Rhode Island Renewable Energy Growth Program

Review of Capacity Factor and System Sizing
Feb. 22, 2021
What is Capacity Factor for Solar PV?

- Capacity factor is a measure of the percentage of time a system can operate at its peak nameplate rating over a period of time on average.
- Solar PV capacity factor is the result of system losses and solar insolation, driven by latitude, cloud and snow cover, shading, and orientation of any tilt.
- Capacity factor varies by hour, day and month, and averages out to an annual number.
- The peak rating and efficiency of a panel has more to do with power density (kWp/sq. meter).
- An easy measure of capacity factor is kWh AC/kW-DC per year divided by total hours.
  - 1226 kWh AC / 1 kW DC / 8760 = 14%
RE Growth and NEM System Sizing Methodologies

- To receive bill credits, RE Growth systems must be sized like Net Metering systems to not produce more than the 3-year annual average use of the customer.
- Net Metered systems are measured in Alternating Current (AC).
- RE Growth Systems are measured by Direct Current (DC).
- Capacity factor between DC and AC accounts for losses in the system and inverter efficiency, and inverter sizes are typically smaller than the DC rating of the panels.
  - RE Growth average is 115% DC/AC ratio, or an 87% derate.
- An average Rhode Island capacity factor for DC nameplate is 14%.
- The AC capacity factor is this rate divided by the derate (0.14/0.87) or 16.1%, which we use for Net Metered systems.
- ISO-NE finds a lower AC capacity factor of ~13%, or 11.3% in DC based on actual inverter data.
System Sizing and PV Watts

- Sizing of maximum allowed system is calculated to the DC nameplate using 14% capacity factor. An example:
  - 9,000 kWh avg. 3-yr annual use / 14% capacity factor / 8,760 hours/year = **7.34 kW DC**

- PV Watts shows for a 20% tilt, 180 degrees south 1 kW DC array an average annual output of 1,301 kWh AC, or 14.85% capacity factor, which would restrict customers
  - 9,000 kWh avg. 3-yr annual use / 14.85% CF / 8760 = **6.92 kW DC** => this would be a smaller system!
Current Study Outline

- Reviewing actual output of 100+ systems with at least a year of production, and comparing with standard method projected output (14%) and projected output with PV Watts using reported angle and azimuth.

- Our study will review the sizing outputs, variation, distribution, and main cause of variation among the randomly selected systems.

- The outcome will also suggest if limits on shading input, and/or adjustments to other settings in PV Watts would reduce variation.
Timeline Going Forward

- Study will be functionally finished in March
- National Grid will bring initial results to DG Board at March meeting
- Refinements and investigation of implementation issues will occur in April and May
- A recommendation for any changes or new process will be presented at the May DG Board Meeting