

WECC Power Supply Assessment

August 1, 2003

A. Executive Summary

The purpose of this report is to present the results of the power supply assessment based on the April 2003 WECC Loads and Resources data for the years 2003 through 2012.

An Excel-based zonal model provided by the California Energy Commission (CEC) was used to conduct the studies. The model, SAM version 4.0, is the same version of the model that was used last year. The demands and resources data collected for WECC's 2003 Loads & Resources reports were used as input to the model.

The assessment utilized a deterministic approach in evaluating the power supply margin in meeting the firm peak demand requirements for the peak hour of the study month. Non-firm peak demands (~1,800 MW) were not considered. Uncertainties associated with such factors as resource availability and seasonal demand variations were considered explicitly by running additional scenario cases.

The results of the base summer study case (scenario #1) indicate that supplies in WECC should exceed demands through 2007, provided that conditions do not change beyond those studied. The study used a 7% reserve margin to represent reserve requirements, and a 5% de-rate (8% for CAISO and LADWP) to non-hydro generation to simulate forced outages. The Northwest hydro capacity was reduced by 4,200 MW to model an adverse hydro condition, and an additional 1,388 MW to model the sustained peaking adjustment¹. Generation additions that are currently under construction and all planned retirements were included along with the existing generation. The zonal transfer capabilities were set at the adverse OTC levels (ratings that may reasonably be expected to apply under simultaneous high seasonal transmission loading conditions).

Four additional summer scenarios were run as sensitivity studies with various combinations of generation and reserve margin. These other scenarios provide sensitivity analysis for a higher reserve margin and for fewer resource additions. In the studies where deficiencies developed in later years, surplus resources in the northwest were stranded by transmission constraints as depicted in the graphic on page 21.

¹ The sustained peaking adjustment is a reduction to available hydro capacity that is often used in northwest planning studies to model weekly capacity based on 10 hours per day and 5 days per week (see BPA White Book for further information).

A winter study case (scenario #6) was run using resource and demand data for January, and similar parameters to the base summer case. The Northwest hydro capacity reduction was 2,200 MW instead of 4,200 MW, and the sustained peaking adjustment was 6,972 MW. The adverse OTC transfer capabilities for winter conditions were used for this case. Under the conditions studied, the CFE-Mexico and Northern California areas showed supply deficiencies in 2013, the last year of the study.

The assessment model is designed to measure the supply/demand margin based on forecasts of peak demands and resources. While peak demand forecasts for several years into the future are readily available from the WECC control areas, the forecasts of resource additions only exist for a few years into the future. Therefore, the validity of the results decreases the further out one looks. There is a point where the results shift from a determination of power supply margin to a determination of future needs.

The stated assumptions should be considered together with the presented results. A determination of a positive supply margin for a zone does not necessarily mean that all demands within that zone are met. Transmission constraints internal to a zone may limit electricity transfers to local demand areas, leaving them without a positive margin. These transmission-constrained local demand areas may include one or more major metropolitan areas within a zone and may include most of the total population within a zone. WECC's seasonal assessments and Ten-Year Coordinated Plan Summaries address potential intra-zonal resource inadequacies based on information provided by representatives from the various areas.

Supply studies related to the effect that reduced forward prices might have on the development of future generating resources were beyond the scope of the assessment methodology.

B. Introduction and Background

The WECC, including its committees, recognized the need to study the power supply/demand margin on a council-wide basis and to identify areas within WECC that have the potential for electricity supply shortages based on reported demand and resource data and considering transmission constraints between areas.

The WECC Reliability Subcommittee has the responsibility to establish the tools, methodology, and data requirements for conducting the power supply assessments. This responsibility is described in the attached document entitled “WECC Power Supply Assessment Policy.” The attached policy document provides additional information regarding the need to conduct such assessments.

The WECC staff was given the assignment to use the WECC Loads and Resources (L&R) data as input for the CEC model and utilize the model’s results to measure the supply/demand margins in the sub-areas or zones within the WECC. The purpose of this report is to document the results obtained from the model with the updated input data for the years 2003 through 2012.

C. Model Topology

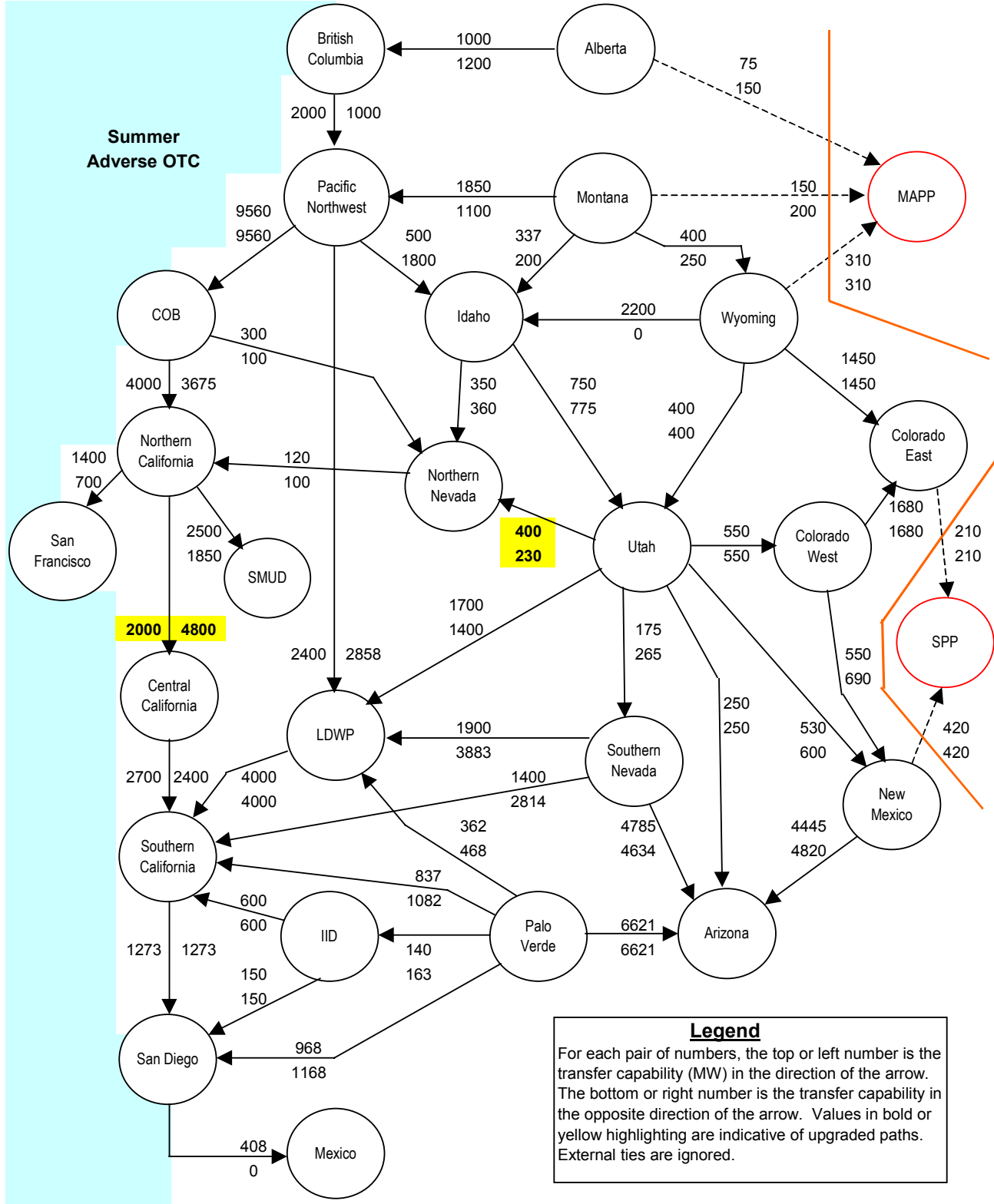
The topology of the CEC model is shown in the bubble diagram (Bubble diagram #1) on the next page. The lines between zones are intended to represent transmission connections between the zones and the listed numbers are the transfer path capabilities as reported by the control area representatives. The model observes these maximum capabilities as it solves each iteration.

