Reserve Margin

The California energy agencies periodically evaluate short-term market developments and a range of system variations to determine if there are any significant risks of electricity supply shortfalls during the upcoming peak demand season.

The electricity supply assessment for the summer peak demand season includes evaluating existing generation capacity reserves that serve as a buffer for unplanned fluctuations (sudden increases in demand or power plant outages), and analyzing the probabilities that a system emergency may occur.¹ A reserve margin is the amount of electricity imports and in-state generation capacity available over average peak demand conditions. Reserve margins are measured at two levels: planning (month-ahead to 10 years) and operating (real time).

The real-time minimum operating reserve margin target is established by the Western Electricity Coordination Council and implemented by balancing authority area operators, such as the California Independent System Operator (ISO).² Dropping below an operating reserve margin target triggers additional power purchases and calls for demand response and voluntary interruptible programs to reduce load. The system operator will initiate supply warnings at a 7 percent (Stage 1) and 5 percent (Stage 2) operating reserve. Stage 3 is called when operating reserves fall to a level between 3 percent and 1.5 percent, depending on the operating conditions. The system operator may initiate rotating outages (involuntary load curtailment) during a Stage 3 event to insure that the system remains stable and avoids the possibility of uncontrolled outages that can cascade throughout the West.

A planning reserve margin target is a long-term measurement intended to assure sufficient electricity supplies can meet real-time operating reserve requirements and avoid the possibility that a loss of load would occur more frequently than one-day-in-ten-years. Rare conditions will occur, such as the 2006 summer temperatures that caused a simultaneous spike in electricity demand throughout California and the West. Even though this 1-in-30 year event topped out above the range of uncertainties established for the planning reserve margin target, sufficient electricity imports and generation supplies avoided any consumer curtailments. The purpose of a planning and operating reserve margin target is to balance the risks of outages and overall costs to maintaining a redundant system.

The one-day-in-ten-year outage reliability criterion translates into a 15 percent to 17 percent planning reserve target, which has been the California reliability standard for years. The California Public Utilities Commission uses this target for determining the amount of electricity supplies that the investor-owned utilities must procure to meet customer demand. This reliability target may slightly differ from the planning reserve margin used by publicly owned utilities and other utilities throughout the West.

¹ System emergencies do not include distribution outages or possibilities of natural catastrophes.
² Operating reserve margin is the amount of imports and actual spinning generation above current demand and represents real-time operations that fluctuate minute by minute. This does not include the generation that is not scheduled to operate, shut down for planned maintenance, unexpected outages or unable to be delivered because of transmission problems. Actual demand levels may also be higher than expected when generation was scheduled to operate the day before and result in a shortfall in operating power plant supply.
Calculating the planning reserve margin is done early each year to determine if sufficient generation will be available to meet summer peak demand and established reliability targets. Resource capability is calculated as a sum of generation available at time of peak demand, anticipated imports during peak load conditions, and expected load reductions from demand response and interruptible programs.

The planning reserve margin is calculated using the forecast 1-in-2 peak demand based on 1-in-2 weather and economic conditions. The 1-in-2 peak demand means there is a 50 percent probability that the demand will be higher or lower than the 1-in-2 forecast amount. The reserve margin is calculated by subtracting the forecast peak demand from the total available supply and dividing the result by the forecast 1-in-2 peak demand. Figure 1 shows that the generation reserves to serve the summer peak demand (August) was almost double the planning reserve reliability target. The figure also shows that the reserve margin using a 1-in-10 peak demand forecast also exceeds that planning reserve target. The 1-in-10 peak demand forecast assumes temperatures at the 90th percentile of the historical annual peak temperature distribution and has a 10 percent probability of being exceeded.3

