September 9, 2020

**MEMORANDUM**

**TO:** **Power Committee Members**

**FROM:** **John Fazio, Senior Systems Analyst**

**SUBJECT:** **Adequacy Update: Part 2 – ASCC Results**

## BACKGROUND:

Presenter: John Fazio

Summary: To ensure that the resource strategy in the 2021 power plan will lead to an adequate supply, the Council's adequacy standard is incorporated directly into the Regional Portfolio Model via the Adequacy Reserve Margin (ARM). The ARM represents the amount of surplus generation above the expected load to cover unknown future conditions, such as extreme temperature events, low river runoff conditions, poor wind and solar generation and generating resource breakdowns. The Associated System Capacity Contribution (ASCC) is the amount of reliable capacity that an added resource contributes toward meeting the ARM requirement.

*At the August power committee meeting, Council members were briefed on these two parameters but, unfortunately, results for the ASCC were not available. At this meeting, staff will present the completed ASCC table and demonstrate how it is used in the Regional Portfolio Model.*

Relevance: Through its power plan, the Council is mandated to ensure an adequate, efficient, economic and reliable power supply. Toward that end, the Council adopted a regional adequacy standard in 2011. By using the ARM and ASCC metrics in its planning models, the Council ensures that future

resource acquisitions will not lead to costly overbuilt systems or to inadequate underbuilt systems.

Workplan: A.5.2 Related to power supply adequacy assessments

Background: The Adequacy Reserve Margin is the amount of surplus generating capability above the expected load required to maintain an adequate power supply. The ARM thresholds are derived from resource and load data taken from a stochastic GENESYS study that produces a precisely adequate system (i.e. exactly meets the 5% LOLP target). The theory is that acquiring sufficient new resource capability to meet the ARM thresholds will result in a supply that, when analyzed stochastically, will yield a 5% LOLP.

The Associated System Capacity Contribution is a measure of how much reliable capacity a resource provides when added to a power supply. It indicates how much new load can be served by adding this resource, without affecting adequacy. A resource's ASCC is assessed by analyzing how much a potential peak-hour shortfall is reduced by adding an incremental amount of new resource. However, because of the dynamic interaction among all resources in a power supply, the ASCC for a specific resource can change as the resource mix changes. To accommodate for this dynamic interaction, aggregate ASCC values are assessed for many different combinations of new resources and are stored in an ASCC array (or table). When resources are needed to meet the ARM threshold, the composite ASCC value for the entire package of new resources can be interpolated from the ASCC array.

# Adequacy Update for the 2021 Power Plan

## Associated System Capacity Contribution Results

September 15, 2020 Power Committee Meeting
John Fazio
Senior Systems Analyst

THE 2021
NORTHWEST
POWER PLAN
FOR A SECURE & AFFORDABLE
ENERGY FUTURE

# Outline

- Brief review of ARM and ASCC
- How the ASCC is calculated
- ASCC Table (for resource portfolios)
- How the ASCC Table is used
- Why the ASCC Table is so important

# Adequacy Reserve Margin

- The Adequacy Reserve Margin (ARM) is the amount of surplus capacity (or energy) needed, over the expected weather-normalized peak load (or average load), to ensure adequacy, in units of percent of expected load.

- The ARM is used in the Regional Portfolio Model as the adequacy test for resource buildouts. Building to this target should ensure that the resulting supply will meet the Council's 5% LOLP adequacy standard.

# Associated System Capacity Contribution

- The Associated System Capacity Contribution (ASCC) is the net firm capacity gained when a resource is added to a power supply, in units of percent of nameplate capacity.

- ASCC values are used to determine the amounts of new resources needed for adequacy (i.e. to meet the ARM threshold).

