

South Carolina EMRM Advisory Board/Brattle Meeting #1

PRESENTED BY

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PRESENTED FOR

South Carolina EMRM
Advisory Board

JUNE 28, 2022



Agenda

1

Introductions and Objectives

2

Review Key Takeaways from Individual Conversations

3

Discuss Scope of the Market Reform Study

4

Review Modeling Tools and Assumptions

Objectives for this Afternoon

- **Review key takeaways from the individual conversations with Advisory Board members**
- **Create plan to communicate Advisory Board positions to Study Committee**
- **Create preliminary plan for market reform options to analyzed in the study**
- **Discuss modeling tools used to analyze market reform options**
- **Develop plan for Advisory Board involvement in creating modeling assumptions and providing data used in the study**

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Summary of Individual Conversations with Advisory Board

Over the last weeks, we have met individually with all of the Advisory Board to discuss your initial thoughts on market reform and our study

These conversations have helped us understand that:

- There is broad consensus on several topics (see next slide)
- Key issues and concerns that are most important for each organization represented
- Initial thoughts on the opportunities and risks each organization sees in the market reform options being considered
- What is an appropriate scope for the market reform study, and which benefit/cost metrics should be evaluated in the study

Summary of Individual Conversations with Advisory Board

Areas of Broad Consensus

(most or all members of the advisory board indicated...)

- Market reform options should be pursued if, and only if, they reduce costs for customers
- SEEM is a beneficial step in the right direction, and there are likely additional benefits in expanding its footprint and deepening market functionality in the footprint
- Wholesale markets tend to provide operational benefits (e.g., lowest-cost dispatch of resources)
- There are complications to consider with generation divestiture, including potential stranded costs of existing resources, types of resources a market can incentivize
- Risks related to retail choice, including price volatility for small C&I and residential customers
- Concerns about lost oversight, governance authority, and increased federal regulation
- The study should analyze options SC can pursue unilaterally (or with limited interstate coordination)
- Pursuing market reform incrementally is more likely to succeed and create broad buy-in

Summary of Individual Conversations with Advisory Board

Areas of Differing Opinions

(members of the advisory board expressed mixed opinions on...)

- Whether regional wholesale markets deliver investment benefits (e.g., does regional transmission planning reduce costs long-term and create benefits for customers?)
- The ability of wholesale markets to integrate renewable resources faster and at a lower-cost to consumers
- Which customer types benefit from wholesale markets (do all benefits accrue to industrial and large commercial customers, or will residential/small commercial customer also see benefits)
- Whether generation divestiture and market-driven generation investment (vs. resource planning) will deliver benefits to customers

Communication of Advisory Board Positions to Study Committee

In our last meeting, the Study Committee asked the Brattle team to compile positions from each Advisory Board member

We would like to develop a plan with the group on how we should gather that feedback and deliver it to the Study Committee.

- Would each be willing to draft and provide us with a short (1-2 page) write-up, which we can share with the Study Committee?
 - Could include initial thoughts or opinions on the different reform options
 - Key issues or concerns most important to your organization
 - Consideration for the legislature to take into account as it pursues market reform
 - Any other topics you want to communicate to the Study Committee
- Would it be helpful for us to provide a template?
- Alternatively, we could provide the Study Committee with a summary based on our one-on-one conversations, including follow up conversations if needed.

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Developing the Scope of the Study

We would like input from the Advisory Board on which market reform options we should analyze, and which ones are better to discuss qualitatively or recommend for later analysis

- Given the timeline we have to work with, as well as modeling/data limitations, it is not feasible to analyze all of these options, nor would it make sense to focus on some of the options listed
- The Study Committee has asked us to consider other reform options, not listed in Act 187, and several members of the Advisory Board have provided other ideas in our one-on-one conversations (we would welcome more ideas)
- This question of which market reform options to analyze is directly connected with the question of geographic footprint to analyze

Market Reform Options

We are looking to start the conversation with the Advisory Board on scoping out the study:

- Adding additional ideas to the list of potential market reform options to be considered in the study
- Helping determine what options we should spend the most time and effort analyzing in the study vs. options to discuss and assess qualitatively
- Discussing the appropriate geographic footprint to analyze for each option



