AGENDA

Electric Utility Commission Resource Planning Working Group Meeting
Date: November 7, 2019
Time: 4:00 pm – 6:00 pm
Location: Town Lake Center, Room 100

Safety Moment (5 Min)

Demand Side Programs (20 Min)

How the Market Works (30 Min)

Storage Outlook (30 Min)

Scenario Next Steps (20 min)

Closing Remarks (15 Min)
Follow-up from October 24 Meeting & Subsequent Resource Planning Study Questions

FOLLOW-UP FROM OCTOBER 24 MEETING

Questions from Kaiba White

1. Is there data to back-up the statement “Increases in rental populations will lessen participation in basic residential programs” in the assumption grid for the DSM report?

The rental population is increasing at a greater rate than the owner population is increasing per demographic data and the proportion of renters participating in our programs has always been lower than those owning; thus, the number of renters will always be lower than the number of owners in our programs. It is based on the trends within the population and the program participation.

2. What evidence is there for this statement “We are on the far end of the adoption curve, focusing on “late adopters” and “laggards”. It will take greater levels of incentives to draw these groups into the programs, thus increasing rebate budgets” in the assumption grid for the DSM report especially with the number of older homes in the community?

The response is not related to the age of the home, but the type of person in the home. Participation is not a function of the home itself, but of the person. The programs while they help the home are determined by the people wanting to participate in the program.

SUBSEQUENT QUESTION FROM OCTOBER 24 MEETING

Question from Cyrus Reed

1. If the budgets needed to reach 1350 by 2029/30 were as stated (essentially a 35% bump-up in budgets), what about the medium-scenario of some 1200 + MWs?

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SUBSEQUENT RESOURCE PLANNING STUDY QUESTION

Solar Plus Storage

Question from Cyrus Reed

1. How many price spikes affected AE last summer (months when 4CP occurs) and last year (perhaps 75th, 80th, 85th, 90th, and 95th percentiles), or what percent of last summer and last year were prices above these percentiles (as relevant to AE)?
   a. How much did this cost of the utility, and how does this cost relate to risk?

### 2019 Summer

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Total Interval Count = 11,712

### 2018

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Total Interval Count = 35,040

*Cost to Utility includes Load Cost Only

We are seeing a decoupling between 4CP and price spikes when viewed in the context of Net Load and Operating Reserve Demand Curve (ORDC) (there is a presentation on this topic to the ERCOT board). We currently do not have risk calculated around 4CP.
Subsequent Questions

FOLLOW-UP FROM OCTOBER 24 MEETING

Questions from Kaiba White

1. Are there no plans to find ways to make these programs work better/be more attractive for rental properties? If this is the direction that the Austin housing market is moving in (and I agree that it is), then AE should be identifying ways to reach that type of housing/customer, not simply assuming that they won’t participate. I know y’all have more creativity than that.

- Our original response did not indicate that we were not attempting to reach the multifamily population. We were sharing the challenge with the unique population that is Austin. We have some definite plans for meeting the energy efficiency needs for these customers, both the residents and the property owners, a balance we must maintain with our programs.

- Austin Energy (AE) has sponsored some of the most aggressive energy efficiency building codes in the US.

- AE has partnered with Austin Water, Health & Human Services, Neighborhood Housing and Austin Public Health.

- AE is one of the few utilities which allow non-home owners to participate in our programs pending the property owner release to complete the project for low income weatherization with over 19,000 homes participating.
  - AE has hired a third party, Solix, who coordinates with HHS to identify low income potential customers. They also provide outreach calling over 40,000 customers sharing information about the CAP and weatherization program.
  - AE has expanded the eligibility requirements.

- AE is one of a few utilities that have a multifamily (MF) program with over 100,000 units receiving energy efficiency.
  - For the MF program, we have expanded our reach in the following manner:
    - Realigned AE staff from 1.5 FTEs to 2 FTE with another 4 available as needed merging Demand Response (DR) with the Energy Efficiency (EE) team to offer more comprehensive packages.
    - Hired a third party to provide outreach and recruitment to property managers/owners and contractors. Provide contractor quality report cards, training and tenant education.
    - AE is integrating the Energy Conservation and Disclosure (ECAD) audit information into a centralized rebate processing system in

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order to identify those properties requiring more energy efficiency.

