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Public Utility Commission of Texas

Memorandum

TO: Chairman Peter Lake
Commissioner Will McAdams
Commissioner Lori Cobos
Commissioner Jimmy Glotfelty

FROM: Connie Corona, Deputy Executive Director

DATE: August 26, 2021

RE: Work Session for August 26, 2021

Attached are the slides for the Work Session being held August 26, 2021. They have been filed in Project 52268 and Project 52373.

PUCT Work Session Meeting

Woody Rickerson
Vice President ERCOT Grid Planning and Operations

8/26/2021

Market Concepts

- Evaluate market design changes that would result in an appropriate planning reserve margin.
- Improve incentives for attraction and retention of flexible, dispatchable resources.
- Develop financial incentives for resource owners that maintain existing or acquire new dual fuel capability, on-site fuel storage, and/or energy storage.
- Establish a minimum generation deliverability requirement for dispatchable generation in transmission planning studies.
- Establish operational requirements for private-use networks during emergency energy scarcity conditions.

Wire Company Concepts

- Improve the ability of Transmission and Distribution Providers to rotate higher levels of load shed
- Evaluate increasing Transmission Service Provider (TSP) demand response programs
- Establish clear requirements communication of the availability of distributed generation (DG) installations
- Implement winterization requirements
- Require meter read data to be sent to ERCOT for industrial (IDR) meters within same timeframe as smart meter data

Dispatchable Generation Concepts

- Improve the accuracy of Current Operating Plan (COP) data from thermal generation.
- Evaluate removing the Reliability Unit Commitment (RUC) opt out provision.
- Improve Resource Outage reporting in the ERCOT Outage Scheduler.
  - Improve the accuracy of end times for outages
  - Require the reporting of all Forced Outages
  - Modification of the 60-day rule for outage disclosures.
- Timely updates to the High Sustainable Limits to improve Physical Responsive Capability (PRC) measurements.
- Implement winterization requirements based on specific weather metrics (temperature, wind speed/chill, precipitation, and duration of conditions).
- Establish a process whereby ERCOT can obtain proprietary and confidential natural gas delivery limitation information

Inverter-Based Resource Concepts

- Require inverter-based resources to have additional reliability attributes such as grid-forming capability

- Improve Resource Outage reporting in the ERCOT Outage Scheduler.
  - Improve the accuracy of end times for outages
  - Require the reporting of all Forced Outages
  - Modification of the 60-day rule for outage disclosures.

- Implement winterization requirements based on specific weather metrics (temperature, wind speed/chill, precipitation, and duration of conditions).

✓ (Not in the Memorandum) Implement requirements to provide and maintain accurate dynamic models from generating units.

Customized Energy Solutions

Analyze · Simplify · Implement

Beyond ERCOT: Market Design 101

August 2021

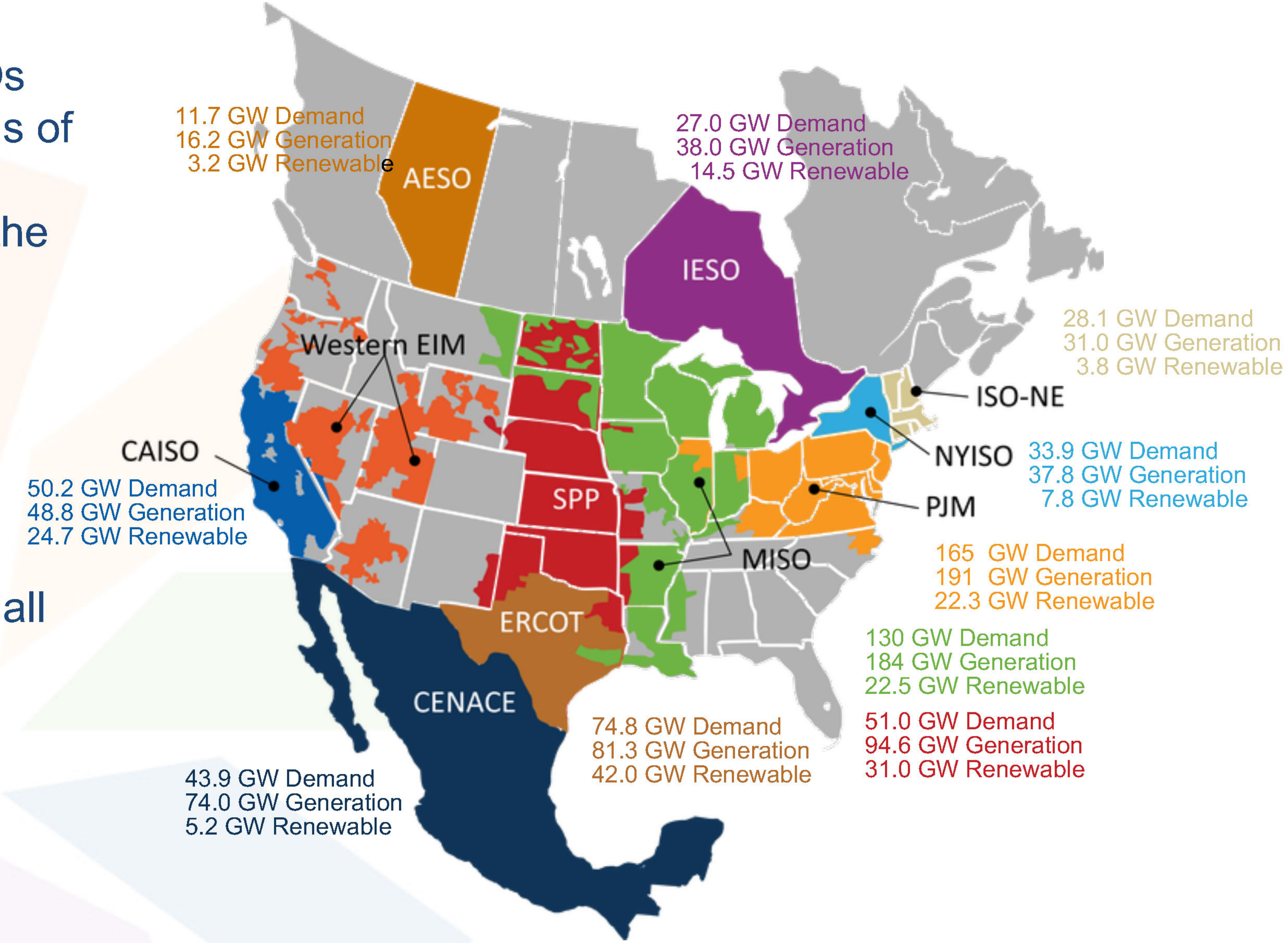
Barbara Clemenhagen

Vice President, Market Intelligence

The Markets

The ISOs/RTOs serve two-thirds of electricity consumers in the United States, more than 50 percent of Canada's population…

The CENACE market serves all of Mexico.