Market Reform Options

Exercise

Take 10-15 minutes for each organization to write down market reform options you would like to see analyzed in the study, including

- Options you think it makes sense to exclude (or discuss qualitatively)
- The geographic footprint for each option
- Ideas not listed on the previous slide

Its OK not to have a firm opinion on any of the options, and we can think about more options later

Proposed Market Reform Options to Analyze

As a starting point for discussion, we propose modeling five different market reform options and assessing others options qualitatively based on experience in other jurisdictions

Proposed Model Scenarios

Status Quo w/ SEEM

Joint Dispatch in the Carolinas

EIM in the Carolinas

Southeast RTO

Carolinas in PJM RTO

To model these five options we would build a production cost model of the Southeast and PJM

- From our modeling results we would be able to calculate several benefit/cost metrics (see next section)
- We would also analyze other types of benefits, costs, and risk based on supplemental analyses or observed outcomes in similar markets
- We propose modeling one near-term future year (e.g., 2028)
 - The benefit of modeling a near-term future year is that we can incorporate changes known/expected prior to market reform and still be confident in load forecasts and generation mix assumptions

Proposed Market Reform Options to Analyze

For market options not explicitly modeled, we would assess them based on the negative/positive experiences in other jurisdictions, and other credible analyzes of costs, benefits, and risks that are applicable to South Carolina

Proposed Market Reform Options to Assess Qualitatively and Based on Experience in Other Jurisdictions

Partial Retail Choice

Full Retail Choice

Additional Reforms of IRP Process

Generation Divestiture

Securitization of Retiring Thermal Assets

Retail Rate Re-Design

Community Choice Aggregation

Creation of Distribution System Operators

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Overview of Modeling Approach

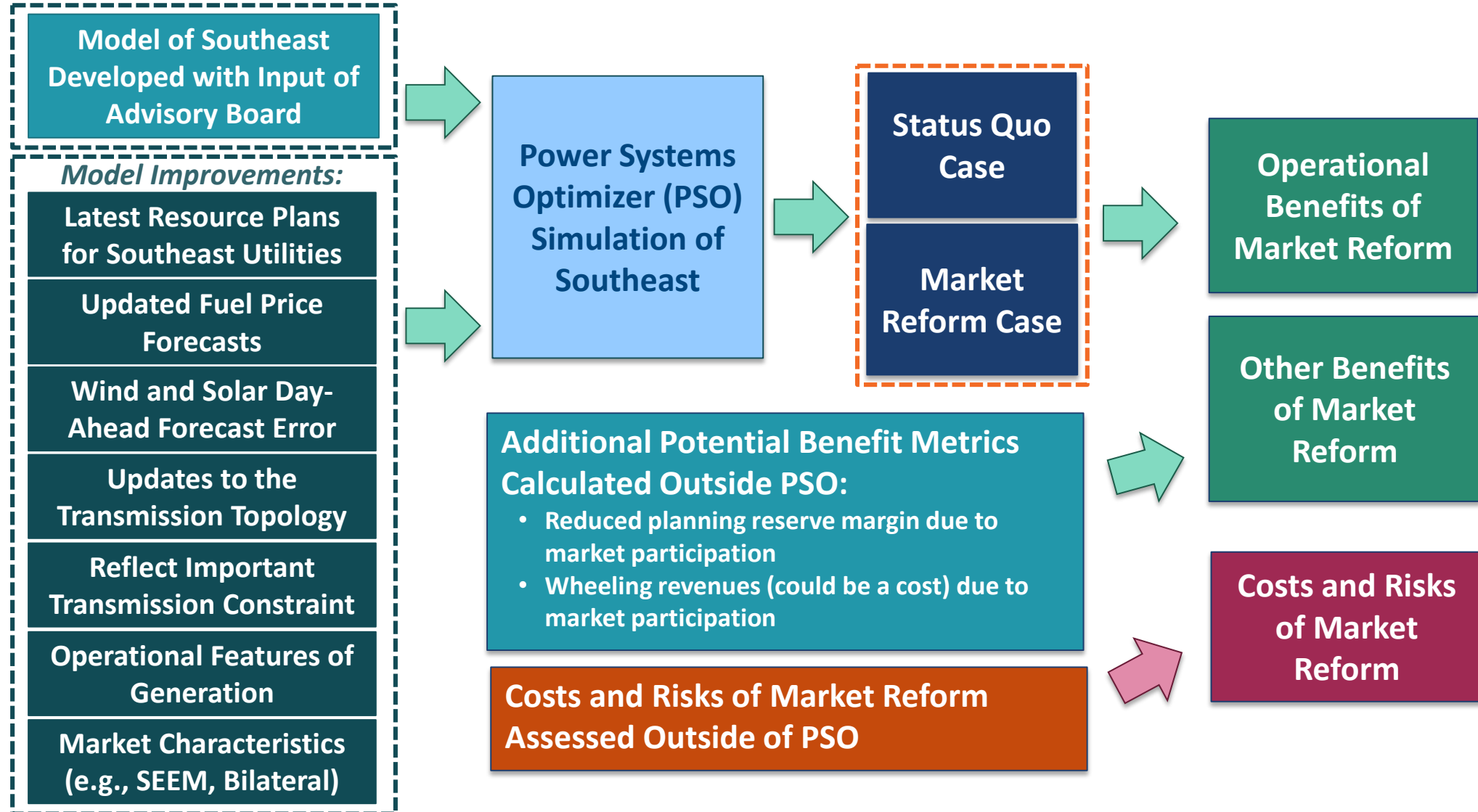
To assess operational benefits of market reforms, we propose to run a production cost simulation of the Southeast under different market structures and compare outcomes of the simulations