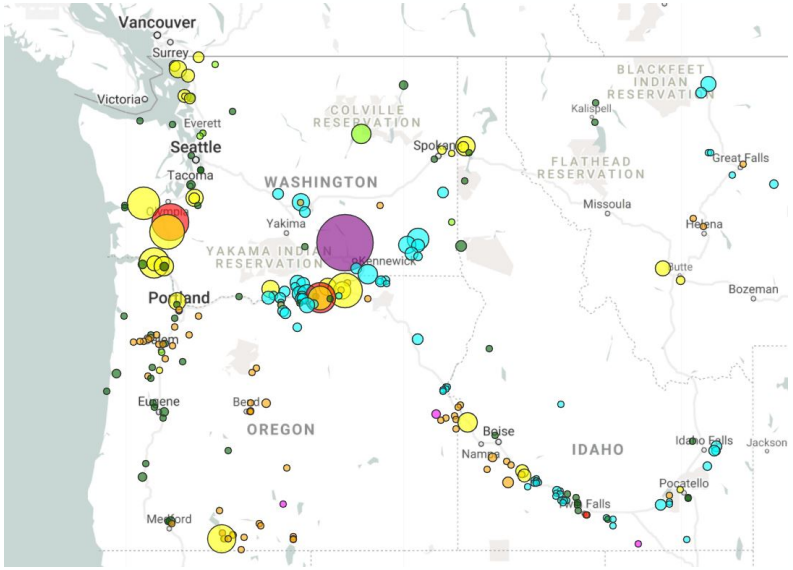
# Calculating the ASCC

- ASCC is calculated by measuring the reduction in the peak-hour curtailment after an increment of new resource is added

- The reduction in peak-hour curtailment is derived from the peak-hour curtailment duration curves (examples to follow)

$$\text{ASCC} = \frac{\text{Reduction in Peak Curtailment}}{\text{Incremental Capacity Added}}$$

# Creating the Curtailment Duration Curve

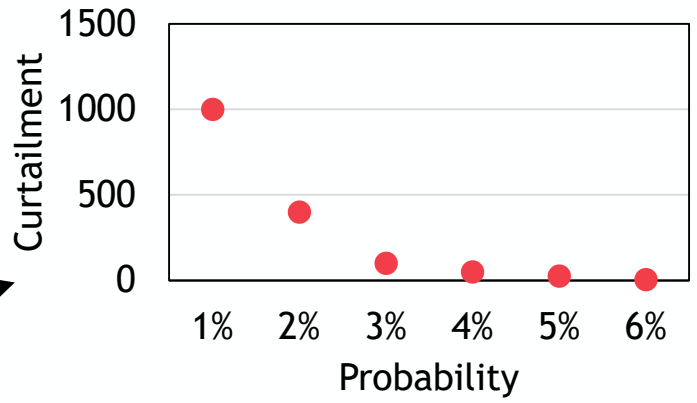



- **GENESYS:** Chronological hourly simulation of all PNW resources for one year
- Thousands of simulations with different combinations of future unknowns