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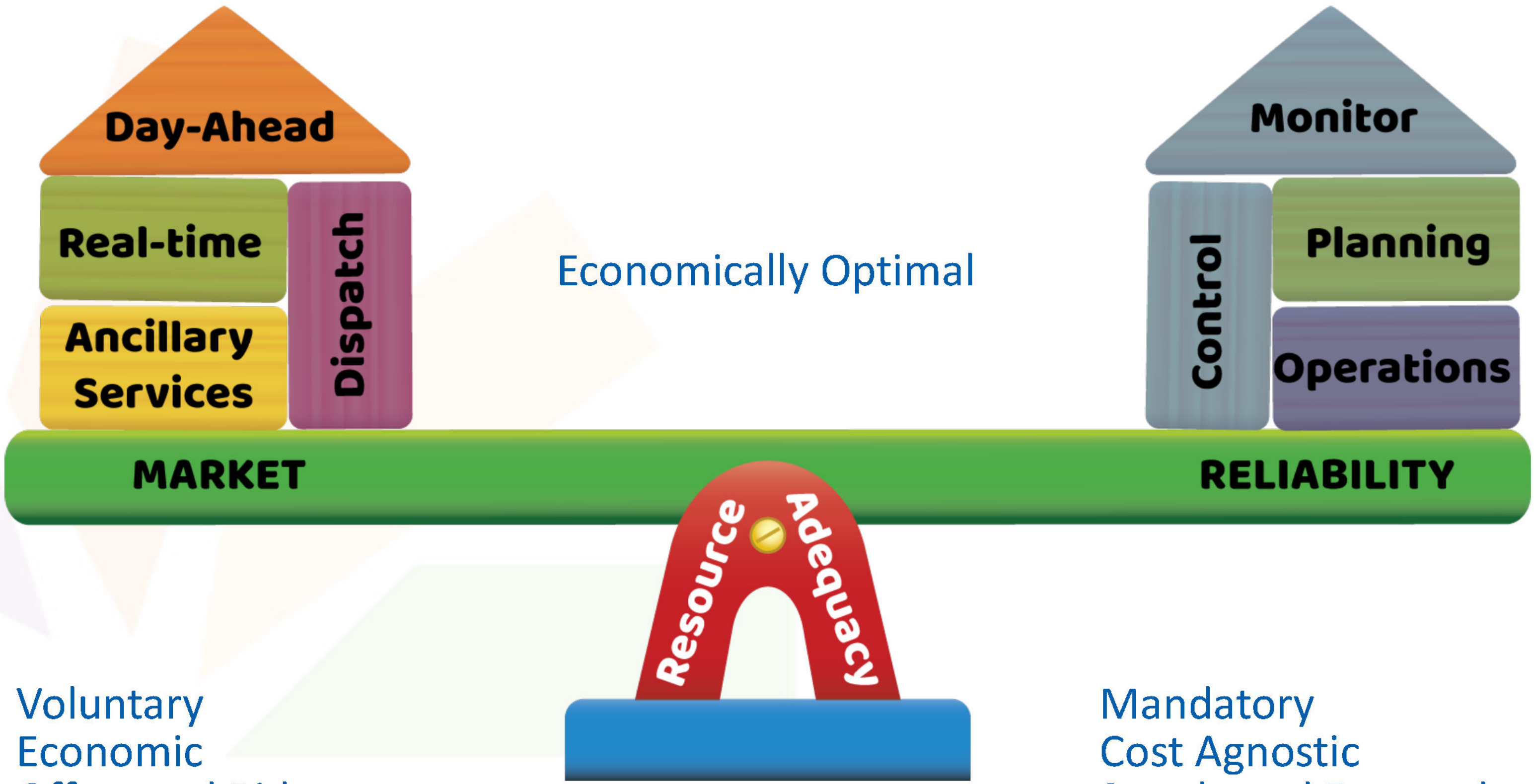
Market Fundamentals



Voluntary
Economic
Offers and Bid
Sophisticated Buyers and Sellers

Mandatory
Cost Agnostic
Supply and Demand
Operational

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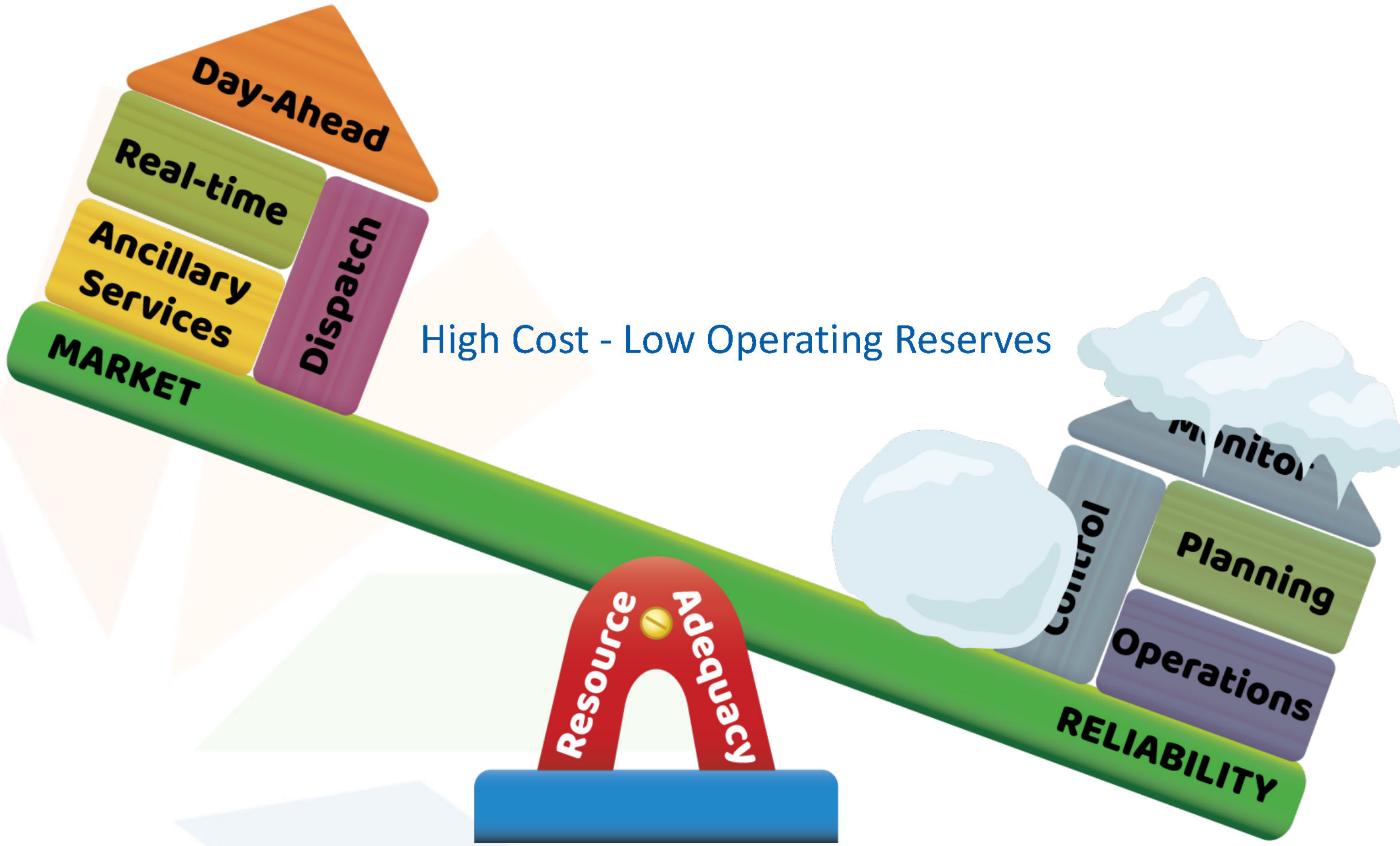
Market Fundamentals