Our modeling team employs an advanced production cost simulation model called Power System Optimizer (PSO) to simulate the power systems in the U.S.

- Brattle licenses PSO from the developer, Enelytix, and we maintain a deep relationship with them, advising on the development of new features
- Nodal production cost model; it will represent each load bus and generator bus in the Southeast
- Can we calibrated to fully capture day-ahead forecasting uncertainty for load and renewable resources
- Granular operating reserve and ancillary service product definition
- As part of our licensing, Enelytix will provide a pre-populated model of the Southeast region
- We updated modeling assumptions to reflect the most recent resource plans for several WMEG members and CA; and updated other assumptions with recent forecasts of system conditions and costs

Uniquely suited to simulate bilateral trading, joint dispatch, imbalance markets, and RTOs

Study Framework and Benefits Calculation



Multi-Functional Simulation of the Power System

Markets/RTO Functions & Configurations

State and Federal Energy Policies

Operating Reserve Sharing Groups

Balancing Area Authority Functions

Bilateral Contract Paths and Transmission Rights

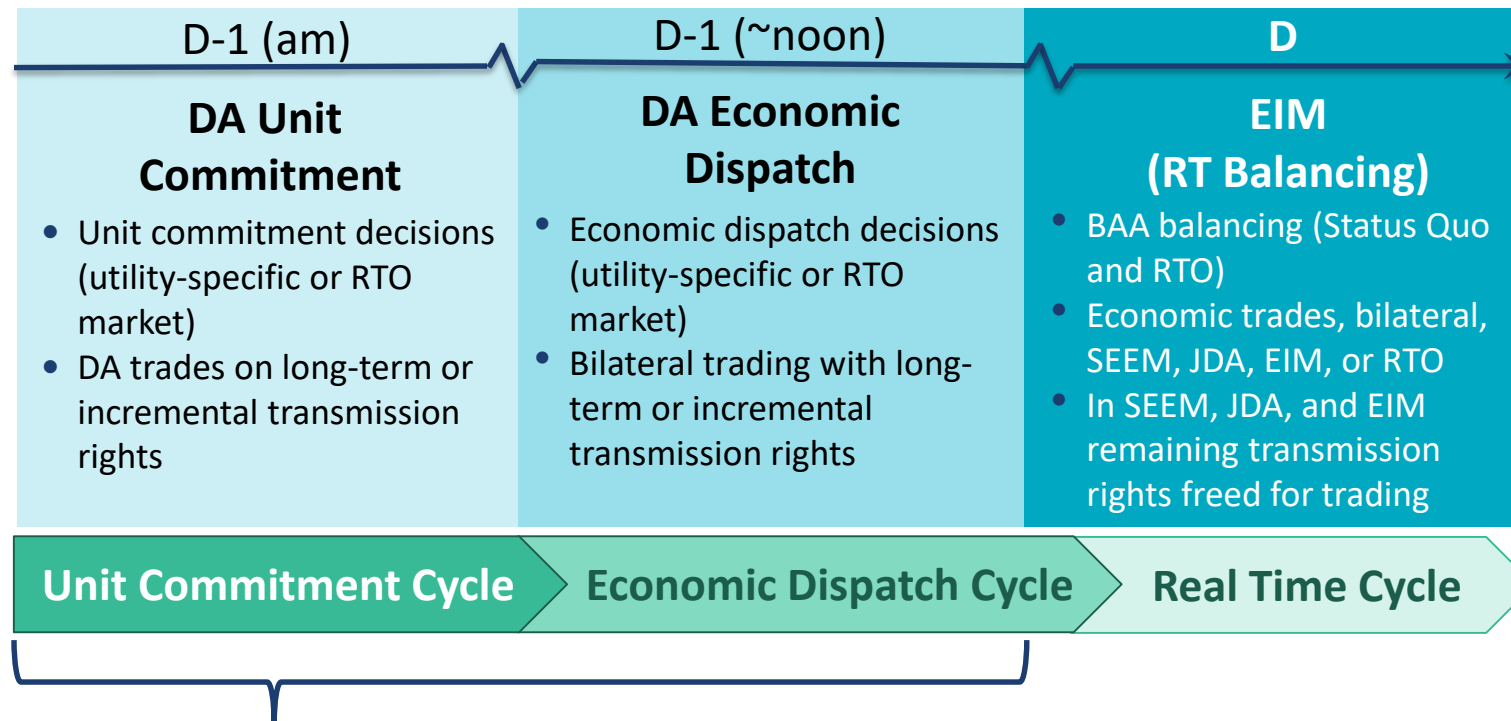
Physical Transmission Flows and Constraints

PSO employs multi-layer simulations to represent the various physical, policy, and operational facets of the power system

- Physical transmission grid with all buses, lines, and generators in the Southeast represented
- All balancing areas (BAAs) represented in the model
- Representation of reserve sharing groups that reduce OR requirements in the Status Quo (and reserve sharing in RTO markets)
- Modeling of state and federal clean energy policies
- Bilateral trading relationships, transfer limits between utilities, and transmission rights
- Renewable diversity, day-ahead forecast uncertainty, real-time operations

Independent Simulation of Multiple Time Horizons

PSO simulates multiple independent decision cycles to capture day-ahead vs. real-time unit commitment and dispatch



Independent real-time decision cycle necessary to accurately simulate RT markets (e.g., SEEM, JDA, EIM).

Used to simulate DA vs. RT, including forecast error for wind and solar.

Day-ahead decision cycles capture bilateral trading, market clearing, and BAA functions

