CAISO's SB350 Evaluation Plan

Ratepayer Impact Analysis

PRESENTED TO:

SB350 CAISO Stakeholder Meeting

PRESENTED BY:

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THE Brattle GROUP

SB350 Study Process

Ratepayer Impact Analysis: Assumptions and Methodology

Topics to be covered:

- Framework for estimating operating and investment cost savings (in addition to renewable integration savings)
- Simulations assumptions and methodology

Key areas for stakeholder input

- Brattle' proposed approach will be used to analyze the potential impact on CA ratepayers, does the approach omit any category of potential impact that should be included?
- Are the methodology and assumptions to estimate the potential impact on CA ratepayers reasonable? If not, please describe your concerns.

Ratepayer Benefits of Regional Market

Expanding the CAISO into a regional "Day-2" market offers a number operating and investment cost savings over the current market design, for California and the Rest of Market (even compared to further expansion of the EIM).

- **Operating Cost Savings** are associated with:
  - De-pancaking of regional transmission charges for all transactions
  - Full real-time imbalance market (vs. EIM using only a portion of the grid)
  - Day-ahead market and regionally-optimized unit commitment
  - Consolidated "Balancing Areas" and integrated ancillary services markets
- **Investment Cost Savings** are associated with:
  - Regionally uniform and integrated resource adequacy construct
  - Regional flexible resource procurement
  - More efficient utilization of the existing transmission system
  - Reduced overbuild of renewable portfolio caused by curtailment
  - Access to lower-cost renewable resources

Ratepayer Impact Associated with Regional Market

Operating Cost Savings

De-Pancaking of Transmission Charges

- Concept: Eliminate "pancaking" of multiple transmission charges (38 BAs in WECC)
- Operating Cost Savings: Improves utilization of existing grid, reducing production costs by allowing import of power from lower-cost generating units from other areas
- Example: MISO Day-1 market (through 2005, MISO first de-pancaked transmission without centralized markets)

Real-Time Imbalance Market

- Concept: Imbalance market dispatches resources in real time subject to available transmission capacity
- Operating Cost Savings:
  - Improves real-time coordination across region; improve dispatch of lower-cost resources
  - Reduces cost of real-time balancing of uncertain load and variable generation
  - Increases utilization of available transmission capabilities
  - Reduces renewable generation curtailments
- Examples:
  - EIM: utilizes a portion of the transmission grid
  - SPP's Energy Imbalance System: Used the entire grid (T charges fully de-pancaked)

Ratepayer Impact Associated with Regional Market

Operating Cost Savings (cont'd)

Day-2 Energy Market

- Concept: Real-time and day-ahead markets; optimized day-ahead unit commitment
- Operating Cost Savings:
  - Optimizing unit commitment and dispatch on a day-ahead basis
  - Balance real-time load and supply uncertainty over region
  - Maximizes utilization of available transmission capabilities
  - Further reduces curtailments of renewable generation
- Examples: CAISO, SPP IM, MISO, PJM, NYISO, ISO-NE

Integrated Ancillary Service Markets

- Concept: Consolidate "Balancing Areas" and implement market-based procurement of most ancillary services (regulation, spinning and non-spinning reserves)
- Operating Cost Savings:
  - Allows procurement of ancillary services (A/S) from lowest-cost providers
  - Reduced total A/S requirements by spreading variability over larger region
  - Further reduces curtailments of renewable generation from imbalances
- Examples: CAISO, SPP, MISO, PJM, NYISO, ISO-NE

Ratepayer Impact Associated with Regional Market

Investment Cost Savings

Regionally-Integrated Resource Adequacy Construct

- Concept: Uniform, region-wide resource adequacy standard
- Investment Cost Savings:
  - Taking advantage of region-wide load and resource diversity reduces the required planning reserve margin and associated generating capacity
  - Efficient use of all available resource in the region
- Example: MISO, PJM, NYISO, ISO-NE, SPP (in progress)

Regional Procurement of Flexible Resources

- Concept: Region-wide procurement of flexible resources
- Investment Cost Savings:
  - Taking advantage of region-wide load and resource diversity reduces requirement to procure higher-cost flexible units to balance net load variability
  - Improved access to existing flexible resources
- Example: CAISO flexible resource requirement (accepted in ER14-1574)

Ratepayer Impact Associated with Regional Market

Investment Cost Savings (cont'd)

