Saving Electricity in a Hurry

Energy Efficiency: Policy Components, Principles and Instruments

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Shortfalls vary according to constraints, severity, and duration

**Energy Constrained Systems** – lack of MWh
- Poor rainfall – Brazil, Norway, New Zealand (2001), East Africa (2006)
- Poor operations planning & reservoir management – Tanzania, Brazil
- Conflicting uses for the water: Lake Victoria, Bonneville Power Authority
- No money to buy fuel (Ethiopia)
- Curtailment in fuel supply (e.g. Chile, importing gas from Argentina)

**Capacity Constrained Systems** – lack of peaking MW
- Insufficient generation capacity to meet peak load (Kenya)
- Low reserve margins or susceptibility to generation outages (SA)
- Very high prices due to market manipulation or lost interconnection (California, Juneau AK)
- Unsustainable peak demand growth & low load factors (MENA countries)

**Dually Constrained Systems** – lack of MWh and peaking MW
- Energy constrained systems with over-depleted reservoirs (Tanzania)
- Insufficient generation capacity to meeting intermediate load (India, Pakistan)

Source: World Bank 2009
Benefits of an electricity shortfall strategy

- Minimizes economic and social impacts
- Mobilizes support from stakeholders and civil society
- Increase awareness of the need for energy efficiency
Step-wise approach to developing a shortfall mitigation strategy

1. Identify possible shortfall scenarios
   - Cause
   - Severity
   - Duration

2. Understand patterns of customer electricity use

3. Evaluate potential energy savings measures
   - Costs, benefits, social impacts

4. Put in place standby arrangements
   - Identify lead agency
   - Authority for rationing and other measures
1. Identify possible shortfall scenarios and project their anticipated cause and duration.
Recent electricity shortfalls

<table>
<thead>
<tr>
<th>Country/state</th>
<th>Year</th>
<th>Cause</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>2008</td>
<td>Avalanche cut transmission line</td>
<td>Capacity</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>2005</td>
<td>Demand growth, insufficient investment</td>
<td>Capacity</td>
</tr>
<tr>
<td>Chile</td>
<td>2007/08</td>
<td>Drought, gas shortfall, plant breakdowns</td>
<td>Energy/capacity</td>
</tr>
<tr>
<td>China</td>
<td>2007</td>
<td>Drought</td>
<td>Energy</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>2009/10</td>
<td>Demand growth, insufficient investment</td>
<td>Capacity</td>
</tr>
<tr>
<td>Japan</td>
<td>2011</td>
<td>Earthquake/tsunami causes plant failure</td>
<td>Capacity</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2008</td>
<td>Drought</td>
<td>Energy</td>
</tr>
<tr>
<td>Pakistan</td>
<td>2007</td>
<td>Demand growth, insufficient investment</td>
<td>Capacity</td>
</tr>
<tr>
<td>South Africa</td>
<td>2008</td>
<td>Demand growth, insufficient investment</td>
<td>Capacity</td>
</tr>
</tbody>
</table>
2. Understand patterns of electricity use – by sector and end-use

Source: ANRE/METI, 2011.
3. Evaluate energy and demand savings measures

a. Price signals
b. Information campaigns
c. Technology replacement
d. Rationing
e. Market mechanisms
a. Price signals

- Time-of-use (TOU) pricing, in which price varies according to a preset schedule, *e.g.* time of day, day of week and season.

- Real-time pricing (RTP), in which the end-user price is linked directly to hourly spot prices in a wholesale market.

- Critical-peak pricing (CPP), a hybrid of TOU and RTP in which a TOU rate is in effect all year except for a contracted number of peak days (exact dates unknown) during which electricity is charged at a higher price.
b. Information campaigns

- Analyse what consumer behaviour to change
- Identify the target group
- Choose effective communications channels
- Convey urgency while keeping an upbeat tone
2. New Zealand: Proven practice information campaigns (EECA)

- Energywise campaign – Patt Murray
- Provides concrete advice
- Resonates in terms of things people care about (comfort, health)
- Really good website to find out more information [www.energywise.govt.nz](http://www.energywise.govt.nz)
- ‘Normalises’ energy-saving behaviour
Italy: No lift days

7 minutes of stairs a day can...

