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Sustainability through demand management

Jim Jaska
AECOM

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Sustainability through Demand Management

AECOM Energy
James Jaska
Agenda

– Mega trends
– Global dynamics
– Generation economics
– Demand management economics
– Future
Mega Trends—Global

- Population growth of 75 million per year with increased per capita consumption

- Electricity consumption doubled between 1970 and 2002 with projections of 57% increase by 2030 (IEA reports)

- Energy is a key factor in geopolitics

  - Imbalance of energy demand by developing countries growing at 121% per year

  - BRIC countries account for 75% of the increase in energy demand, 85% of the increase in CO2 emissions through 2030

Comparative Energy Statistics

Source: International Energy Agency; World Energy Statistics

AECOM Energy
Mega Trends—U.S.

- 50% growth in electricity demand expected over next 25 years

- Using current technologies, meeting this demand would require the building of 350 new power plants

- Renewables currently meet only 6% of demand
Mega Trends—Global Challenges

- Environmental threats from energy demand
  - Climate change could shrink global economy 20%
  - Up to 200 million people could become refugees (The Stern Report)

- Challenge: USD $10 trillion needed for power plants and infrastructure (IEA)
  - Over 4,800 Gigawatts of new capacity by 2025; 2,000 GW in industrial countries
  - 50% more output infrastructure in 2030 than today
  - Clean, reliable and sustainable
  - Efficient electrical use
  - Yet; over 2 billion have no electricity

- Shift to urban environment living (World Bank)
  - By 2015, 54% of the world’s population living in urban areas
  - Pressure to create sustainable environments
Factors of generation construction far out weigh the investment in demand management:
- Physical plant
- Siting
- Time

Upfront cost per generated unit of renewable technologies are more costly than CO2 producing technologies.

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>$ per MW hour</th>
<th>Plant Permitting</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>$60</td>
<td>$4 million</td>
<td>8-10 years</td>
</tr>
<tr>
<td>Coal with CO2 capture</td>
<td>$132</td>
<td>$4 million</td>
<td>8-10 years</td>
</tr>
<tr>
<td>Natural Gas Simple Cycle</td>
<td>$80-100</td>
<td>$1 million</td>
<td>2 years</td>
</tr>
<tr>
<td>Natural Gas Combined</td>
<td>$70-90</td>
<td>$1 million</td>
<td>2 years</td>
</tr>
<tr>
<td>Nuclear</td>
<td>$360-$600</td>
<td>$4-$10 million</td>
<td>12-15 years</td>
</tr>
<tr>
<td>Wind</td>
<td>$1 million</td>
<td>$500K</td>
<td>2-4 years</td>
</tr>
<tr>
<td>Solar</td>
<td>$2.7 million</td>
<td>$200K</td>
<td>2-4 years</td>
</tr>
<tr>
<td>Hydro</td>
<td>$1.2 to $5 million</td>
<td>$2-$4 Million</td>
<td>10-15 years</td>
</tr>
</tbody>
</table>
Demand Side Management—A Renewable Tool for Sustainable Supply

- **Objective:** manage consumption to optimize energy resources
  - Adds diversity to energy supply portfolio
  - Contributes to environmental sustainability
  - Increases overall energy security
- As a ‘flexible’ resource, demand management provides benefits beyond generation offsets
  - Enhancing system reliability
  - Dampening price volatility
  - Reducing other infrastructure costs (transmission, distribution, etc.)
Technology Response

Graph showing technologies that could reduce global CO₂ emissions from energy generation. The graph includes lines for energy efficiency, fossil-fuel switch, renewable energies, nuclear energy, carbon capture and storage, and remaining CO₂ emissions. The data is sourced from the European Commission.
# Demand Side Management Programs

<table>
<thead>
<tr>
<th>Approach</th>
<th>Program Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandated</td>
<td><em>Legislated standards</em></td>
<td>Min. performance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Top-runner stds</td>
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<tr>
<td></td>
<td><em>Industry “agreed” actions</em></td>
<td>Voluntary stds</td>
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<tr>
<td></td>
<td></td>
<td>Technologies</td>
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<tr>
<td></td>
<td><em>Delegated actions</em></td>
<td>Regional bodies</td>
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<td></td>
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<td>Municipalities</td>
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<tr>
<td></td>
<td></td>
<td>Certifications</td>
</tr>
<tr>
<td>Market adopted</td>
<td><em>Price-responsive customers</em></td>
<td>Tax reduction and rebates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Price elastic response</td>
</tr>
<tr>
<td></td>
<td><em>Commoditized energy efficiency</em></td>
<td>Energy services contracts—existing buildings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Green buildings</td>
</tr>
</tbody>
</table>
– So the **big green** question for “new build”
  – Life cycle vs. first cost
  – Green premiums - 2% to 6% to achieve a moderate level of sustainable design (LEED Silver)
  – A green building (USGBC):
    – Costs 9% less to operate
    – Increases resale value by 7.5%
    – Has a 3% increase in rent
C. Significant energy consumer

- More often life extended than replaced without addressing energy consumption factors
- More than 50% will still be in use in 2030
- Office buildings create high density demand
- Investment breakevens at 3 to 10 years

U.S. BUILDINGS IMPACTS ON RESOURCES

- 39% of total energy consumption (2006 US DOE Buildings Energy Databook)
- 71% of electricity consumption (2006 US DOE Buildings Energy Databook)
- 39% of CO₂ emissions (EIA, Emissions of Greenhouse Gases in the U.S.)
- 36% of all greenhouse gas emissions (EIA, Emissions of Greenhouse Gases in the U.S.)
The most cost effective and sustainable kilowatt is the one that is not used.
No longer a fad – demand management has grown dramatically over the last 10 years.