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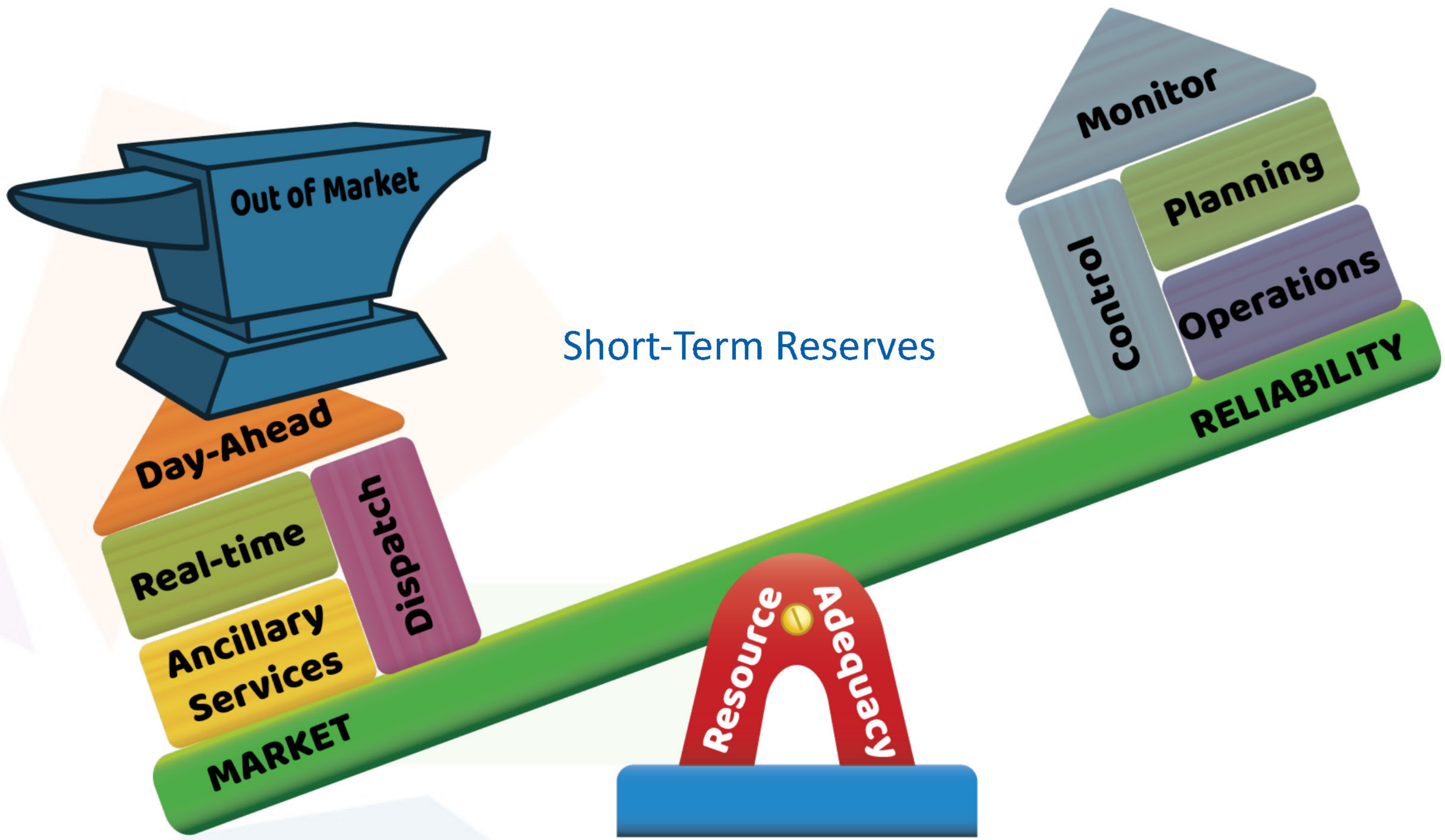
Market Fundamentals



ERCOT is not ALONE

– Regional RTO/ISOs are:

- Experiencing **challenges with facilitating higher renewable penetrations**
- Seeking **Marked-Based Solutions to Incentivize Flexible Generation**
- Requiring significant and potentially expensive **new transmission investment** to link wind and other renewable resources to the grid
- Undertaking efforts to address **programs/policies** that are meant to encourage the development of renewables, retain local generation, and/or bypass markets within their respective states and regions.
- Addressing **Fuel Security and Concerns related to Extreme Weather Events**

Customized Energy Solutions

Summary of Designs

	AESO	CAISO	ERCOT	IESO	ISO-NE	MISO	NYISO	PJM	SPP
Market Types									
Centralized Capacity Market		ISO Procurement Backstop		Incremental	✓	✓	Prompt	✓	Reserve Margin Requirement for Utilities
Day-Ahead Market	Ancillary Services procurement only	✓	✓	2023	✓	✓	✓	✓	✓
Financial Transmission Rights		✓	✓	✓	✓	✓	✓	✓	✓
Offline Reserve Market	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ramping Market		✓				✓			
Real-Time Market	✓	✓	✓	✓	✓	✓	✓	✓	✓
Regulation Market	✓	✓	✓	Contract Service	RT Only	✓	✓	RT Only	✓
Resource Adequacy Requirement		✓		✓	✓	✓	✓	✓	✓
Synchronous Reserve Market	✓	✓	✓	✓	RT Only	✓	✓	RT Only	✓
Market Pricing									
Co-Optimization of Energy & Reserves		✓	DA only	✓	✓	✓	✓	✓	✓
Energy Pricing	System	Locational	Locational	Uniform/2023 LMP	Locational	Locational	Locational	Locational	Locational
Marginal Losses		✓			✓	✓	✓	✓	✓
Settlements									
Resource Make-Whole	✓	✓	✓	✓	✓	✓	✓	✓	✓
Settlement Interval	Hourly	5 & 15 min	15 min	5 min	5 min	Hourly & 15 min for real-time schedules	5 min	5 min	5 min
Other Market Features									
Demand Response	✓	✓	✓	✓	✓	✓	✓	✓	✓
Must Offer in Day-Ahead	✓	✓		✓	RT Only	✓	✓	✓	✓
Offer Energy Floor/Cap ($/MWh)	0/999	-150/2,000 but must cost justify if >1,000	-250/9,000	-2,000/2,000	-150/No Cap but must cost justify if >1,000	-500/2,000 but must cost justify if >1,000	No Floor/2,000 but must cost justify if >1,000	No Floor/2,000 but must cost justify if >1,000	-500/No Cap but must cost justify if >1,000
Energy Price Floor/Cap ($/MWh)	0/1,000	-150/2,000	-251 Floor/9,000	-2,000/2,000	-150/2,000	-500/3,500	None, but highest shadow price 3,725	No Floor/3,700	50,000
Scarcity Pricing Mechanism ($/MWh)		✓	9,000		✓	3,500	✓	5,700/14,000 (May 2022)	✓
Reserves Depletion Pricing		Additive penalty factors + step functions by type	ORDC		<=1,500 + LMP <=3,500/<= $7,000 Gen	Hybrid penalty factors + VOLLxLOLP	Additive penalty factors + step functions by type	Additive penalty factors + step functions by type / ORDC (May 2022)	Additive penalty factors + step functions by type
Relationship to VOLL			Price Cap = VOLL		Price Cap + FCM Incentive = VOLL	Price Cap = Res. VOLL		Price Cap + RPM Incentive = VOLL	
Virtual Transactions	✓	✓	✓	2023	✓	✓	✓	✓	✓

Source: IRC (2017) and Customized Energy Solutions (2021)

Customized Energy Solutions

ERCOT Issues of Interest

Description	Pros	Cons
Real-time Co-optimization (2025 Or Later)	Improve pricing during supply shortages/lower costs Opportunities for Quick Start/Load/Storage	Lower cost may exacerbate low margins
Contingency Reserve (2025)	More discrete frequency response services/reserves when systems needs forecasted	Constraints on load participation
Implement Emergency Pricing Mechanism	Provide pricing clarity during emergencies	May not reflect the reliability cost of the emergency
Critical Load Standards and Processes	Ensure fuel security as well as health and welfare	May include too many circuits
Ramping/Dispatchable Ancillary Service(s)	Manage intermittent resource ramps	May be fulfilled by Contingency Reserve/Potentially higher cost reserve
Emergency or Firm Fuel Ancillary Service	Ensure reliable supply during extreme weather emergencies	Limited Pool of Providers/Potentially higher cost reserve
Increase DC or AC Ties	Expand reserve pool / May have helped in February recovery	FERC jurisdiction / Could not Prevent February
Expand Transmission/Reduce Congestion	Increase deliverability of energy	Slow to build/expensive
Smaller Load Zones	Recognize key transmission constraints, incent demand response, reduce congestion	Increase costs for some load zones/PPA impacts
Flexible Capacity Requirement	Procure sufficiently flexible resources to manage reliability	Complex and potentially discriminatory
Forward Capacity Market	Introduces a resource adequacy (RA) requirement	Complex
Transition From 4 Coincident Peak (CP)	Incentive better reflects the true drivers for new transmission	May increase demand in summer and impact reliability
Weatherization	Increase reliability in extreme winter weather	May increase costs and impact summer reliability

