Overview of California’s Electricity System

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California Energy Commission
January 21 and 28, 2005
Overview

• What is unique about electricity?
• How much do we use?
• Where does it come from?
• Who does what in the system?
• Why are we talking about this?
Electricity...
Electricity…

- Instantaneous
- No storage
- Follows laws of physics
- Essential to our society
- Complex and Integrated system
California’s Electric System

- 12.9 million customers
- Average use - 624,000 megawatt hrs/day
- Peak demand - 56,714 megawatts (2004)
- Over 1,200 electrical generators
- Over 53,700 megawatts of capacity
- Over 38,000 miles of transmission lines
Patterns of Daily Peak Demand

Demand is volatile in the summer

Low points are weekend or holidays

Summer (May - Sept)
CA Generation Fuel Type

- Natural Gas: 57%
- Hydro: 21%
- Wind: 2%
- Biomass: 2%
- Geothermal: 4%
- Coal: 6%
- Nuclear: 7%
- Solar: 1%
- Biomass: 2%
- Natural Gas: 57%
Aging Facilities

<table>
<thead>
<tr>
<th></th>
<th>Power Plants (#)</th>
<th>Power Plants (%)</th>
<th>Capacity (MW)</th>
<th>Capacity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>971</td>
<td></td>
<td>53,000</td>
<td></td>
</tr>
<tr>
<td><strong>Over 40</strong></td>
<td>128</td>
<td>13.2</td>
<td>17,200</td>
<td>32.1</td>
</tr>
<tr>
<td><strong>Over 30</strong></td>
<td>181</td>
<td>18.6</td>
<td>26,000</td>
<td>48.6</td>
</tr>
</tbody>
</table>
Aging Power Plants

Age of California Power Plants

Nameplate Capacity, MW

1900 - 1909
1910 - 1919
1920 - 1929
1930 - 1939
1940 - 1949
1950 - 1959
1960 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 -
The Western Grid
California’s Power Sources

- NW 10%
- SW 8% imports 14% owned
- 68% in-state

California’s Power Sources:
- Idaho-SPP
- Utah
- Wyoming
- ID-SPP
- Southern Nevada
- Arizona
- New Mexico
- Palo Verde
- California
California Electric Industry Restructuring Act (AB 1890)

- Signed September 1996

- Primary Goals
  - Increase competition
  - Reduce rates -- 10 to 20%
  - Maintain a reliable system

- Reliability - THE major concern
Energy “Agencies”

- Public Utilities Commission - rates, utility oversight
- Energy Commission - siting, forecasting, efficiency stds.
- Electricity Oversight Board - ISO oversight (reorg?)
- Independent System Operator - transmission operation
- Power Exchange - exchange forum (no longer exists)
- Power Authority – financing (no longer funded, reorg?)
- Federal Energy Regulatory Commission
  - wholesale rates
Supply Demand Balance

- **MegaWatts**

<table>
<thead>
<tr>
<th>Year</th>
<th>1- in- 10 Summer Temperature Demand (Hot)</th>
<th>1- in- 2 Summer Temperature Demand (Normal)</th>
<th>Net Firm Imports</th>
<th>High Probability Additions - Only count plants deemed 75% or better chance of being built.</th>
<th>Spot Market Imports</th>
<th>Emergency Response Programs/Interruptibles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>33000</td>
<td>34000</td>
<td>28000</td>
<td>40000</td>
<td>50000</td>
<td>60000</td>
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<tr>
<td>2005</td>
<td>33000</td>
<td>34000</td>
<td>28000</td>
<td>40000</td>
<td>50000</td>
<td>60000</td>
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<tr>
<td>2006</td>
<td>33000</td>
<td>34000</td>
<td>28000</td>
<td>40000</td>
<td>50000</td>
<td>60000</td>
</tr>
<tr>
<td>2007</td>
<td>33000</td>
<td>34000</td>
<td>28000</td>
<td>40000</td>
<td>50000</td>
<td>60000</td>
</tr>
<tr>
<td>2008</td>
<td>33000</td>
<td>34000</td>
<td>28000</td>
<td>40000</td>
<td>50000</td>
<td>60000</td>
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<tr>
<td>2009</td>
<td>33000</td>
<td>34000</td>
<td>28000</td>
<td>40000</td>
<td>50000</td>
<td>60000</td>
</tr>
<tr>
<td>2010</td>
<td>33000</td>
<td>34000</td>
<td>28000</td>
<td>40000</td>
<td>50000</td>
<td>60000</td>
</tr>
</tbody>
</table>
Local Electricity Reliability Areas

- Humboldt Area
- Battle Creek Area
- Chico Area
- Sierra Area
- Stockton Area
- North Bay Area
- Greater Bay Area
- Fresno Area
- Los Angeles Basin
- San Diego Area
## 2005 Monthly Outlook - SCE and SDG&E Service Territories