- AE has hand delivered the ECAD benchmarking information to over 800 multifamily properties.
- Green Building (GB) has participated in various remodels and new construction projects.

2. What is this “type of person” referred to in response #2? I know many people who have middle to even upper-middle incomes who simply have never heard of or looked into efficiency or demand response programs. I have taken my personal time to help educate some friends and neighbors who were grateful to learn of these options. If AE has data about the “type of person” who has and has not participated, that’s what I’d like to see. I also disagree that the age (and therefore efficiency) of the home isn’t relevant. If we know that there are a large number of homes/buildings that are underperforming, AE should be figuring out ways to reach the owners of those buildings and getting them to participate. Again, just writing off a large portion of the city as too difficult to reach isn’t the right approach.

- The challenge we face is the ever-growing population of Austin, balanced against a limited outreach and education budget for the various markets and vehicles for outreach. While AE has provided over $800k of marketing and outreach annually providing various messaging aligned with Tapestry preferences, which has proven very successful, it does not go far enough to message to every new customer moving to in Austin.

- Our response did not “write off” any portion of the city as difficult to approach. We have been very successful in using data analytics to find the best participants for our programs. This is a combination of home and person. Not all are “ready” for participation, for a variety of reasons. By using data mining techniques, we compare the current participants with potential new participants. We were able to show increases in participation in the Home Performance with Energy Star program by specifically marketing to those who were the best “fit” for the program. This was a function of the person as well as the home.

- The original question supposed that participation was based on age of home. Our answer was indicating that the home is not the decisionmaker. It is the person living in the home who makes the decision. With real estate turnover, we know from our internal research that new owners often do not consider rebate program participation until that have lived in the home for about 2 years. If they do not stay in the home beyond 5 years, they are also less likely to participate in our programs. Our research also has indicated that customers do not understand how their homes operate. If they are “comfortable” and do not see their utility bill as “too high”, they do not think about energy efficiency. They believe everything is “fine”. The need for energy efficiency measures will often come with home discomfort or a failing air conditioning unit.
• We are incorporating demand response programs and behavioral programs into all energy efficiency programs. This provides a broader reach to customers, the opportunity for more participation, and savings.
ERCOT Service Territory
Overview of the Evolution of ERCOT

• Around the start of WWII, several electric utilities in Texas agreed to operate together as the Texas Interconnected System (TIS) to support war effort
  • Members recognized reliability advantages of interconnection and continued to operate and develop interconnected grid
  • ERCOT formed in 1970 to comply with NERC requirements (not reliability)
  • Control Areas managed reliability
  • Generation served load within control area
  • Production cost drove cost to serve load

• 1995 Legislation passed to deregulate wholesale electric markets
  • Texas still had 10 control areas, but generation could be bought or sold to help serve load or maximize generator revenue
  • Generation still served load in control areas but now augmented with some purchases and sales
Overview of the Evolution of ERCOT

- 1999 SB7 passed to lead to deregulation of retail load in Texas
  - Unbundled investor-owned utilities
  - Assigned ERCOT 4 primary responsibilities
    - System reliability
    - Open access to transmission
    - Retail switching process for customer choice
    - Wholesale market settlement for electricity production and delivery

- 2001, the 10 existing control areas in Texas were consolidate into a single control area administered by ERCOT (ISO)
  - Zonal Market structure
  - Wholesale power sales now subject to centralized power scheduling
  - Centralization of ancillary services to ensure reliability

- In 2003, PUCT orders development of a wholesale nodal market design

- December 2010, ERCOT Nodal Market goes live
  - All load is purchased from ERCOT
  - All generation is sold to ERCOT
ERCOT Nodal Market

- **Generation Dispatch**
  - Security Constrained Economic Dispatch (SCED)
  - Resource specific offers
  - Resource specific dispatch

- **Goal**
  - Balance generation & demand
  - Manage congestion

- **Energy Pricing**
  - Locational marginal price for energy (LMP)
  - > 10,000 nodes (electrical buses)
  - > 650 Settlement Point Prices (SPPs)
How Does Austin Energy Participate?