Transfer capabilities have been reported based on the following criteria:

- Maximum Transfer Capabilities are the rated path capabilities associated with ratings found in the WECC Path Rating Catalog.
- Nominal OTC Transfer Capabilities are the transfer limits used in day to day operations based on thermal and/or stability limits for the season.
- Adverse OTC Transfer Capabilities are the limits that may reasonably be expected to apply under simultaneous high seasonal transmission loading conditions.

Only the Adverse OTC Transfer capabilities were considered for this assessment. The values shown on the bubble diagram are the adverse OTC capabilities for the summer season. The capabilities shown with yellow highlighting reflect changes in transfer capability during the study period. Transfers with other regional councils such as MAPP and SPP are ignored in this assessment.

Bubble Diagram #1 – Zone Topology (Summer – Adverse OTC)



D. Study Cases and Results

The criteria used in the six study cases are summarized in the following table. Note that “additions” refers to generation additions and retirements.

Table #1 – Scenario Criteria

Criteria	Study Scenarios					
	#1	#2	#3	#4	#5	#6
Generation						
Existing as of 12/31/02	yes	yes	yes	yes	yes	yes
Committed Additions Online by – (units that are under construction)	all	all	all	July 2003	July 2004	all
Uncommitted Additions (units that have not yet started construction)	no	yes	no	no	no	no
Non-Hydro De-rate (%) to model forced outages *	5%	5%	5%	5%	5%	5%
L&R Sched. Maint. and Inoperable	yes	yes	yes	yes	yes	yes
Peak Demands / Reserves **						
Peak Month	Aug	Aug	Aug	Aug	Aug	Jan
Margin Applied to Peak Demands (%)	7%	7%	12%	7%	7%	7%
Transfer Capability						
Maximum Path Rating						
Seasonal OTC Rating						
Adverse OTC Rating	X	X	X	X	X	X

*The non-hydro de-rates were set at 8% for the following zones: Northern California, Central California, Southern California, San Diego, San Francisco, and LADWP. See “Resource Adjustments” section for the restrictions used for hydro generation.

** Only firm peak demands were included in the demand requirements. Approximately 1,800 MW of non-firm demands were excluded.

The following pages present the detailed results of each of the six scenarios, including graphical representations of the annual margin by WECC area (areas are defined in Table #2). Note that the results may not accurately reflect the extent of the supply surplus or deficiency for a given area. If multiple areas are in need of additional capacity, several factors may determine which area(s) get access to any surplus capacity. Generally, the model will make excess capacity available first to the deficit area that is closest to the surplus area.

Table #2 – Area definitions

Area	Zones in Area	Area	Zones in Area
Canada	Alberta, British Columbia	No. CA	Central CA, Northern CA, San Francisco, SMUD
Northwest	COB, Idaho, Montana, No. Nevada, Northwest, Utah	Desert SW	Arizona, IID, New Mexico, Palo Verde, So. Nevada
Rockies	Colorado-East, Colorado-West, Wyoming	So. CA/MX	CFE-Mexico, Southern CA, San Diego, LADWP

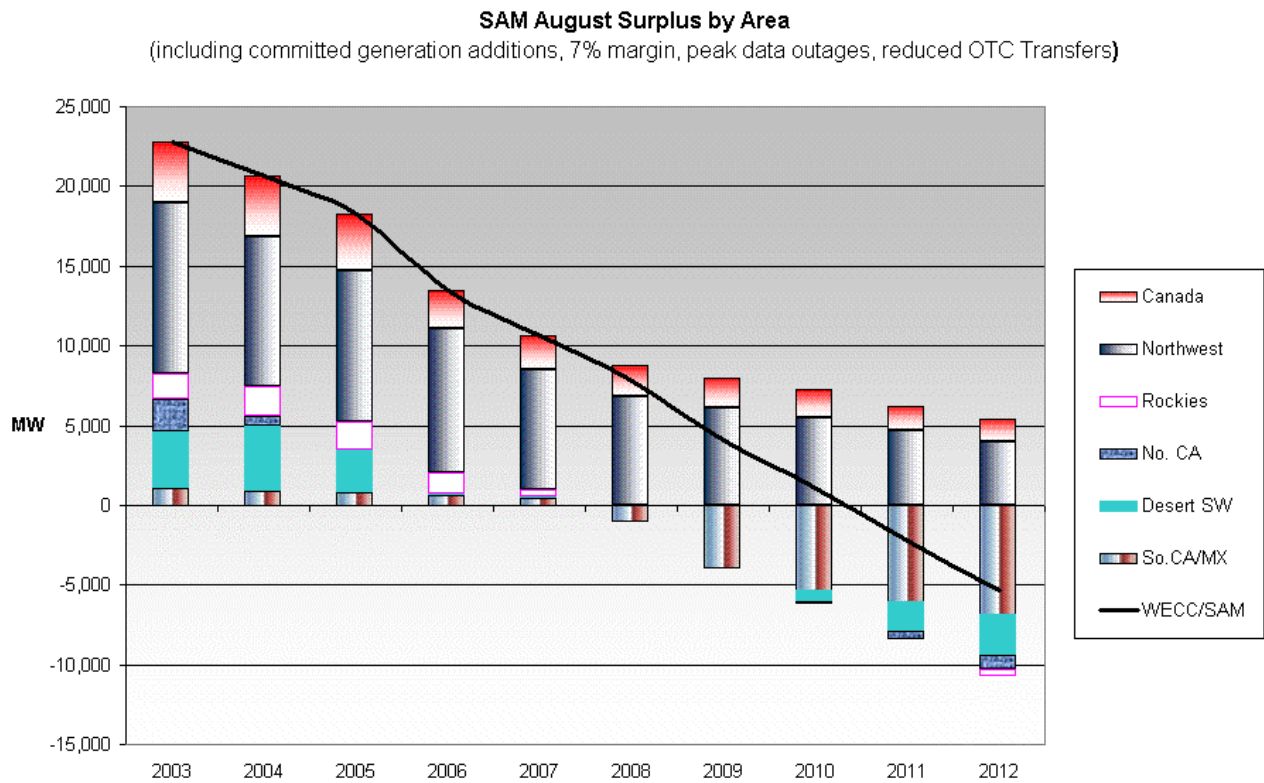
Scenario #1 – Results

Criteria: Reserve Margin 7%, Generation Additions = Committed² through August 2012, Scheduled outages & Inoperable, De-rates - Hydro 0%, Non-hydro 5% (8% CAISO & LADWP), Adverse OTC ratings, August peak demands.

The results of this case predict that under the studied conditions, power supplies in WECC will exceed demands through 2007. Beginning in 2008, transmission constraints prevent a surplus in the north (see north – south division in Bubble Diagram #2 on page 21) from reaching the deficit areas in the south. By 2011, the south deficit is larger than the north surplus, resulting in an overall deficiency for WECC.

The following graph presents the results by WECC area. When the surplus for an area is zero (0) and no bar is shown on the graph, the area is in resource / demand balance, or else it is importing to meet its demand.

Graph 1 - Scenario #1 Margin Graph³



The dip in 2006 is the result of the Mohave power plant retirement.

² Committed generation is generation that is currently in start-up or under construction.

