State Drivers: Input for Regional Profiling

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Overview

• Regional Profiling for distributed resource integration
  – What is meant by distributed resources
  – Scope of Task 1.1
  – Defining regions

• Regional Drivers
  – Regional market conditions (economics)
  – Regional resource constraints (reliability)
  – State policy and financial incentives
  – Utility programs and tariffs to support distributed resource integration

• Regional Barriers and Activities
  – Primary research via interviews and survey monkey
  – Vet results via webcasts and regional workshops

• Integration Framework
  – Relate utility programs, retail tariffs, and pilot implementations
  – Identify trends and gaps
  – Recommend other implementations enabled by smart grids towards overcoming integration barriers
Regional Profiles Task

Regional Profiling to clarify drivers, barriers, and activities to integrate distributed resources along the distribution system

• Also review utility distributed resource programs and retail tariffs designed to coordinate electricity usage with power system or market conditions or to accommodate renewables

• Scope of distributed resources:
  – located along the distribution system or customer-side of the meter
  – distributed generation, storage, dispatchable load, PHEV, etc. integrated to respond in coordinated fashion
  – renewable resources located along distribution system
Distributed Resource Integration Drivers & Barriers

Drivers
- Peak resource constraints
- Improve economics
- Reliability concerns
- Environmental concerns
- Enhanced innovation

Barriers
- Aggregation
- Automation
- System operator confidence
- Economic justification
- Wholesale market structures and retail rates
- Customer convenience
U.S. Census Regions and Divisions

Census Regions and Divisions of the United States
Regional Market Conditions
(Market Economics)
Regional Wholesale Electricity Markets

This map was created using Platts POWERmap, November 2008

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Average On-Peak Spot Electricity Prices 2007

Source: Derived from Platts data.

Source: FERC Market Oversight

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Updated March 20, 2008
Regional Resource Constraints
(Reliability)
Year Net Capacity below NERC Reference Margin Level

Source: NERC Long-Term Reliability Assessment (2008)
Coal: Plants denied, cancelled, approved
Growth of Installed Wind Capacity in U.S. (MW)

Midwest includes: IL, IA, KS, MI, MN, MS, NE, ND, OH, OK, SD, WI
East includes: ME, MA, NH, NJ, NY, PA, RI, TN, VT, WV

Source: American Wind Energy Association (AWEA)
Source: FERC Market Oversight

Updated March 7, 2008
State Policy Drivers
(Green House Gas Reduction)
### Renewable Portfolio Standard