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ERCOT Issues of Interest

Description	Pros	Cons
Operating Reserve Demand Curve (ORDC)	Improve pricing during supply shortages to reflect scarcity / Encourages Demand Response	Very high market prices—even if only in rare events
Conservative Operations	Short-term reliability	High cost / inefficient /suppresses energy prices /reduce load resource participation
Reliability Unit Commitments (RUC)	Short-term reliability	High cost / inefficient / suppresses energy prices
CDR and SARA Reporting	Provides a snapshot of Planning Reserves	Does not account for deliverability

Note: two IMM Recommendations Completed - NPRR 1080, Limiting Ancillary Service Price to System-Wide Offer Cap; NPRR 1081, Revisions to Real-Time Reliability Deployment Price Adder to Consider Firm Load Shed

Customized Energy Solutions

Analyze · Simplify · Implement

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Vice President, Market Intelligence
Customized Energy Solutions
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Useful Links

- [FERC: Technical Conference on Modernizing Electricity Market Design: Energy and Ancillary Services in the Evolving Electricity Sector - Docket No. AD21-10-000 - September 14, 2021]

- [IRENA: Flexibility in Conventional Power Plants: Innovation Landscape Brief – 2019]

- **FERC Order 831** - (1) cap each resource's incremental energy offer at the higher of $1,000/megawatt-hour (MWh) or that resource's verified cost-based incremental energy offer; and (2) cap verified cost-based incremental energy offers at $2,000/MWh when calculating locational marginal prices (LMP).

PUC Ancillary Services Panel

Randa Stephenson,

Chief Commercial Officer, LCRA

August 26, 2021

LCRA's Proposal

Add Two New Ancillary Service Products:

1. Dispatchable Reliability Service
2. Firm Fuel Ancillary Service

Enhances reliability by:

- Incentivizing new build of dispatchable generation above what the current market design will support
- Incentivizing resources to ensure availability of fuel during severe weather events

Commission should focus on market-based principles that correctly and sufficiently compensate resources providing backup/reliability services. An efficient market design will minimize customer costs.

Rate Based Generation Additions

- **Rate Based Solutions for New Build**
  - Berkshire Hathaway's $8.3 billion proposal is estimated to have a net annual increase on market costs of $800m - $1.0b
  - Any rate based generation capacity additions will cause a loss of scarcity pricing and require an additional market solution that may cost load significantly more than $800m annually
  - All future thermal generation would require rate based recovery and is likely to precipitate retirement of existing dispatchable generation

Note: Berkshire Hathaway indicated the lifetime cost of its proposal would be $3.55b. Such a low net cost on a project with capital costs of $8.3b requires the project to receives high market revenues over its life. LCRA believes such market revenues are significantly overestimated with lifetime net costs likely to be $10b or greater.

Dispatchable Reliability Service

- **Available to qualifying resources that can respond within 30 mins and provide uninterruptable power for at least 24 hours**
- **Longer term procurement to provide price certainty**
  - Increased product procurement during higher risk periods
- **Financial penalties for failure to deliver or maintain availability**
- **Product available during scarcity conditions**
- **Cost of market-based backup service can be directly assigned, in a manner consistent with cost-causation principles, or paid for on a traditional basis**
  - Conventional generation functionally acts as a back-up service for intermittent resources today, but is not compensated
  - Value of Back-up Service can be computed; acknowledging and valuing this as a service will provide predictability and incentivize availability

Firm Fuel Ancillary Service

- **New product to compensate resources that ensure reliable fuel supply during extreme weather emergencies**
- **Independent consultant reviews proposals and determines the most cost-effective solution**
- **Competitive bid process from generator side**

- **Options:**
  - Compression/pumping stations (new or additional)
  - Storage (natural gas, liquified natural gas, lakes)
  - Additional pipeline interconnections at plants and between pipelines
  - Dual fuel unit capabilities

New Builds

Why Build?

- Return on investment is greater than the developer's cost of capital investment

Key Considerations

- Long lived assets; capital intensive
- Future power & gas curves
- Current & future environmental regulations
- Fuel supply, transmission access, technology, etc.

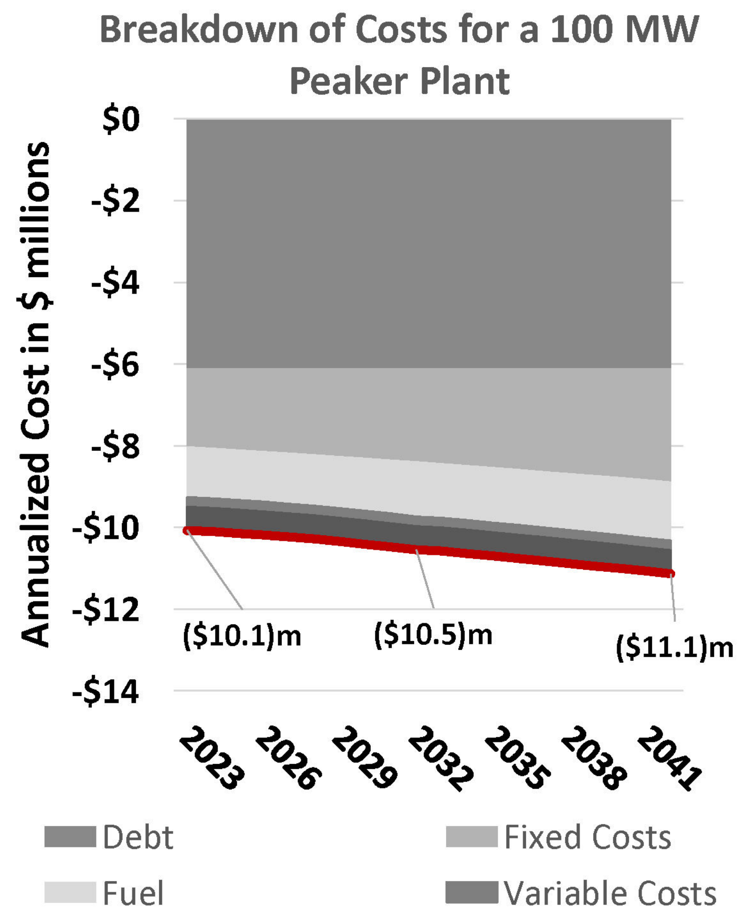
Plant Costs

- Construction costs
- Operational costs - fixed & variable
- Debt – (principal, interest, and debt coverage)

Economic Evaluation

Discounted Cash Flow Analysis

- Models cash flow over life of asset – construction and operating costs, capital costs, debt service, inflation and discount rates, **<u>and market price (revenues)</u>**



Market prices need to provide Peaker Plants with predictable & sustained annual revenues greater than $10m/year, either through energy and/or ancillary service product sales.