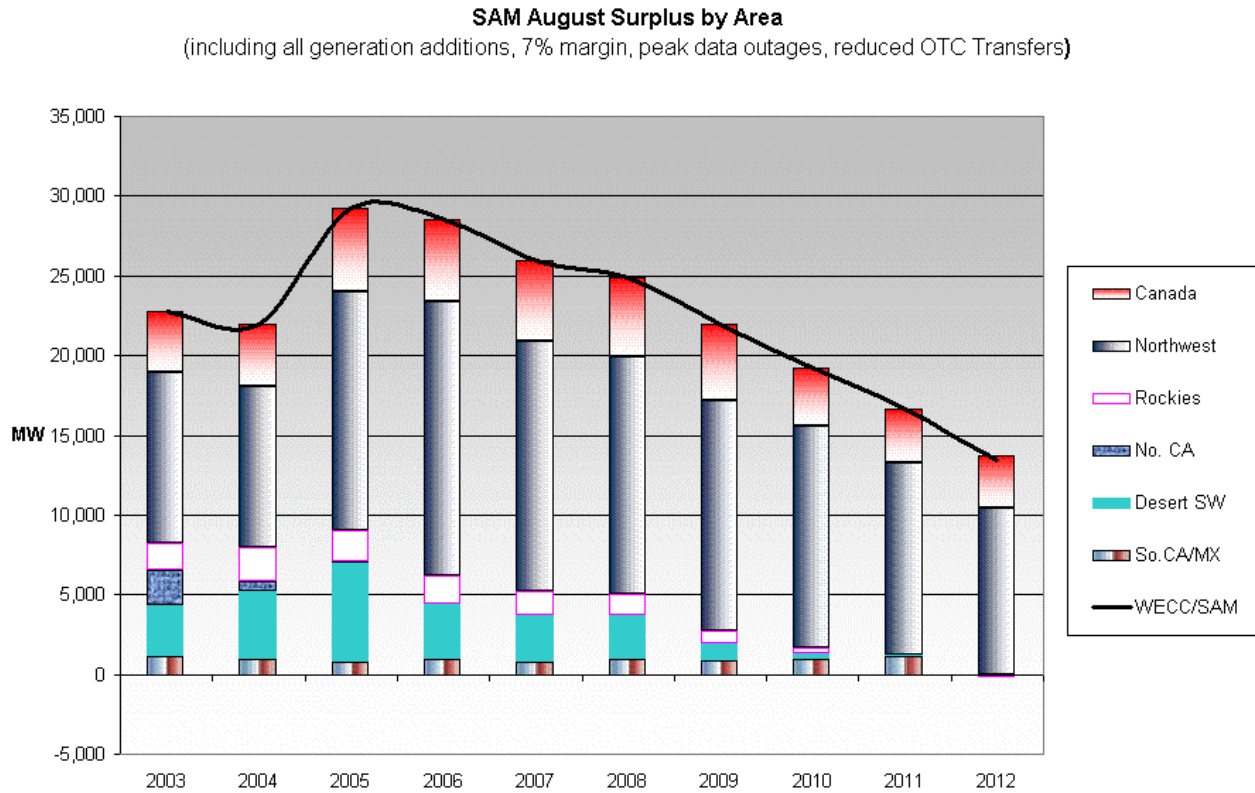
³ It is estimated that only 10% to 15% of the Northwest Capacity margin is firm energy availability.

Scenario #2 – Results

Criteria: Reserve Margin 7%, Generation Additions = Committed + Uncommitted through August 2012, Scheduled outages & Inoperable, De-rates - Hydro 0%, Non-hydro 5% (8% CAISO & LADWP), Adverse OTC ratings, August peak demands.

The results of this case predict that with the inclusion of the uncommitted generation additions and under the studied conditions, power supplies in WECC will exceed demands through 2011. The uncommitted resource additions accumulate to a total of 20,027 MW by the year 2011, with most of these additions coming online during 2005 and 2006 (see table #5). Since these projects have not started construction, there is a higher likelihood that a portion of them will be delayed or canceled. The following graph presents the results by WECC area.

Graph 2 - Scenario #2 Margin Graph



Once again, only a portion of the northwest capacity margin is firm energy availability. With the planned addition of nearly 5,000 MW of thermal generation in the Northwest in 2005, the amount of firm energy availability is higher here than in the previous scenario.

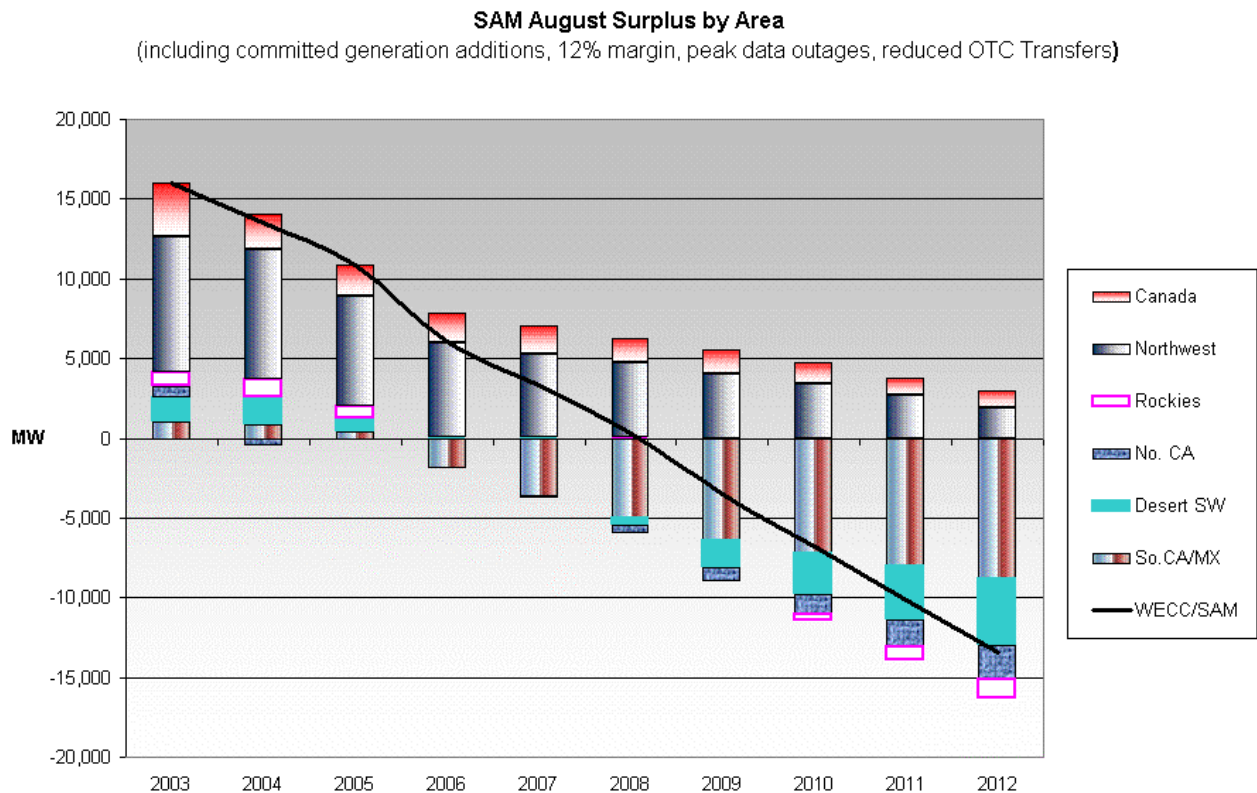
Scenario #3 – Results

Criteria: Reserve Margin 12%, Generation Additions = Committed through August 2012, Scheduled outages & Inoperable, De-rates - Hydro 0%, Non-hydro 5% (8% CAISO & LADWP), Adverse OTC ratings, August peak demands.

The results of this case predict that under the studied conditions (note the increase in reserve margin from 7% to 12%), power supplies in WECC will only exceed demands through 2003. In 2004 a deficit condition occurred in Northern California due to transmission constraints that are alleviated in 2005 by the Path 15 upgrade. However, transmission constraints resurfaced in 2006 to prevent a surplus in the north from reaching the deficit areas in the south. By 2009, the south deficit is larger than the north surplus, resulting in an overall deficiency for WECC. The following graph presents the results by WECC area.

This scenario represents the worst case of the five summer studies run. The higher reserve margin caused the deficits in the south to occur three years earlier (compared to scenario #1).