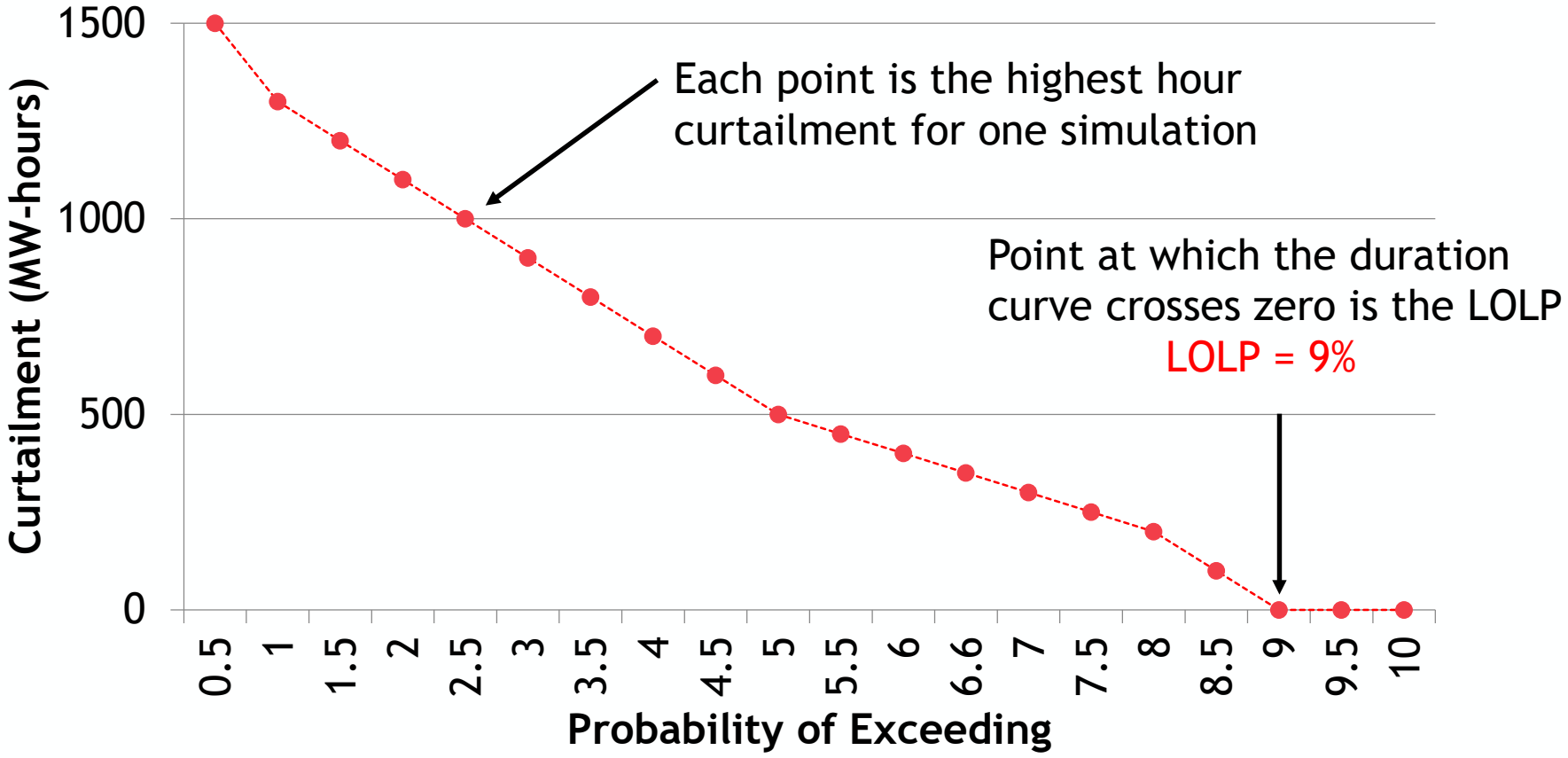

- Record all hours when load cannot be served

## Curtailment Duration Curve

- Take highest curtailment hour for each simulation from the curtailment record
- Sort from highest to lowest
- Each simulation is equally likely
- Plot curtailments in descending order