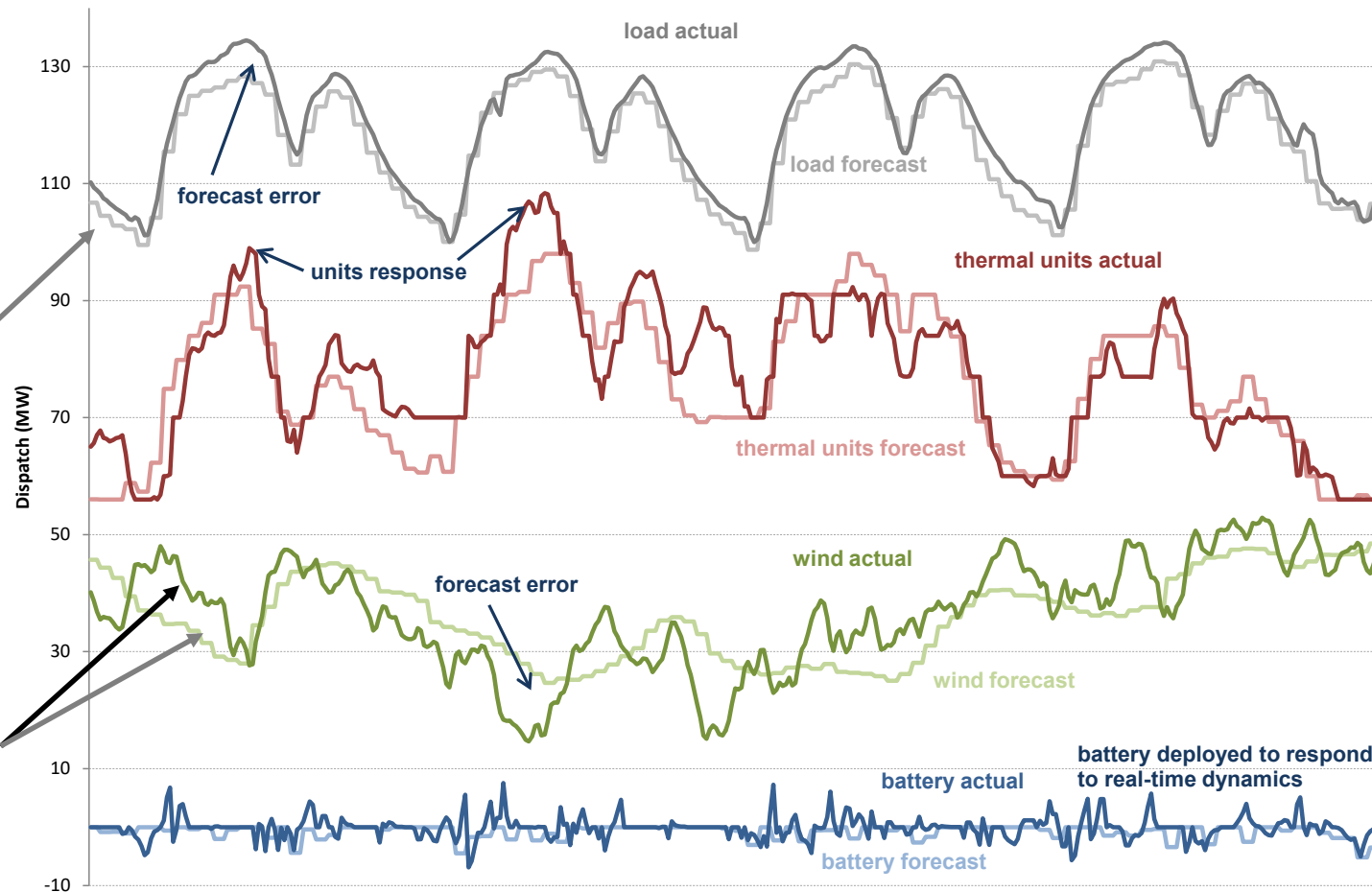
Forecast Uncertainty can be a Major Driver of Production Costs

Our study starts with the conventional “Perfect Foresight” study approach by simulating multiple scheduling horizons with day-ahead load and renewable generation forecasts

A “Perfect Foresight” simulation typically focuses on just one view, often the day-ahead

We additionally simulate the need to respond to uncertainty and intra-hour variance in real-time with a more limited set of resources, considering both scheduling and actual operations

Illustrative 4-Day Operations Simulation Summary



Dark lines are real-time “actual” outcomes

Light lines are day-ahead scheduling outcomes, based on forecasted conditions

Result Metrics: Adjusted Production Cost

Adjusted Production Cost (APC) is a standard metric used to capture the direct variable energy-related costs from a customer impact perspective

The APC is the sum of production costs and purchased power less off-system sales revenue:

- (+) Production costs** (fuel, startup, variable O&M, emissions costs) for generation owned or contracted by the load-serving entities
- (+) Cost of bilateral and market purchases** valued at the BAA load-weighted energy price
- (-) Revenues from bilateral and market sales** valued at the BAA generation-weighted energy price

