



PacifiCorp

UM 2011 Capacity Workshop

June 14, 2019





What is Capacity?

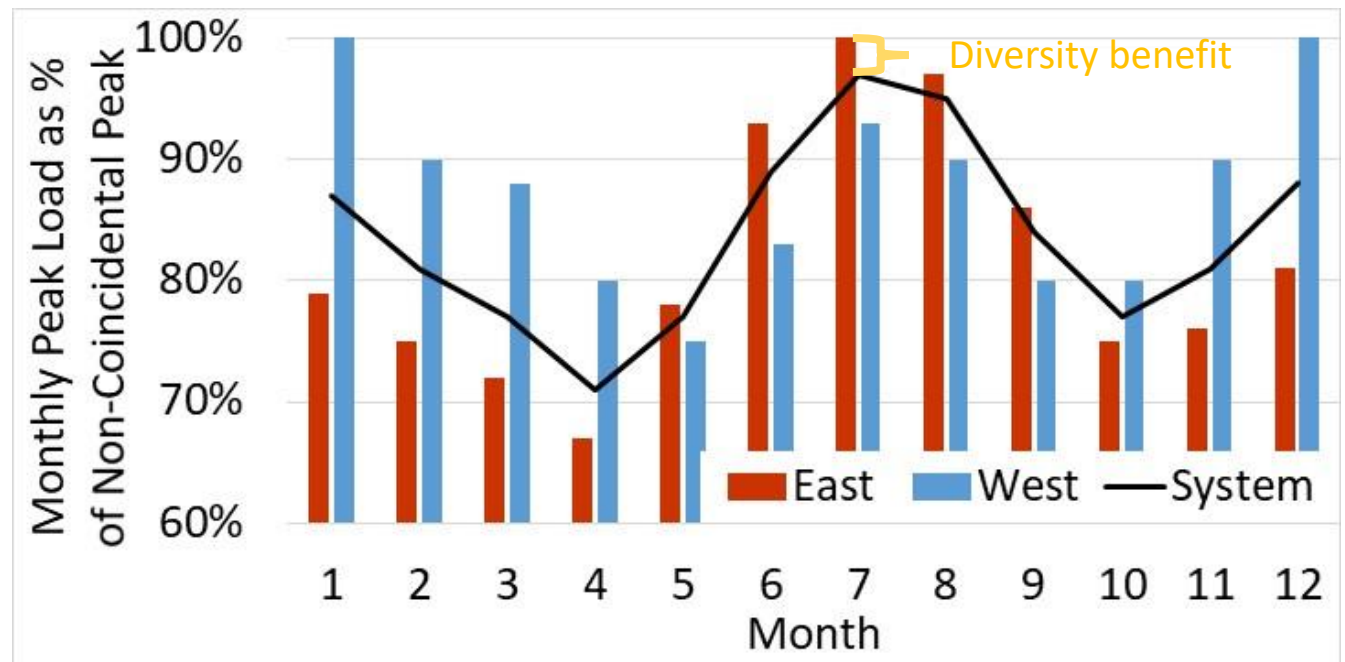
- To provide reliable service to customers, a utility must have sufficient resources in every hour to:
 - Serve customer load, including losses and any unanticipated load increase.
 - Hold operating reserves to meet NERC and WECC reliability standards.
 - Contingency, regulation, frequency response.
 - Replace resources that are unavailable due to:
 - Forced and planned outages
 - Dry hydro conditions
 - Wind and solar conditions
 - Market conditions
- PacifiCorp refers to “Capacity” as the total quantity of resources necessary to reliably serve customers, after accounting for the items above.



Coincident Peak Load

- The highest hourly load in the year.
- If your resources are available in all hours, you only need to plan for this single requirement.
- If your resources are available in all hours, you will have excess resources in 11 months.

- The merger of winter-peaking Pacific Power and summer-peaking Utah Power took advantage of under-utilized resources.