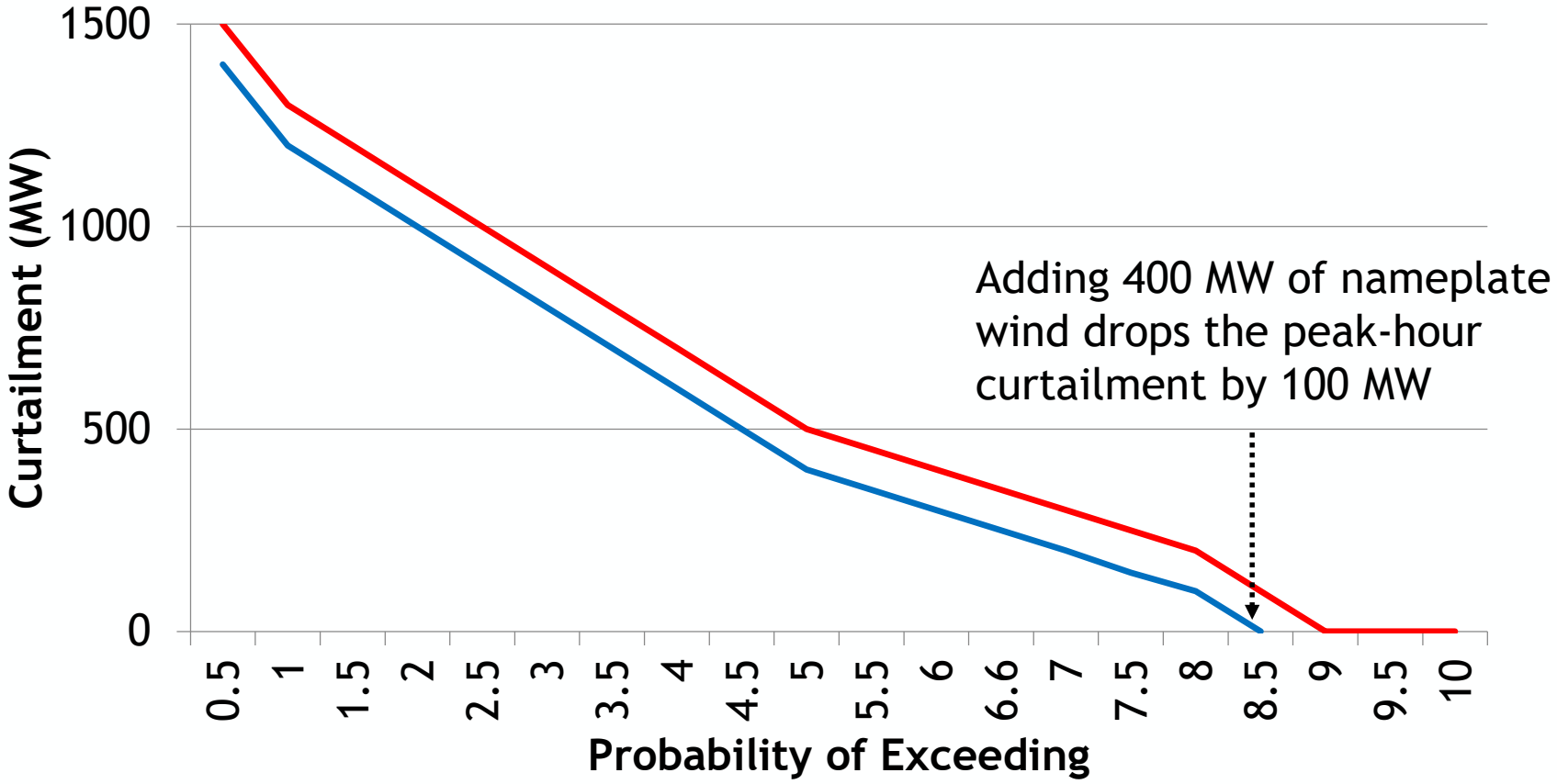


# Sample Peak-Hour Curtailment Duration Curve



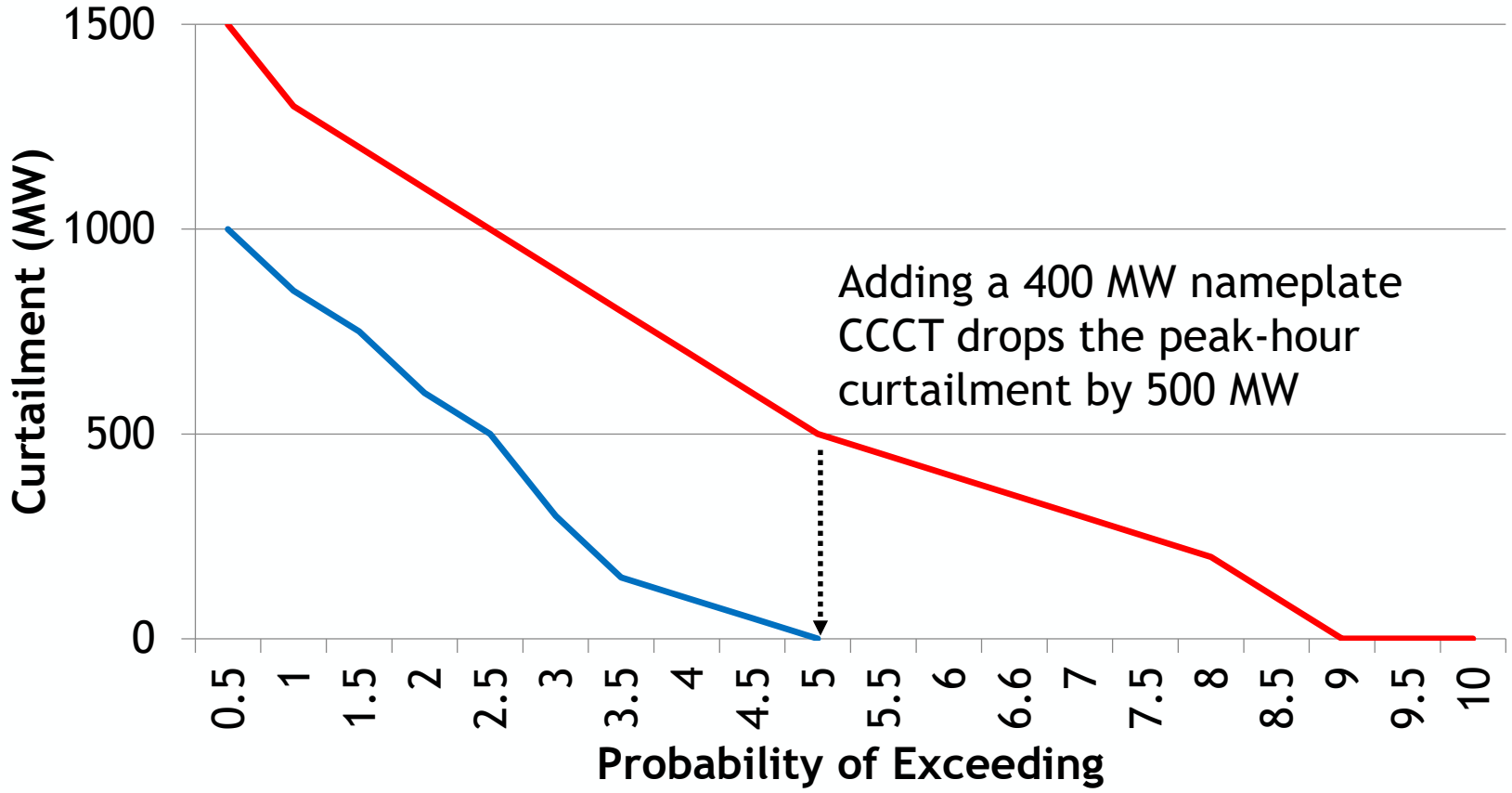

LOLP = 9% because only 9% of the simulations had some level of curtailment

# Peak-Hour Curtailment Duration Curve




ASCC = 100/400 = 25%

# Peak-Hour Curtailment Duration Curve




ASCC = 500/400 = 125%

# The Problem with Single-resource ASCC

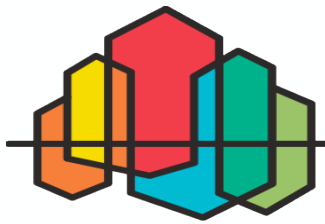
- Problem: Single resource ASCC declines as more resource is added
- Solution: Use an ASCC that is a function of installed capacity

- Problem: ASCC also declines as other competing resources are added
- Solution: Take the average ASCC of the added resource types

- Problem: Average ASCC is not the same as the composite ASCC
- Solution: Calculate an ASCC table for all combinations of available new resource additions

# Resource Types for the Power Plan

| Resource Type | Resources Included | Min Level | Max Level |
|---|---|---|---|
| Thermal | CCCT, New SCCT, Geothermal | 0 | 2100 MW |
| Solar | Westside & Eastside solar, Solar + Storage | 0 | 6000 MW |
| Wind 1 | Montana Wind, SE WA Wind | 0 | 6000 MW |
| Wind 2 | Gorge Wind | 0 | 1900 MW |
| Energy Efficiency | Energy Efficiency (Bins 1-14) | 700 aMW | 3500 aMW |
| Short Term Energy Limited | DR (Bins 1-4), 4-hour battery | 0 | 3000 MW |
| Long Term Energy Limited | Pumped Storage (8 hours) | 0 | 3000 MW |