Graph 3 - Scenario #3 Margin Graph

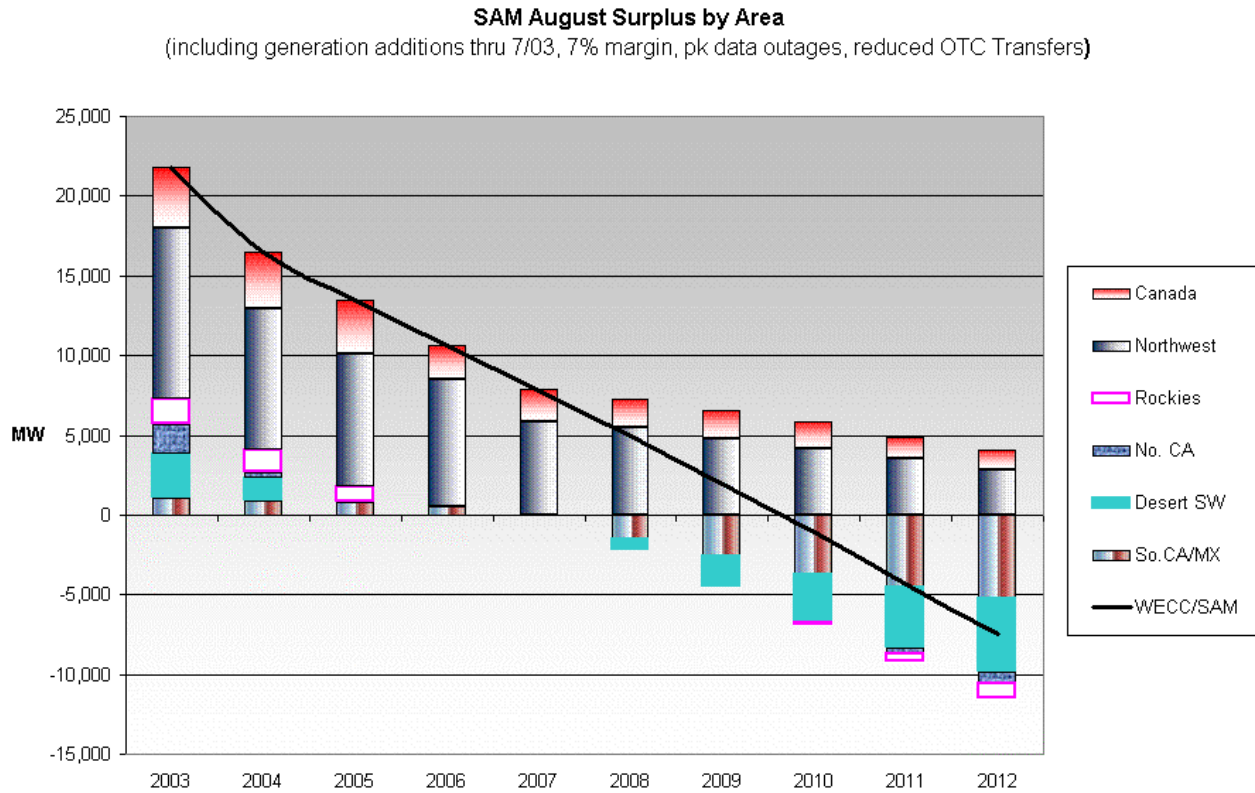


Scenario #4 – Results

Criteria: Reserve Margin 7%, Generation Additions = Committed through July 2003, Scheduled outages & Inoperable, De-rates - Hydro 0%, Non-hydro 5% (8% CAISO & LADWP), Adverse OTC ratings, August peak demands.

The results of this case predict that with no generation additions or retirements beyond July 2003, and under the other stated conditions, power supplies in WECC will exceed demands through 2007. Beginning in 2008, transmission constraints prevent a surplus in the north from reaching the deficit areas in the south. By 2010, the south deficit is larger than the north surplus. The July 2003 cutoff excluded approximately 1,000 MW of August 2003 additions. The following graph presents the results by WECC area.

Graph 4 - Scenario #4 Margin Graph



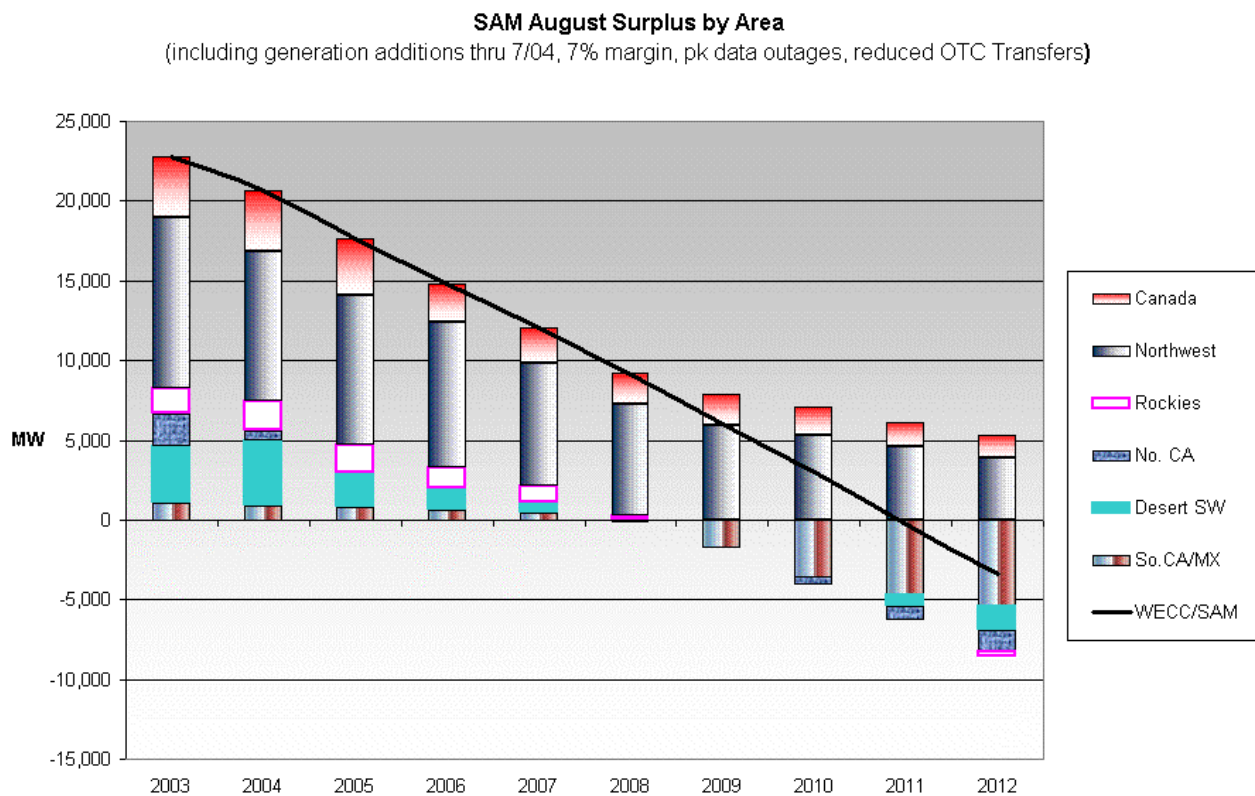
Scenario #5 – Results

Criteria: Reserve Margin 7%, Generation Additions = Committed through July 2004, Scheduled outages & Inoperable, De-rates - Hydro 0%, Non-hydro 5% (8% CAISO & LADWP), Adverse OTC ratings, August peak demands.

The results of this case predict that under the studied conditions, power supplies in WECC will exceed demands through 2008. Beginning in 2009, transmission constraints prevent a surplus in the north from reaching the deficit areas in the south. By 2011, the south deficit is larger than the north surplus.

This scenario is similar to scenario #1 since most of the generation additions beyond July 2004 are uncommitted. The most significant difference is that retirements after July 2004 are also ignored in this scenario. The following graph presents the results by WECC area.