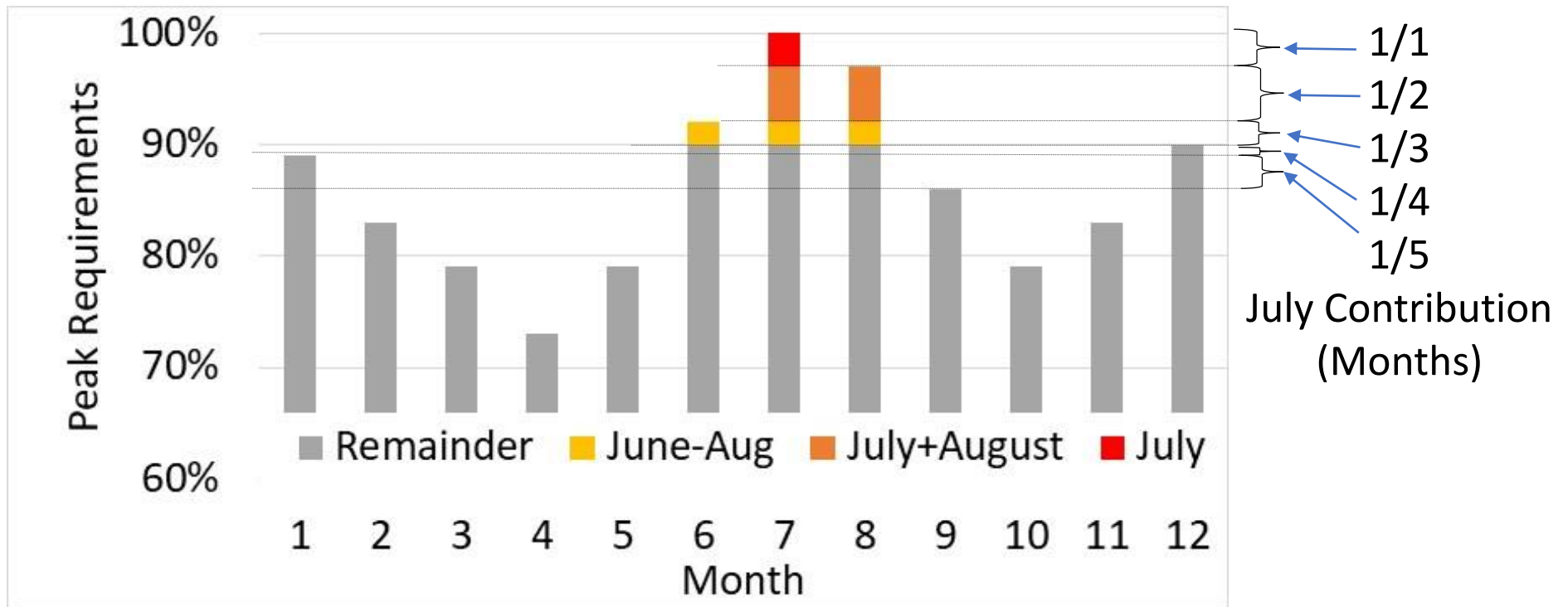


- These benefits can also be achieved with seasonal resources.