- Decrease risk of heart attack by more than 60%
- Burn fat!
- Oh yeah...save energy

Results: decrease final energy consumption by 35%
Japanese energy saving innovation

Web site for households to check energy use

Household Power Saving Menu

Check the actions below and prepare measures of your household.

<table>
<thead>
<tr>
<th>Suggested Menu for Household Power Saving Actions</th>
<th>Power Saving Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction Rate</td>
<td>Power Reduction</td>
</tr>
<tr>
<td>A/C</td>
<td></td>
</tr>
<tr>
<td>① Set room temperature at 28°C.</td>
<td>10%</td>
</tr>
<tr>
<td>② Use “sudare” or “yoshizu” (Japanese shades made of rattan and reed) to decrease sun exposure.</td>
<td>10%</td>
</tr>
<tr>
<td>③ Turn off A/C and use electric fan.</td>
<td>50%</td>
</tr>
</tbody>
</table>

Refrigerator

④ Change the refrigerator temperature setting from powerful to medium, minimise opening doors and limit amount of food kept inside. | 2% | 25W |

Lighting

⑤ Turn off lights during the day and reduce lighting in the evening. | 5% | 60W |

⑥ Use energy savings mode, decrease brightness, and switch off when not in use. | 2% | 25W |

Toilet heater/

⑦ Switch off seat-heating & hot-water functions. | Reduction by either one of the two | >1% | 5W |

Rice cooker/jar

⑧ Cook rice for the day and store it in the refrigerator rather than keeping it warm in the rice cooker. | 2% | 25W |

Standby Power

⑨ Unplug unused appliances. | 2% | 25W |

Apply ④⑦⑧⑨ measures even when you are away from home.

Save power by more than 15% (sum of power reductions) | % | W |

※Numbers listed for power saving effect are estimated as reduced power consumption and their % changes from the average daytime power consumption of about 1200W at 14:00 when family member(s) is(are) at home (ANRE estimation).

Super Cool Biz Summer 2011 office fashion ideas
What a little behaviour change can do

Which actions did you take?

- I took no action
- Installed insulation in attic, walls, or floor
- Switched to an alternative energy source for
  - Installed low-flow shower head
  - Installed water heater blanket
  - Turned off my hot tub and/or sauna
  - Sealed and/or weather-stripped windows
  - Switched to an alternative energy source for
  - Reduced the light output of bulbs in fixtures
  - Other
- Turned my water heater down
- Used power-saving settings on appliances
- Reduced the number of bulbs in light fixtures
- Took fewer showers
- Only heated rooms which were in use
- Took shorter showers
- Hung clothes to dry
- Washed full loads of laundry and/or washing
- Replaced normal light bulbs with compact
- Turned my thermostat down
- Unplugged appliances not in use
- Turned off lights more frequently
- Turned off appliances when not in use
- Had fewer lights on than I normally would
- Used electrical devices less often
c. Technology replacements

- deploying energy-efficient lighting, especially compact fluorescent lamps (CFLs) and light-emitting diodes (LED);
- replacing old equipment (ranging from refrigerators to traffic signals) with new, more-efficient technology;
- retrofitting and/or adjusting existing equipment to make it more efficient;
- installing load-control devices on selected appliances and equipment.
d. Rationing and market instruments

- Block load shedding
- Consumption rationing via quotas or entitlements
- Market-based rationing (quota and trade)
- Incentive/reward schemes (e.g. California’s 20/20 rebate programme)
The cases

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<tbody>
<tr>
<td>15% for most sectors</td>
<td>25% to 40%</td>
<td>3.6% to 6.7% for households</td>
<td>20%, primarily for industry</td>
<td>No demand growth</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Since March 2011</th>
<th>6 weeks</th>
<th>June-July 2008</th>
<th>January 2008-2009</th>
<th>Several months</th>
</tr>
</thead>
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<table>
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<tr>
<th>Electricity shortage management measures</th>
</tr>
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<tr>
<td>Price increases</td>
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<tr>
<td>Information campaigns</td>
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<tr>
<td>Technology replacement</td>
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<td>Rationing</td>
</tr>
<tr>
<td>Market mechanisms</td>
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2011 Japan earthquake & tsunami