# Creating the ASCC Table

- For the 2021 plan, an ASCC table will be used, which has ASCC values for all combinations of new resource types

- To assess the ASCC for all combinations of 7 resource types and 2 levels of installed capacity requires 128 GENESYS studies

- And because the plan incorporates 3 climate change scenarios, 384 studies are needed to create the full ASCC table

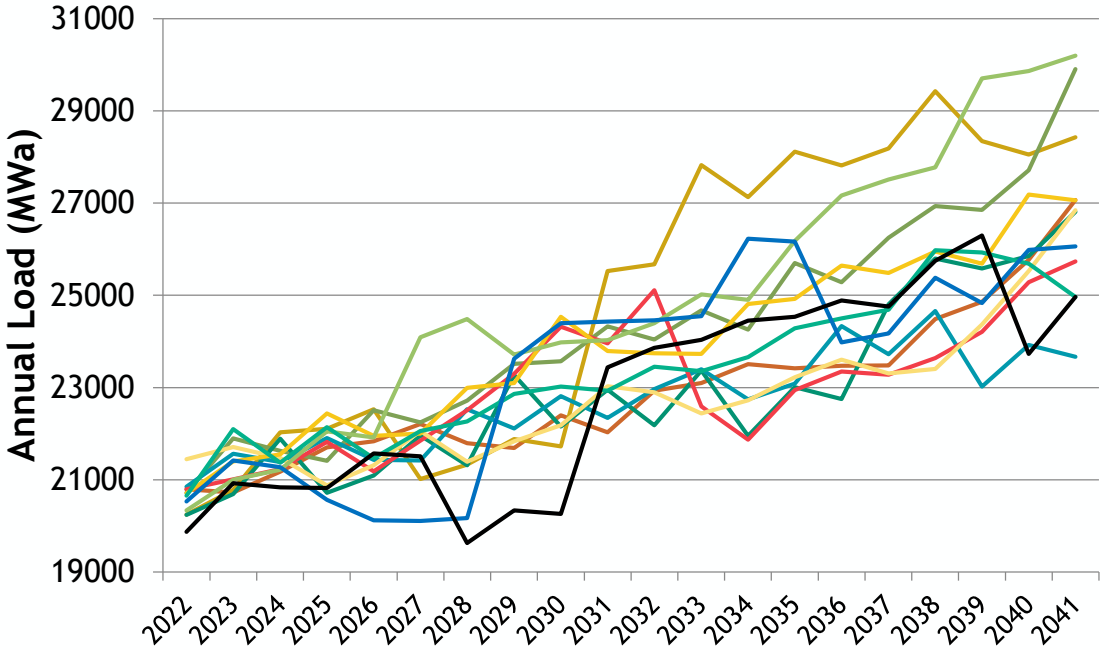
# ASCC Table

(First 18 rows of 128, using CC forecasted modified flows and temperatures)