Seasonal Resources

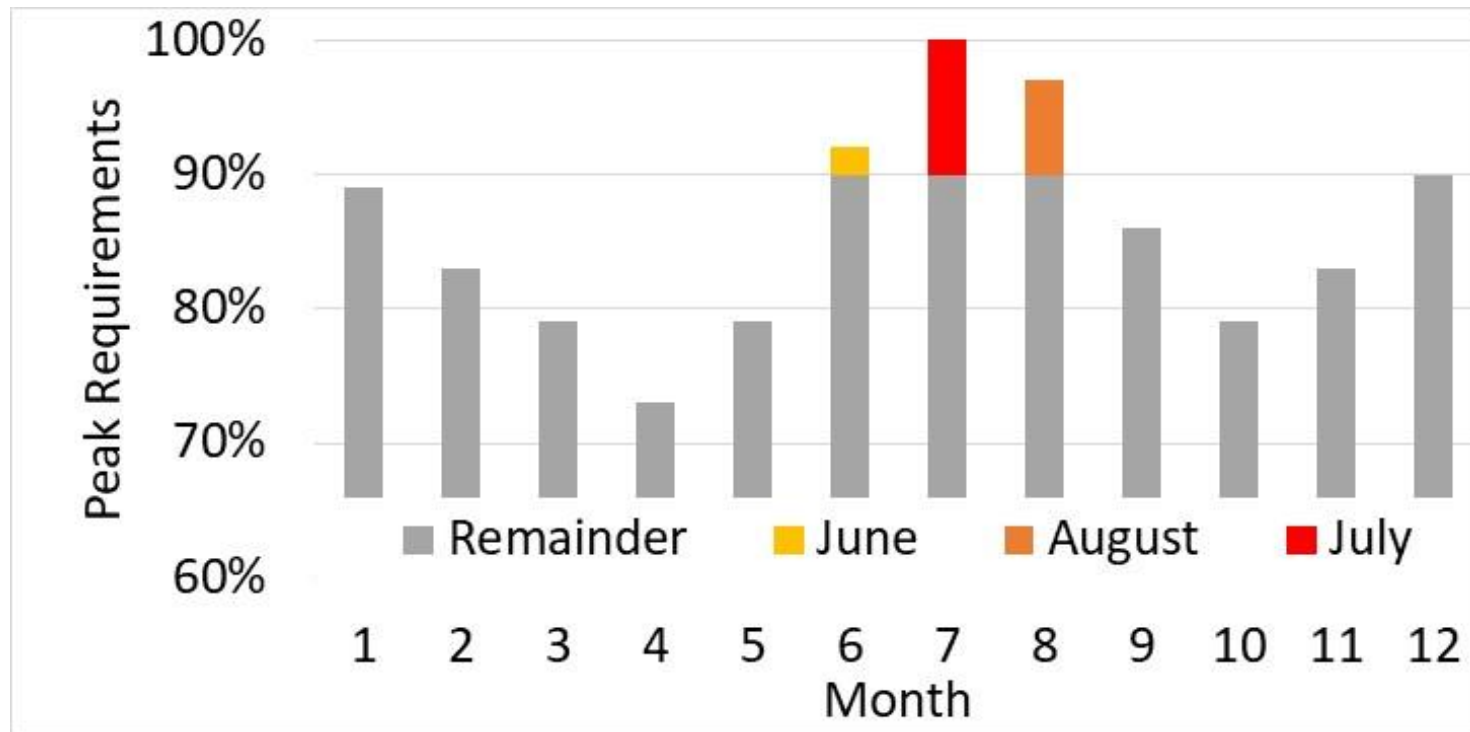
- **What if your resources are not available in all months?**
 - When seasonal resources reduce the annual peak below other months, incremental resources are needed in other periods
 - Example: July-only resources cover fewer peak requirements as more are added





Seasonal Resources

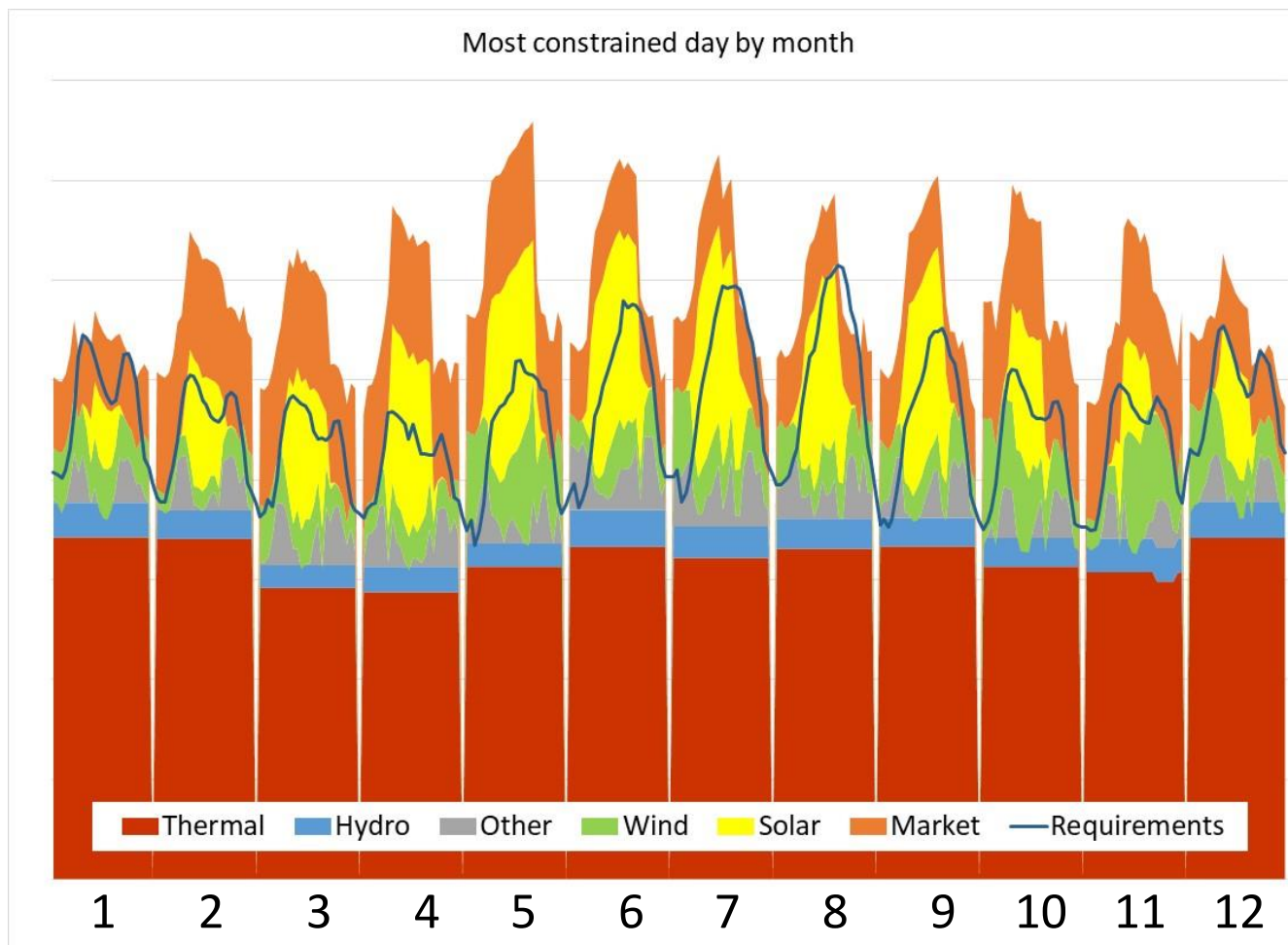
- **Does one resource need to cover all periods?**
 - Resources don't need to cover all peak requirements on their own...they support reliable service if the portfolio also includes other resources to cover requirements at other times.