Graph 5 - Scenario #5 Margin Graph

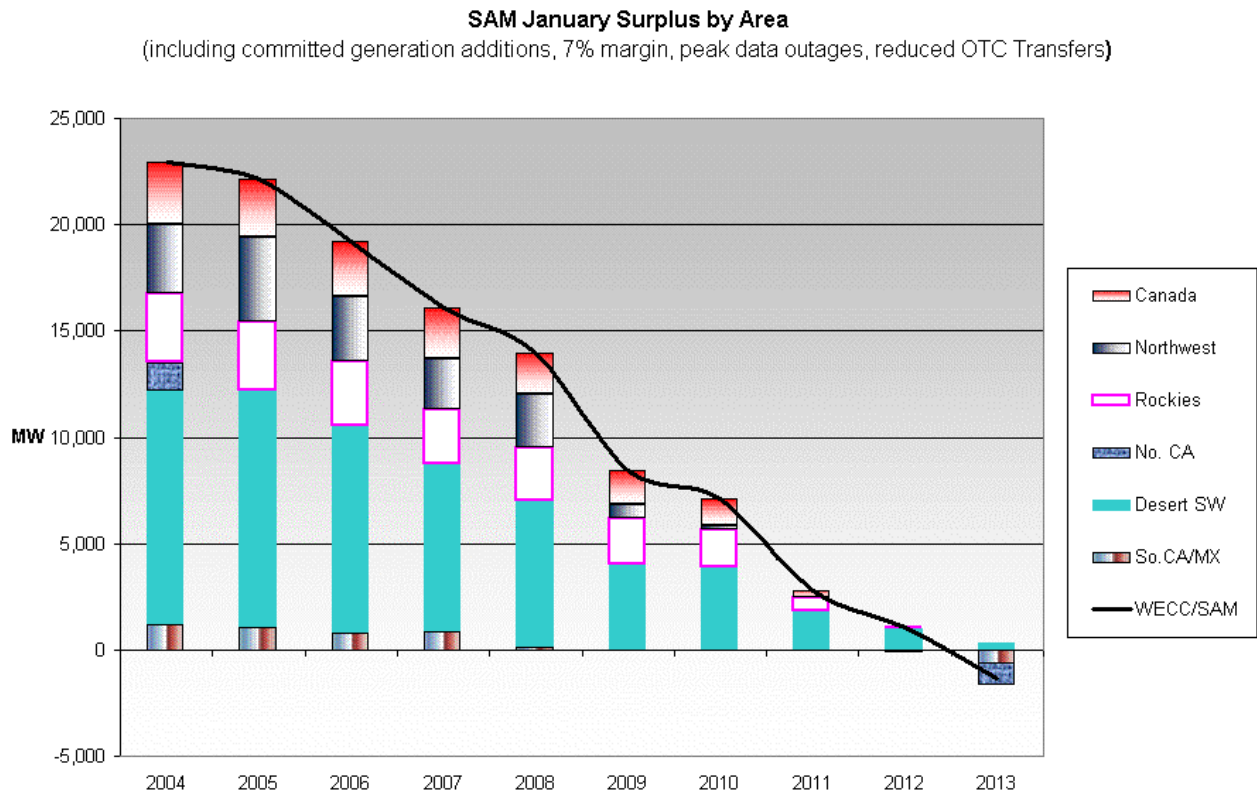


Scenario #6 – Results

Criteria: Reserve Margin 7%, Generation Additions = Committed through January 2013, Scheduled outages & Inoperable, De-rates - Hydro 0%, Non-hydro 5% (8% CAISO & LADWP), Adverse OTC ratings, January peak demands.

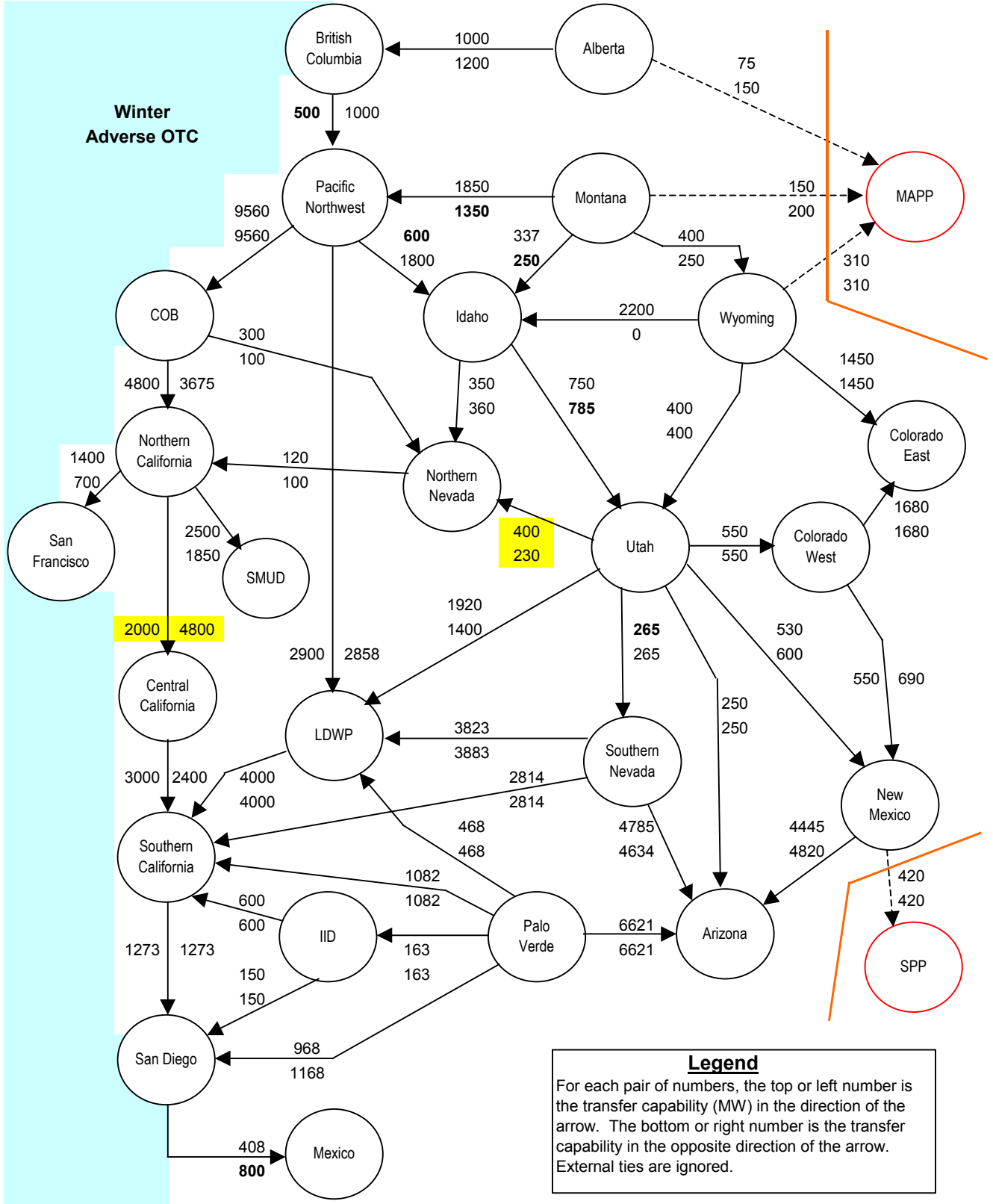
The results of this case predict that under the studied conditions, winter power supplies in WECC will exceed demands through 2012 (winter is the December to February period). In 2013, deficiencies developed in CFE-Mexico and Northern California. The deficiency for CFE-Mexico was due to the path from San Diego to Mexico being fully loaded. The following graph presents the results by WECC area, and Bubble Diagram #2 represents the winter adverse OTC transfer capabilities.

Graph 6 - Scenario #6 Margin Graph



The dips in 2009 and 2011 are due to an increase in the reported scheduled maintenance for those years.

Bubble Diagram #2 – Zone Topology (Winter – Adverse OTC)



E. Description of Model

The SAM model was developed by the CEC to study the balance between projected demands and resources in California and other WECC areas, taking into consideration transmission limitations between sub-areas. The model has the capability to perform either multiple-iteration probabilistic (stochastic) studies or single-iteration deterministic studies. Per instructions from the Reliability Subcommittee, all of the studies conducted for this report were deterministic. If probabilistic studies are requested in the future, it will be necessary to collect additional information.

For the purposes of this model, the WECC region is divided into the following sub-areas or zones. The zones are configured around demand centers and transmission hubs. Refer to the topology bubble diagram for connections between zones.

Alberta	Calif., San Francisco	Montana
Arizona	California, SMUD	Nevada, North
British Columbia	California, South	Nevada, South
California, Central	CFE-Mexico	New Mexico
California, IID	COB	Northwest
California, LADWP	Colorado, East	Palo Verde
California, North	Colorado, West	Utah
California, San Diego	Idaho	Wyoming

The following acronym definitions apply to this report.

AZ-NM-SNV	Arizona – New Mexico – Southern Nevada
CA-MX	California – Mexico (CFE –WECC)
CFE	Comision Federal de Electricidad
CISO	California Independent System Operator
COB	California Oregon Border
IID	Imperial Irrigation District
LDWP	Los Angeles Department of Water and Power
MAPP	Mid-Continent Area Power Pool
NWPP	Northwest Power Pool
PSC	Public Service of Colorado
RMPA	Rocky Mountain (Colorado – Wyoming)
SMUD	Sacramento Municipal Utility District
SPP	Southwest Power Pool
WACM	WAPA – Colorado / Missouri
WALC	WAPA – Lower Colorado

Demands

One component of the model's input data is estimated peak demands for each SAM zone. The control area firm peak demands as submitted for the L&R reporting were used in the model. Where control areas spanned more than one zone, the demands were allocated by percentages

(see details in Assumptions). The following table is an area summary of the actual and forecast firm peak August demands through 2007.

