NREL
NATIONAL RENEWABLE ENERGY LABORATORY

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

Ashwin Ramdas
EPRC 2019
Boise, Idaho
September 30th 2019

Introduction

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

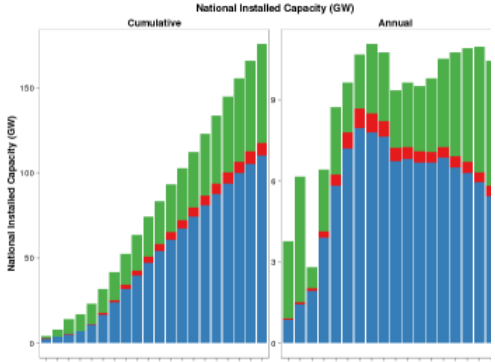
	Date of Default TOU Implementation
PG&E	October 2020
SDG&E	March 2019
SCE	October 2020

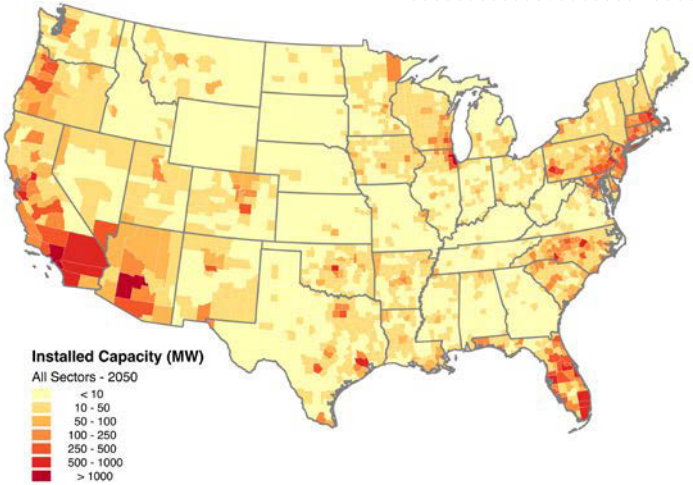
Purpose of Study

- 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

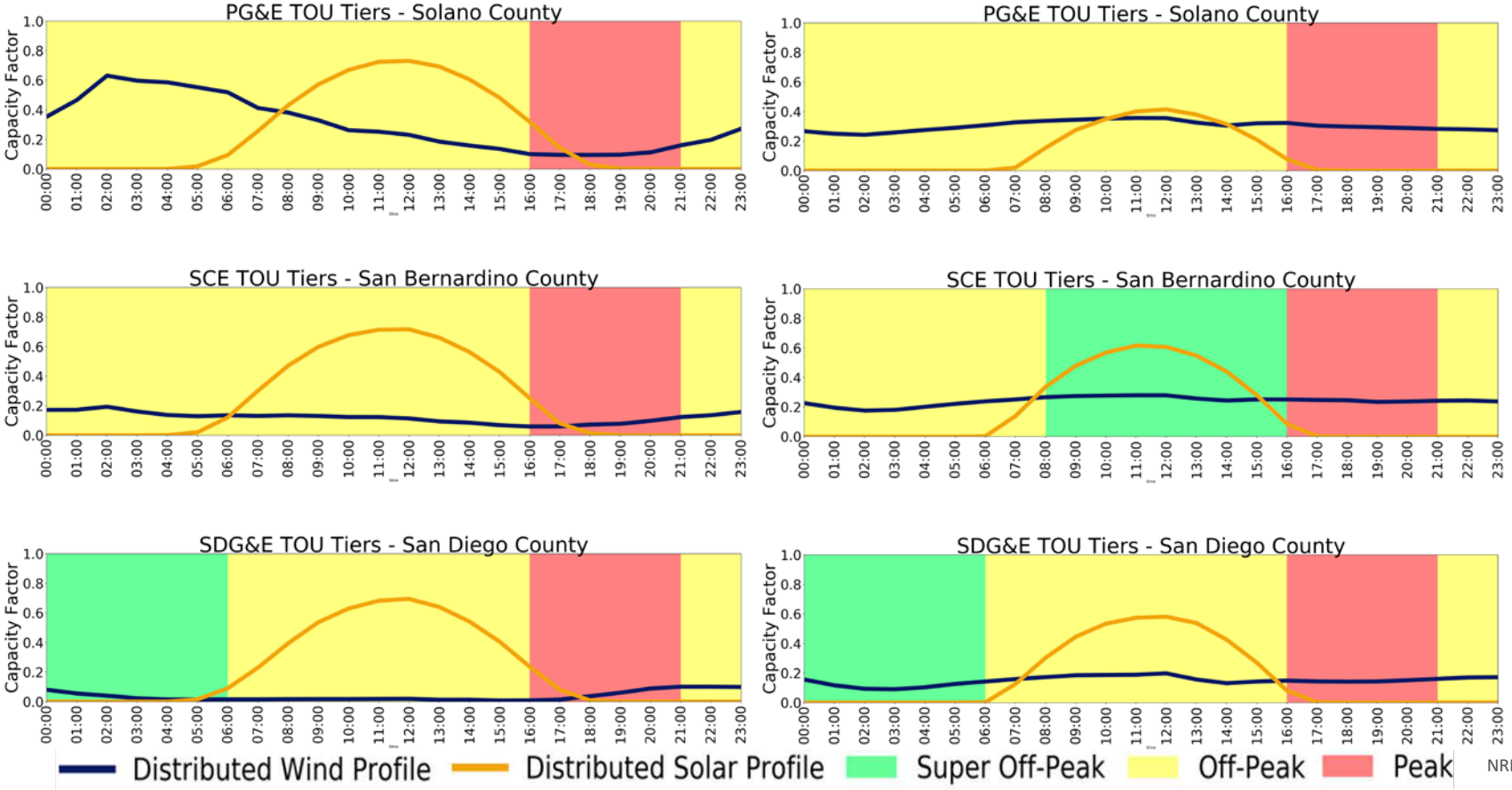
Scenario Name	Wind Cost Schedule	Solar Cost Schedule	Residential TOU or non-TOU?