Intermittent Resources

- The principles illustrated in the seasonal examples also apply to intermittent resources – but resource availability must be assessed in all hours (8760/year).



Hourly Loss of Load Evaluation



- Production cost model evaluates portfolio reliability in each hour
 - Load, hydro, and thermal resource outages vary stochastically.
 - Hourly granularity for one year (8760) with 500 iterations
 - **Limitations:**
 - Wind and solar profiles vary from day to day consistent with historical patterns, but do not vary from one iteration to the next.
 - Available market supply does not vary from specified levels.
 - **Very intensive computation:** several days of run time.
- **Results:**
 - **Loss of Load Probability:** the loss of load risk in every hour.
 - **Loss of Load Hours:** the total risk for the year.
 - **Results are dependent on resource portfolio.**

Current IRP Assumptions



- **Requirements:**

- Identify resources to cover coincident peak load in two hours per year (summer and winter peak), plus an additional fixed percentage to cover operating reserves and uncertainty (a.k.a. Planning Reserve Margin, currently 13%).
- Requirements are applied to each load area (a.k.a. “bubble”), and transfers between areas are allowed up to transmission limits.
- Coincident peak load is an input, so it doesn’t require computation, and is independent of the resource portfolio.

- **Resources:**

- Fixed winter and summer capacity contribution percentages are entered for each resource in System Optimizer (“SO”) model.
 - Despite values being portfolio specific, the supporting loss of load evaluation is very involved, so opportunities to update are limited.
- Fixed percentages are intended to reasonably estimate the incremental contribution of a given resource.
 - But, SO model does not account for hourly requirements so it may add too much in some hours and not enough in others.
 - Adding more July-only resources will not reduce loss of load in August.
 - Hourly reliability analysis within the Planning and Risk (“PaR”) model is necessary to assess portfolio performance.



Capacity Questions

- *How do the resource characteristics such as dispatchability, firm capability to meet peak needs, commercially operational date vs timing of system need, and physical location on the system (T&D circumstances) factor in to the definition of capacity?*
 - **To the extent these factors impact reliable operation, they will impact how a resource contributes to system capacity needs and what other resources must be present in the reliable portfolio.**
 - **These factors also impact energy benefits and total revenue requirement.**
- *What system operational needs does capacity meet?*
 - **Load, operating reserves, uncertainty in load and resource availability.**
 - **Portfolios must meet minimum requirements for each type of reserves.**
- *In the evolving energy grid is there a difference between flexible and firm capacity?*
 - **If the hourly availability is the same, the flexible dispatch and firm dispatch provide the same capacity.**
 - **But, flexible and firm resources provide very different energy benefits.**
 - **If dispatch is limited to a specified set of hours, the capacity value in those hours will change over time as the portfolio changes.**
- *Do different resource types bring different capacity levels or values?*
 - **Yes, and the levels will change over time with portfolio changes.**