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>Sept</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Existing Generation</td>
<td>20,154</td>
<td>20,120</td>
<td>20,249</td>
<td>20,249</td>
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<tr>
<td>2</td>
<td>Retirements (Known)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Retirements (High Risk)</td>
<td>-676</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>High Probability CA Additions</td>
<td>642</td>
<td>129</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Forced Outages</td>
<td>-1,200</td>
<td>-1,200</td>
<td>-1,200</td>
<td>-1,200</td>
</tr>
<tr>
<td>6</td>
<td>Zonal Transmission Limitation</td>
<td>-800</td>
<td>-800</td>
<td>-800</td>
<td>-800</td>
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<tr>
<td>7</td>
<td>Net Interchange</td>
<td>9,903</td>
<td>9,903</td>
<td>9,903</td>
<td>9,903</td>
</tr>
<tr>
<td>8</td>
<td>Total Supply (MW)</td>
<td>28,023</td>
<td>28,152</td>
<td>28,152</td>
<td>28,152</td>
</tr>
<tr>
<td>9</td>
<td>1-in-2 Summer Temperature Demand (Normal)</td>
<td>24,782</td>
<td>26,275</td>
<td>26,691</td>
<td>27,001</td>
</tr>
<tr>
<td>10</td>
<td>Projected Operating Reserve (1-in-2)**</td>
<td>21.8%</td>
<td>11.5%</td>
<td>8.7%</td>
<td>6.7%</td>
</tr>
<tr>
<td>11</td>
<td>1-in-10 Summer Temperature Demand (Hot)</td>
<td>26,214</td>
<td>27,793</td>
<td>28,233</td>
<td>28,561</td>
</tr>
<tr>
<td>12</td>
<td>Projected Operating Reserve (1-in-10)**</td>
<td>11.1%</td>
<td>2.0%</td>
<td>-0.4%</td>
<td>-2.2%</td>
</tr>
<tr>
<td>13</td>
<td>MW need to meet 7.0% Reserves in SP26</td>
<td>-667</td>
<td>893</td>
<td>1,364</td>
<td>1,715</td>
</tr>
</tbody>
</table>

### Notes:
- While preliminary, these numbers are suitable for projection/planning purposes and are best estimates as of Dec. 7, 2004.
- "So. Calif." represents SCE and SDG&E service territories only.
- ** Does not reflect uncertainty for "Net Interchange" or "Forced Outages" which can result in significant variation in Operating Reserve.
- Dependable capacity by station includes 1,080 MW of generation located South of Miguel
- CAISO-provided estimate.
- 2004 CAISO estimate for DC imports of 1,500 MW; Path 26 2,700 MW; SW imports 2,500 MW; Dynamics 1,003 MW, plus CEC estimate of LADWP imports of 1,000 MW. 2005 estimate increases DC imports by 500 MW, Path 26 by 300 MW and South of Miguel by 400 MW.
2005 Reserve – So. Cal.

- 2005 Reserve – So. Cal.
- Desired 7% Reserve
- Forecast for 1-in-2
- Forecast for 1-in-10
2005 Reserve – No. Cal.

- **Operating Reserve**
- **Forecast for 1-in-2**
- **Forecast for 1-in-10**
- **Desired 7% Reserve**

- June 2005: 15%
- July 2005: 20%
- August 2005: 25%
- September 2005: 30%
Loading Order...
Energy Efficiency

Impact of the Energy Efficiency Standards

Megawatts (MW) Saved

Year


Pre-2001 Standards  2001 Stds  2005 Stds
Total Electricity Use per Person (kWh)

- California
- Western U.S. (less CA)
- U.S.


kWh: 0, 2000, 4000, 6000, 8000, 10000, 12000, 14000, 16000
Renewables

33% by 2020
2004 IEPR Recommendation

20% by 2010
EAP policy

20% by 2017
current law

1983-2003
historical data

Estimated Statewide Total Eligible Renewables GWh/year (Excluding Large Hydro)
# Power Plant Development
**(since 1996)**

<table>
<thead>
<tr>
<th>Permitted Projects Status</th>
<th>Total</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational</td>
<td>24</td>
<td>8,311</td>
</tr>
<tr>
<td>Construction</td>
<td>13</td>
<td>5,189</td>
</tr>
<tr>
<td>Financing</td>
<td>1</td>
<td>185</td>
</tr>
<tr>
<td>On hold by developer</td>
<td>13</td>
<td>7,939</td>
</tr>
<tr>
<td>Canceled by developer</td>
<td>3</td>
<td>342</td>
</tr>
<tr>
<td><strong>Total Projects Permitted</strong></td>
<td>54</td>
<td>21,967</td>
</tr>
<tr>
<td><strong>Total Projects Currently in Review</strong></td>
<td>8</td>
<td>995</td>
</tr>
</tbody>
</table>
California’s Air Quality

2001 Area Designations for State Ambient Air Quality Standards
OZONE

2001 Area Designations for State Ambient Air Quality Standards
PM10

- Unclassified
- Attainment
- Nonattainment-Transitional
- Nonattainment
- Air Basin
- County
California’s Natural Gas Use

- Residential, Commercial, and Industrial
- Electric Generation

Graph showing the trend from 1995 to 2012.
California CO₂ Sources

- Transportation: 58%
- Electricity Generation: 16%
- Industrial: 13%
- Residential: 9%
- Commercial: 4%

Source: Draft Greenhouse Gas Inventory Update, California Energy Commission, 2001
California Snow Pack

Sacramento River Runoff (1906-2001)
April to July as a Percent of Total Runoff

Source: Ca. Env. Protect. Agency, Environmental Protection Indicators for California, 2001
Electricity System Concerns

• Growing demand in state (~2% per year)
• Growing demand in the west
• Potential retirement of older plants
• Delays building new power plants
• Growing dependence on one fuel
• Weaknesses in the transmission system
• Environmental and Env. Justice issues
• Long-term uncertainty
Conclusion

• There are plenty of challenges.

• We must act now for the short-term.
  – Encourage energy efficiency
  – Develop alternatives
  – Improve infrastructure

• We need a clear, stable, long-term plan.