Baseline	Mid	2018 ATB Mid	Extension of non TOU
TOU Baseline	Mid	2018 ATB Mid	TOU on in 2020
High Cost Wind	High	2018 ATB Mid	Extension of non TOU
TOU High Cost Wind	High	2018 ATB Low	TOU on in 2020
TOU High Cost Solar	Mid	2018 LBNL[a] High	TOU on in 2020
TOU Low Cost Solar	Mid	2018 ATB Low	TOU on in 2020

TOU Rates

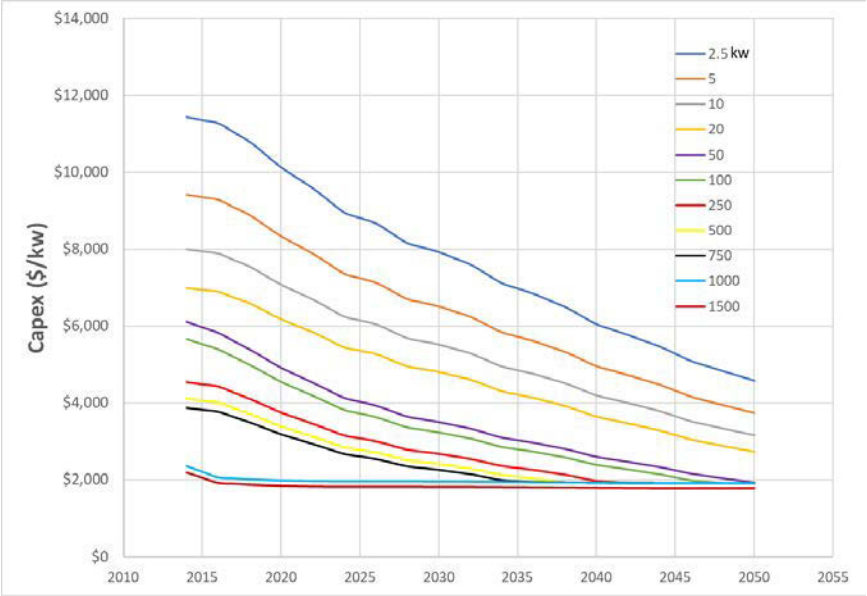
- TOU rates applied for all utilities
  - Either default to existing TOU for utility specific, or default to TOU rate from an IOU
- For non-TOU scenarios
  - Continue 2018 default rates and adjust annually by average electricity price escalator

