Utah Schedule 38
Capacity Contribution Study for Wind and Solar Resources
December 2, 2014

PACIFICORP

Pacific Power | Rocky Mountain Power

Introduction

- Capacity contribution is a measure of the ability for a resource to reliably meet demand – it is not the same thing as capacity factor
- PacifiCorp completed a wind and solar capacity contribution study consistent with the Commission order in Docket No. 12-035-100
- The methodology (the CF Approximation Method) is based on a National Renewable Energy Laboratory (NREL) report on Effective Load Carrying Capability (ELCC) approximation methods
- The CF Approximation Method relies upon weighted hourly loss of load probability (LOLP) statistics specific to PacifiCorp's system

Capacity Contribution Values		
Wind	Single Axis Tracking Solar	Fixed Tilt Solar
14.5%	39.1%	34.1%

Methodology

1. Calculation of hourly LOLP statistics
   - 500-iteration hourly Monte Carlo simulation of PacifiCorp's system using Planning and Risk (PaR)
   - LOLP for each hour is calculated by counting the number of iterations in which system load could not be met divided by 500 (the total number of iterations)
2. Calculation and use of weighting factors
   - The CF Approximation method uses LOLP weighting factors on the basis that a resource is especially needed during hours with the highest LOLP
   - Weighting factors are based upon the LOLP in each hour divided by the sum of LOLP among all hours

$$w_i = \frac{LOLP_i}{\sum_{j=1}^{T} LOLP_j}$$

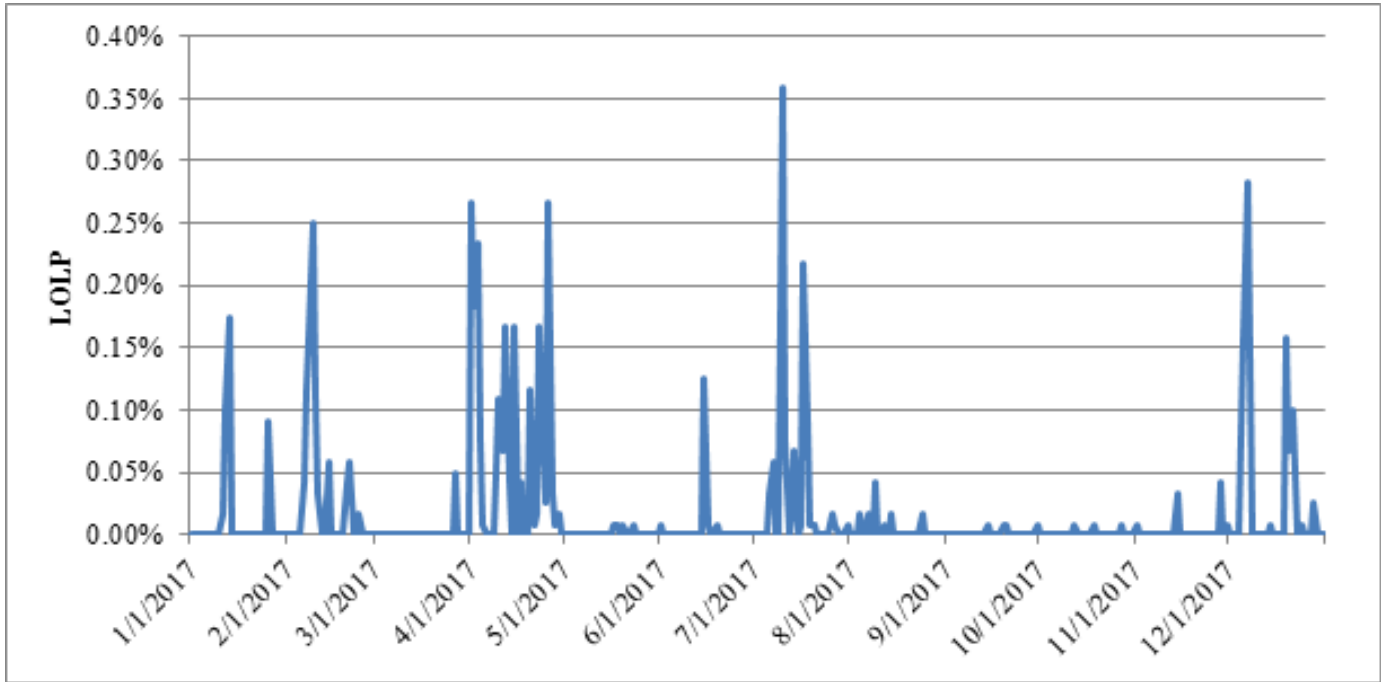
w_i is the weight in hour i,
$LOLP_i$ is the LOLP in hour i, and
T is the number of hours in the study period (8,760)