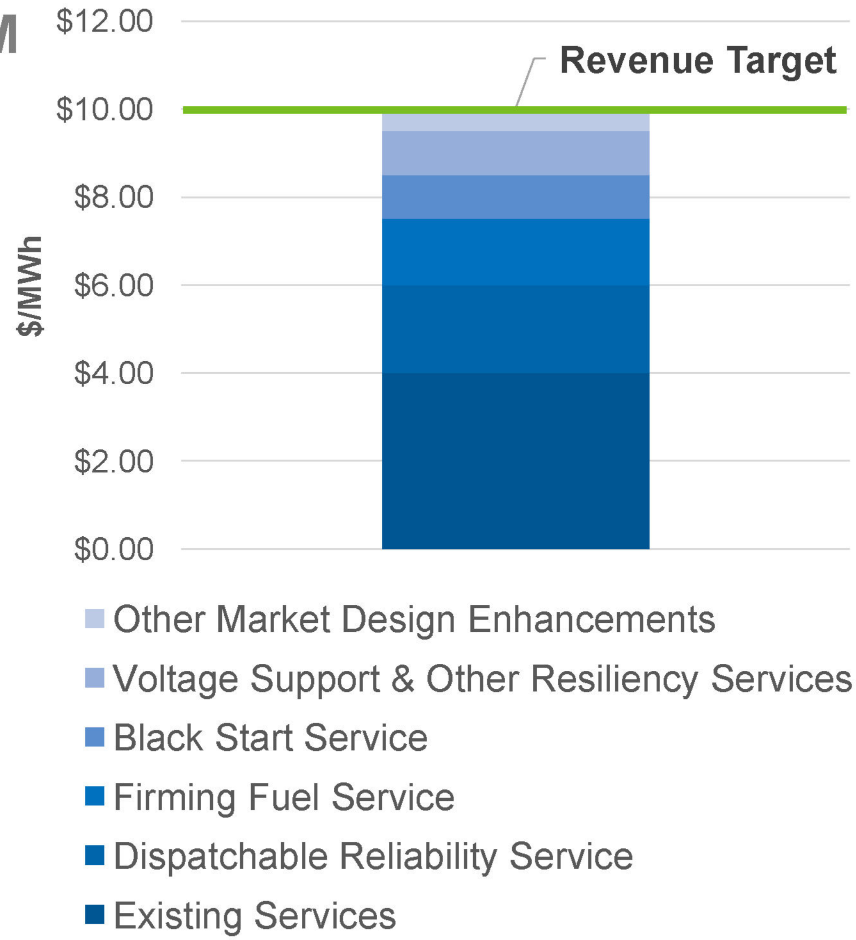
New 100 MW Peaker – Valuation

100 MW PEAKER – 20-YEAR TERM

Modeled Capacity	100 MW
Revenues	$92m
Operational costs	($46)m
Debt	($128)m
Net margin	**($82)m**

Revenues are from Non-Spin Ancillary Services	
Average 20-year price	$5.19/MWh
Required average 20-year price	$9.86/MWh
Percent increase required	**89%**

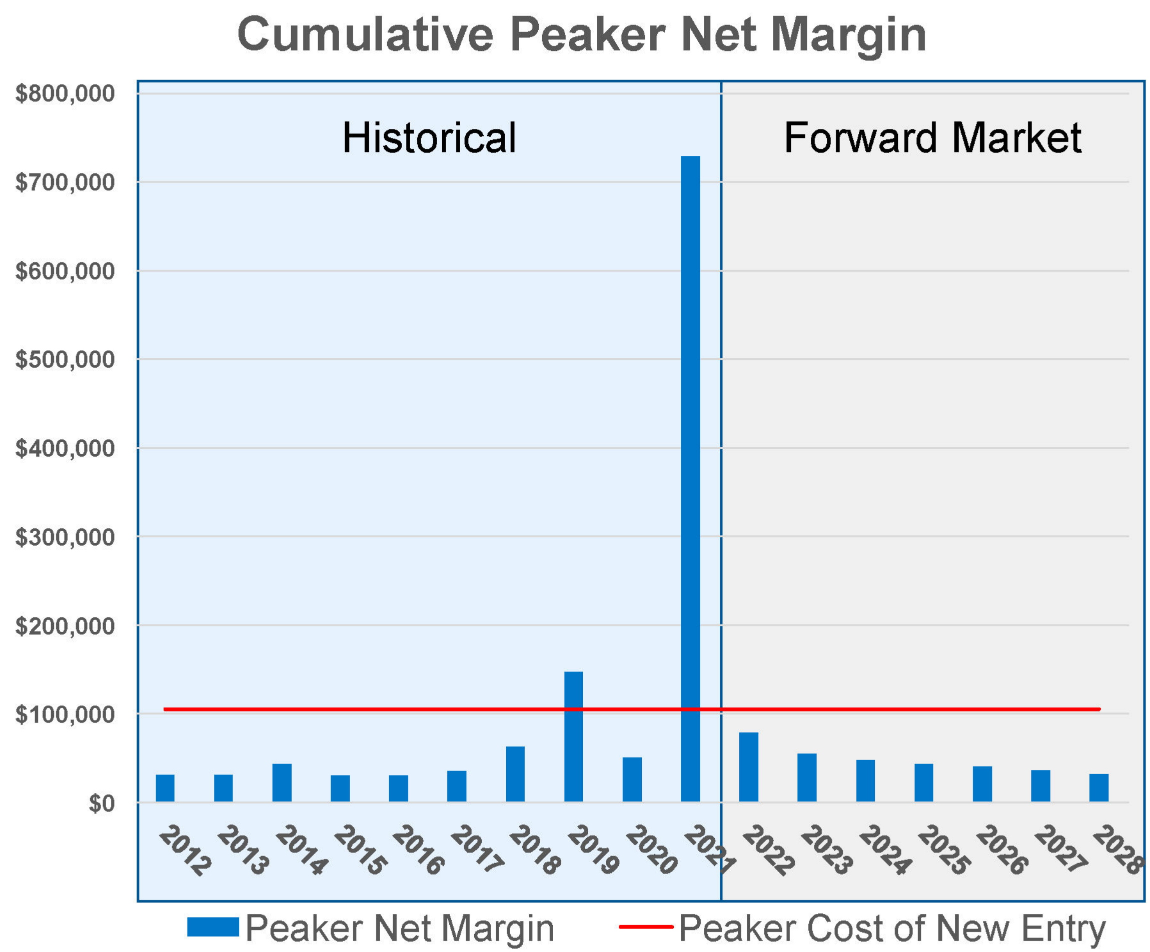
- 2032 Ancillary Service (A/S) prices used for 2033-2042
- A/S prices provide ~30% higher net revenue than energy-only prices
- Forward curve date: Mid-Prices, May 27, 2021



Predictable & sufficient annual revenue streams are needed to justify new build

Ensure Proper Market Incentives to Building Backup Generation

- Peaker Net Margin study is one available metric to determine dispatchable plant investment viability
- Only reached Peaker cost benchmark twice since 2012
- Monitor market design change impacts to forward markets
- Ensure balance to reach reliability targets



ERCOT North Hub prices as of August 23, 2021

Takeaways

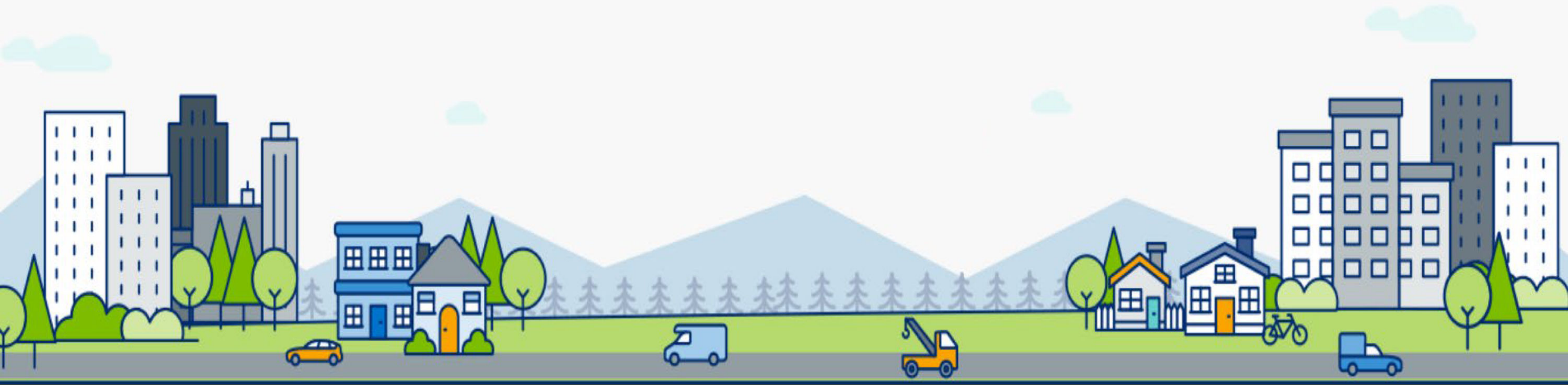
- Commission must provide clear guidance, including formal rule language, on new products to enhance reliability and provide market certainty
- LCRA believes the “1 in 10” standard needs to be the ultimate goal of the Commission to ensure a level of resiliency against extreme weather events
- Additional analysis will be required to validate expected impacts of market enhancements to reliability