Figure 1: Statewide 2011 summer outlook reserve target

The planning reserve margin values in Table 2 and Figure 2 are drawn from the Electricity Supply and Demand Outlook produced by the Energy Commission since 2002. This table shows the statewide peak generation capability, demand response and interruptible programs, expected imports, and 1-in-2 peak demand, as well as the calculated planning reserve margin for the peak electricity demand for 2009, 2010 and 2011. The values in Table 2 are planning numbers and were generated in the months prior to the summer in question. As a result, the demand values do not match actual demand for each summer. New generation facilities have

---

3 There is no reliability reserve targets that apply a 1-in-10 demand projection, so even if the 1-in-10 reserve margin estimate falls below the 15 percent target, the electricity system is still considered to be adequate.
been added since the 2000-2001 energy crisis, which pushes the planning reserve margins above the reliability targets for the decade.

Table 2: Reserve margin for California

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-peak Generation (MW)</td>
<td>53,897</td>
<td>54,676</td>
<td>55,680</td>
<td>54,902</td>
<td>57,377</td>
<td>58,553</td>
<td>59,224</td>
<td>60,329</td>
<td>61,100</td>
<td>61,362</td>
</tr>
<tr>
<td>Demand response and Interruptible Programs</td>
<td>2,044</td>
<td>1,845</td>
<td>1,885</td>
<td>1,840</td>
<td>2,040</td>
<td>2,127</td>
<td>2,486</td>
<td>2,599</td>
<td>2,784</td>
<td>2,946</td>
</tr>
<tr>
<td>Expected Imports (MW)</td>
<td>5,374</td>
<td>5,374</td>
<td>5,374</td>
<td>12,921</td>
<td>13,118</td>
<td>13,118</td>
<td>13,118</td>
<td>13,118</td>
<td>13,118</td>
<td>13,118</td>
</tr>
<tr>
<td>Total Net Supply (MW)</td>
<td>61,315</td>
<td>61,895</td>
<td>62,939</td>
<td>69,663</td>
<td>72,535</td>
<td>73,798</td>
<td>74,828</td>
<td>76,046</td>
<td>77,002</td>
<td>77,426</td>
</tr>
<tr>
<td>1-in-2 Peak Demand (MW)</td>
<td>51,277</td>
<td>52,073</td>
<td>53,896</td>
<td>57,913</td>
<td>58,228</td>
<td>60,344</td>
<td>61,094</td>
<td>61,623</td>
<td>60,797</td>
<td>59,571</td>
</tr>
<tr>
<td>Projected Planning Reserve Margin</td>
<td>20%</td>
<td>19%</td>
<td>17%</td>
<td>20%</td>
<td>25%</td>
<td>22%</td>
<td>22%</td>
<td>23%</td>
<td>27%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Note 1: Calculation methodologies changed over the period. Table 2 includes an adjustment to reconcile the differences between the accounting methodologies to create reasonable comparisons from year to year. Therefore, reserve margins shown Table 2 may not match those in the source documents.

Note 2: Pre-2005 imports only include out of state generation owned or under contract by California utilities. 2005 and later generation reflects the value the system is capable of importing during a limited number of peak summer hours. During the 2006 heat storm, imports exceeded these values for several hours at peak.

Figure 2: Projected planning reserve target

The peak demand forecast used for the 2011 outlook is a limited update to the 2009 Integrated Energy Policy Review forecast, primarily to account for worse-than-projected economic conditions. As such, it includes the same demand-side adjustments as that forecast: 2011 incremental effects of about 525 MW from committed utility efficiency programs and 71 MW of
customer-side distributed generation. No demand response program adjustments were made on the demand side; 2,976 MW of demand response programs are treated as supply-side resources.

**References:**
For more information on resource adequacy see this link:
http://www.cpuc.ca.gov/PUC/energy/Procurement/RA/

For daily demand forecast, actual demand, and available resources in the California Independent System Operator balancing authority area see:

**Figure and Table Sources:**
Figure 1 and Table 2
2011 values from Page 2, Table 1

2010 values from Page 3, Table 1

2009 values from page 2, Table 1