   - Weighting factors are applied to contemporaneous hourly capacity factors for wind and solar resources, and the capacity contribution is calculated by summing the hourly capacity factors weighted by LOLP

$$CV = \sum_{i=1}^{T} w_i C_i \,,$$

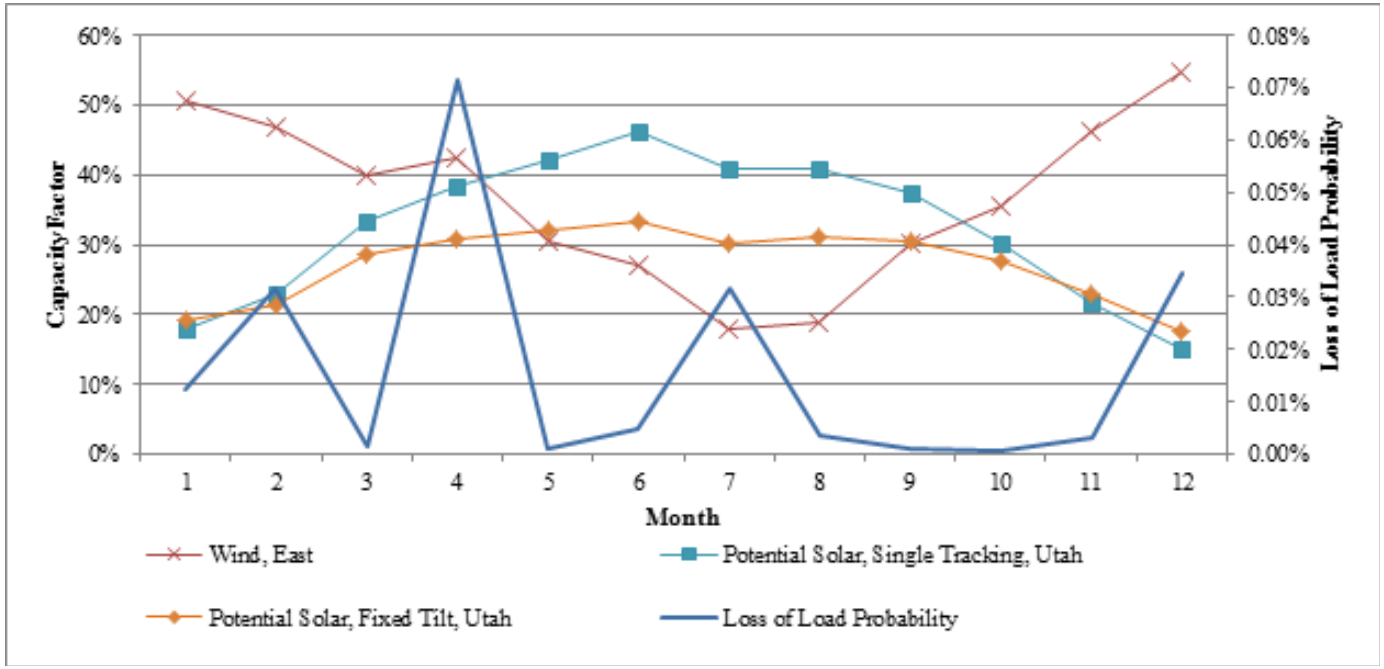
C_i is the capacity factor of the resource in hour i, and
CV is the weighted capacity contribution value of the resource