Table #3 - Firm August Peak Demands by Sub-Region (MW)

Sub-Region *	2001	2002	2003	2004	2005	2006	2007
AZ-NM-SNV	22,523	23,748	24,923	25,764	26,597	27,366	28,052
CA-MX	47,000	48,741	52,014	55,231	56,223	57,047	58,068
NWPP	44,444	46,781	47,402	48,329	49,289	50,159	51,043
RMPA	9,226	10,089	10,427	10,539	10,649	10,839	10,976
Total WECC	123,193	129,359	134,766	139,863	142,758	145,411	148,139

* For the purposes of this assessment, interruptible or non-firm demands are not included. Also, PACE-Wyoming demand is assigned to the RMPA sub-region for 2002 forward.

Each of the sub-regions is projecting steady load growth throughout the study period. The most significant change from last year's forecast is an increase in the CA-MX area forecast (57,047 MW by 2006, compared to 54,663 last year).

Resources

The resource data includes the existing generation units, the generation additions, the generation retirements, the scheduled maintenance, the inoperable generation, the forced outages, and miscellaneous deratings. The net resource capacities were summarized by zone and type (hydro or non-hydro) before being copied into the model. The detailed generation data are available in the WECC publication (Existing Generation and Significant Additions and Changes to System Facilities 2002 – 2012).

The tables below are a summary of the generation additions/retirements that became available or unavailable from 2002 through 2007 (months are inclusive). Committed generation is generation that is currently in start-up or under construction. Uncommitted generation is generation that has not started construction. Although the plans could change, all reported generation retirements were considered as committed.

Table #4 - Committed Generation Additions / Retirements by Sub-Region (MW)

Sub-Region	1/02-8/02	9/02-8/03	9/03-8/04	9/04-8/05	9/05-8/06	9/06-8/07
AZ-NM-SNV	2,218	5,001	2,791	1	-1,542	1
CA-MX*	2,658	3,557	-1,334	485	-501	10
NWPP	2,183	1,643	1,261	118	8	0
RMPA	736	803	585	0	0	0
Total WECC	7,795	11,004	3,303	604	-2,035	11

- The CA-MX 2002 additions do not reflect data adjustments to existing generation in the CAISO control area.

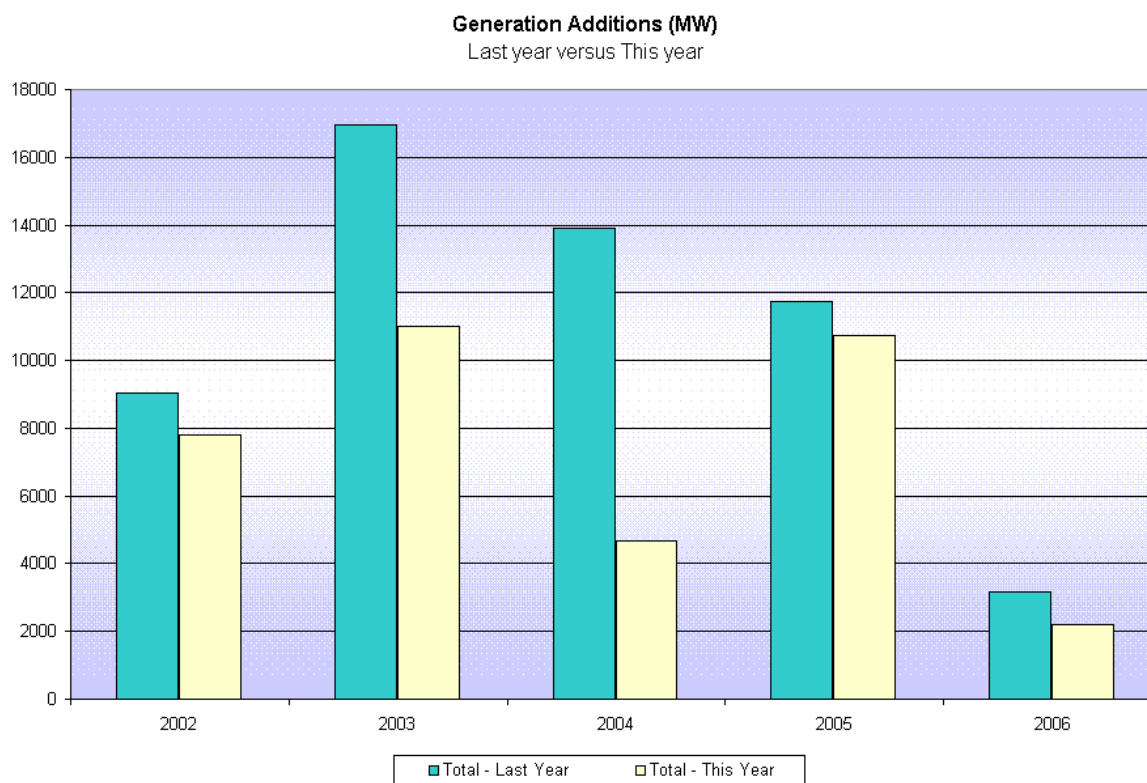
Only the years of most significance are shown in the tables. Data to support studies from 2003 through 2012 are included in the model.

Table #5 - Uncommitted Generation Additions by Sub-Region (MW)

Sub-Region	1/02-8/02	9/02-8/03	9/03-8/04	9/04-8/05	9/05-8/06	9/06-8/07
AZ-NM-SNV	0	0	0	2,025	520	120
CA-MX	0	0	648	3,295	829	0
NWPP	0	0	725	4,829	2,625	250
RMPA	0	0	0	0	274	0
Total WECC	0	0	1,373	10,149	4,248	370

In spite of having several generation projects canceled or postponed, there continues to be an aggressive construction program in WECC. As indicated in the following graph, WECC has experienced a significant decrease in planned generation additions since last year.

Graph #7 – Comparison of Planned Generation Additions



As new efficient plants are added, older inefficient plants are retired. The following table breaks out retirements by sub-region from 2002 through 2009. Note the retirement of Mohave in 2006.

Table #6 - Retirements by Sub-Region (MW)

Sub-Region	1/02-8/02	9/02-8/03	9/03-8/04	9/04-8/05	9/05-8/06	9/06-8/07	9/07-8/08
AZ-NM-SNV	0	0	0	0	-1,580	0	0
CA-MX	-152	-1,328	-1,347	-444	-521	0	0
NWPP	0	-147	0	0	0	0	0
RMPA	0	-90	0	0	0	0	0
Total WECC	-152	-1,565	-1,347	-444	-2,101	0	0

Scheduled maintenance and inoperable generation as reported in the L&R data were included as indicated in the studies. The majority of the August outages are scheduled for generation in Alberta and British Columbia. Other areas try to have all their units available for the summer peak. Some environmental constraints and wind de-rates in California are also represented.

Resource Adjustments - Hydro

Northwest – The reported reductions to decrease the hydro generation capabilities from median to adverse levels were used in the studies (January = -2,200 MW, August = -4,200 MW). In addition, adjustments were applied to reflect the “Sustained Peaking Adjustment” values that are commonly used in the northwest (January = -6,972 MW, August = -1,388 MW).

California – The CAISO hydro capacity was reduced from “nameplate” to nominal levels.

The hydro capacities in the other areas were not adjusted. It is anticipated that the available hydro capabilities throughout WECC will receive more emphasis in future assessments. There is no doubt that this will have a negative impact on the surpluses reported in future assessments.

Resource Adjustments – Non-hydro

The non-hydro generation capacities were de-rated in all six of the scenarios to model forced outages. An 8% de-rate was applied to the zones associated with the CAISO and LADWP. In all of the other zones the seasonal non-hydro capacities were reduced by 5%.

Transfer Paths

The transfer paths used by the program are based on the SAM zones, with paths connecting one SAM zone to another SAM zone where applicable. The model has data fields for the path, transfer capability, wheeling cost, and loss factor. The wheeling costs for each path are used to calculate the transfer costs for any imports into a zone. The loss factors are used to calculate the net transfer after losses for any imports into a zone. Standardized wheeling costs were used in the studies.