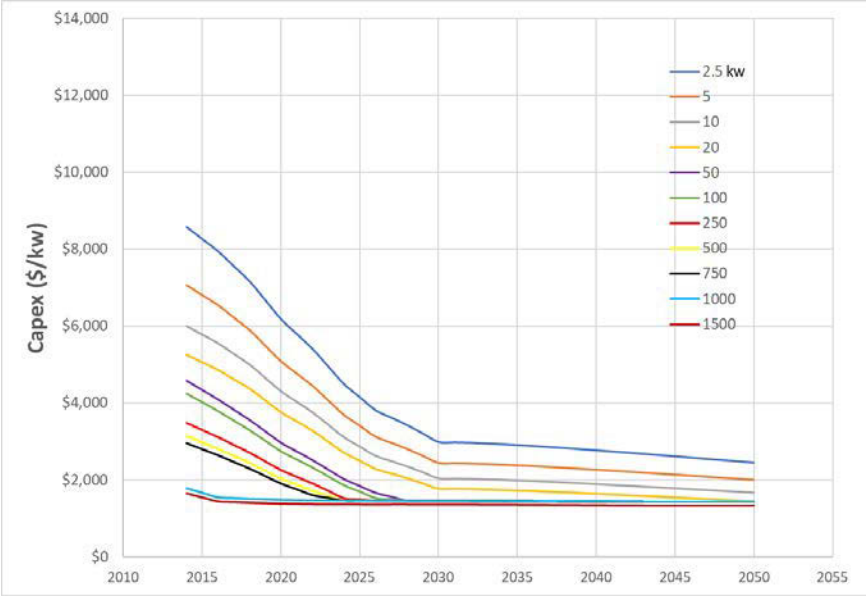
TOU Overlay

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



Methodology: dWind Capex





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

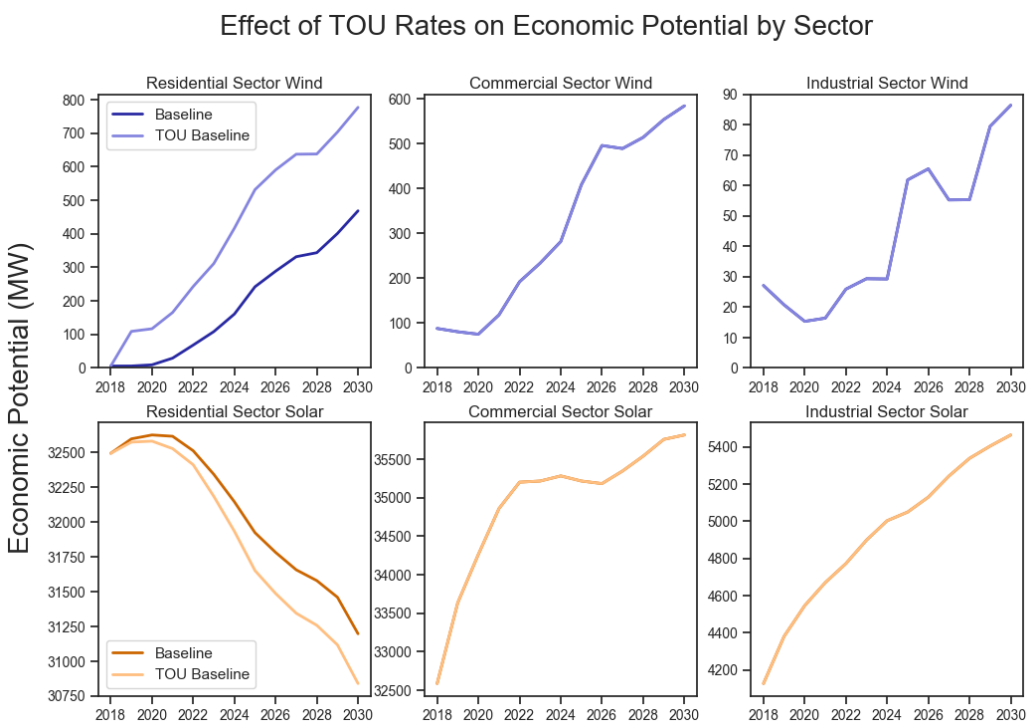
Competition between dPV and dWind

- 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

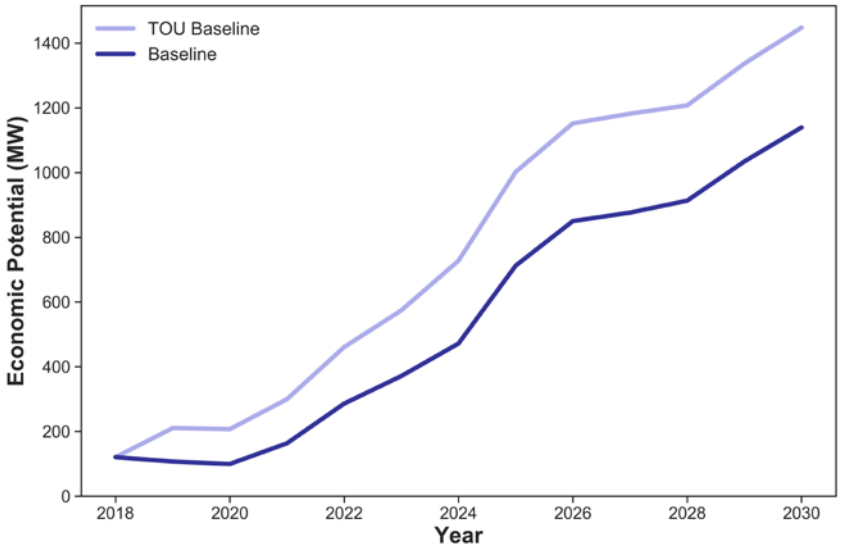
- Economic potential is based solely on positive NPV
- Not projecting adoption, just economic viability