Current rising energy prices creating awareness:
- 3.7% drop in vehicle miles travelled
  - U.S. Federal Highway Administration
- IEA projects 22% hike in home heating oil
- U.S. oil use in its steepest dive in 26 years
New Demand Management Responses

- Established energy policies creating order
  - Energy Efficiency Portfolio Standards (EEPS)
  - Renewable Energy Portfolio Standards (RPS)

- National and State Executive Orders

- 48 state financial incentive programs

- Local response
  - Cambridge Energy Alliance

- Corporate social responsibility

- Utilities creating DSM programs
Renewable Portfolio Standards

**State Goal**

- **PA**: 18% by 2020
- **NJ**: 22.5% by 2021
- **CT**: 23% by 2020
- **MA**: 4% by 2009 + 1% annual increase
- **WI**: requirement varies by utility; 10% by 2015 goal
- **IA**: 105 MW
- **MN**: 25% by 2025 (Xcel: 30% by 2020)
- **TX**: 5,880 MW by 2015
- **AZ**: 15% by 2025
- **CA**: 20% by 2010
- **CO**: 20% by 2020 (IOUs)
- **CO**: 10% by 2020 (co-ops & large munis)
- **HI**: 20% by 2020
- **IL**: 25% by 2025
- **VT**: RE meets load growth by 2012
- **HI**: 20% by 2020
- **ME**: 30% by 2000
- **ME**: 10% by 2017 - new RE
- **NH**: 23.8% in 2025
- **MA**: 4% by 2009 + 1% annual increase
- **RI**: 16% by 2020
- **CT**: 23% by 2020
- **NY**: 24% by 2013
- **NJ**: 22.5% by 2021
- **PA**: 18%¹ by 2021
- **MD**: 9.5% in 2020
- **MD**: 9.5% in 2020
- **DE**: 20% by 2021
- **DE**: 20% by 2021
- **DC**: 11% by 2022
- **VA**: 12% by 2022
- **MO**: 11% by 2020
- **NC**: 12.5% by 2021 (IOUs)
- **NC**: 10% by 2018 (co-ops & munis)
- **NC**: 12.5% by 2021 (IOUs)
- **NC**: 10% by 2018 (co-ops & munis)
- **ND**: 10% by 2015
- **ND**: 10% by 2015
- **VA**: 12% by 2022

**Minimum solar or customer-sited RE requirement**
- *NV*: 20% by 2015
- *CA*: 20% by 2010
- *AZ*: 15% by 2025
- *NM*: 20% by 2020 (IOUs)
- 10% by 2020 (co-ops)
- *WA*: 15% by 2020
- OR: 25% by 2025 (large utilities)
- 5% - 10% by 2025 (smaller utilities)
- *WA*: 15% by 2020
- *NV*: 20% by 2015
- CO: 20% by 2020 (IOUs)
- *10% by 2020 (co-ops & large munis)
- *CO*: 20% by 2020 (IOUs)
- 10% by 2020 (co-ops & large munis)
- *NM*: 20% by 2020 (IOUs)
- 10% by 2020 (co-ops)
- HI: 20% by 2020
- TX: 5,880 MW by 2015
- WI: requirement varies by utility; 10% by 2015 goal

* Increased credit for solar or customer-sited RE
¹PA: 8% Tier I / 10% Tier II (includes non-renewables)
Decoupled Response Creates Challenges

– CA Governor’s Executive Order S.20.04 requires state agencies to reduce their energy use by 20% by 2015
– State RPS - 20% by 2010, goal is 33% by 2020
– State Bill AB32 - reduce GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, to 80% reduction from 1990 levels by 2050
– Los Angeles - RPS of 35% by 2020 - GHG emissions to be 35% lower than 1990 by 2030
– San Francisco - 100% renewable electricity by 2010
– San Diego - GHG 15% lower than 1990 by 2010
– San Jose – GHG 25% lower than 1990 by 2015
Managing Demand Can Pay Back

- **Demand side management investments**
  - Driven by simple payback – short term financing
  - Performance contracts compared to other investments

- **Institutional demand side management**
  - Longer term performance contracts – up to 25 years
  - Colleges, hospitals and federal buildings

- **Small business and residential DSM**
  - Simple technologies – lighting, appliances, weatherization, roofs, windows
  - Utility rebates and Energy Star ratings driven
Demand Management - $6 Billion US

22% Annual Growth

(Source: Consortium for Energy Efficiency)
Renewable sources of energy are becoming a part of the mainstream.

As energy demand continues to increase, energy efficiency improvements become evermore important:
- Cost of generation
- Time
- Environmental

Simple math: The most cost effective and sustainable kilowatt is the one that is not used.
AECOM (NYSE: ACM)
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- Renewable Energy Generation
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