**28 states and D.C. have an RPS**

<table>
<thead>
<tr>
<th>State</th>
<th>Target</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>WA</td>
<td>15% by 2020</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>25% by 2025</td>
<td>small utilities 5-10%</td>
</tr>
<tr>
<td>ID</td>
<td>Priority to DR, EE, and in-state RE</td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>20% by 2010; goal: 33% by 2020</td>
<td></td>
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<tr>
<td>NV</td>
<td>20% by 2015; solar 5% per year</td>
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<tr>
<td>UT</td>
<td>20% by 2025</td>
<td></td>
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<tr>
<td>CO</td>
<td>20% by 2020; co-ops &amp; munis 10%; includes 4% solar</td>
<td></td>
</tr>
<tr>
<td>AZ</td>
<td>15% by 2025; includes 30% DG</td>
<td></td>
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<tr>
<td>NM</td>
<td>20% by 2020; co-ops 10%</td>
<td>TX: 5,880 MW by 2015; goal: 10,000 MW by 2025</td>
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<tr>
<td>HI</td>
<td>20% by 2020; proposed increase to 40% by 2030 agreed to for 2009 session</td>
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<tr>
<td>MT</td>
<td>15% by 2015</td>
<td>Xcel 30% by 2020</td>
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<tr>
<td>ND</td>
<td>10% by 2015</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>10% by 2015</td>
<td></td>
</tr>
<tr>
<td>KS</td>
<td>20% wind by 2020</td>
<td>Studying an RPS</td>
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<tr>
<td>OK</td>
<td>Studying an RPS</td>
<td></td>
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<tr>
<td>MN</td>
<td>25% by 2025</td>
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<tr>
<td>WI</td>
<td>10% by 2015</td>
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<tr>
<td>IL</td>
<td>25% by 2025</td>
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<tr>
<td>MI</td>
<td>10% by 2015, and new RE capacity: 1,100 MW by 2015</td>
<td></td>
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<tr>
<td>IA</td>
<td>1,105 MW by 2011*</td>
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<tr>
<td>MO</td>
<td>15% by 2021; at least 2% solar</td>
<td></td>
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<tr>
<td>AR</td>
<td>Utility IRPs to include RE</td>
<td></td>
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<tr>
<td>IN</td>
<td>Introduced: 25% by 2026</td>
<td></td>
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<tr>
<td>KY</td>
<td>Proposed: 1 GW of by 2025</td>
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<tr>
<td>ME</td>
<td>40% by 2017; goal: 3 GW wind by 2020</td>
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<tr>
<td>NH</td>
<td>23.8% by 2025</td>
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<tr>
<td>VT</td>
<td>25% by 2025</td>
<td></td>
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<tr>
<td>MA</td>
<td>15% by 2020; goal: 250 MW solar by 2017</td>
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<tr>
<td>RI</td>
<td>16% by 2019</td>
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<tr>
<td>CT</td>
<td>23% Class I/II by 2020; 4% Class III by 2010</td>
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<tr>
<td>NY</td>
<td>25% by 2013</td>
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<tr>
<td>PA</td>
<td>8% Tier I, 10% Tier II by 2020; 0.5% solar set-aside</td>
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<tr>
<td>NJ</td>
<td>22.5% by 2020; 2% solar</td>
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<tr>
<td>DE</td>
<td>20% by 2019; with 2% solar</td>
<td></td>
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<tr>
<td>DC</td>
<td>20% by 2020; with 0.4% solar</td>
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<tr>
<td>MD</td>
<td>20% by 2022; with 2% solar</td>
<td></td>
</tr>
<tr>
<td>VA</td>
<td>12% by 2022</td>
<td></td>
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<tr>
<td>TVA</td>
<td>50% of generation from zero- or low-carbon sources by 2020*</td>
<td></td>
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<tr>
<td>NC</td>
<td>12.5% by 2021; co-ops &amp; munis: 10% by 2018</td>
<td></td>
</tr>
<tr>
<td>FL</td>
<td>PSC draft RPS: 20% by 2020</td>
<td></td>
</tr>
</tbody>
</table>

**All but 13 states have RPS, voluntary standards, or renewable energy goals. Four states have proposed RPS or studies in progress.**

Source: FERC Market Oversight

Updated January 13, 2009
9 states have EE only as part of RPS, 10 have stand-alone regulation, and 4 have voluntary standards. 3 states have proposed EE goal or studies in progress.

Source: FERC Market Oversight

Updated December 5, 2008
Solar/DG Provisions in RPS Policies

NM: 4% solar electric by 2020
0.6% DG by 2015

AZ: 4.5% DG by 2025

NV: 1% solar by 2015; 2.4 to 2.45 multiplier for PV

CO: 0.8% solar electric by 2020

UT: 2.4 multiplier for solar

MI: triple credit for solar

MO: 0.3% solar electric by 2021

NC: 0.2% solar by 2018

WA: double credit for DG

NH: 0.3% solar electric by 2014

MA: TBD by MA DOER

NY: 0.1542% customer-sited by 2013

NJ: 2.12% solar electric by 2021

PA: 0.5% solar PV by 2020

DE: 2.005% solar PV by 2019; triple credit for PV

MD: 2% solar electric in 2022

OH*: 0.5% solar by 2025

It is unclear if solar water heating is eligible for OH's solar carve-out.

TX: double credit for non-wind (non-wind goal: 500 MW)

Source: www.dsireusa.org (January 2009)

DG: Distributed Generation

Solar water heating counts towards solar set-aside
Solar Hot Water in RPS Policies

12 states have solar hot water eligible under RPS

Source: www.dsireusa.org (January 2009)
Financial Incentives by State
(Economics for Renewable Energy)
 Rebate Programs for Renewable Energy Technologies

All but 11 states have utility or state rebate programs for renewable energy technologies.  