Economic Potential with and without TOU



- 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

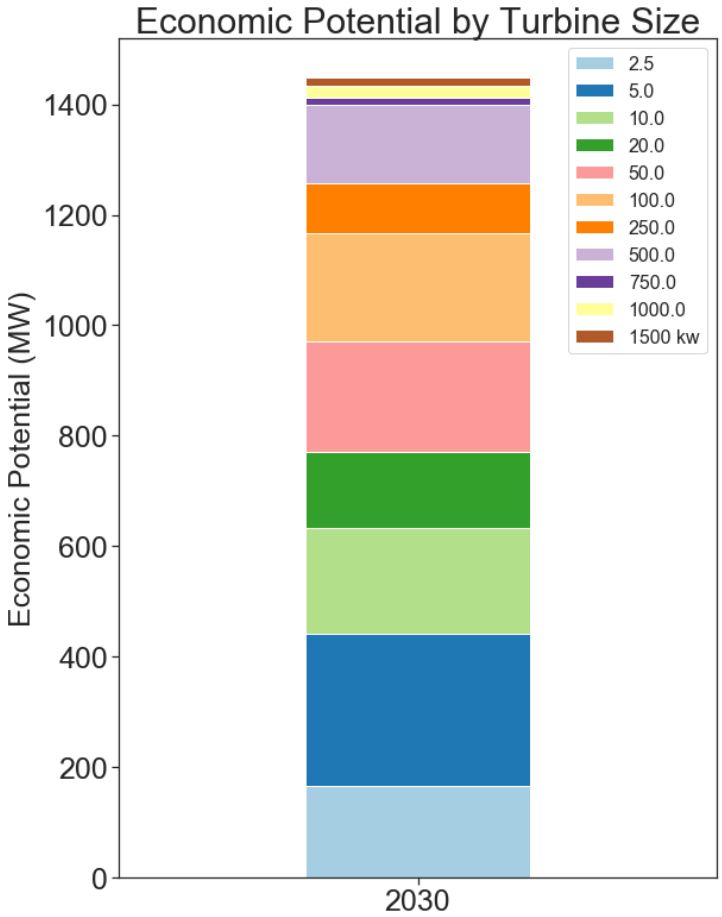
dWind – A Robust Market?



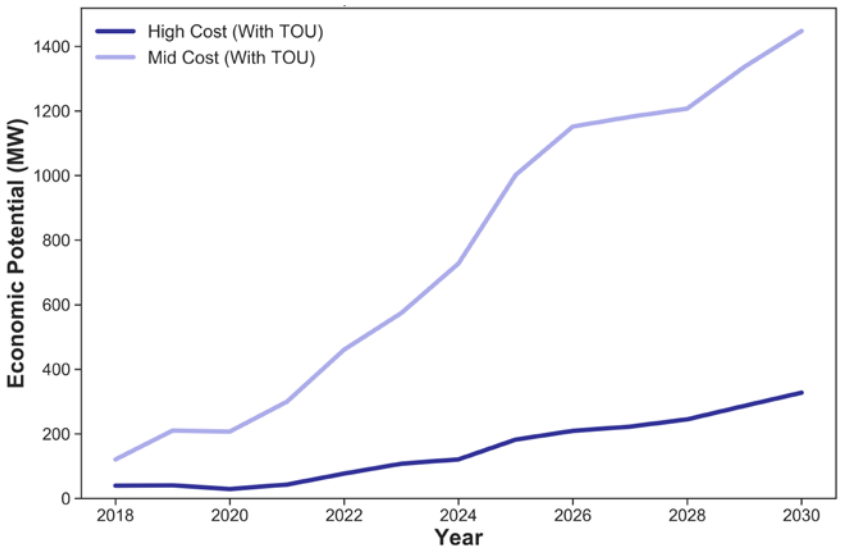
- With non-Tou rates, dWind has 1.1 GW of economic potential in 2030
- Total dWind economic potential grows to 1.4 GW with TOU

