



# California ISO – Leading the Transition to a Low Carbon Grid

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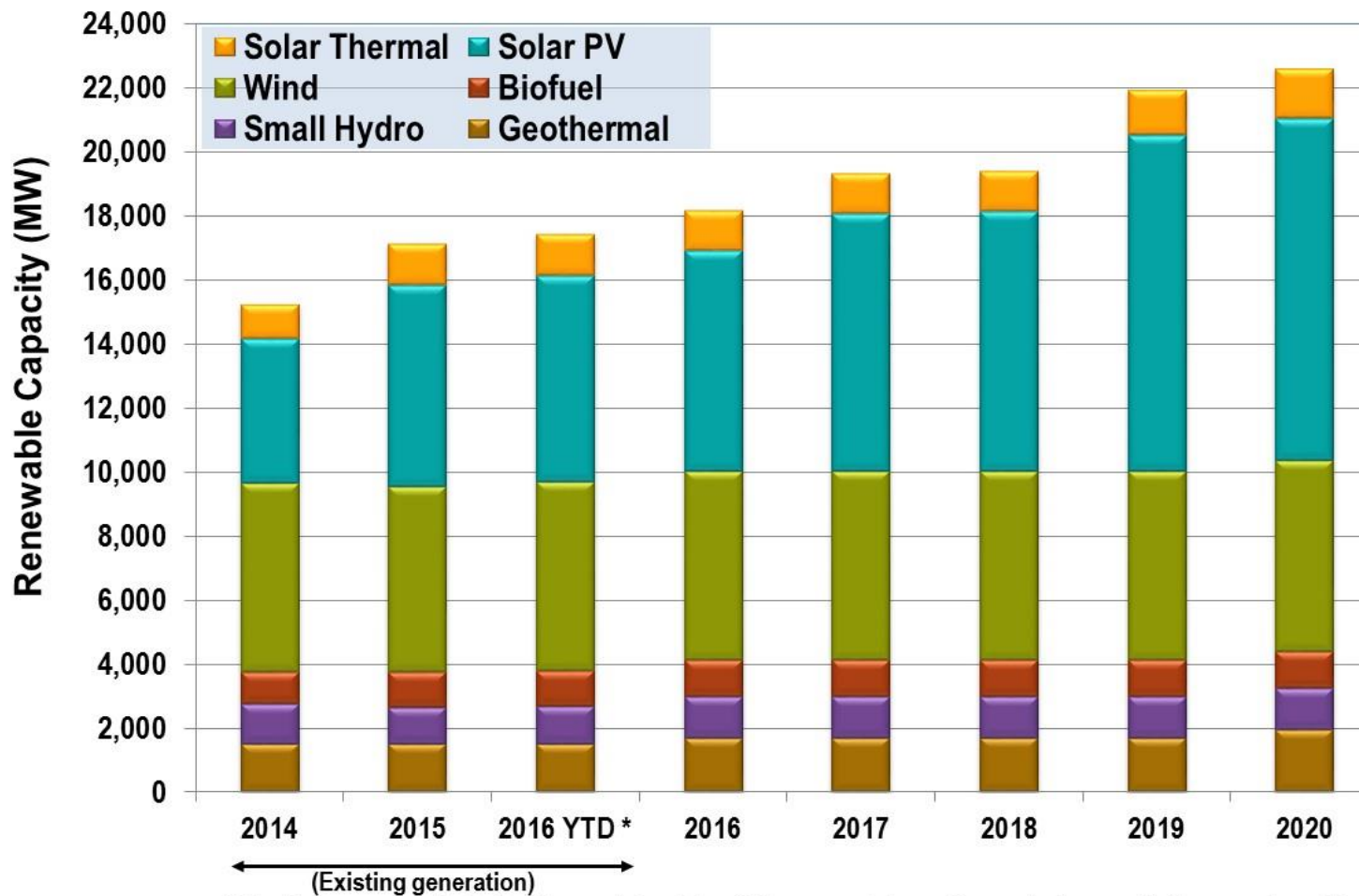
Vice President, Market and Infrastructure Development  
California Independent System Operator

Department of Energy  
Quadrennial Energy Review, Meeting #6  
Los Angeles, California  
May 10, 2016

