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Modeling, Simulation, And Optimization for the 21st Century Electric Power Grid

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

George Angelidis
*California ISO*

California ISO
Shaping a Renewed Future

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

George Angelidis, Ph.D.

Principal, Power Systems Technology Development

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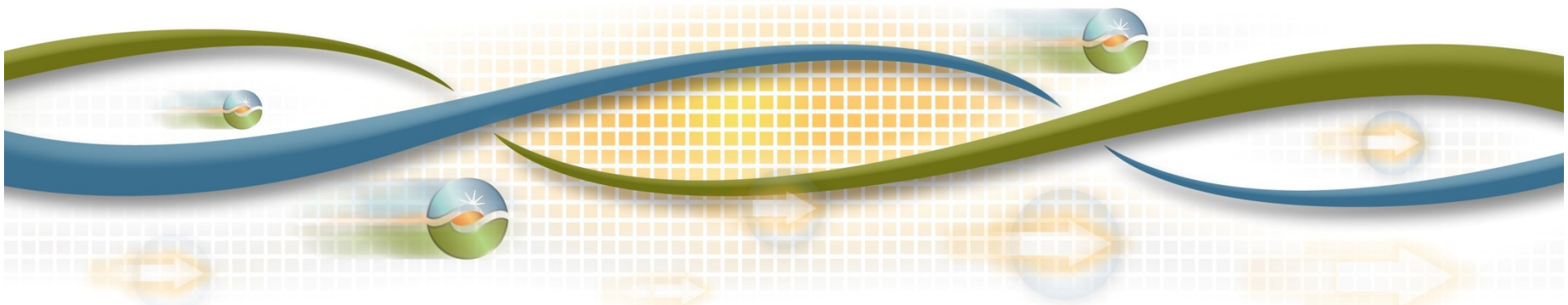


# Overview

- 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?

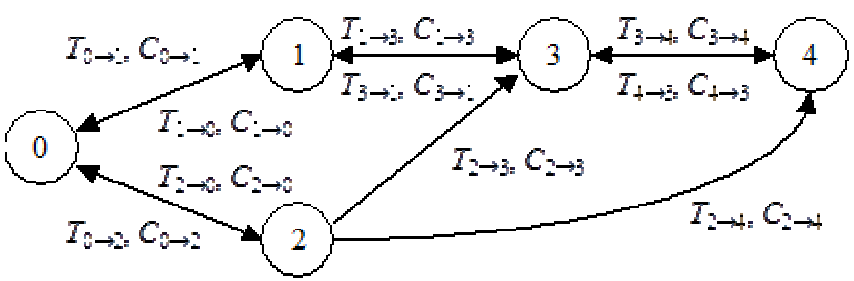
- Reduced voltage support capability
  - Most wind turbines and solar plants cannot generate reactive power
  - No market for reactive power, thus no incentives
- Reduced frequency response
  - No market for primary reserve, thus no incentives
- Reduced system inertia
  - Stability limits must be reevaluated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

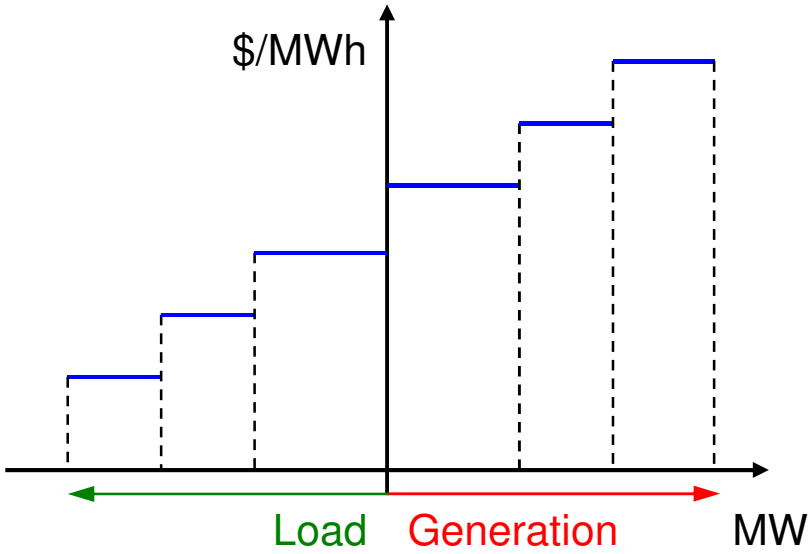
# What are the needs?

- 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

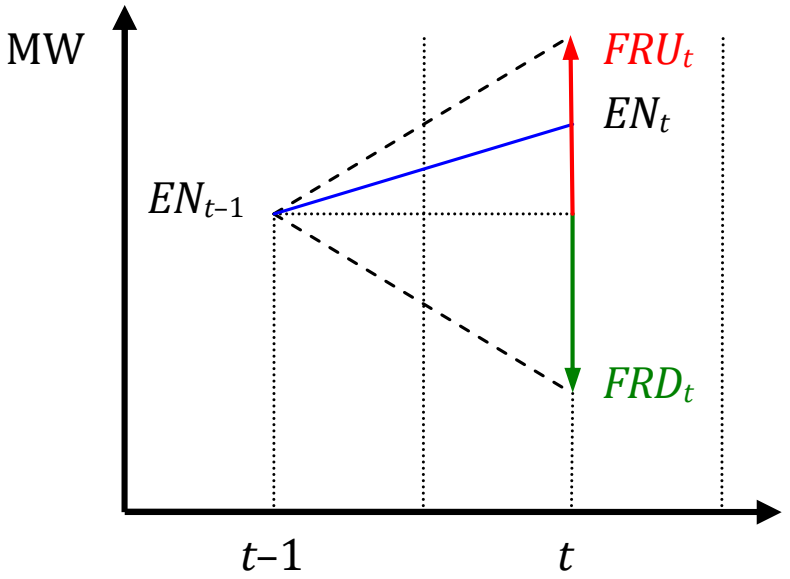
- Multi-State Generator
  - Combined Cycle Gas Turbine plant
- Non-Generator Resource
  - Energy Storage Resource
  - Dispatchable Demand Resource



# 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?