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

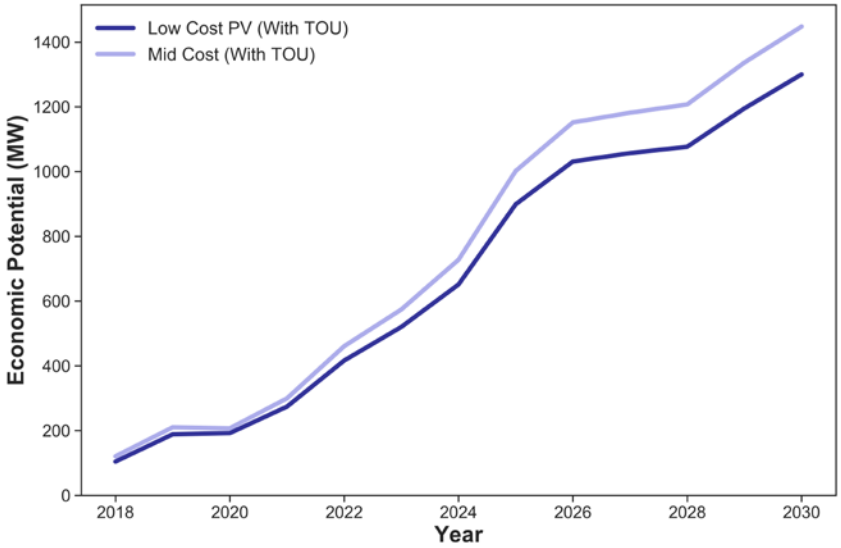


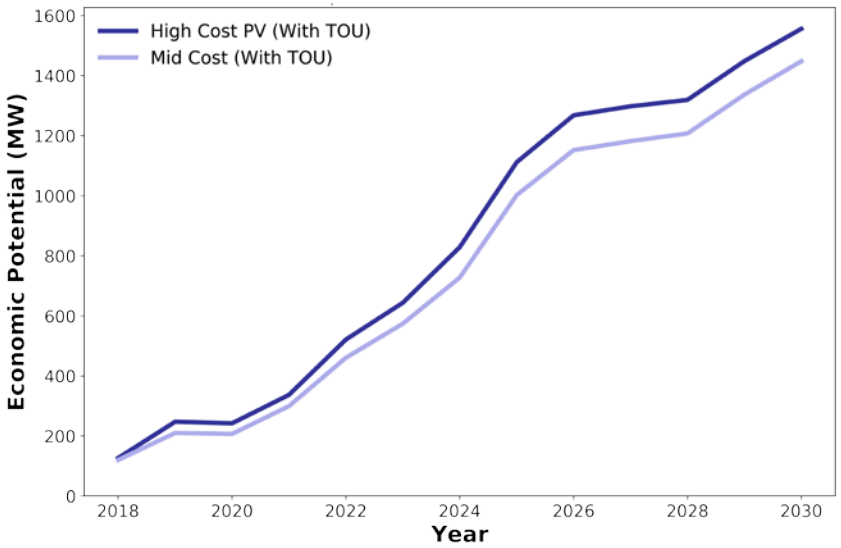
Affect of Cost on dWind Economic Potential



- If dWind costs align with High Cost schedule, economic potential drops
- By 2030, economic potential under High Cost is 330 MW

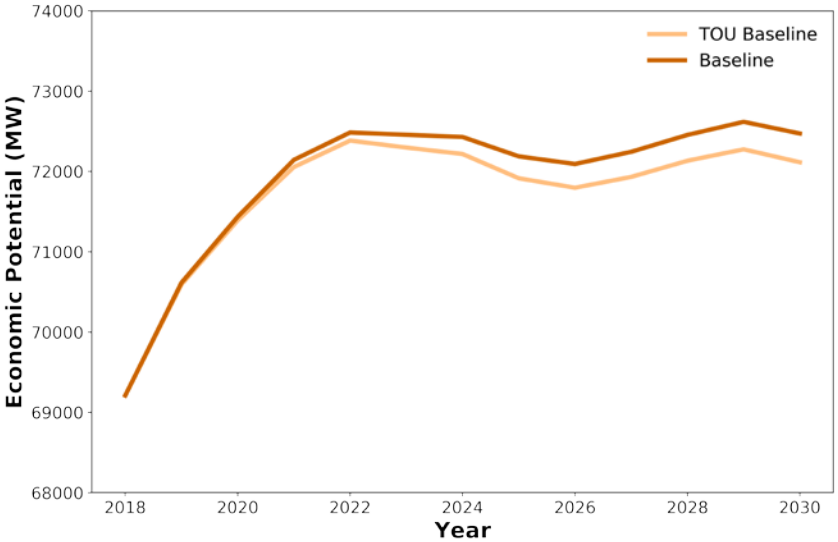
Affect of Cost on dWind Economic Potential

