Today's Central Utility

Central Generation

Customers

Tomorrow's Distributed Utility?

Central Generation

Genset

Fuel Cell

Customer Efficiency

Remote Loads

Wind

PV

Battery

Microturbine

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Distributed Generation: What Is It?

Distributed Resources (DR) are small (usually under 10 MW), modular electric generation and storage technologies that provide electric capacity and/or energy when and where needed. DR may either be interconnected with the electric grid or isolated from the grid in "stand-alone" applications, but its locational value is important to its economics and operation.

Distributed generation = DG
Distributed storage = DS
One View of the Future

1990s and Beyond

**Generation**
- Economies of mass production
- Smaller, clean generation units
- Fuel security, diversify generation portfolio

**Customers**
- Keeping competitive
- Buying services, not energy
- Good citizens: being green

**Strategy:** manage and deliver energy services
**Focus:** provide valued services at least cost
**Technology:** exploit economies of mass production
Some Utility Benefits of Using DG

- Dispatchable peak demand reduction
- Maximum use of standby capacity through safe parallel operation with the utility grid
- Cost-effective solution consistent with least cost planning emphasis
- Improved system load factor
- Enhanced voltage stability and avoided line losses during heavy-load conditions
- Improved customer relations
## The Distributed Utility Opportunity:
### Improved Asset Utilization

### Typical System Load and Percent of Feeder Maximum Load

<table>
<thead>
<tr>
<th>Asset Utilization</th>
<th>100</th>
<th>90</th>
<th>80</th>
<th>70</th>
<th>60</th>
<th>50</th>
<th>40</th>
<th>30</th>
<th>20</th>
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<tbody>
<tr>
<td>Electric Generation Asset Utilization</td>
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<tr>
<td>System Load Factor Percentage (%)</td>
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<tr>
<td>Typical Feeder</td>
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<tr>
<td>Distribution Asset Utilization</td>
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Customer Benefits of DG

- Bill reduction
- Reliability improvement
- Power Quality (PQ) improvement
- Customer partnerships
Forces Shaping Opportunities in the New Energy Marketplace

1) customer choice

2) utility restructuring

3) technology innovation

4) societal issues and trends
Customer Forces

• Restructuring and evolving regulation drive customers to be more proactive and informed about energy purchases and investments.

• Increasing need for differentiated energy services, e.g.
  – reliability
  – cogeneration/thermal
  – “green” energy
  – quality
Enabling Value-Added Customer Energy Services, for example:

- DU technologies are key enablers/elements
- DSM, curtailable/interruptible rates, real-time pricing
- premium power (quality and/or reliability)
- back-up/temporary/off-grid power products and services
- renewable/“green” energy products and services
- cogeneration and thermal energy
Technology Forces

• Smaller, More Modular Generation
• Shifting Economies of Scale
  – equipment manufacturing versus central generation
• Improving Efficiencies of Smaller Technologies
• More Flexible “Optimizable” Solutions
• Many Improvements Driven by Significant Technology Push in Automotive Sector
Electric Utility Perspective

• Better Asset Utilization

• Improved Operation

• New Customer Products and Services
Customer Perspective

• Lower Energy Prices
• Better Service
• New Energy Products and Services
Gas Utility Perspective

• Increased Gas Sales

• Possible Demand Smoothing

• New Customers and Services
DU Technologies Characteristics

✓ mass produced  ✓ “small”
✓ modular          ✓ efficient
✓ clean            ✓ reliable
✓ natural gas      ✓ renewables
✓ cogeneration     ✓ hybrids
✓ supportable by domestic industries
$DG > 2\text{\$}/\text{kWh}$

Ultimately it’s Economics... …but Whose?

<table>
<thead>
<tr>
<th>Utility</th>
<th>Customer</th>
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</thead>
<tbody>
<tr>
<td>Is DG the least expensive way to serve customers?</td>
<td>Is DG the least expensive way to get electricity?</td>
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<td><em>Cost of Service</em></td>
<td><em>Bill Comparison</em></td>
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</table>
Tomorrow’s DR “Markets”

- 90% Customers
- 10% Utilities
In the Best of All Worlds...

• Free market economics rule
• Environmental issues are included
• All parties cooperate for the common good
In This World...

• Utilities entrenched for 100+ years
• Customers bewildered, oblivious, and/or powerless
Yesterday’s Rules Being Applied to:

• Today’s technologies
• Formerly monopoly situations
Barriers

**Technical** - addressable with traditional technology-based RD&D
  - DR technologies
  - technical evaluation techniques & tools

**Institutional** - requires covering new, mostly non-technical ground
  - business/management theories
  - new regulatory structures
  - new standards
Tomorrow’s Power Market?

• More choices? Lower Costs? Eco-efficient & Sustainable Development?

• Full product range: *What Color is Your Electron?*

• Mass - Customization for All: McDonald’s meets Thomas Edison

• DG will be a physical & financial hedge, due to:
  – enabling information technologies: neural networks, genetic algorithms, enterprise-level middleware for bulk optimization of supply and demand
  – “omni-directional” power flow, in response to spot/future power market signals
Summary Conclusions: Market

• Market studies indicate significant potential for Distributed Resources
• The Distributed Utility concept is becoming mainstream - developing the mindset is the next step
• The Distributed Utility concept is a viable way to meet many of the world’s present and emerging energy needs, both urban and rural
On the Horizon: Utility Acceptance

• Distributed Utility concept is becoming mainstream - next step is to develop the mindset
• Need for more explicit regulatory “policy”
• Planning and evaluation tools are emerging
• Risk mitigation via small, redeployable infrastructure enhancements
• Under “performance based rates” distributed utility solutions yield superior financial returns in many situations, compared to traditional central generation/wires solutions
On the Horizon: Regulatory

- Who may own, for what?
- Who regulates?
- Interconnection standards?
- Emissions and siting standards?
- Standby charges?
- Exit fees?