A request was sent out to a key control area in each zone to provide information on the transfer capabilities between zones. The responses were used to update the capabilities in the model based on the values provided. The transfer capabilities were further reduced based on input from the Reliability Subcommittee.

Solution

Microsoft Solver, a third-party tool included with Excel for solving constraint-based problems, is used to solve the demand/resource balance and calculate the surplus generation in each zone. The solution seeks the lowest overall resource cost subject to the following constraints:

- the demand requirements of each zone must be met (surplus ≥ 0); but it's possible for a zone to be deficit before solver starts
- the resource solution for each zone must be equal to or greater than zero
- the resource solution for each zone must not be greater than the available resources

- the resource solution for each zone must not be less than the minimum resource allocation

The solution uses transfers between zones to export resources from surplus zones to deficit zones. If a deficit is greater than the available transfer capability from the connected zones, then the zone will have a net deficit. The solution will also back off internal generation in a zone if a connecting zone has a surplus that is less expensive and the transfer path has available capability. Lower cost resources such as hydro resources are given priority within a zone and as imports, to serve local load and to displace more expensive generation.

The assessment model is designed to measure the supply/demand margins based on forecasts of peak demands and resources. While peak demand forecasts for several years into the future are readily available from the WECC control areas, the forecasts of resource additions only exist for a few years into the future. Therefore, the validity of the results decreases the further out one looks. The assessment results for the period beyond 2005 or 2006 are not a realistic picture of future supply margins. The addition of generation plants that are not accounted for in the current data should be expected. There is a point where the results shift from a determination of supply margin to a determination of future needs.

F. Application Summary

The SAM program uses an iterative methodology to determine the supply/demand margin. By design it isn't intended to perform a sophisticated engineering analysis. The solver add-in attempts to find a solution where resources and imports satisfy the demand requirements in each zone. The stochastic solutions model the system uncertainties based on historical demand and outage factors. The deterministic solutions simply compare total resources to total demands without modeling the uncertainties. For these studies, surplus is defined by the following formula.

$$\text{Surplus} = \text{Internal Resources} + \text{Imports} - \text{Demand} - \text{Exports}$$

While the model does consider transfer capabilities between zones, it is not designed to perform any sophisticated analysis of transfer limitations involving simultaneous flows or loop flows.

WECC Workarounds / Enhancements

WECC has implemented workarounds and enhancements to address problems with using the WECC L&R data in SAM, and problems with external resources and the posting of summary results. An intermediate spreadsheet was developed that reads the L&R data from the standard WECC data files and aggregates the demands and resources by SAM zone.

A workaround to account for external resources was developed to force the transfer of some jointly owned generation (such as Palo Verde, Colstrip, and others) from the host zones to the appropriate participants' zones.

An enhancement to account for changes to transfer path capacities was also added. For this assessment, the following transfer capability changes (selected from the Phase 3 projects of the WECC Three-Phase Rating Process) were represented.

- Utah – Northern Nevada, new rating of 400 MW east to west (230 MW west to east) due to planned addition of Falcon-Gonder line, effective July 2004.
- California, Central – California, North, new rating of 4,800 MW south to north due to path 15 upgrade, effective November 2004.

Assumptions

The following assumptions were used for the WECC studies:

- The input data represents demand forecasts and resources as of April 2003. Changes to this data will be collected and used in the power supply assessment prepared in the fall of 2003.
- Coincidental demands were used such that the peak zonal demands are the sum of the control area peak demands for each zone for each month.
- August was chosen as the summer peak month for each year. January was chosen as the winter peak month.

- Peak demands for CISO, PSC, WACM, and WALC were allocated to SAM zones based on the following ratios reported by the PCC representatives as part of their review in early 2003.

Table #7 - Percent of Control Area Demand Allocated to Zones

Zones \ Control Area	CISO	PSC	WACM	WALC
Arizona				72%
Colorado, East		88%	67%	
Colorado, West		12%	15%	
Nevada, South				
New Mexico				28%
Wyoming			18%	
California, North	39.4%			
California, Central	6.5%			
California, South	43.0%			
California, San Diego	8.6%			
California, San Fran.	2.5%			

- Since insufficient data were available for a detailed economic solution, the summary resources in each zone were all assigned the same costs (Hydro = \$5/MWH, Non-hydro = \$20/MWH), with the exception of Palo Verde (\$15/MWH).
- The adjustments for external generation that were used in the studies were for Bridger, Colstrip, Four Corners, Hayden, Hoover, Intermountain, Mohave, Navajo, Palo Verde, and San Onofre. No other adjustments were made for other joint plants or firm purchases.
- Ties to MAPP and SPP are not modeled since this would require generation and/or demand to be associated with these external areas.
- The model freely transfers resources from areas with surplus generation to deficit areas, considering transfer path constraints and transmission losses. Simultaneous flows, loop flows, and other transfer restrictions are loosely modeled in the adverse OTC ratings that were used in the studies.
- The model is not intended to measure the supply margins in the individual control areas (unless the zone definition and transfer capabilities exactly match the control area). The model assumes that there are no constraints internal to a zone.

