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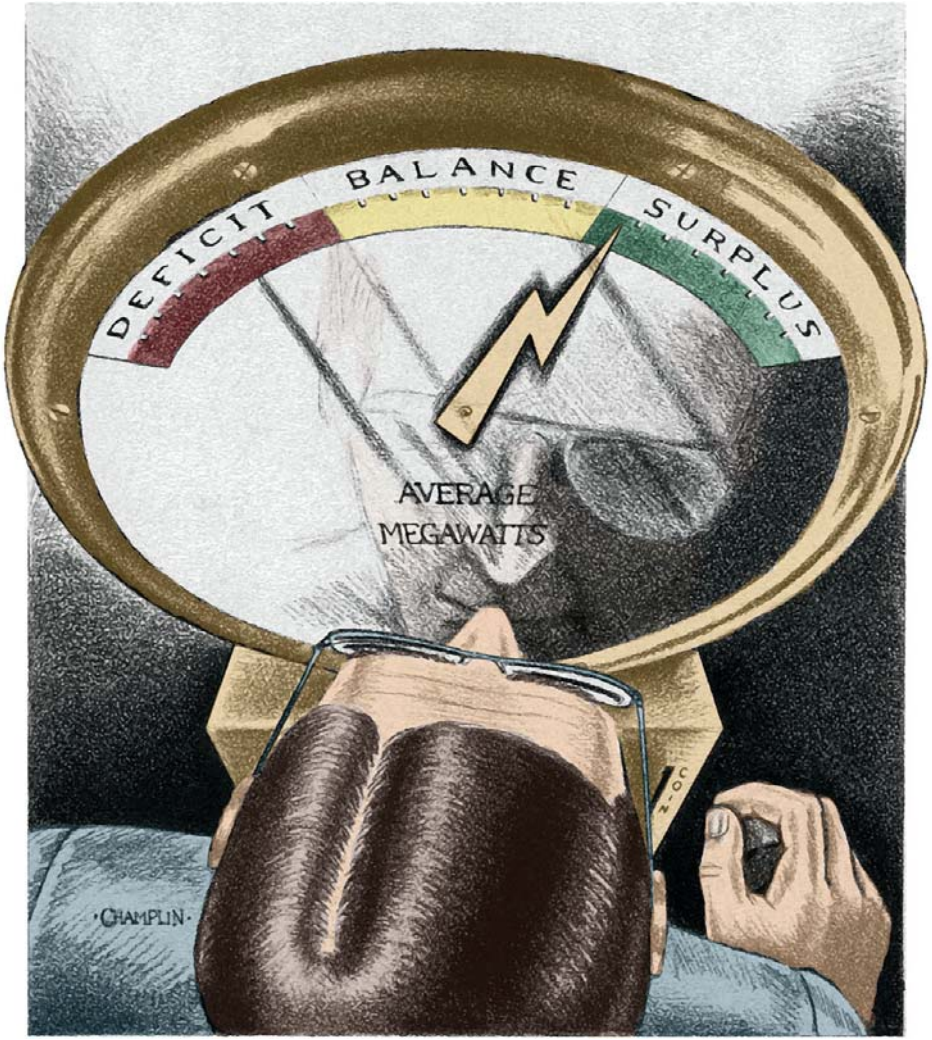

Pilot Capacity Standard

Resource Adequacy Forum

Technical Committee

September 22, 2006

Northwest Power and Conservation Council

Outline

- Review the Proposed Pilot Capacity Metric
- Develop Initial Winter and Summer Targets
- Assess the Region's Current Capacity Status
- Review Conditions during the July Heat Wave
- Examine a Statistical Approach for setting the Capacity Targets

Capacity Metric

- Average surplus generating capacity
- over the average expected peak load,
- over the peak load duration period,
- in units of percent, also referred to as the *Surplus Sustained Peaking Capability* or the *Planning Reserve Margin (PRM)*

Capacity Target Components

- A portion to cover contingency reserves
- A portion to cover supplemental reserves
- A portion to cover adverse temperature conditions

