Distributed Resources -- New Paths for Power

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The Time to Act is Now

- Population, resource use, and energy demand is growing worldwide.
- Energy price spikes threaten economic growth.
- Rising oil imports causes urgent needs for petroleum alternatives.
- The “dot.com” revolution is redefining business practices and energy uses.
- Power reliability and quality concerns are opening new markets for distributed energy systems.
- Air and water quality remain significant public health and safety concerns.
- Addressing climate change requires global solutions.

Source: EIA International Energy Outlook 1999
Stagnant Efficiency of U.S. Electric System

U.S. electricity conversion losses totaled 23.4 quads in 1998, enough energy to fuel Japan.

Fossil Electric Generation Efficiency (at plant, W/O T&D)

Source: EIA, Annual Energy Review 1998
Reliability Concerns


Areas with Capacity Margins < 10 percent

2007 Projections

“It costs us millions of dollars per hour. It’s so important, you almost can’t calculate the value, to us and our customers.”, says Jeffery Byron, Oracle’s Energy Director, when asked about the worth of self sufficiency. -- Wall Street Journal, May 11, 2000.

Source: National Energy Reliability Council, 1999
Aging Infrastructure

Boilers and Electric Plant Vintage

<table>
<thead>
<tr>
<th>Decade</th>
<th>% Electric</th>
<th>% Boilers</th>
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<tbody>
<tr>
<td>&lt;1950</td>
<td></td>
<td></td>
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<tr>
<td>1950-1960</td>
<td>35%</td>
<td></td>
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<tr>
<td>1960-1970</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>1970-1980</td>
<td>25%</td>
<td></td>
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<tr>
<td>1980-1990</td>
<td>20%</td>
<td></td>
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<tr>
<td>1990+</td>
<td>15%</td>
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Sources: Energy Information Administration, Gas Research Institute
“Disruptive” Technologies

Disruptive Technologies
- PCs
- Internet
- Minimills
- Wireless
- Biotech
- Nanotech

Attributes
- Challenges existing infrastructure
- New market entrants
- Ultimate value hard to establish

Distributed resources could be a disruptive technology
Distributed Energy Technologies

- Reciprocating Engines
- Photovoltaics
- Storage Systems
- Fuel Cells
- Wind
- Microturbines
The Federal Role

An Integrated Approach

- Support RD&D in advanced energy technologies
- Address regulatory and institutional barriers
- Establish cost-shared RD&D partnerships with industry and others

The Ultimate Goal

A competitive marketplace for the expanded use of clean, efficient, reliable, and affordable energy resources
OPT Goal 1 -- Enhance the use of renewable energy, triple the installed U.S. capacity of non-hydroelectric renewables by 2010, and maintain the viability of hydropower.

OPT Goal 2 -- Enable distributed energy resources to achieve 20%+ of new generation capacity by 2010.

OPT Goal 3 -- Maintain the present high reliability of the nation’s electricity system.
Integrated Solutions

- Command & Control Systems
- Energy Storage
- Fuel Supply System
- Utility Grid Interconnection & Power Conditioner
- Dynamic System Management Software
- Distributed Generator (prime mover)
- Facility Interface and Energy Management System
- Distributed Energy

Source: NREL
Distributed Energy Applications

- Energy Management and Sell to Grid
- Base-load, and Combined Heat and Power
- Remote Power
- Bulk Power
- Grid Ancillary Services
- Power Quality
- Peaker and Reliability

Source: NREL
Distributed Energy Benefits

Consumer-Side Benefits
• Lower cost electricity
• Price risk management
• Reliability and power quality
• Energy and load management
• CHP capabilities

Grid-Side Benefits
• Reduced electric line loss
• Reduced upstream congestion
• Grid investment deferment
• Improved grid asset utilization
• Improved grid reliability
• Ancillary services, e.g. voltage support, VARs, contingency reserves, and black start capability

Ideally, the “owner” of the distributed energy asset would realize the value of both the consumer- and grid-side benefits.

Source: NREL
Energy Storage Solutions

- Uses unprocessed wellhead gas
  - Up to 7% Sour (H2S) gas
- Reduce flare gases
- Power for remote sites Zincflow battery

Williams Energy Conversion Unit (ECU™)

Williams DPS Installation in Colorado
Energy Storage Solutions

- Full suite of advanced technologies: lead-acid batteries, advanced batteries, SMES, flywheels, ultracapacitors
- Power quality, renewable generation, reliability, peak shaving, transportable systems, telecommunications
- Evaluation of a 400 kWh zinc-bromide battery storage device

Transportable Power Quality System

- 2 MW / 15 second prototype tested at Virginia Power in 1998
- Trailer-mounted system easily located
- Provides customers with premium power
Addressing Barriers

- Uniform interconnection standards
- Output-based emissions standards
- Streamlined siting and permitting processes
- Net metering
- Green power
- Utility restructuring
- Renewable Portfolio Standards
- Public Benefits Funds
Federal Coordination

- Address environmental siting and permitting issues
  - Output based emissions standards
  - Pre-certification of small scale facilities
- Install clean and efficient distributed energy systems in federal facilities
- More equitable tax treatment for CHP
- Federal electricity restructuring legislation
Challenges to Action

- Capitalizing on the opportunities
  - differentiation through “distributed energy solutions”
  - new ways to “aggregate” customers
- Leadership in the marketplace
  - address risks
  - “first”use
- Industry-Government partnerships
  - joint R&D initiatives
  - field tests
  - demonstration projects
  - institutional and regulatory barriers
Partnerships

- Equipment Manufacturers
- Project Developers (A&Es)
- Industrial, Commercial, Residential, Institutional Users
- Energy Services Providers (gas and electric utilities)
- Federal, State & Local Government Agencies
U.S. DOE RD&D - A Catalyst for National Action

- Strengthening the economy and creating jobs.
- Positioning U.S. businesses for success in global markets.
- Protecting the environment, public health, and safety.
- Addressing the global challenges posed by climate change.
- Ensuring the security and reliability of our energy supplies.