- 15-25 GW of TEPCO’s total 70 GW capacity knocked out of service from the March 11 earthquake and tsunami
- 9 days of black-outs caused confusion and hardship
- Transport, hospitals, businesses hit hard
- Emergency Response entity (Electricity Supply Demand Emergency Response Headquarters) developed plans for the summer peak period
- Energy savings measures:
  - Multi-media awareness-building campaign
  - Mandatory rationing of 15% for industry
  - Super Coolbiz programme
  - Energy savings advice to small and medium enterprises
- Japanese community spirit and innovation in gear
- Most consumers are ready to respond to a crisis. They just need some guidance to contribute.
## Key messages from the case studies

<table>
<thead>
<tr>
<th>Case study</th>
<th>Key message</th>
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<tbody>
<tr>
<td>Japan</td>
<td>Most consumers are ready to respond to a crisis. They just need a little guidance in order to quickly contribute</td>
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<tr>
<td>Juneau, Alaska</td>
<td>Establishing a new, neutral entity (not government or industry) can help mobilize community response</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Shortfall-prone countries should put in place pricing and other mechanisms to mitigate shortfalls</td>
</tr>
<tr>
<td>South Africa</td>
<td>Don’t rely on a single sector – need to mobilize all consumers</td>
</tr>
<tr>
<td>Chile</td>
<td>Plan ahead through collecting good data.</td>
</tr>
</tbody>
</table>
Recommendations for Governments and Regulators

- Evaluate whether your power sector is exposed to electricity shortfalls, and if so make contingency plans.
- Designate responsibility for planning and implementing shortfall management strategies.
- Make sure energy providers collect data on electricity usage patterns, to identify energy savings measures.
- Consider the full range of energy savings measures in any electricity shortfall strategy.
- Anticipate and resolve any regulatory or other barriers to your energy savings measures.
- Clearly articulate a trigger point that defines when a shortfall is imminent, and when shortfall management should commence.
Discussion topics

- Which of these demand side measures have been used in Ukraine?
- Which do you think would have the most impact on a shortfall?
Questions?

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Juneau Alaska

- Small, isolated community
- Electricity shortfall by avalanche brought on a quick response
- *Juneau Unplugged* campaign reduced demand by 40%
- Fuel switching provided the most savings
- An NGO proved effective in mobilizing the community
### Evaluating rationing strategies

<table>
<thead>
<tr>
<th>Rationing Strategies</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block load shedding</td>
<td>Easy to implement</td>
<td>Unpredictable, very inefficient, unpopular</td>
<td>Bangladesh, California</td>
</tr>
<tr>
<td>Class-wide consumption quotas</td>
<td>Equitable</td>
<td>Inefficient</td>
<td>Brazil, Japan</td>
</tr>
<tr>
<td>Market-based rationing (quota and trade)</td>
<td>Economically efficient</td>
<td>Requires &quot;safety nets&quot;</td>
<td>Brazil, Japan</td>
</tr>
<tr>
<td>Incentive/reward schemes</td>
<td>Equitable</td>
<td>More difficult to implement</td>
<td>California</td>
</tr>
<tr>
<td></td>
<td>Sustainable</td>
<td>Requires strong leadership</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Encourages efficiency investment</td>
<td>More expensive in the short run</td>
<td></td>
</tr>
<tr>
<td>Rationing using price signals</td>
<td>Equitable</td>
<td>Bill impacts from higher rates</td>
<td>Most OECD countries</td>
</tr>
<tr>
<td></td>
<td>Sustainable</td>
<td>Need to maintain a social safety net</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reflects marginal costs</td>
<td>May induce load impact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Encourages investments</td>
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*Source: Heffner, et al 2009*