California Time-of-Use (TOU) Transition: Effects on Distributed Wind and Solar Economic Potential

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Introduction

- TOU prices electricity differently throughout the day

- CPUC Decision D.15.07-001
  - Mandatory transition of IOU residential default rates to TOU
  - Transition to TOU began in 2019

<table>
<thead>
<tr>
<th>Company</th>
<th>Date of Default TOU Implementation</th>
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<tbody>
<tr>
<td>PG&amp;E</td>
<td>October 2020</td>
</tr>
<tr>
<td>SDG&amp;E</td>
<td>March 2019</td>
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<tr>
<td>SCE</td>
<td>October 2020</td>
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Purpose of Study

- Understand the affect of TOU rates and cost on the economic potential of distributed wind (dWind) and distributed solar (dPV)
- Ascertain if a “robust” market for dWind exists in California based on economic potential
- Understand the geospatial distribution of economic potential for dWind and dPV
dGen Model Overview

- Forecasts adoption of distributed solar, storage, wind, and geothermal by region and sector through 2050
- Agent-Based Model simulating consumer decision-making
- Incorporates detailed spatial data to understand regional adoption trends

Learn More: https://www.nrel.gov/analysis/dgen/
Methodology: Scenarios

- Vary by cost and TOU vs non-TOU rates
- TOU scenario compared to hypothetical scenario where non-TOU rates remained default and extend

<table>
<thead>
<tr>
<th>Scenario Name</th>
<th>Wind Cost Schedule</th>
<th>Solar Cost Schedule</th>
<th>Residential TOU or non-TOU?</th>
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</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Mid</td>
<td>2018 ATB Mid</td>
<td>Extension of non TOU</td>
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<tr>
<td>TOU Baseline</td>
<td>Mid</td>
<td>2018 ATB Mid</td>
<td>TOU on in 2020</td>
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<tr>
<td>High Cost Wind</td>
<td>High</td>
<td>2018 ATB Mid</td>
<td>Extension of non TOU</td>
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<tr>
<td>TOU High Cost Wind</td>
<td>High</td>
<td>2018 ATB Low</td>
<td>TOU on in 2020</td>
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<tr>
<td>TOU High Cost Solar</td>
<td>Mid</td>
<td>2018 LBNL® High</td>
<td>TOU on in 2020</td>
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<tr>
<td>TOU Low Cost Solar</td>
<td>Mid</td>
<td>2018 ATB Low</td>
<td>TOU on in 2020</td>
</tr>
</tbody>
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TOU Rates

- TOU rates applied for all utilities
  - Either default to existing TOU for utility specific, or default to TOU rate from an IOU
- For non-TOU scenarios
  - Continue 2018 default rates and adjust annually by average electricity price escalator
TOU Overlay

Overlay of residential TOU tiers with average summer (left) and winter (right) capacity factor profiles in each IOU.

- PG&E TOU Tiers - Solano County
- SCE TOU Tiers - San Bernardino County
- SDG&E TOU Tiers - San Diego County

Graphs show capacity factor over time with different color bands representing different times of day and seasons.
Methodology: dWind Capex

High (left) and Mid (right) capex schedules for dWind in this analysis
Competition between dPV and dWind

- Agent is presented with either dPV, dWind, or no system
- Economic potential awarded to the system with highest net present value (or no system if negative)
- Results reflect how much economic potential a distributed technology has in the presence of the other
Caveats

• Economic potential is based solely on positive NPV
• Not projecting adoption, just economic viability
- TOU improves dWind economic potential by ~309 MW
- TOU reduces dPV economic potential by ~360 MW or 0.5%
- Roughly 50 MW less potential of either
dWind – A Robust Market?

- With non-Tou rates, dWind has 1.1 GW of economic potential in 2030
- Total dWind economic potential grows to 1.4 GW with TOU
dWind Economic Potential by Size

- <=50 kw makes up majority of economic potential
- 66,000 2.5kw and 55,000 5kw systems have positive and higher NPV than dPV
• If dWind costs align with High Cost schedule, economic potential drops
• By 2030, economic potential under High Cost is 330 MW
Affect of Cost on dWind Economic Potential

• If dPV costs lower, dWind economic potential lowers by 150 MW

• If dPV costs align with high schedule, dWind gains 100 MW
dPV Economic Potential

- dPV economic potential remains at ~72 GW for several years and even with TOU decrease
- Change in price does not drastically effect long term economic potential of PV
Increased dPV penetration could lead to decreased prices during the day and increased ramp up evening prices.

By 2030, all counties except 3 saw the value of dWind generation increase more than the value of dPV generation.
Key Takeaways

• dWind sees an improvement in economic potential with these default TOU rates and dPV is hardly affected (within model uncertainty)

• A “robust” market for dWind exists with TOU rates and our Mid Cost prices
Key Takeaways

• dWind has most economic potential in southern and central California by 2030

• Value of dWind generation increases over time as dPV penetration increases
Thank you!