Daily Average LOLP



- Loss of load events are most likely to occur during the spring, when maintenance is often planned, and during peak load months, which occur in the summer and the winter

Monthly Capacity Factors and LOLP

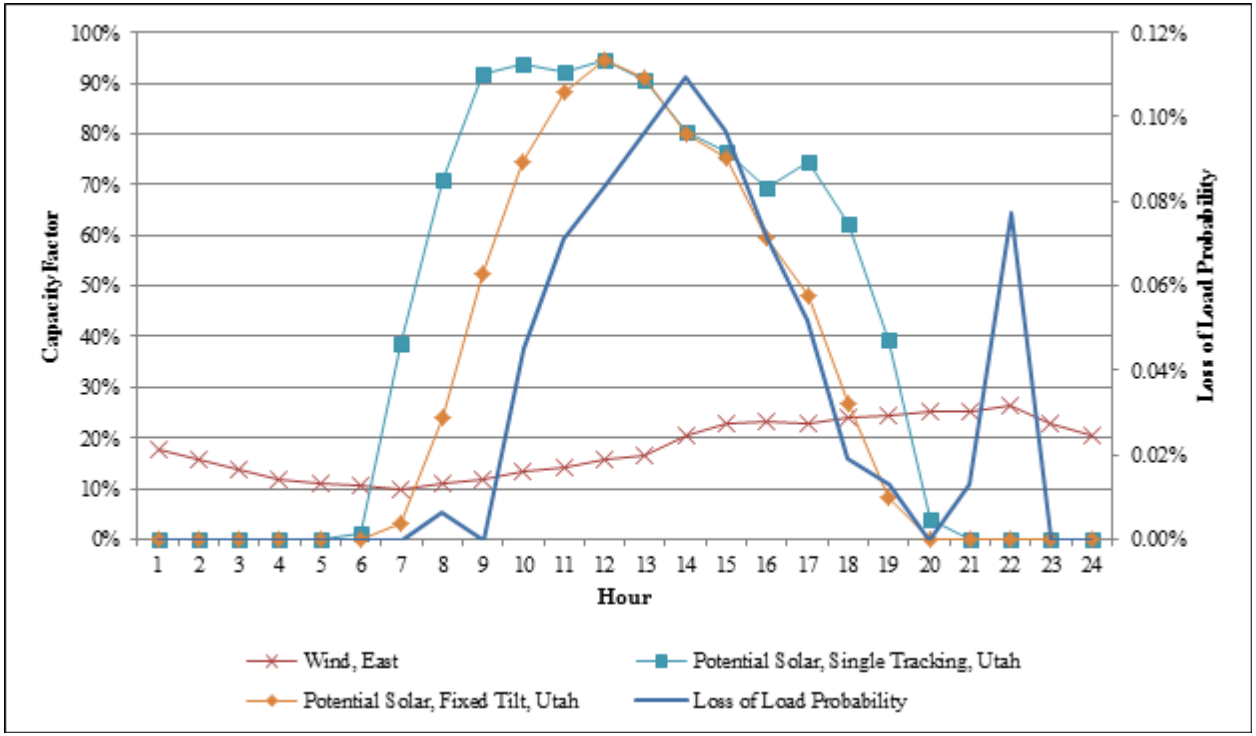


- As noted on the prior slide, the average monthly LOLP is most prominent in April (spring maintenance period), summer (July peak loads), and winter (when loads are high)

Hourly Capacity Factors and LOLP for an Average Day in April

- LOLP events peak during morning and evening ramps when generating units are transitioning between on-peak and off-peak operation

Hourly Capacity Factors and LOLP for an Average Day in July



- LOLP events peak during higher load hours and during the evening ramp

Hourly Capacity Factors and LOLP for an Average Day in December

- LOLP events peak during higher load hours and during evening hours