Exelon recommendations on market design

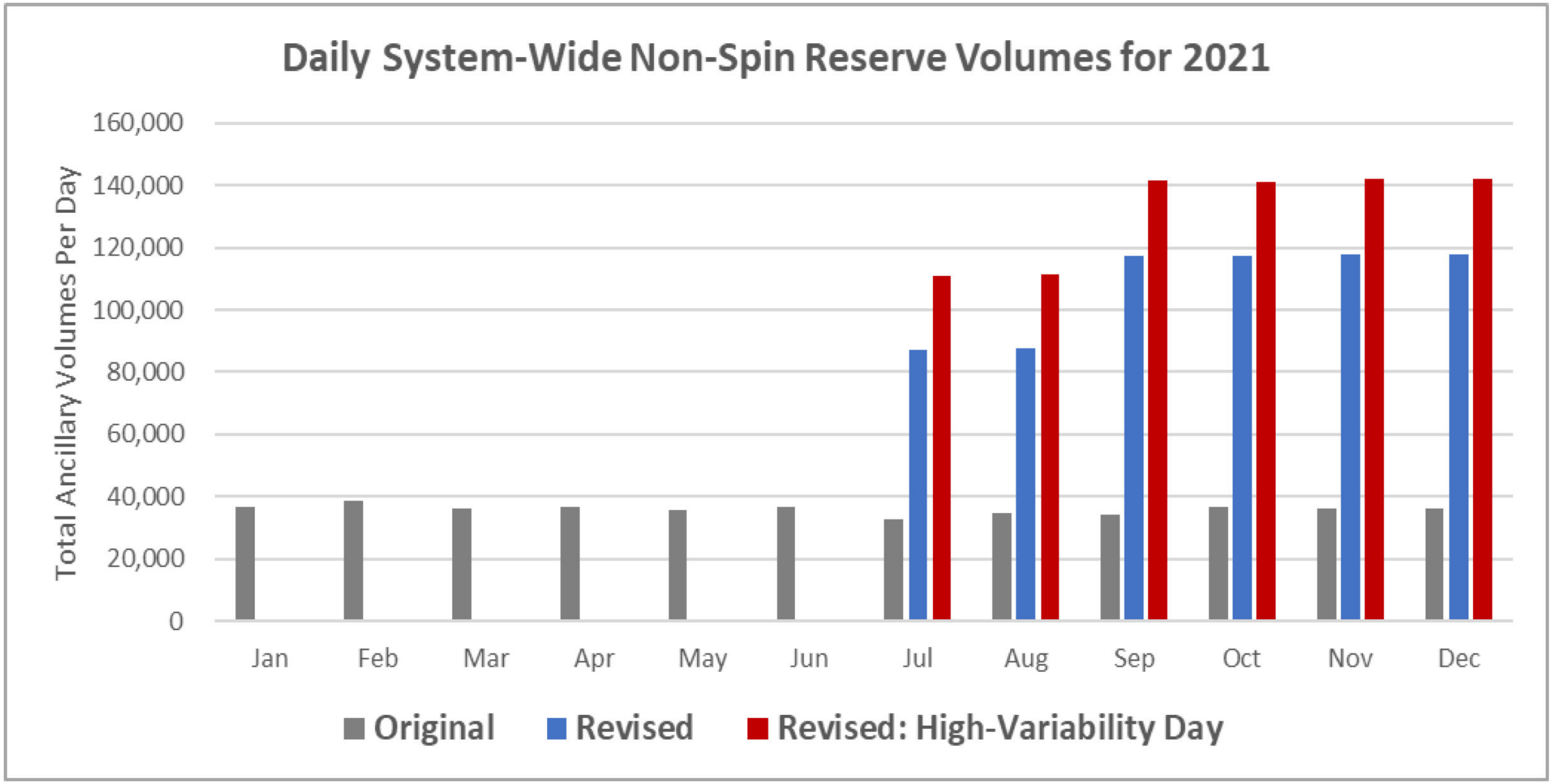
	Item	Recommendation	Why is this needed and what does it accomplish?
1	**Price cap & ORDC**	The energy cap should be lowered and the Operating Reserve Demand Curve (ORDC) widened to ensure sufficient real-time operating reserves are procured.	1. Moves the market away from a crisis-based pricing scheme with extreme price volatility, and thereby reduces systemic financial risk 2. Provides a stronger price and performance signal well before a loss of load condition occurs 3. Maintains the current high standard for real time operating reserves through a market-based mechanism as opposed to command-and-control
2	**Reliability Standard**	A reliability standard should be set by calculating the quantity of Dispatchable Firm Resources (DFRs) needed to meet each season's peak net load plus the real-time operating reserve under extreme weather and extreme low output from intermittent resources.	1. Ensures sufficient procurement of DFRs in step 3 below.
3	**Dispatchable AS Product**	A DFR procurement process should be created where ERCOT procures seasonally the quantity of dispatchable resources required by the reliability standard.	1. Significantly improves reliability during all seasons of the year, including times when customer demand is high and intermittent resource output is low. 2. Reduces price volatility by strengthening the investment signal for existing and new dispatchable generation
4	**Season-specific requirements**	DFR procurement should ensure sufficient generation is procured to meet season-specific requirements	Includes, but is not limited to: 1. Winter: on-site fuel storage, dual fuel capability, or fuel supply arrangements to ensure winter performance for several days. 2. Summer: facilities or procedures to ensure operation under drought conditions. 3. Spring and Fall: resource planned outage scheduling to ensure sufficient dispatchable generation.