Source: www.dsireusa.org (December 2008)
States with Sales Tax or Local Property Tax Exemptions for Renewables

D.C.

Puerto Rico

State gives localities the option to offer an exemption
State has property tax exemption/ special assessment or State Sales Tax Exemption
State has property tax exemption/ assessment and Local Option for Sales Tax Exemption

Source: www.dsireusa.org (December 2008)
State Income Tax Credits & Deductions for Renewables

Source: www.dsireusa.org (December 2008)
States with Income Tax Credits/Deductions, Sales Tax, or Local Property Tax Exemptions for Renewables

Source: www.dsireusa.org (December 2008)
Net Metering

State-wide net metering for all utility types
State-wide net metering for certain utility types only (e.g., investor-owned utilities)
Net metering offered voluntarily by one or more individual utilities

Note: Numbers indicate individual system size limit in kilowatts (kW). Some states’ limits vary by customer type, technology and/or system application; this is the case when multiple numbers appear for one state. Other limits may also apply. For complete details, see www.dsireusa.org.

Source: www.dsireusa.org (January 2009)
Loan Programs for Renewables

Source: [www.dsireusa.org](http://www.dsireusa.org) (December 2008)
Grants for Renewable Energy Technologies

Source: www.dsireusa.org (December 2008)
Regional Pilots and Integration Activities
Distributed Resource Integration: Barriers and Program Objectives

Barriers

- Aggregation
- Automation
- System operator confidence
- Economic justification
- Wholesale market structures and retail rates
- Customer convenience

Objectives

- Market Economics
- Green House Gas Reduction
- Grid Support
- Reliability
- Security/Protection
- Power Quality
Program Participation Levels

Implementation Framework Parameters

Implementation methods can be related by

• Time Horizon - *Timeframe to address imbalance risk*
  – Resource Planning (year)
  – Operational Planning (months)
  – Day-ahead Operations (day)
  – Day-of Operations (<day)

• Implementation Type - *Motivation for participant engagement*
  – Alternative Pricing: pricing structures determine what customers pay
  – Direct Incentives: financial incentives determine rewards to participants
  – Outreach and Cooperation*: information exchange to engage customers or encourage voluntary behavior
  – Regional Codes & Standards*: dictate minimum regional requirements

* Chuang and Gellings (CIGRE paper, 2008)
## Demand-Side Implementation Framework

<table>
<thead>
<tr>
<th>Implementation Horizon &amp; Type</th>
<th>Alternative Pricing</th>
<th>Direct Incentive</th>
<th>Outreach &amp; Cooperation</th>
<th>Regional Codes &amp; Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Planning (years)</td>
<td>Alternative Pricing &amp; Rate Structures</td>
<td>Paid for Adoption</td>
<td>Trade Ally Cooperation</td>
<td>Energy Efficiency Standards</td>
</tr>
<tr>
<td>Operational Planning (months)</td>
<td>Time of Use (Seasonal)</td>
<td>Paid for Performance</td>
<td>Direct Customer Contact</td>
<td>Building codes</td>
</tr>
<tr>
<td>Day-ahead Operations (days)</td>
<td>Dynamic Pricing</td>
<td>Public Conservation Appeal</td>
<td>Ads and Promotions</td>
<td>Appliance efficiency</td>
</tr>
<tr>
<td>Day-of Operations (&lt;day)</td>
<td>Discounted Rate</td>
<td>Public Appeal for Voluntary DR</td>
<td>Customer Education</td>
<td>Variable Service Subscription</td>
</tr>
</tbody>
</table>

### Planning
- **Resource Planning (years):** Alternative Pricing & Rate Structures
- **Operational Planning (months):** Time of Use (Seasonal)
- **Day-ahead Operations (days):** Dynamic Pricing
- **Day-of Operations (<day):** Discounted Rate

### Alternative Pricing
- **Resource Planning (years):** Alternative Pricing & Rate Structures
- **Operational Planning (months):** Time of Use (Seasonal)
- **Day-ahead Operations (days):** Dynamic Pricing
- **Day-of Operations (<day):** Discounted Rate

### Direct Incentive
- **Paid for Adoption:** Cash grant, Rebate, Low-interest loan, subsidized installation
- **Paid for Performance:** Seasonal Conservation Cr., Installed Capacity, Aggregator Economic DR

