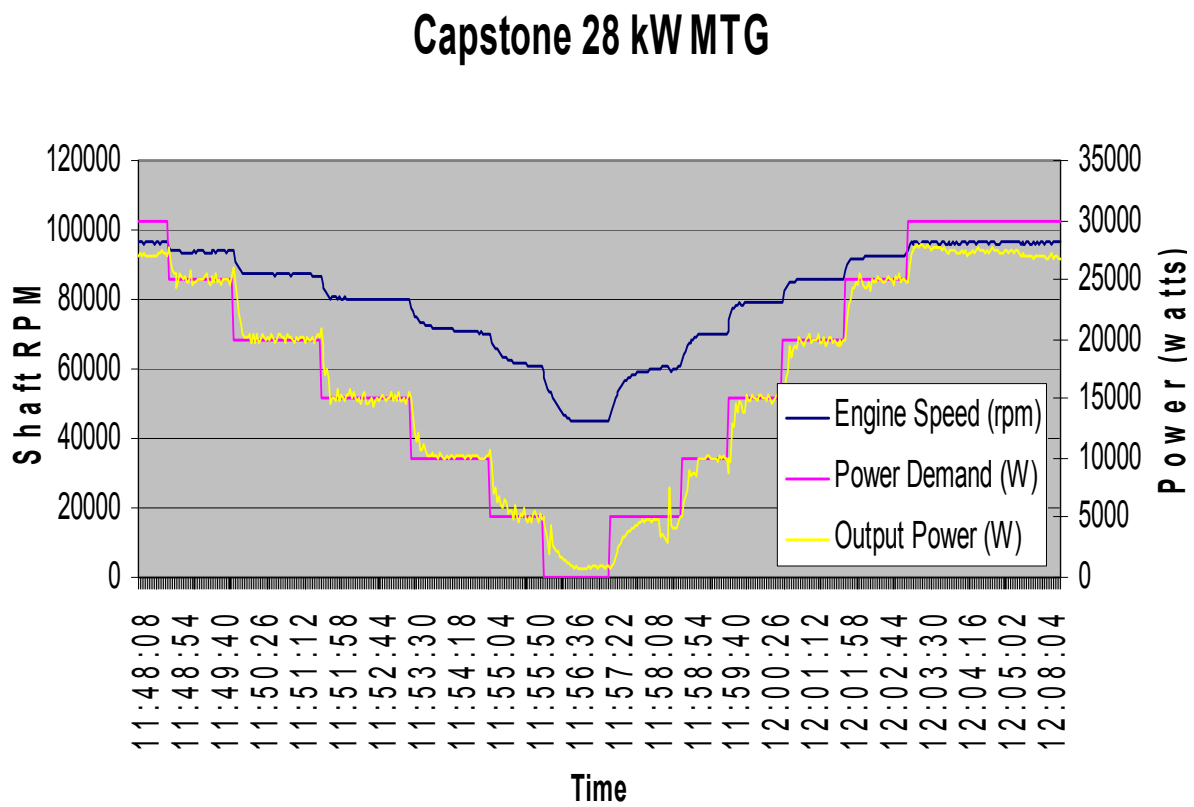
Grid-Connected Tests Reveal Important Operating Parameters

- Capstone – 28kW
  - Ramp from 0 to full load in ~50 seconds
  - Ramp from full load to 0 in ~50 seconds
  - Start up time ~ 2 minutes
  - Rough operation at loads less than 10 kW



Response time for incremental loading

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Issues Important to the Successful Penetration of DER

- Demonstrating “good” and “model” citizenship of the μGrid concepts in the field
- Modeling the DER interactions at the distribution level
- Lowering costs/improving functionality of power electronics interface
- Developing national policy recommendations around siting and environmental aspects of DER

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