Energy Efficiency as a Resource

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Alberta Climate Summit
Pembina Institute

September 28, 2017
Energy Futures Group Consulting

EE/RE Areas of Expertise
- Policy
- Market Analysis
- Program Design
- Evaluation

Range of Clients
- Regulators
- Government Agencies
- Advocates
- Utilities

Clients in more than 25 states, 5 Canadian provinces, Europe & China.
Rationale for Efficiency Programs

- **Market barriers** prevent many cost-effective investments
  - Financial
  - Awareness/info
  - Risk
  - Transaction costs

- **Large, untapped, potential** that can be cost-effectively acquired
  - Studies typically estimate ~10-20% of energy use...
  - ...But those estimates are inherently very conservative
  - Potential mostly constrained by policy – not technology or economics

- **30+ years experience** in leading jurisdictions
  - Typical program cost ~2-3 cents per kWh saved
  - “low hanging fruit” keeps growing back
Estimates of Max Achievable Well Below Leading Jurisdictions’ Actual Achievements
## The Bar Keeps Getting Raised

(annual savings as % of sales)

<table>
<thead>
<tr>
<th>2006</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2%: CT, RI</td>
<td>≥2.7%: MA, RI</td>
</tr>
<tr>
<td>≥1.0%: 3 states</td>
<td>≥1.0%: 16 states</td>
</tr>
<tr>
<td>≥0.5%: 12 states</td>
<td>≥0.5%: 34 states</td>
</tr>
</tbody>
</table>

6 states have EERS ≥2.0% savings in the future

Sources: ACEEE 2008 and 2016 State Energy Efficiency Scorecards
“Layer Cake” of Efficiency Benefits

Utility System Benefits
- Power Supply
- T&D Capacity
- Environmental
- Losses and reserves
- Risk
- Credit and Collection

Participant Benefits
- Other Fuels
- Water, Sewer
- O&M Costs
- Health Impacts
- Employee Productivity
- Comfort

Societal Benefits
- Air Quality
- Water
- Solid Waste
- Energy Security
- Economic Development
- Health Impacts

Efficiency as a Resource - Energy

Massachusetts Example

- Mandate to acquire “all cost-effective” efficiency
- Spending >6% of electric revenue on EE programs
- Will meet >20% of electric energy needs in 10 yrs
Efficiency as a Resource - Capacity

New England ISO Capacity Market Example

- Demand resources (DRs), including EE, compete w/supply
- 11 annual auctions to date
- DRs and EE have lowered market clearing prices

~2300 MWh of DRs cleared; without them market clears at ~$1/kW-month higher price
Efficiency as a Resource - Transmission

New England Example

- ISO began integrating long-term forecast of EE programs into transmission planning in 2012
- Removed >$400 million in just Vermont/New Hampshire transmission projects from 10-year plan

Efficiency as a Resource - Distribution

Con Ed (New York) Example

**Passive Deferrals**
- Substation level forecasts of impacts
- >$1 billion reduction in 10-yr forecast

**Active Deferrals**
- >30 projects since 2003
- RFPs for DERs, but mostly EE won
- Many successful deferrals
- Also hedge vs. forecast uncertainty
  - bought time to determine some projects never needed

Vermont’s 2013 Estimated Value of Efficiency
($/MWh)

Q&A

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Multiple Benefits of Efficiency

Utility System Benefits
- Energy
- Generating Capacity
- T&D infrastructure
- Line losses
- Environmental Compliance
- RPS compliance
- Credit & Collection Costs
- Price Suppression
- Lower risk

Other Consumer/Societal
- Consumer Non-Energy Bens:
  - Comfort
  - Health & safety
  - Building durability
  - Water
  - O&M
  - Business productivity
  - Etc.
- Jobs/Economic Devt
- Environment
- Public Health
- Energy Security
Efficiency as a Resource – T&D

Passive Deferrals
- Indirect, long-term impacts system-wide programs

Active Deferrals
- Geographically-targeted programs intentionally designed to defer specific T&D projects
Most EE Programs Provide Some Savings at All Hours of Potential Interest