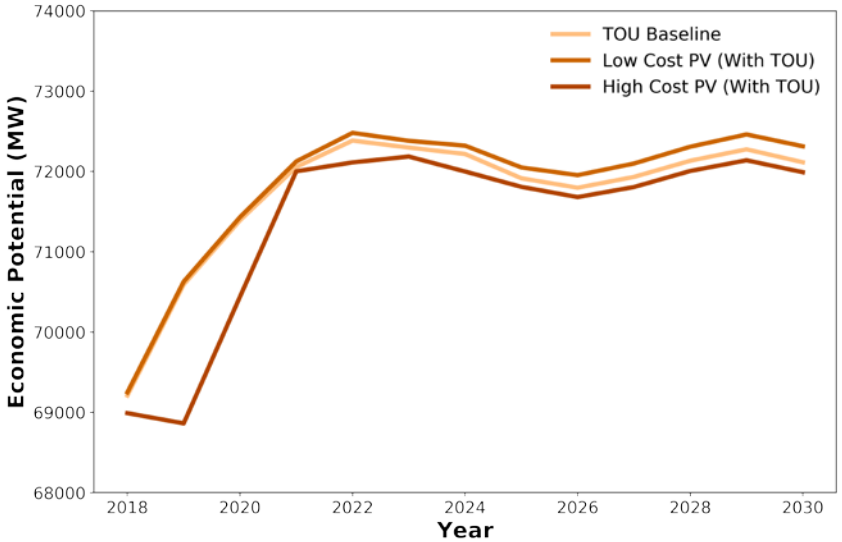




- If dPV costs lower, dWind economic potential lowers by 150 MW
- If dPV costs align with high schedule, dWind gains 100 MW