PUCT Work Session

26 August 2021



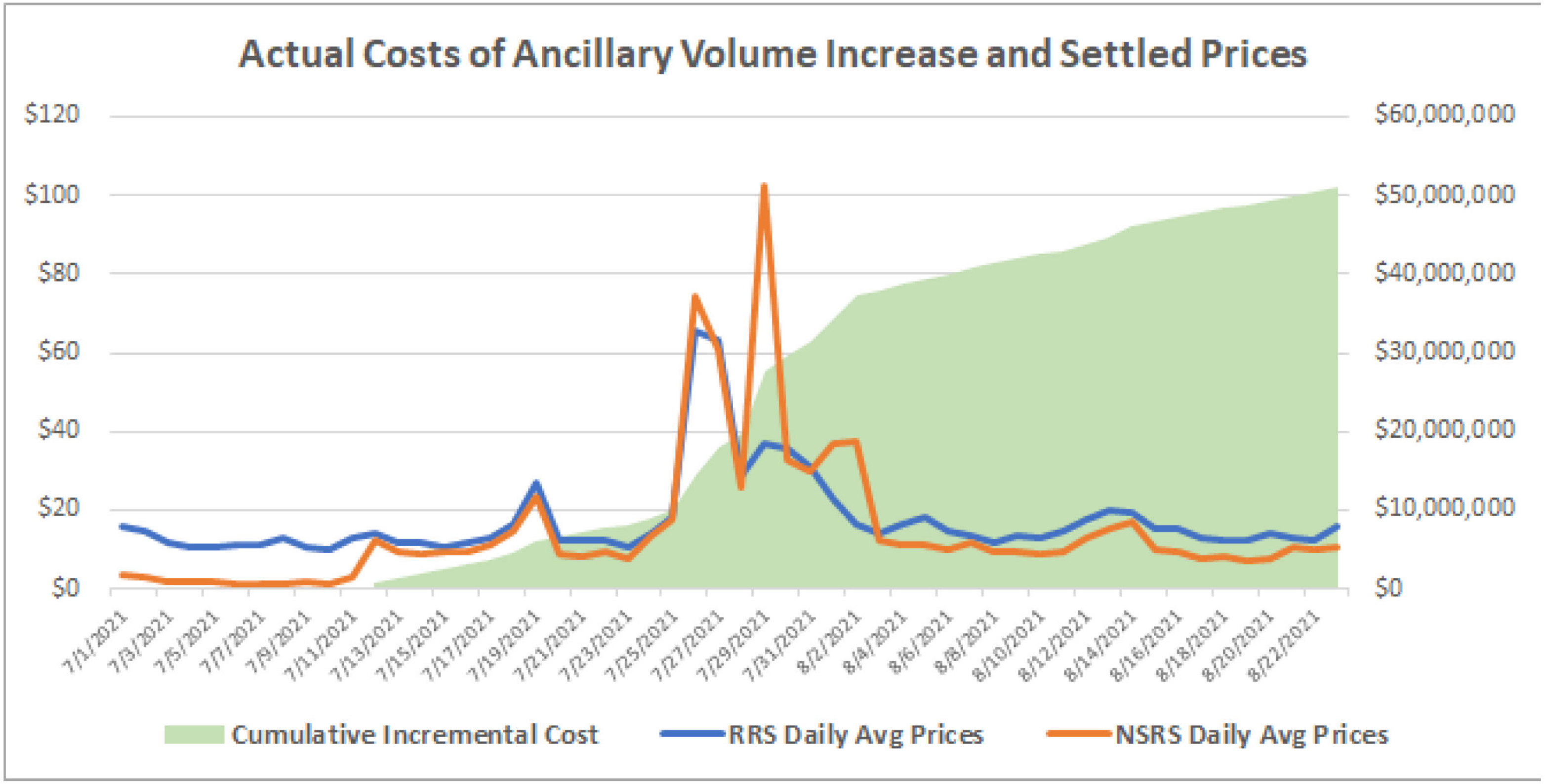
Increase in Obligation and Uncertainty



- **Volume requirements and associated costs** to serve REP customers **increased due to nonmarket, reliability actions** in July and August for both Non-Spinning Reserves and Responsive Reserves
- **2022 volumes are still unknown** with added uncertainty around pending market re-design. REPs cannot predict how much to price in and hedge
- This type of uncertainty **decreases wholesale market liquidity,** creates **significant hedge risk for REPs,** and **increases premiums** on new customer pricing

Notes:
1. Volume increases started July 12, 2021

Ancillary Services Cost Increase



- After 43 days of a relatively mild summer since the increase started on 7/12, the cost of the incremental ancillary services are **approximately $50M**
- **Higher volume requirements** announced for the upcoming outage season and early winter

Notes:
1. Incremental Cost = (Market Clearing Prices for Capacity*[Actual Ancillary Quantities - Original Planned Ancillary Volumes])

Illustrative Breakdown of Each Residential Revenue Dollar Earned

<u>Any</u> increase in costs from market design changes will put significant pressure on operating income

Notes:
1. Includes ancillary service and uplift charges, however, excludes recent increase in ancillary service charges.
2. All amounts are illustrative and may vary depending on customer size, costs for each REP, TDU, commodity arrangements, etc.

What principles should the Commission focus on to optimize between reliability and customer cost?

1. **Competitive markets should be utilized** to the maximum extent practical to ensure Grid Reliability, as associated competitive market reliability costs will be minimized

2. **Costs arising from non-market reliability actions should be socialized** to the broadest level of Market Participants and Customers who benefit from grid reliability and reliability actions

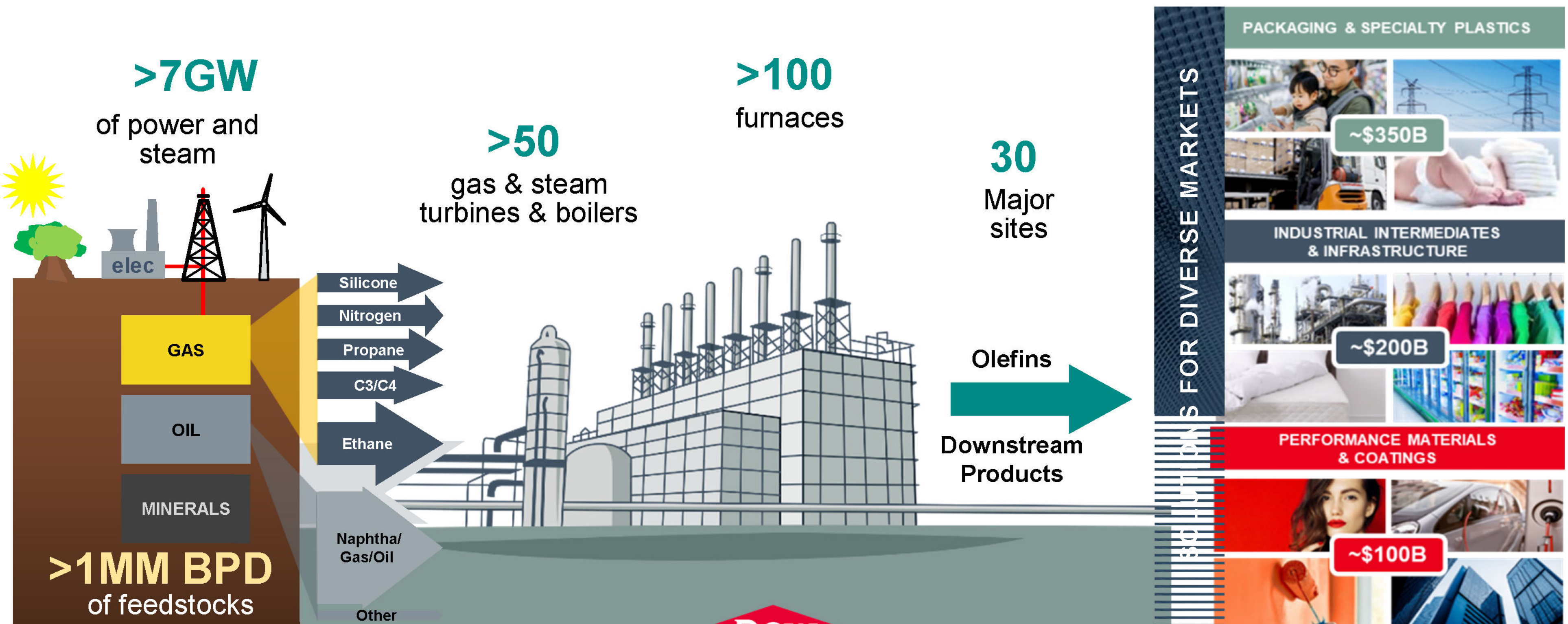
3. **Encourage all market participants and customers to participate**, within an organized framework, in Grid Reliability and associated costs

4. **Minimize uncertainty of reliability actions:** Uncertainty in markets creates risk, which must be managed at a cost – **minimize uncertainty, minimize cost, minimize customer price**

These Four Principles should guide focus and will optimize between <u>Reliability</u> and <u>Cost</u>