• Austin Energy is a Non-Opt in Municipal Market Participant

• Remain vertically integrated – Load (Demand), Generation, Transmission & Distribution

• Transmission & Distribution is not deregulated in ERCOT

• Load (Retail Customers) is not deregulated for Austin Energy

• Generation participates in a deregulated wholesale market
  • Austin Energy’s generation faces competition with all other generation resources to meet overall ERCOT load (demand)
How Does ERCOT Dispatch Resources?

Source: BNEF
Locational Marginal Price (LMP)

• In ERCOT, LMP is made up of System Energy Price and Congestion Cost
• System Energy Price - the cost of providing the next MW to serve load
• Congestion Costs - the price of congestion at binding constraints within the power system
Nodal Dispatch Example

Source: ieeexplore.ieee.org
Nodal Dispatch Example (cont.)

Dispatch 50 MW, Price $100/MWh

Dispatch 50 MW, Price $100/MWh

Dispatch 50 MW, Price $100/MWh

Dispatch 1000 MW, Price $100/MWh

Dispatch 300 MW, Price $100/MWh

150 MW flow

1200 MW flow

1500 MW
Demand, Price $100/MWh

Source: ieeexplore.ieee.org
Nodal Dispatch Example (cont.)

Dispatch 100 MW total from three wind turbines, Price $20/MWh

Dispatch 850 MW, Price $50/MWh

Dispatch 500 MW, Price $100/MWh

100 MW flow, at capacity

1000 MW flow, at capacity

Source: ieeexplore.ieee.org
Monthly 15 Minutes Settles

LZ_AEN 15 minute RT SPP
August 2019

LZ_AEN 15 minute RT SPP
October 2019

3 Negative Intervals

22 Negative Intervals
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Total RT Online Reserve: 6666.2
RT Online Reserve Price Adder: 0.00
RT Online Reliability Deployment Price Adder: 0.00
Total RT Offline Reserve: 3556.0
RT Offline Reserve Price Adder: 0.00
Purchase Power Price (PPA) or Production Cost vs Actual Load Cost (with congestion)

Example 1:
LZ_AEN = $6.96
Resource Node = $114.79
Contract Price = $30
$6.96 + ($114.79 - $30) = ($77.83)

Example 2:
LZ_AEN = $24.01
Resource Node = $6.96
Contract Price = $30
$24.01 + ($6.96 - $30) = $47.05
ERCOT Market Price Risk

• Prices change every 5 minutes in the Real-time market and settle on weighted average 15 minute periods
• Day Ahead Market allows for hedging load and generation revenue on an hourly basis
• Bilateral Trades and Exchanges allow for longer dated hedging for load and generation revenue
• Congestion Revenue Rights (CRRs) can be used to hedge congestion/basis differentials
Questions?
Battery Energy Storage
ERCOT Market

Murali Sithuraj
Energy Market Analyst Sr.

11/07/2019
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Acronyms

- GR – Generation Resource
- CLR – Controllable Load Resource
- ESR – Energy Storage Resource
- DOE – Department Of Energy
- CDR – Capacity Demand Report
- SARA - Seasonal Assessment of Resource Adequacy
- MMS – Market Management System
- EMS – Energy Management System
- NMMS – Network Model Management System
- RARF – Resource Asset Registration Form
- RIOO – Resource Integration and On-Going Operations
- DER – Distributed Energy Resource
- 4CP – 4 Coincidental Peak during Jun, Jul, Aug & Sep
- FRRS – Fast Responding Regulation Services
- FFR – Fast Frequency Response
- DG – Distributed Generation
- WSL – Wholesale Storage Load
- SODG – Settlement Only Distributed Generation
- PRC – Physical Responsive Capability
- ORDC – Operating Reserve Demand Curve
- SCED – Security Constraint Economic Dispatch
Battery Energy Storage - Where We Are Today