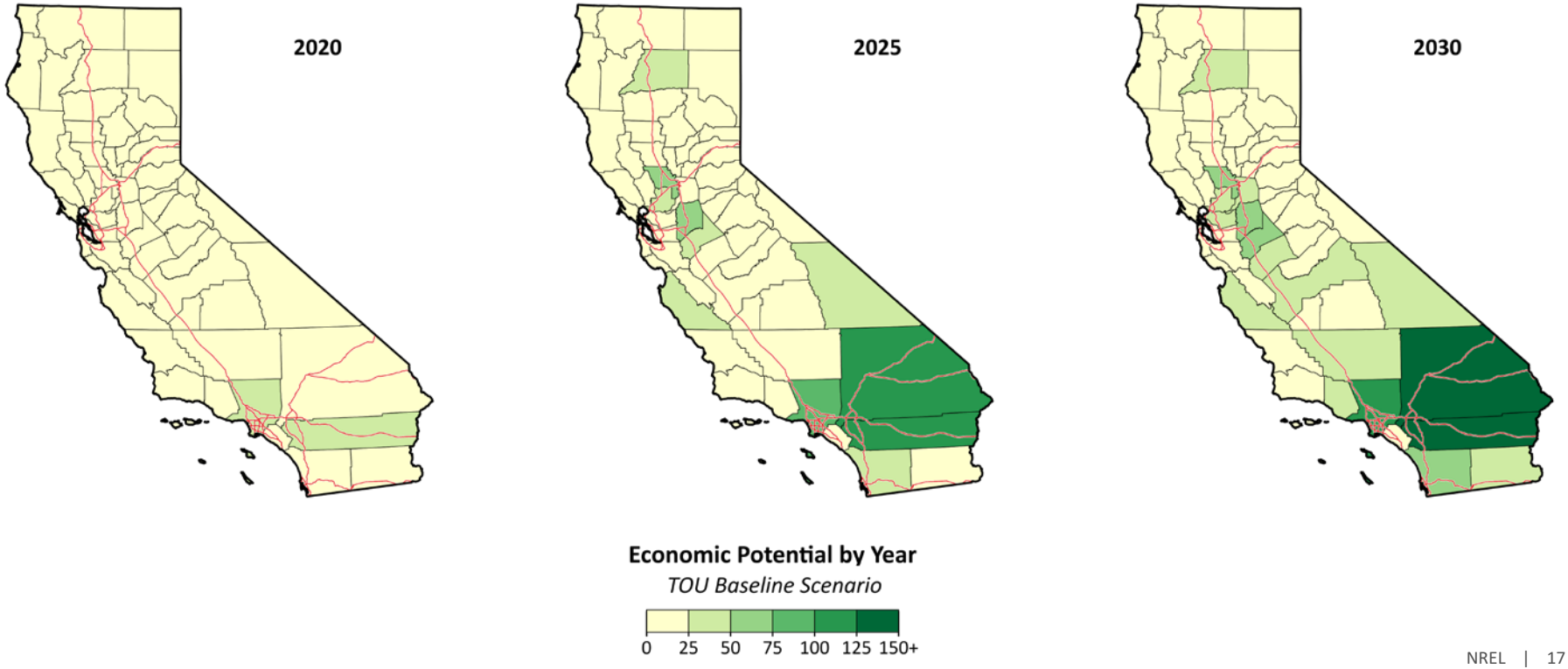
dPV Economic Potential



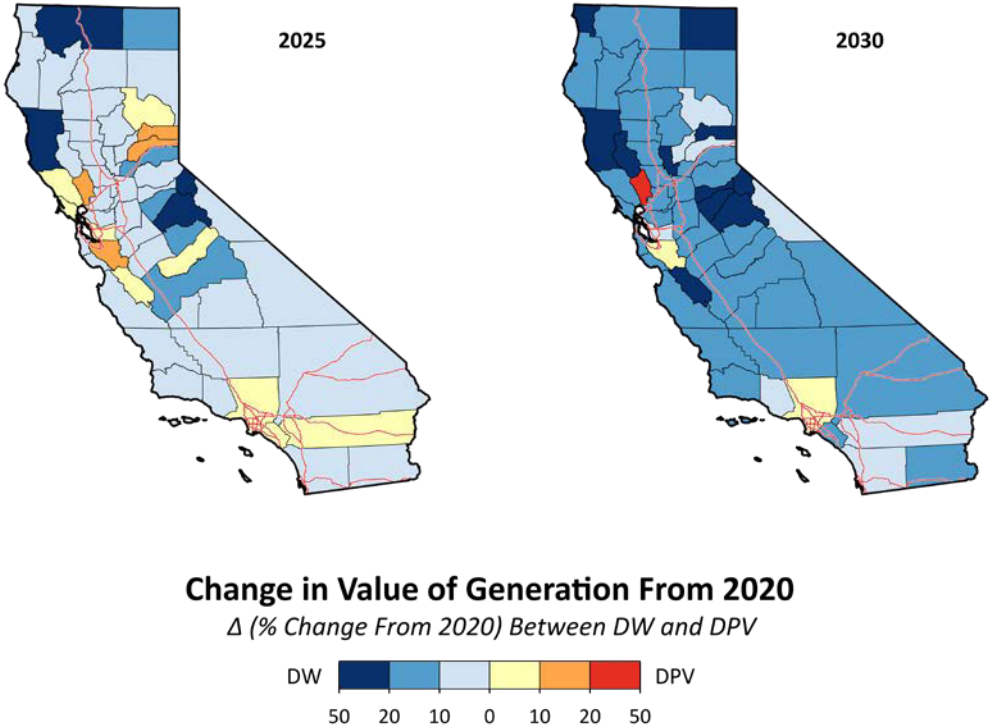


- dPV economic potential remains at ~72 GW for several years and even with TOU decrease
- Change in price does not drastically effect long term economic potential of PV

Geospatial Distribution of dWind Economic Potential



Difference in Generation Value with dPV Penetration



- 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!

www.nrel.gov

NREL/PR-6A20-74986

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Wind Energy Technologies Office. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

NREL
Transforming ENERGY