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Contingency Reserves (CR)

- 5% for hydroelectric resources
- 7% for thermal resources
- In the northwest, hydro provides about 50% of the firm resource supply
- Portion for CR is **6%**

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Supplemental Reserves (SR)

- Covers additional contingencies beyond the loss of the largest unit
- Is used to restore operating reserves to required levels if contingency lasts longer than one hour
- Portion for SR is **5% for summer**
- Portion for SR is **0% for winter**

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Adverse Temperature Reserve (TR)

(A few definitions)

- Regional daily-average temperature
  - average of the day's high and low temps from Seattle, Portland, Spokane and Boise, weighted by population
- EPT
  - Expected Peak daily-average Temperature
- 1-in-20 Temperature
  - 5% likelihood of exceeding this temp in any given year

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Temperature Statistics

Regional Daily-Average Temperatures

	Dec	**Jan**	**Feb**	**Jul**	**Aug**
EPT	28.7	22.9	29.0	75.4	74.2
1-in-20	14.3	10.2	14.5	80.1	79.6
Diff	-14.4	-12.7	-14.5	4.7	5.4

In degrees Fahrenheit

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Temperature – Load Relationship

(Weekdays, 1995-2002 NW data)

Month	Avg
December	**-336**
January	**-226**
February	**-277**
July	**236**
August	**253**

Units are daily-average megawatts per degree change in daily-average temperature (Fahrenheit)

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Temperature Load Deviations and Required Reserve Margins

	Dec	Jan	Feb	Jul	Aug
Load	25,297	27,251	26,872	22,008	21,511
Dev	4,752	2,921	3,785	1,109	1,366
TR	19%	11%	14%	5%	6%

Units are in megawatt-days. TR = Temperature Reserve

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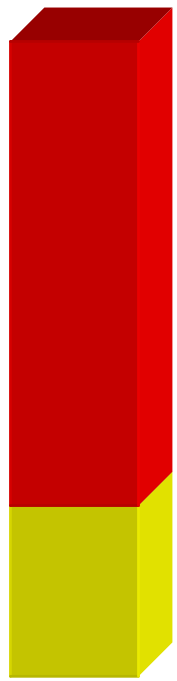
Initial Capacity Targets

	Dec	Jan	Feb	Jul	Aug
TR	19%	11%	14%	5%	6%
CR	6%	6%	6%	6%	6%
SR	0%	0%	0%	5%	5%
PRM	25%	17%	20%	16%	17%

Units are in megawatt-days. **CR** = Contingency reserve requirement
SR = Supplemental reserve requirement **TR** = Temperature reserve requirement
PRM = Total reserve requirement = Planning Reserve Margin = Capacity Target

Proposed Winter Capacity Target

Target: 25%



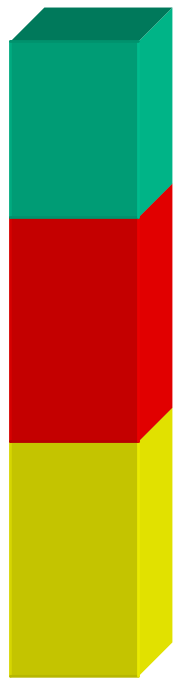
0% for
Supplemental reserves

19% for
Adverse temperature

6% for
Contingency reserves

Proposed Summer Capacity Target

Target: 17%



5% for
Supplemental reserves

6% for
Adverse temperature

6% for
Contingency reserves

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Pilot Capacity Metric

Capacity Metric = Planning Reserve Margin over the Sustained Peaking Duration

- The **peak load period** is the **10-consecutive-hour** period over **five consecutive days**, which results in the highest load for a 50-hour period
- **Expected peak load** is the average load over the peak load period based on the expected (average) coldest/hottest day temperature of the month
- The expected coldest/hottest day temperature is the average temperature of the coldest/hottest day for each historical year
- Generating capacity is the sum of the generation from all regional resources and from out-of-region resources contractually obligated to meet regional load

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Should any uncontracted IPP Capacity be Counted Toward Summer PRM?