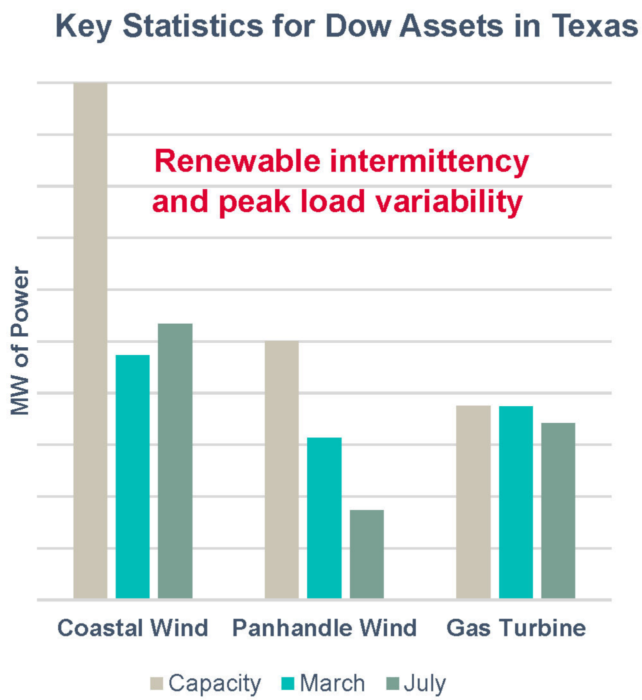
LEADING THE ENERGY TRANSITION AT SCALE

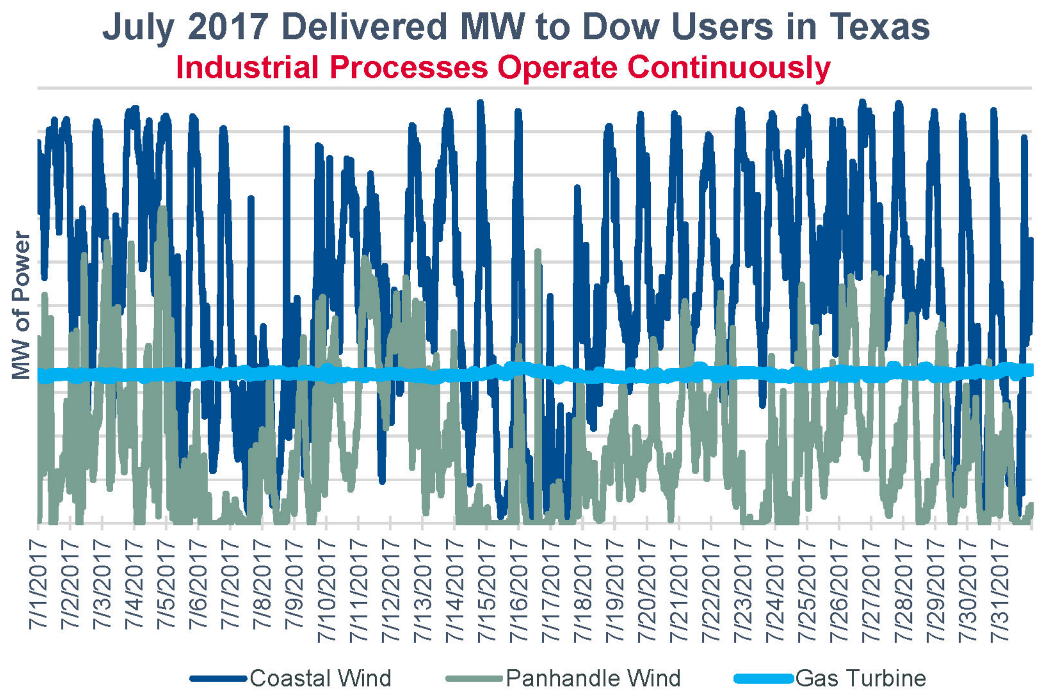
By 2030, Dow will reduce its net annual carbon emissions by 5 million tons (15%)
By 2050, Dow intends to be carbon neutral (Scopes 1+2+3 plus product benefits)



TECHNICAL ASPECTS OF GRID DESIGN MATTER TO INDUSTRIALS

RENEWABLES + CO-GEN = STEADY POWER





ERCOT System Reliability Work Session

Terry Naulty

Asst. General Manager – DME

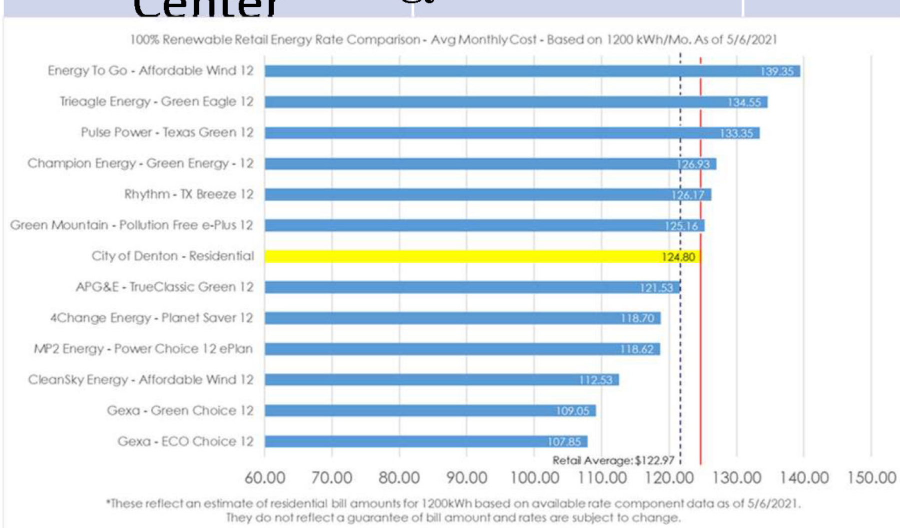
8/26/2021

Denton's Unique Perspective

- MOU serving the City of Denton and surrounding areas
- Peak demand of 385 MW but rapidly growing
  - Large energy users will push peak demand to over 700 MW in 2 yrs.
- 100% renewable energy supplied community with competitive rates

Resource	Type	Size (MW)
Santa Rita	Wind	150 MW
White Tail	Wind	60 MW
Bluebell I	Solar	30 MW
Bluebell II	Solar	100 MW
Longview	Solar	75 MW
Samson	Solar	75 MW
Denton Energy Center	Natural Gas	225 MW

100% Renewable Energy Retail Electric Rates in ERCOT



ERCOT Market Truths

- Intermittent renewable generation will continue to dominate the market
  - Tax incentive continue
  - All customers benefit from low-cost renewables
  - Environmental benefits are important
  - ERCOT transmission model incentivizes additional renewables
- Intermittency during peak demand periods is highly likely
- The PUCT can't control or drive changes in the natural gas delivery system
  - Weatherization may or may not happen
  - PUCT should drive policy to increase grid reliability based upon what you can control
- The PUCT's policies should continue to facilitate access to low-cost renewable energy for all Texans
- Current ORDC methodology does not provide sufficient levels of high probability cash to support fixed costs and ROI needed to build new dependable dispatchable generation to back-up intermittent resources

Use of ORDC to Provide Market Signals to Drive New Dispatchable Generation

DENTON MUNICIPAL ELECTRIC

- Significant changes to ORDC that provide certainty of cash flows are required
- Short-term competitive retail offers do not incentivize price discovery of market liquidity
  - Hedged future revenues are problematic
- We believe that there are potential unintended consequences with wholesale ORDC changes
- Investors & financers will need a track record of adequate cash flow to add dispatchable resources

Immediate Actions are Required that ORDC changes can not achieve

1. PUCT should determine the amount of dual fuel generation needed to avoid a repeat of February.
   - Reliance on “weatherization” of natural gas delivery system is not recommended
2. PUCT should determine the cost of dual fuel supply and establish a new **Grid Reliability Service** charge to pay for these upgrades
   - All market participants should bear the costs of these incremental reliability costs

Immediate Actions are Required that ORDC changes can not achieve

DENTON MUNICIPAL ELECTRIC

3. Based upon dual fuel capacity, PUCT should determine the amount of incremental peaking generation needed to achieve desired level of reliability
4. PUCT should establish a new cost of peaking capacity (capital, debt structure, ROI, fixed operating costs) and establish a component of Grid Reliability Service to fund the development of additional peaking generation.
   - This process could be competitive to achieve the lowest cost for customers
   - Grid Reliability Service funded by non-by passible charge to all market participants
5. Reduce VOLL to $2,000/MWh until all dual fuel and incremental peaking generation is fully operational
6. Intermittent resources offers and dispatching should continue under current market protocols
   - Existing renewable customers will bear the incremental costs due to change in law provisions.

We recommend that the PUCT seek input from the financial community on the measures that they feel are necessary to facilitate financing of incremental dispatchable generation.

PUCT Market Design Workshop 8/26/2021

- Engie suggests the Commission change the curve to a piecewise linear curve; move the value of X to 2500 or based on load growth; and reduce the VOLL to somewhere around $4500Mwh
- If the Commission and ERCOT desire to operate the grid in a conservative manner than any additions to A/S levels should be transparent, liquid and stable
- Any new A/S should be based on an ERCOT studied need. Any new products should also be neutral allowing any qualified technology to participate. Such as storage, which is on the rise and we would suggest the commission place a priority on full integration
- Any solution should incentivize addition integration of Demand Response
- Any changes to the market to incentivize “dispatchable generation” the Commission should not harm any other type of generation