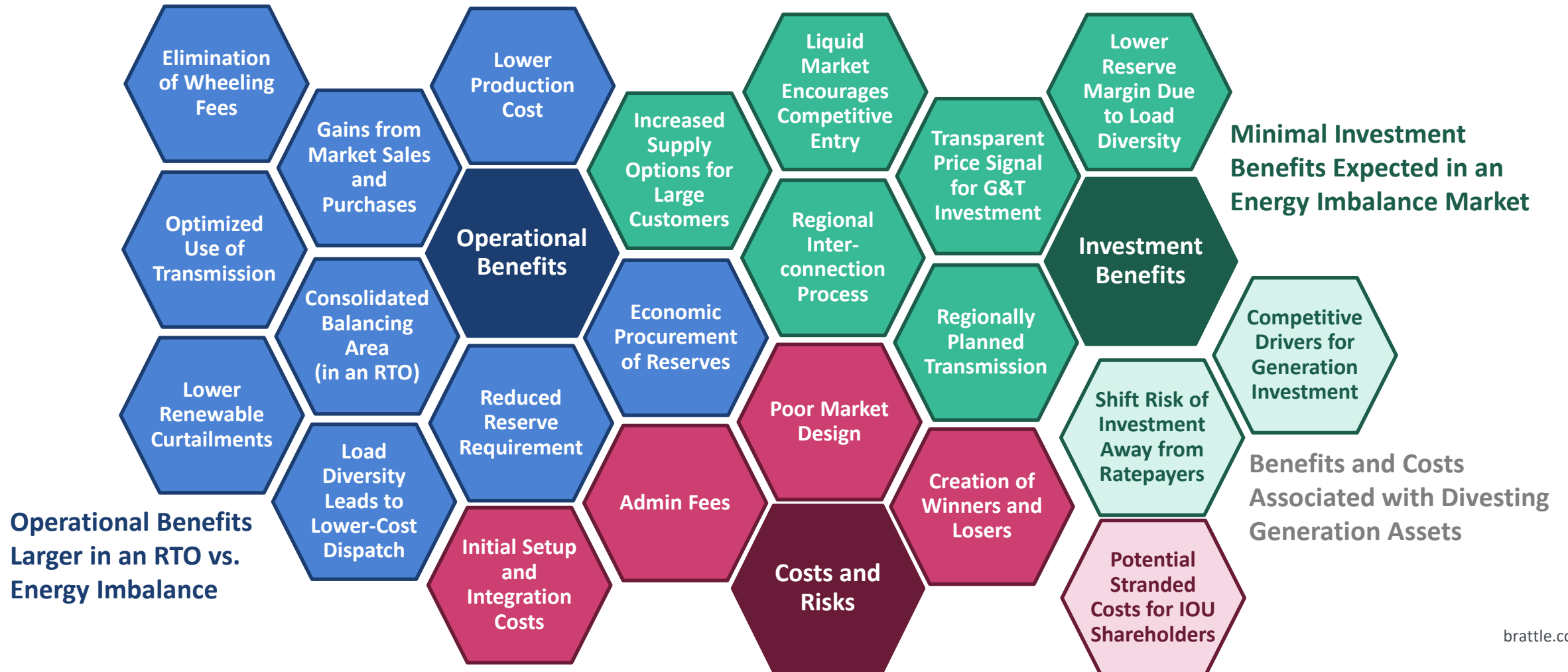
Typically, production cost simulation produce conservative estimates of APC savings, due to the use of weather-normalized loads, absence of extreme system events, and transmission outages

The APC is calculated for the Status Quo Case and for the Market Reform Cases (each representing a new market structure) to determine the APC savings due to market reform