YES

- Uncontracted IPPs physically located in region & do not have firm out-of-region transmission rights
- IPP market available to PNW utilities as well as CA utilities

NO

- On July 24th, it appears uncontracted IPP cap sold to CA
- CA's resource adequacy standard requires utilities to secure capacity a month in advance

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How much hydro flexibility should be assumed?

Winter

- Increase in FCRPS sustained peaking capacity during cold snap (w/o emergency declaration) = 15,600-11,200= 4,400 MW
- PNW increase in sustained hydro peaking capacity = 5,000 to 6,000 MW
- **2,000 MW** is a conservative estimate for a 1-in-20 year event

Summer

- Increase in FCRPS sustained peaking capacity during 7/24 heat wave (w/o spill curtailment) = 13,581-12,100 ≈ 1,450 MW
- PNW increase in sustained hydro peaking capacity = ?
- **1,000 MW** is a conservative estimate for a 1-in-20 year event

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Suggested Assumptions

Values in **bold blue** will be reviewed annually

- The net of firm imports and exports is added to the generating capacity
- Hydro generation is based on critical water conditions (1937)
- **2,000** megawatts of hydro flexibility is added for the winter and **1,000** megawatts for summer
- Generating capacity includes **3,000** megawatts of out-of-region capacity in winter and **0** megawatts in summer
- **100%** of uncontracted regional resource generation (IPPs) will be counted in winter but **50%** will be counted in summer
- Wind generation will be derated to **15%** of its nameplate capacity (this is a placeholder value until better data is obtained)

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Assessment of the Capacity Reserve Margin

Op Year 2007	**December**	**July**
Hydro ('37)	17,500	18,200
Hydro Flex	2,000	1,000
Non-hydro	10,400	10,400
Net Imports	-850	-2,500
IPP	3,500	1,750
Wind (15% of cap)	160	160
Spot Imports	3,000	0
Total Resource	35,710	29,010
Exp Peak Load	25,300*	22,000*
Balance	10,410	7,010
Reserve	**41%**	**32%**

*These load estimates come from the GENESYS HELM algorithm.

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Energy vs. Capacity Assessment

Units in MW-days, unless noted	**Current** L/R = 2,000 LOLP = 0%		**@ Energy Limit** L/R = -1,500 LOLP = 5%		**Note**
	Dec	**Jul**	**Dec**	**Jul**	To simulate a supply that just meets NW energy needs, 3,500 MW of resource generation was removed.
Resources	35,710	29,010	32,210	25,510	
Load	25,300	22,000	25,300	22,000	
Balance	10,410	7,010	6,910	3,510	
RM	41%	32%	27%	16%*	
Target	25%	17%	25%	17%	

*Using only half of the IPP generation for the summer assessment, the July reserve margin falls slightly below the target when the system is at the energy limit.

July 24, 2006
Heat Wave

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Power Pool Hourly Loads for July 24, 2006

NWPP peak hourly load on 7/24	~ 54,600 mw
Expected NWPP peak hourly load*	~ 52,200 mw
Observed NWPP peak load deviation	2,400 mw
NWPP temp/load relationship	300 mw/degree
NWPP temp deviation on 7/24	8 degrees
Expected NWPP peak load deviation	2,400 mw

*This is the expected peak hourly load for the power pool under normal temperature conditions.

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Estimate of PNW Hourly Loads for July 24th Based on NWPP Hourly Loads

Observed NWPP peak hourly load	~ 54,600 mw
PNW hourly load/NWPP hourly load	0.48
Est. observed PNW peak hourly load	~ 26,200 mw
Expected NWPP peak hourly load	~ 52,200 mw
Est. expected PNW peak hourly load	~ 25,050 mw

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Estimate of PNW **Daily** Loads for July 24th and Comparison to HELM Output

Est. observed PNW peak **hourly** load	26,200 mw
Est. expected PNW peak **hourly** load	25,050 mw
Daily avg load/peak **hourly** load	0.885
Est. observed PNW **daily** load	~ 23,200 mw-days
Est. expected PNW peak **daily** load	~ 22,200 mw-days
Estimated **daily** load deviation	1,000 mw-days
Expected PNW peak **daily** load (HELM)	22,000 mw-days*

*The HELM estimates for daily average load is reasonable.