### Outreach & Cooperation
- **Trade Ally Cooperation:** Direct Customer Contact, Ads and Promotions, Customer Education

### Regional Codes & Standards
- **Energy Efficiency Standards:** Building codes, Appliance efficiency
- **Variable Service Subscription:** Demand, Subscription Service

### Day-ahead Operations (days)
- **Dynamic Pricing:** CPP, RTP

### Day-of Operations (<day)
- **Discounted Rate:** Interruptible Load, Direct Load Control

### Dynamic Pricing
- **CPP, RTP**

### Discounted Rate
- **Interruptible Load, Direct Load Control**

### Alternative Pricing & Rate Structures
- **Resource Planning (years):** Alternative Pricing & Rate Structures
- **Operational Planning (months):** Time of Use (Seasonal)
- **Day-ahead Operations (days):** Dynamic Pricing
- **Day-of Operations (<day):** Discounted Rate

### Public Conservation Appeal
- **Public Appeal for Voluntary DR:** Flex Alert

### Variable Service Subscription
- **Demand Limiting:** Premium Power, Priority Service, OBMC

### Rolling Blackout
- **Demand-Side Implementation Framework**
# Extension of Demand-side Framework to include Renewable Programs

## Implementation Horizon & Type

**Resource Planning (years)**
- Alternative Pricing
  - Alternative Pricing & Rate Structures
  - Net Metering
- Paid for Adoption
  - Cash grant & Rebate
  - Tax incentive
  - Low-interest loan
  - Subsidized installation
- Trade Ally Cooperation
  - Direct Customer Contact
  - Ads and Promotions
  - Customer Education
- Energy Efficiency Standards
- Renewable Portfolio Standards

**Operational Planning (months)**
- Time of Use (Seasonal)
- Paid for Performance
  - Seasonal Conservation Cr.
  - Installed Capacity
  - Aggregator Economic DR
  - Demand Bidding of forward energy
  - Emergency DR & Ancillary Services
  - Interruptible Load
  - Direct Load Control
  - Public Conservation Appeal
  - Flex Alert
- Public Appeal for Voluntary DR
  - Demand Limiting
  - Premium Power
  - Priority Service
  - OBMC
  - Rolling Blackout

**Day-ahead Operations (days)**
- Dynamic Pricing
  - CPP
  - RTP
- Interruptible Load
- Direct Load Control

**Day-of Operations (<day>)**
- Discounted Rate
- Interruption Load
- Direct Load Control

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*Regional Codes & Standards*
Application of Framework to Identify Gaps

Resource Planning (years)

Operational Planning (months)

Day-ahead Operations (days)

Day-of Operations (<day)

Planning

Alternative Pricing

Direct Incentive

Outreach & Cooperation

Regional Codes & Standards

Implementation Horizon & Type

Planning Operations (years)

Operational Planning (months)

Day-ahead Operations (days)

Day-of Operations (<day)

Operations

Domestic utility demand response program

Utility demand-side planning, state policies and incentives

European utility examples (so far)
Next Steps

• Continue Secondary Research
  – Develop table characterizing drivers supporting distributed resource integration
  – Data mining for regional activities

• Regional Barriers and Activities
  – Characterize regional results and vet via webcast
  – Survey additional utility programs and tariffs that support distributed resource integration
  – Refine regional boundaries for Workshop Invitations and Surveys
  – Primary research via interviews, survey monkey, and workshop feedback

• Integration Framework
  – Relate utility programs, retail tariffs, and pilot implementations
  – Identify trends and gaps
  – Identify characteristics of other implementations enabled by smart grids towards overcoming integration barriers
Defining Regions for Workshops (Example)

- West (Pacific to Rockies)
- Midwest (MN to OH)
- Northeast (MD to ME)
- South (TX to VA)
Defining Regions for Workshops (Alternate)

- West (Pacific to Rockies)
- Mountain Central (Rockies to Plains)
- Midwest (MN to OH)
- Northeast (MD to ME)
- Southeast (LA to VA)
Smart Grid Demonstrations of Distributed Resource Integration (TBD)
Together…Shaping the Future of Electricity