Residential Lighting Savings Load Shape
## Depth of Savings Matters

### Hypothetical Distribution Substation w/100 MW Capacity

<table>
<thead>
<tr>
<th>Level of Savings</th>
<th>Net Growth Rate</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
<th>2027</th>
<th>2028</th>
<th>2029</th>
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</thead>
<tbody>
<tr>
<td>No EE programs</td>
<td>3.0%</td>
<td>90</td>
<td>93</td>
<td>95</td>
<td>98</td>
<td>101</td>
<td>104</td>
<td>107</td>
<td>111</td>
<td>114</td>
<td>117</td>
<td>121</td>
<td>125</td>
<td>128</td>
</tr>
<tr>
<td>0.5% savings/year</td>
<td>2.5%</td>
<td>90</td>
<td>92</td>
<td>95</td>
<td>97</td>
<td>99</td>
<td>102</td>
<td>104</td>
<td>107</td>
<td>110</td>
<td>112</td>
<td>115</td>
<td>118</td>
<td>121</td>
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<tr>
<td>1.0% savings/year</td>
<td>2.0%</td>
<td>90</td>
<td>92</td>
<td>94</td>
<td>96</td>
<td>97</td>
<td>99</td>
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<td>105</td>
<td>108</td>
<td>110</td>
<td>112</td>
<td>114</td>
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<tr>
<td>1.5% savings/year</td>
<td>1.5%</td>
<td>90</td>
<td>91</td>
<td>93</td>
<td>94</td>
<td>96</td>
<td>97</td>
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<td>101</td>
<td>103</td>
<td>104</td>
<td>106</td>
<td>108</td>
</tr>
<tr>
<td>2.0% savings/year</td>
<td>1.0%</td>
<td>90</td>
<td>91</td>
<td>92</td>
<td>93</td>
<td>94</td>
<td>95</td>
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<td>98</td>
<td>99</td>
<td>100</td>
<td>101</td>
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</tr>
</tbody>
</table>
# Season & Hour of T&D Peak Matter

<table>
<thead>
<tr>
<th>Substation</th>
<th>Customer Mix</th>
<th>Peak Season</th>
<th>Peak Hour</th>
<th>Residential CFLs</th>
<th>Residential A/C</th>
<th>Commercial Lighting Retrofits</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Primarily Business</td>
<td>Summer</td>
<td>3:00 PM</td>
<td>0.4</td>
<td>0.9</td>
<td>0.7</td>
<td>2.0</td>
</tr>
<tr>
<td>B</td>
<td>Primarily Residential</td>
<td>Summer</td>
<td>7:00 PM</td>
<td>0.4</td>
<td>1.4</td>
<td>0.3</td>
<td>2.1</td>
</tr>
<tr>
<td>C</td>
<td>Primarily Residential w/Electric Heat</td>
<td>Winter</td>
<td>7:00 PM</td>
<td>1.0</td>
<td>0.0</td>
<td>0.4</td>
<td>1.4</td>
</tr>
</tbody>
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Con Ed Distribution Deferral Cost-Effectiveness

NPV of Net Benefits of Con Ed’s 2003-2010 Non-Wires Projects
(millions $)

- Energy Savings
- T&D Savings
- Other Savings

Other Costs
Vendor Payments
# Institutionalizing Non-Wires Alternatives

## Screening Criteria for Triggering Detailed Assessments of NWAs

<table>
<thead>
<tr>
<th>Transmission</th>
<th>Must Be Load Related</th>
<th>Minimum Years Before Need</th>
<th>Maximum Load Reduction Required</th>
<th>Minimum T&amp;D Project Cost</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vermont</td>
<td>Yes</td>
<td>1 to 3</td>
<td>15%</td>
<td>$2.5 Million</td>
<td>Regulatory policy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 to 5</td>
<td>20%</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>6 to 10</td>
<td>25%</td>
<td></td>
<td></td>
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<tr>
<td>Maine</td>
<td>Yes</td>
<td></td>
<td>&gt;69 kV or &gt;$20 Million</td>
<td></td>
<td>Legislative standard</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>Yes</td>
<td>3</td>
<td>20%</td>
<td>$1 Million</td>
<td>Regulatory policy</td>
</tr>
<tr>
<td>Pacific Northwest (BPA)</td>
<td>Yes</td>
<td>5</td>
<td></td>
<td>$3 Million</td>
<td>Internal planning criteria</td>
</tr>
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</table>

## Distribution

<table>
<thead>
<tr>
<th></th>
<th>Must Be Load Related</th>
<th>Minimum</th>
<th>Maximum T&amp;D Project Cost</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG&amp;E (California)</td>
<td>Yes</td>
<td>3</td>
<td>2 MW</td>
<td>Internal planning criteria</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>Yes</td>
<td>3</td>
<td>20%</td>
<td>$1 Million</td>
</tr>
<tr>
<td>Vermont</td>
<td>Yes</td>
<td></td>
<td>25%</td>
<td>$0.3 Million</td>
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