# California energy and environmental policies drive renewable integration and transmission needs

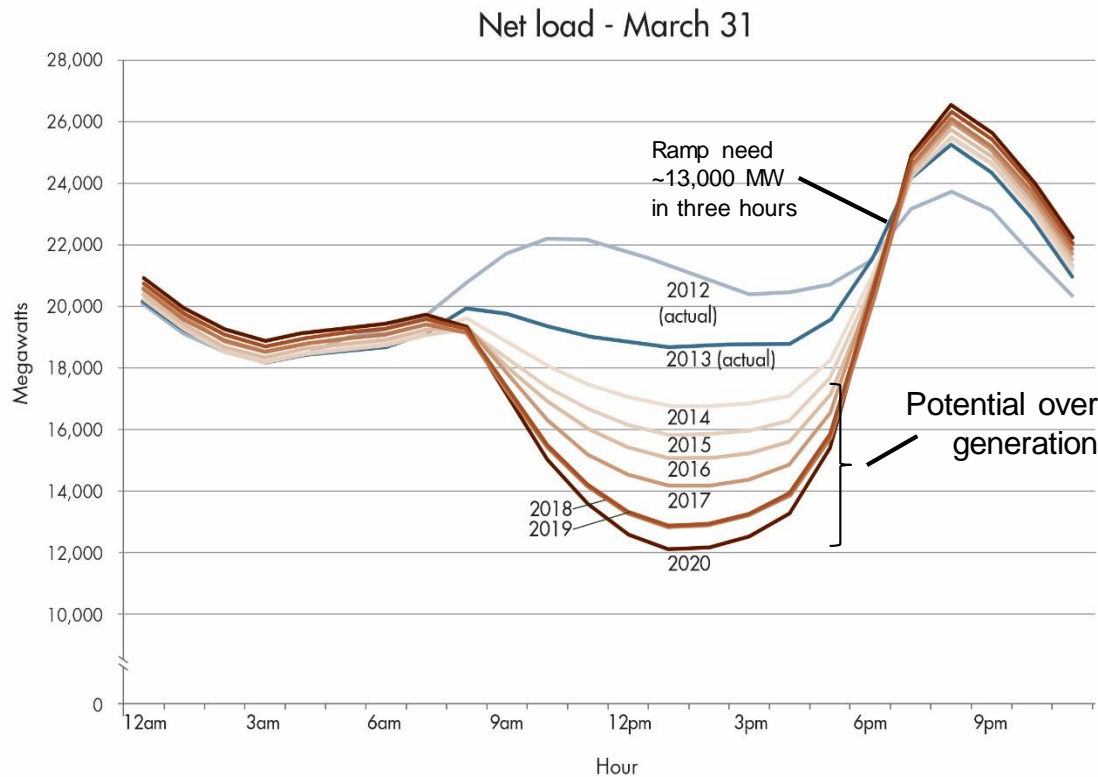
- 2020 Policies
  - Greenhouse gas reductions to 1990 levels
  - 33% of load served by renewable generation
  - 12,000 MW of distributed generation
  - Ban on use of once-through cooling in coastal power plants
- 2030 Policy Goals
  - 50% renewables
  - Double energy efficiency existing buildings
  - Greenhouse gas reductions

# Renewable Development Projections (transmission-connected)



\*All online resources, including those yet to achieve full commercial operation, up to to capacity they are cleared to operate at.

# New resource mix can lead to significant over-supply conditions and potential for renewable generation curtailments.

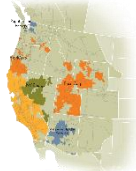


Solutions
Increase storage and demand response
Enable economic dispatch of renewables
Decarbonize transportation fuels
Retrofit existing power plants
Align time-of-use rates with system conditions
Target energy efficiency
Deepen regional coordination

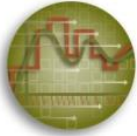
# Key CAISO initiatives for enabling renewable integration



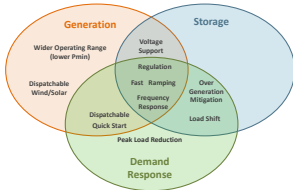
Advanced Forecasting



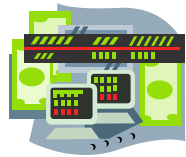
Enhancing regional coordination



Advanced Applications



Removing market barriers for new technologies



Market Enhancements



# Energy imbalance market (EIM) is an easily-scalable extension of the real-time market to a broader region

- Total savings of \$45.69 million through year ending 2015
- 17,776 MWh curtailment avoided, displacing 7,521 metric tons of CO2.
- Integration of renewables across a larger geographical area
- Enhances reliability with improved situational awareness
- Reduces costs through automatic economic dispatch
- Balancing authorities maintain control and reliability responsibilities

