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# System Operators' Perspectives on the Need for Power Grid Modeling, Simulation, and Optimization

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*California ISO*

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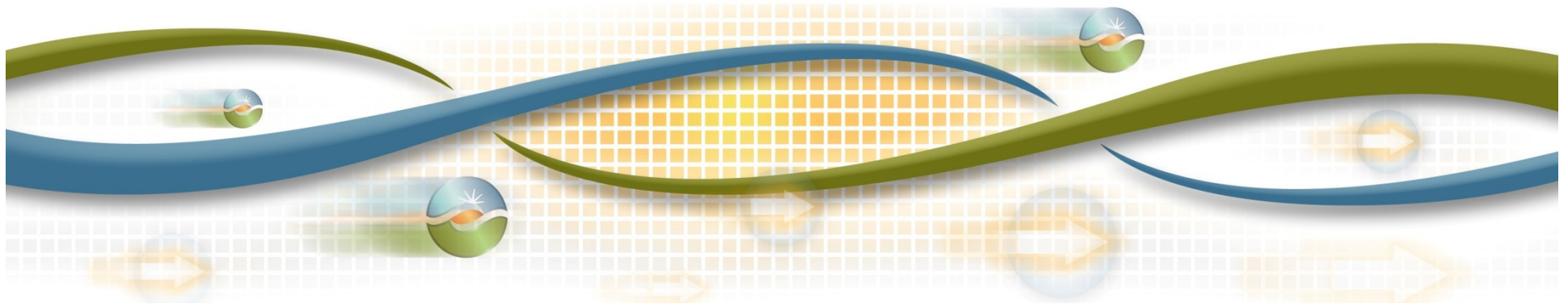
California ISO  
Shaping a Renewed Future

# System Operators' Perspectives on the Need for Power Grid Modeling, Simulation, and Optimization

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# Overview

- What drives the need for change?
- What are the challenges?
- What are the needs?
- Need for new resource models
- Need for new ancillary services
- Need for new optimization methods

# What drives the need for change?

- 33% Renewable Policy Standard in CA by 2020
- Once-through cooling regulation
- Greenhouse gas emission regulation
- Carbon tax
- Fossil plant economic retirement
- Radical change in generation fleet characteristics

# What are the challenges?

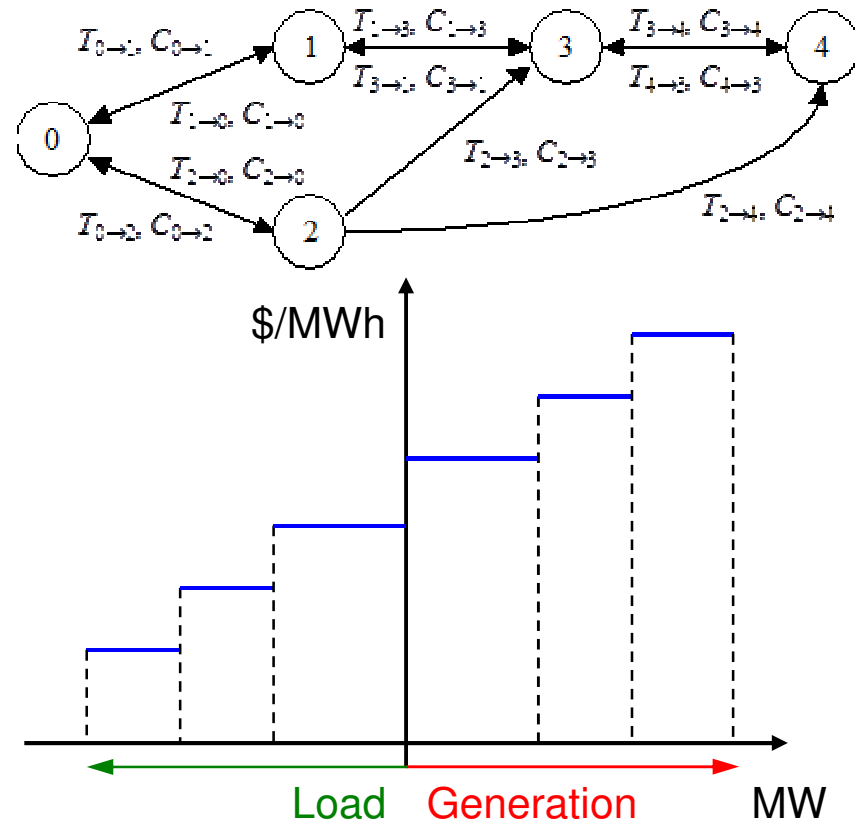
- Reduced voltage support capability
  - ◆ Most wind turbines and solar plants cannot generate reactive power
  - ◆ No market for reactive power, thus no incentives
- Reduced frequency response
  - ◆ No market for primary reserve, thus no incentives
- Reduced system inertia
  - ◆ Stability limits must be reevaluated
- Reduced fault current
  - ◆ Protection schemes must be redesigned

# What are the needs?

- Renewable energy production forecast
- Generation fleet flexibility for load following
- New models for new generating technology
- Reevaluate operating reserve requirements
  - ◆ What constitutes largest contingency?
- New/expanded software capabilities to consider uncertainty
- Visibility, dispatch, and metering of distributed generation and demand response

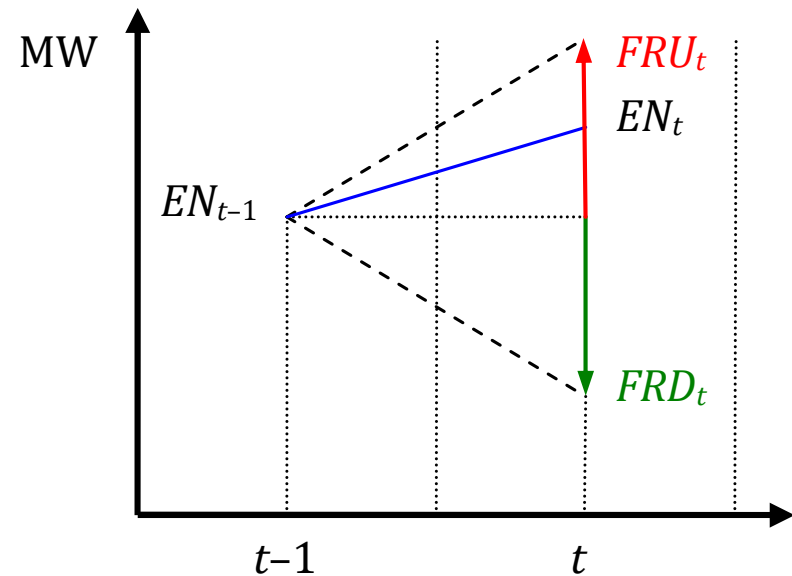
# Need for new resource models

- Multi-State Generator
  - ◆ Combined Cycle Gas Turbine plant
- Non-Generator Resource
  - ◆ Energy Storage Resource
  - ◆ Dispatchable Demand Resource



# Need for new ancillary services

- Regulation mileage
- Dynamic transfers for renewable energy imports
- Flexible Ramp Capacity
  - ◆ 5min ramp capability for demand change and uncertainty







# Need for new optimization methods to consider uncertainty

## ■ Robust optimization

- ◆ Some parameters are known only within certain bounds
- ◆ Find a solution that is feasible for all possible values and optimal in some sense

## ■ Stochastic optimization

- ◆ Some parameters are stochastic with known or estimated probability functions
- ◆ Find a policy that is feasible for all (or almost all) possible values and maximizes an expectation

# Questions?