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"Observed" PNW **Daily** Load Deviation Compared to the "Expected" Value for July 24th

Observed PNW daily load deviation	1,000 mw-days
July 24th PNW Temp deviation	4.8 degrees
PNW temp/load relationship (July)	236 mw-days/degree
Expected PNW daily load deviation	1,132 mw-days*

*The expected July 24th load deviation based on the Council staff's assessment of the relationship between temperature and load is reasonable.

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July Planning Assumptions vs. July 24th "Observed" Values

	Planning	July 24, 2006	Diff
Hydro ('37)	18,200*	~ 17,200*	- 1,000
Hydro Flex	1,000	1,450	+ 450
Non-hydro	10,400	9,800	- 600
Net Imports	-2,500	-2,500	0
IPP	1,750	0	- 1,750
Wind	160	160	0
Spot Imports	0	0	0
Total Resource	29,010	~ 27,110	- 1,900
Exp Peak Load	~ 22,200**	~ 23,200**	+ 1,000
Balance	6,810	2,910	- 3,900
Reserve	**31%**	**13%**	**- 18%**

*The "planning" value includes 1998 BiOp spill, which is less than current spill operations.

**Using PNW loads based on NWPP estimates instead of the HELM estimates.

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PRELIMINARY ASSESSMENT

Capacity Targets via LOLP

- Define a "capacity" event as any hourly curtailment greater than 3,000 MW
- For winter
  - Adjust the annual load/resource balance until the **capacity** LOLP is 5%
  - Calculate the resulting daily reserve margin = winter capacity target
- For summer
  - Remove out-of-region spot market and 50% of IPP generation
  - Adjust annual load/resource balance until the **capacity** LOLP is 5%
  - Calculate the resulting daily reserve margin = summer capacity target

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Winter Capacity Assessment

- Annual load (@5% energy LOLP) + 750* aMW yields a 5% likelihood of a winter season with a "capacity" event
- Winter **daily** average load is ~ 25% higher than the annual load
- Thus, the winter daily average load + 938 mw-days yields a 5% capacity LOLP
- Or, resource generation must be **reduced** by 938 MW to get to a 5% capacity LOLP

*Average of a range of load additions that produces a 5% capacity LOLP.

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December Capacity Target via LOLP Analysis is 22% to 25%

Units in mw-days, unless noted	**@ Cap Limit** Cap LOLP = 5%	**@ Energy Limit** Energy LOLP = 5%
Resources	30,960 to 31,585*	32,210
Daily Load	25,300	25,300
Balance	5,660 to 6,285	6,910
Reserve Margin	**22% to 25%**	27%
Proposed Target	25%	25%

*Resources must be reduced to get to a 5% capacity LOLP.

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Summer Capacity Assessment

- Annual load (@5% energy LOLP) – 1,000* aMW yields a 5% likelihood of a summer season with a "capacity" event
- Summer daily average load is ~ 15% lower than the annual load
- Thus, the summer daily average load - 850 mw-days yields a 5% capacity LOLP
- Or, resource generation must be **increased** by 850 MW to get to a 5% capacity LOLP

*Average of a range of load additions that produces a 5% capacity LOLP.

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August Capacity Target via LOLP Analysis is **19% to 21%**

Units in mw-days, unless noted	**@ Cap Limit** **Cap** LOLP = 5%	**@ Energy Limit** **Energy** LOLP = 5%
Resources	26,130 to 26,695*	25,510
Daily Load	22,000	22,000
Balance	4,130 to 4,695	3,510
Reserve Margin	**19% to 21%**	16%
Proposed Target	17%	17%

*Resources must be increased to get to a 5% capacity LOLP.