Reduced Renewable Overbuild

- Concept: Curtailment of renewable resources due to insufficient power system flexibility requires overbuilding the renewable portfolio to ensure compliance with the RPS. Improved day-ahead commitment, real-time balancing, and integrated ancillary services markets reduces renewable curtailment in high-renewable generation future.
- Investment Cost Savings: Reduced curtailment increases effective renewable capacity factors, lowering capacity needed to meet RPS
- Example: Western SPP, Western MISO, Europe

Access to Lower-Cost Renewable Resources

- Concept: Improved utilization of existing grid with local balancing, and regional and inter-regional transmission expansions allow renewable resource development in lower-cost and/or higher-capacity-factor locations
- Investment Cost Savings: Same renewable energy production with reduced overall capital cost
- Examples: Western SPP, Western MISO, ERCOT

Quantification of Operation and Investment Cost Savings of Market Integration

Cost Savings / Source of Benefits	Captured by Expanding CAISO into a Regional RTO?	Proposed Approach to Quantify Benefit
Operating Cost Savings		
De-Pancaking – Partial	EIM	[already captured by EIM]
De-Pancaking – Full	✓	**Production Cost Model**
RT Imbalance Market – Partial	EIM	[already captured by EIM]
RT Imbalance Market – Full	✓	**Other studies/qualitatively**
Day-ahead Market and Unit Comm.	✓	**Production Cost Model**
Integrated AS Market	✓	**Production Cost Model**
Investment Cost Savings		
Integrated Resource Adequacy	✓	**Load Diversity Estimation**
Flexible Resource Procurement	✓	**Other studies/qualitatively**
Reduced Renewables Overbuild	✓	**RESOLVE Model**
Lower-Cost Renewable Resources	✓	**RESOLVE Model**

Ratepayer Impact Associated with Regional Market

Production Cost Simulations: Methodology

We will conduct nodal market simulations to estimate:

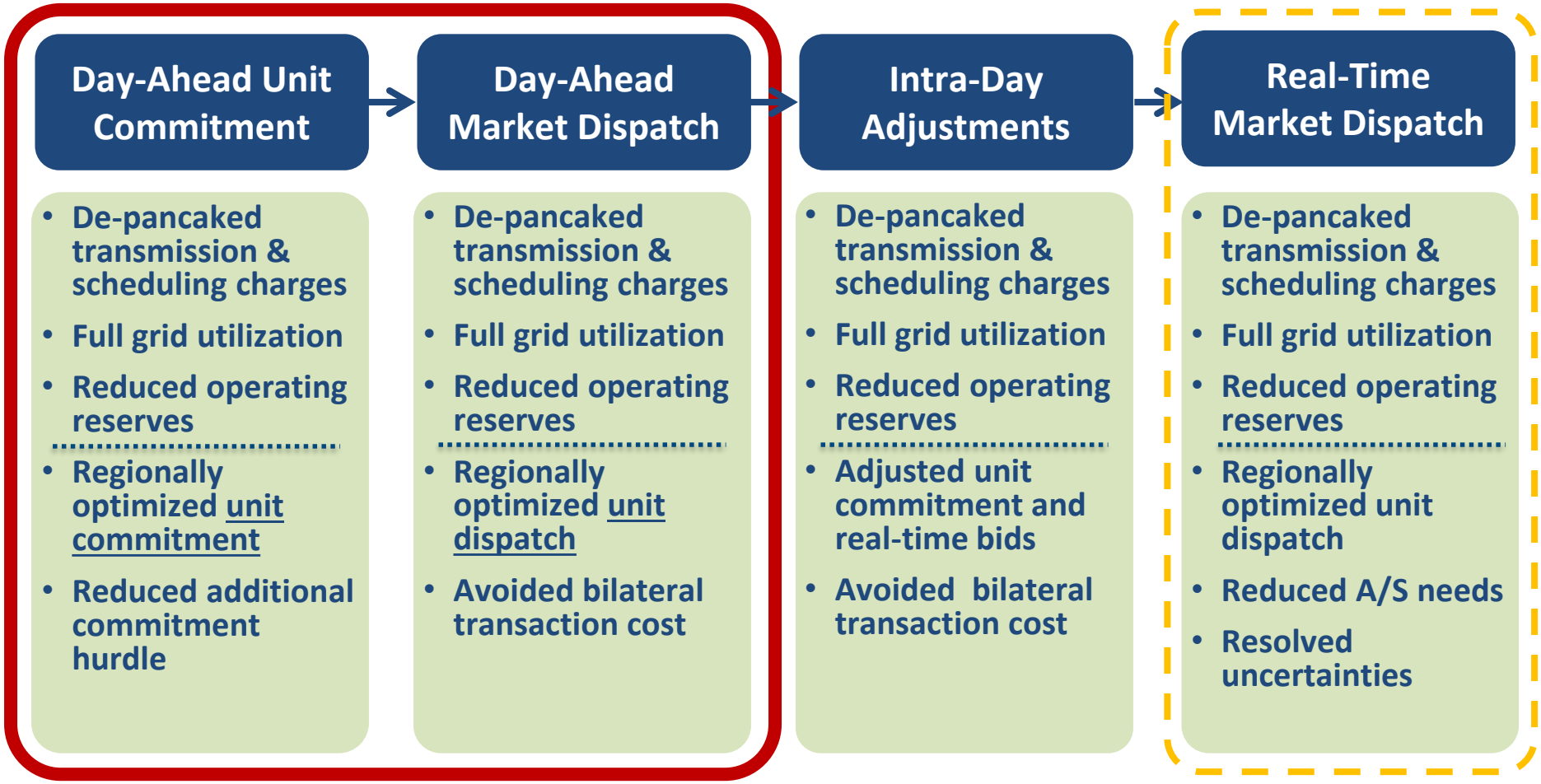
- Production cost savings associated with de-pancaking, unit commitment, and dispatch, which will be a part of the ratepayer benefits
- Changes in generation and associated emissions of GHG and other air pollutants will be carried through to the environmental impacts analysis