| New Resources (all in MW except EE in aMW) | | | | | | | Total Added | Composite ASCC | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EE | CT | BAT | PS | GW | MW | SOL | Resource | Q1 | Q2 | Q3 | Q4 |
| 700 | 0 | 0 | 0 | 0 | 0 | 0 | 700 | 1.21 | 1.49 | 1.03 | 1.20 |
| 700 | 0 | 0 | 0 | 0 | 0 | 5000 | 5700 | 0.47 | 0.32 | 0.52 | 0.36 |
| 700 | 0 | 0 | 0 | 0 | 6000 | 0 | 6700 | 0.43 | 0.26 | 0.32 | 0.41 |
| 700 | 0 | 0 | 0 | 0 | 6000 | 5000 | 11700 | 0.35 | 0.24 | 0.35 | 0.26 |
| 700 | 0 | 0 | 0 | 1900 | 0 | 0 | 2600 | 0.66 | 0.57 | 0.46 | 0.63 |
| 700 | 0 | 0 | 0 | 1900 | 0 | 5000 | 7600 | 0.39 | 0.34 | 0.44 | 0.34 |
| 700 | 0 | 0 | 0 | 1900 | 6000 | 0 | 8600 | 0.39 | 0.18 | 0.31 | 0.35 |
| 700 | 0 | 0 | 0 | 1900 | 6000 | 5000 | 13600 | 0.32 | 0.21 | 0.33 | 0.24 |
| 700 | 0 | 0 | 2000 | 0 | 0 | 0 | 2700 | 0.73 | 0.79 | 0.50 | 0.69 |
| 700 | 0 | 0 | 2000 | 0 | 0 | 5000 | 7700 | 0.46 | 0.36 | 0.47 | 0.38 |
| 700 | 0 | 0 | 2000 | 0 | 6000 | 0 | 8700 | 0.45 | 0.32 | 0.36 | 0.37 |
| 700 | 0 | 0 | 2000 | 0 | 6000 | 5000 | 13700 | 0.34 | 0.21 | 0.36 | 0.29 |
| 700 | 0 | 0 | 2000 | 1900 | 0 | 0 | 4600 | 0.55 | 0.61 | 0.49 | 0.57 |
| 700 | 0 | 0 | 2000 | 1900 | 0 | 5000 | 9600 | 0.38 | 0.29 | 0.42 | 0.30 |
| 700 | 0 | 0 | 2000 | 1900 | 6000 | 0 | 10600 | 0.39 | 0.27 | 0.33 | 0.33 |
| 700 | 0 | 0 | 2000 | 1900 | 6000 | 5000 | 15600 | 0.32 | 0.18 | 0.32 | 0.23 |
| 700 | 0 | 2000 | 0 | 0 | 0 | 0 | 2700 | 0.72 | 0.65 | 0.48 | 0.78 |
| 700 | 0 | 2000 | 0 | 0 | 0 | 5000 | 7700 | 0.40 | 0.36 | 0.44 | 0.37 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |

# Using the ASCC Table in the RPM

- The RPM develops resource strategies for hundreds of load growth paths over 20 years
- Each path faces different combinations of future unknowns
- Resources are acquired if they are economic or if they are needed for adequacy (i.e. if the ARM threshold is not met)




The net capacity of a resource portfolio is its aggregate nameplate capacity times the portfolio ASCC, obtained by using multidimensional linear interpolation methods in the ASCC table

# Example of how the ASCC Table is Used

Proposed Resource Portfolio includes 700 aMW EE and 2,500 MW Solar

| | EE | CT | BAT | PS | GW | MW | SOL | Resource Added | Q3 ASCC | Portfolio Capacity |
|---|---|---|---|---|---|---|---|---|---|---|
| Proposed Portfolio | 700 | 0 | 0 | 0 | 0 | 0 | 2500 | | | |
| Nearest Points | 700 | 0 | 0 | 0 | 0 | 0 | 0 | 700 | 1.03 | |
| | 700 | 0 | 0 | 0 | 0 | 0 | 5000 | 5700 | 0.52 | |
| Summer ASCC and Capacity | | | | | | | | 3200 | 0.78 | **2,480** |

Using single-resource ASCC values

- EE Q3 ASCC = 1.08%
- Solar Q3 ASCC = 0.54%
- Portfolio Capacity = (700 * 1.08) + (2500 * 0.54) = 2,106 MW

Using single-resource ASCC values for this resource portfolio underestimates the net summer capacity by 374 MW!

# Why the ASCC Table is so Important

- Single-resource ASCC values do not account for interactions with other added resources
- Thus, using single-resource ASCC values can lead to overbuilding or underbuilding
- If the resource strategy produces surplus or inadequate supplies, the whole process must be repeated, with adjustments to the ASCCs
- This may require multiple iterations, which consumes a lot of time

As an added benefit, the ASCC table can be used to estimate the net capacity for any number of resource portfolios, which could be an aid to power planners