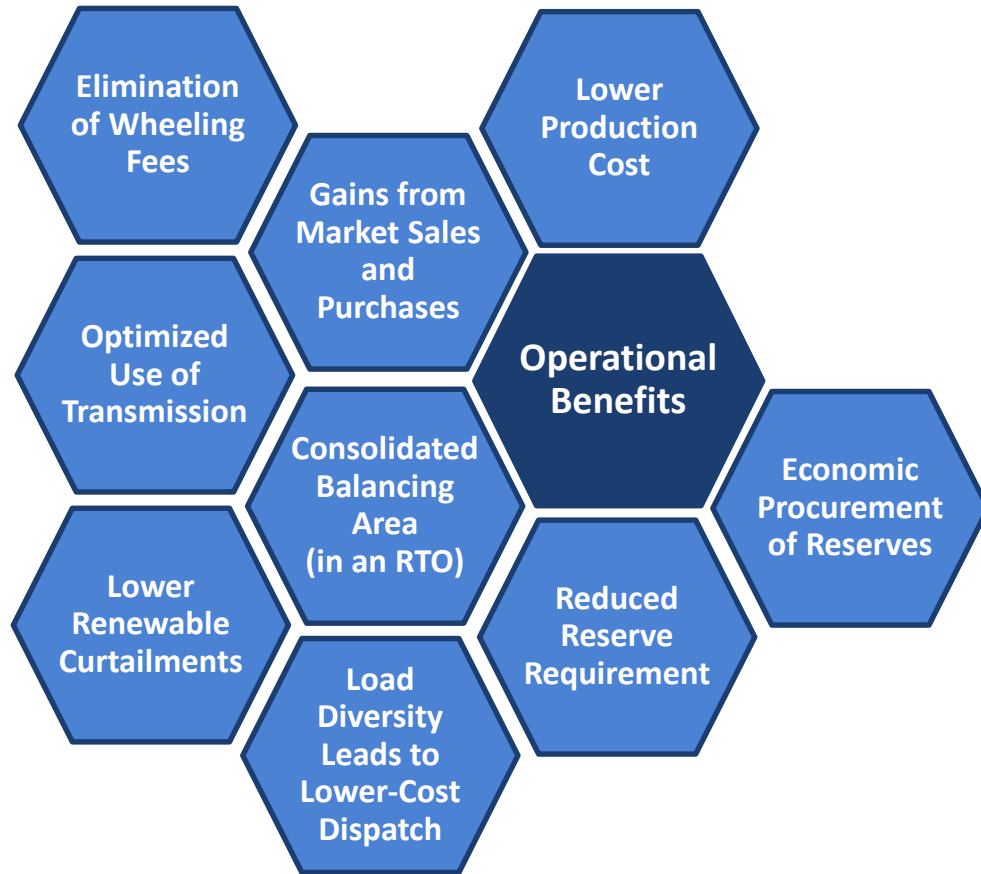
- The APC metric does not capture benefits (or costs) associated with changes in wheeling revenues, or other benefits or costs (see next slides)

Key Performance Metrics

We previously discussed several benefit and cost metrics; now with the Advisory Board we need to determine which to study and how



Key Performance Metrics



The Adjusted Production Cost metric captures most of the operational benefits

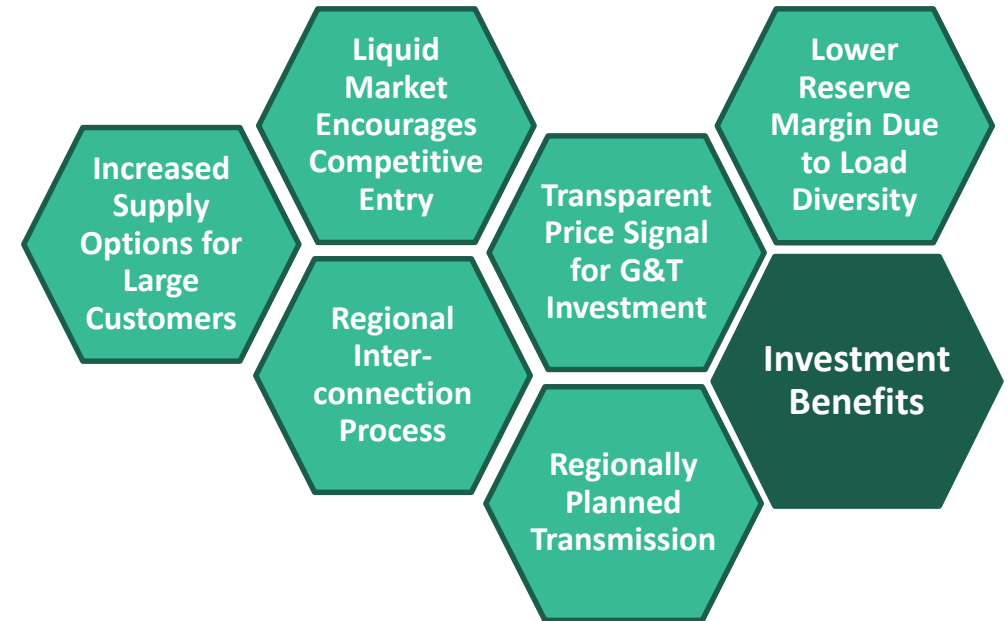
- Others can be calculated separately using the simulation results. For example, changes in wheeling revenues due to market formation (could end up being a net loss)
- We expect operational benefits to be larger as you move to more integrated market structures (SEEM -> JDA -> EIM -> RTO)
- We expect operational benefits to be larger as you move to a larger geographic footprint
- Individual utilities may see costs increases in a market structure, even if the footprint benefits
- We hope to get input from the Advisory Board on other operational benefits it thinks should be assessed, or different approaches for estimating benefits