Modeling Framework:

- Simulating WECC with and without Regional Market for near-term and longer-term
  - Production cost savings for 2020 will demonstrate near-term benefits of regional market prior ramp-up of renewable generation and Clean Power Plan (CPP)
  - A 50% California RPS scenario for 2030 will to highlight additional impact associated with higher renewable resource procurement and CPP compliance in rest of WECC
- Estimating the impact on California (ratepayer impact) and rest of WECC (production cost savings)
- Simulations will also yield emissions (GHG, NOx, SOx) for environmental analysis

Ratepayer Impact Associated with Regional Market

Production Cost Simulations: Methodology (cont'd)



Ratepayer Impact Associated with Regional Market

Production Cost Simulations: Methodology (cont'd)

We will develop and compare results for three cases:

1. **Business-As-Usual (BAU):** Assumes no regional market
2. **WECC-wide Market with BAU Procurement:** Simulated by removing the hurdle rates among current balancing authorities and allowing for reserve sharing across a larger footprint
3. **WECC-wide Market with Regional Procurement:** Consistent with E3's approach, assumes additional out-of-state renewables available to meet 50% RPS in California

The market simulations will capture a large portion of wholesale power costs (Day-Ahead energy and reserves) with many costs to be estimated outside of the model (cost of RPS, other capital costs for generation and transmission, Real-Time markets)

- We will estimate the needed operating reserve requirements under each case
- The RPS portfolios will be incorporated into the simulations
- Changes in production costs will be translated into ratepayer impacts through a calculation of utility revenue requirements

Ratepayer Impact Associated with Regional Market

Production Cost Simulations: Assumptions

Model Used:

- Power Systems Optimizer "PSO" production cost simulation model (developed by Polaris Systems Optimization, Inc.; provides option to model real-time/uncertainty in future)
- Baseline input assumptions: Same as those developed for CAISO's Gridview model used to support its 2015–2016 Transmission Planning Process—already vetted by ISO's stakeholders (TEPPC 2024 Common Case V1.5 as a starting point; released April 2015)

Updates to TEPPC case:

- Load, CA-GHG prices, and gas prices based on CEC forecast
- 33% RPS portfolio provided by CPUC
- Updates to transmission topology (to include all ISO approved projects) and to transmission constraints (from LCR and reliability studies)
- Update hurdle rates to reflect (a) most recent tariff rates; (b) additional bilateral trade "friction" across balancing areas; (c) GHG hurdle rate for CA imports
- Frequency response requirements and reserves (regulation & load following)
- 50% RPS scenarios (discussed later) to capture additional production cost savings in a high renewables environment
- Carbon constraints, coal retirements, and renewables for rest of WECC based on recent TEPPC long-term policy cases

Questions to Stakeholders & Discussion

- Brattle' proposed approach will be used to analyze the potential impact on CA ratepayers, does the approach omit any category of potential impact that should be included?
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