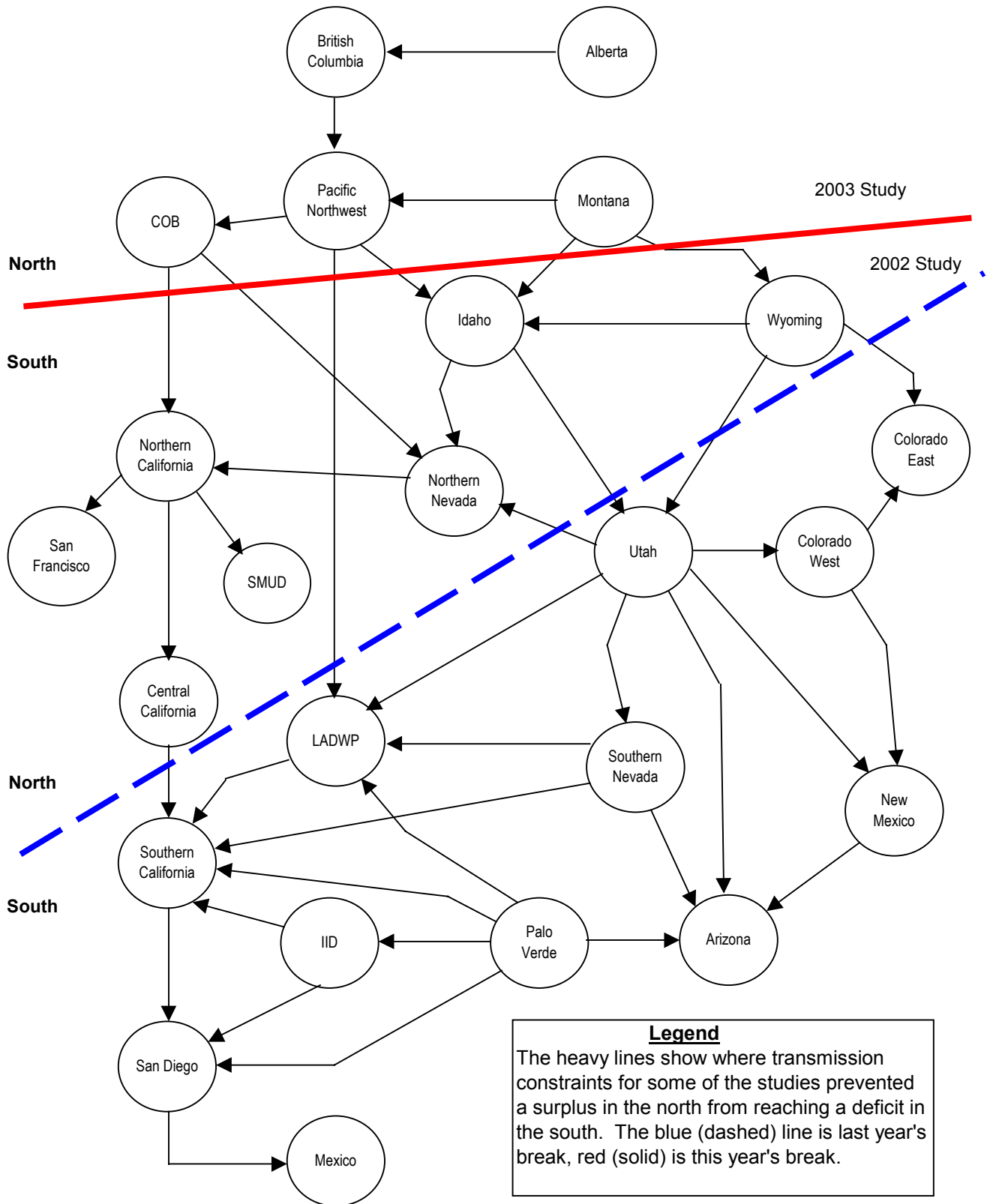
G. Observations

- Surplus generation in the Pacific Northwest was often stranded due to transmission limitations (see Bubble Diagram #3 on page 21 for constraint points). The accuracy of the stranded surplus is uncertain, in light of the complicated hydro restrictions that apply to the northwest. For example, in the spring and early summer hydro flows are increased to simulate to some degree natural spring runoff for fish migration. The goal of filling the reservoirs for summer recreation use and winter power generation is often unrealized.
- There were cases where surplus resources were available, but transfer path limitations prevented the surplus from reaching the areas with deficits. Whenever an individual zone became deficit while the Council overall had a surplus (sum of zonal surpluses/deficits were greater than zero), the deficit was due to transfer path limitations between the surplus area(s)

and the deficit area(s). The predominant locations of these constraints are different than they were in last year's assessment (see Bubble Diagram #3 on page 21). The following factors contributed to this change.

- In each of this year's studies, adverse transfer capabilities were used in place of last year's maximum ratings. There is no doubt that this affected the Idaho and Wyoming zones.
 - The path 15 upgrade increased the amount of capacity that Northern California could import from Central California.
 - Generation additions in several key locations in WECC have changed the import requirements for several zones. For example, additions in Arizona, Mexico, Palo Verde, Southern California, Southern Nevada, and San Diego likely alleviated the constraint from Central California to Southern California.
3. The assessment results for the period beyond 2005 are not a realistic picture of future supply margins. The addition of generation plants that are not accounted for in the current data should be expected. There is a point where the results shift from a determination of supply margin to a determination of future needs.
 4. The model assumes an idealistic efficiency where resources and transmission become immediately available as necessary to meet demand requirements. Economical system operation and other conditions could adversely affect the availability of resources, and could impact the amount and timing of power supply deficiencies.
 5. The most common approaches for resolving power supply deficiencies are the addition of generating capacity or the addition of transmission capability. Given the projected rate of load growth, it may be more practical to add generation capacity in the areas that are anticipating supply deficits.

Bubble Diagram #3 – Constrained Paths (Summer)



H. Recommendations For Future Assessments

1. The accuracy of the study results corresponds directly with the accuracy of the input data. The WECC member systems should continue to be involved in the verification of the data.
2. Unlike stochastic solutions, deterministic SAM solutions do not model sensitivities to demand variations, hydro conditions, forced outages, or transfer path de-ratings. Appropriate factors should be applied to the studies to account for these and other uncertainties.
3. The dynamic status of new generating plants in the WECC has introduced some additional uncertainty to the power supply assessment. The WECC members should be encouraged to provide information about planned resources in a timely manner to WECC for the purpose of conducting power supply assessments. Information regarding the retirement of existing units should also be provided.
4. The hydro generation capability in the Northwest may have limitations beyond those assumed for this assessment. The seasonal operation of the coordinated hydro system is subject to dozens of parameters to accommodate the various interests in the river systems. These parameters should be addressed in future assessments.
5. Future plans for the model may include conducting probabilistic or stochastic studies to study the effects of random uncertainties. This would require that the members provide additional information such as resource forced outage rates, resource operating costs, demand variations, transmission loss data, and transmission wheeling costs.
6. Planned changes to the transfer path capabilities must be reflected in the model to accurately measure their effect on the results. Since they would usually directly affect the results, only changes that are highly probable should be taken into consideration.
7. The studies described in this report do not address the energy supply in WECC. While WECC recognizes the need for an assessment of energy supplies, it is expected that the data and manpower requirements would be significantly higher than for this peak hour assessment. A more sophisticated model would also be needed. Some of the concepts that would have to be addressed are:
 - What is the minimum time resolution that must be studied? It may be necessary to study every hour of every day.
 - What generation parameters would be required? Minimum and maximum hydro availability for each hour, each day, each week, and each month may be required. Emissions limitations should be taken into account. Economic dispatch and startup requirements should be addressed.
 - The model would also need to consider interchange and transmission constraints.

Approved by Board of Directors August 1, 2003

WESTERN ELECTRICITY COORDINATING COUNCIL

POWER SUPPLY ASSESSMENT POLICY

INTRODUCTION

The Western Electricity Coordinating Council was established to promote the reliable operation of the interconnected bulk power system by the coordination of planning and operation of generating and interconnected transmission facilities.

The Planning Coordination Committee assigned the Reliability Subcommittee the task of developing an Adequacy of Supply Assessment Methodology. This document establishes the policy for conducting power supply assessments using the methodology developed by the Reliability Subcommittee. This policy shall be periodically reviewed and revised as experience indicates.

PURPOSE OF POWER SUPPLY ASSESSMENT

To ensure the reliability of the interconnected bulk electric system, it is necessary to assess both the security and the adequacy of the overall Western Interconnection. This document is focused on the portion of the assessment dealing with the adequacy of power supply. As electric industry restructuring has begun to break apart the traditional model of the vertically integrated utility, the responsibility for maintaining the adequacy of the power supply is moving toward market mechanisms. Though there may not be specific entities entrusted to plan for adequate resources, there exists a need to assess whether projected resources will be sufficient to reliably meet demand. Such information will allow regulators and policy makers to anticipate potential shortfalls so that determinations can be made as to whether impediments or insufficient incentives exist in the market.

It is not the intent of an adequacy assessment to replace the market, create sanctionable criteria or anticipate future energy prices. Its purpose is to project whether enough resources exist, at any price, to meet load and possible reserves while considering the transmission transfer capabilities of major paths. Such an assessment is required to comply with the NERC Planning Standards. These standards require that each region perform a regional assessment of existing and planned (forecast) adequacy of the bulk electric system.

It is recognized that it is impossible to provide 100% adequacy of power supply. It is the purpose of this document to establish a uniform policy for assessing the adequacy of installed and planned resources within the WECC region for the purposes of reporting within the Council, and to outside agencies. The assessments shall cover a period encompassing the next 5 years.

ASSESSMENT METHODOLOGY

The Power Supply Assessment Methodology shall be developed and maintained by the Reliability Subcommittee. Adequacy of supply may be defined and measured in terms of generating reserve margins and transmission limitations between load and resource areas and/or based on probabilistic methods. Appropriate technical tools shall be developed and utilized in conducting the assessments. The assessments shall account for diversity of load and generation, and account for transmission constraints between load and resource areas.

DATA REQUIREMENTS

To aid WECC in assessing resource adequacy, the following information shall be provided by the WECC member systems:

Load Forecasts

- Electricity demand and energy forecasts, including uncertainties
 - Variations due to weather
 - Variations due to other factors affecting forecasts

Demand Side Management (DSM) Programs

- Existing and planned demand-side management programs
 - Direct controlled interruptible loads
 - Aggregate effects of multiple DSM programs

Resource Information

- Supply-side resource characteristics, including uncertainties
 - Consistent generator unit ratings, including seasonal variations and environmental considerations affecting hydro and thermal units
 - Availability of generating units
 - Fuel type

Transmission Information

- Capabilities, availability of transmission capacity, and other uncertainties

REPORTING OF POWER SUPPLY ADEQUACY

The assessment of generating reserve margins and transmission limitations between load and resource areas as well as probabilities of supplying expected load levels, accounting for uncertainties, shall be developed and the results reported on a seasonal basis. The assessment shall be consistent with the requirement for maintaining operating reserves as defined in the *WECC Minimum Operating Reliability Criteria* and NERC Operating Policies.

Approved by Reliability Subcommittee June 16, 2000

Approved by Planning Coordination Committee June 30, 2000

Approved by Board of Trustees August 8, 2000

Revised April 18, 2002