Key Performance Metrics

We expect investment benefits to be limited in less-integrated market structures (e.g., SEEM, JDA, EIM)

- Production cost simulations (like PSO) will not capture any investment benefits or costs
- We propose working with the Advisory Board to select among options for how (or if) we should estimate these types of benefit to RTO markets

We are not proposing to model generation divestiture, but would plan to discuss the potential benefits, costs, and risk in the study and highlight experience from other jurisdictions



Key Performance Metrics

Several cost metrics can be assessed from experience in other jurisdictions, such as administrative fees and integration costs

- We can use the results of our production cost simulations to check if any utilities experience an increase in APC or other operational benefits
- Other costs and risks can be assessed qualitatively from experience in other markets
- We welcome input on additional costs/risks to assess

We are not proposing to analyze generation divestiture, therefore potential costs or risks associated with divestiture are not analyzed (same with retail choice)



Gathering Input from Advisory Board Members

In addition to developing benefit/cost metrics, we hope to work with the Advisory Board to develop the modeling assumptions used in the study

The members of the Advisory Board are best positioned help us develop an accurate representation of the Status Quo in the Southeast, including Duke's existing JDA between its two utilities and the proposed market design for the SEEM

Several areas where we would seek input from the Advisory Board members

- Input from subject matter experts within your companies on how best to model the Status Quo and proposed market reform options
- Data on the operational characteristics and costs of generation resources on your systems
- Information and data on transmission usage, transfer capabilities, and wheeling rights between existing utilities in the Southeast

We plan to enter into an NDA with any Advisory Board member that agrees to provide data

Gathering Input from Advisory Board Members

We would hope to get input from the Advisory Board on how best to represent different market structures in our model

- What is the best approach for modeling bilateral trading in the Southeast today and under the SEEM, to differentiate it from Joint Dispatch, an EIM, or and an RTO?
 - One key difference is that SEEM, Joint Dispatch, and an EIM would only operate in the real-time cycle of our model to reflect their actual operation
- Typically, bilateral market and other wholesale market structures are simulated using hurdle rates or transmission limitations to represent wheeling charges, trading margins, restrictions or inefficiency on transmission usage, and bilateral trading frictions
- We would propose working with your power marketing teams to assess how best to represent bilateral trading and joint dispatch operations

Gathering Input from Advisory Board Members

The model we would start with, licensed from our vendor, would come pre-populated with data on all generation resources, fuel prices, transmission topology, and hourly load profiles for each BAA in SERC; we would ask the Advisory Board member to review, update, and provide additional data on the following topics:

- Operational characteristics of generation resources (e.g., min gen, ramp rates, heat curves, VOM, emissions costs, etc.)
- Joint ownership of resources
- Hourly load profiles and forecasts
- Location of load by each bus
- Transfer capabilities with neighboring utilities
- Important transmission constraints not included in the model
- Other important and relevant modeling assumptions

Plan for Gathering Input from the Advisory Board

We are interested in feedback and input from everyone at any time, always feel free to reach out to us

We would like to do more targeted “data and information requests” of companies that own and operate generation, transmission in the region, and engage in off-system trading

- If willing, we would work with these entities to create NDAs to ensure all data and information passed between them and Brattle remains confidential, and all model inputs remain confidential.
- We would ask these entities to designate subject matter experts within their organizations that can gather data for our modeling effort, as well as help us work through conceptual questions on how to model the power system in the Carolinas and different market structures
- The Brattle team would then work with the subject matter experts in each organization gather needed data (if available) and information
- Modeling approaches developed with these subject matter experts would then be vetted and discussed with the Advisory Board (maintaining confidentiality of data and information provided)