- 101.4 MW of registered operational capacity in ERCOT Market
  - Mainly participating in regulation services
  - Some of the projects were kick started due to DOE grant (No trees)
  - There are smaller DER battery systems (<1MW) that are not registered with ERCOT.
  - There also is a 4 MW battery in Presidio, TX, which was installed to improve customer reliability at the end of a 60-mile radial transmission line.*

- Modeled as separate Generation Resource (GR) and Controllable Load Resource (CLR)

- Separate registration for GR & CLR

- ERCOT applications treat them as independent Resources

- For future studies, these Resources are ignored
  - CDR, SARA do not account for these resources (except listing them as FYI)

* (Approved by the PUCT in April 2009 [Docket No. 35994].)
Battery Energy Storage – Revenue Stream

**Price Arbitrage**
- Charge during low price intervals;
- Discharge during high price intervals

**Participate in SCED / Settled as SODG**

**Regulation Services**
- Participate in FRRS-Down
  - Limited to 35 MW
  - Triggered @ 60.09 Hz
- Participate in FRRS-Up
  - Limited to 65 MW
  - Triggered @ 59.91 Hz

**Responsive Reserve Services (RRS)**
- Cannot participate in RRS today
  - January 1, 2020: NPRR863 allow battery to participate in FFR (a subset of RRS)
  - Triggered @ 59.85 Hz
  - Full response in 15 cycles
  - Once deployed, sustains for up to 15 minutes.
  - Once recalled, restores within 15 minutes
Challenges in Today’s Market

• Registration of a Battery Resource
  • There is no Registration form (RARF) designed specifically for BESS

• Definition of Energy Storage Resource
  • NPRR 957 - Definition of Energy Storage Resource and Related Registration and Telemetry Requirements

• Energy Storage Resource's contribution to PRC

• Energy Storage Resource's contribution to ORDC Reserves

• SCED dispatch and Nodal pricing

• Energy Storage Resource Performance Deployment (GREDP) & Base-Point Deviation (BPD)
  • NPRR 963 - Creation of Generation and Controllable Load Resource Group (GCLR Group)

• Allow Energy Storage Resources to reserve capacity
  • NPRR915 & NPRR 967 - Qualified Scheduling Entity (QSE) representing an BES shall indicate ERCOT its unwillingness to be deployed in Real-Time to reserve capacity for expected values above its Energy Offer Curve

• Reactive Capability and Voltage Support Service

• Governor Dead band and Droop Setting Requirement
Challenges in Today’s Market (Cont.)

• Nodal Price Settlement for both Charging and Discharging
• How should BESR be handled by RUC
• Outage Coordination Studies
• Operational Studies
• Transmission Planning Studies
• Forecasting
• WSL Treatment
• Data Requirements from QSEs

• Registration
• IRR/Battery operating as single unit
• GT/Battery operating as single unit
• Participation Model (EMS and MMS)
• How to address hybrid units
  • AC-coupled
  • DC-coupled
Battery Energy Storage Task Force (BESTF)

- A Task Force is created under TAC
  - Develop policies related to the integration of Battery Energy Storage Resources (BESR) into the ERCOT System.
  - Identify and reduce barriers to energy and Ancillary Services markets.
  - Adapt ERCOT system models to facilitate integration of storage technologies.

- Two-step approach:
  1. Work on Rules that can be implemented in the short-term to integrate Battery ESR under the “combination model” structure, and
  2. Work on Rules that can be implemented on a longer timeline to integrate Battery ESR under a “single model” structure.

---

Source: ERCOT
Battery Energy Storage Roadmap

These include NPRRs 963 and 967, as well as several ERCOT-sponsored NPRRs under development.
Resource Planning Scenarios

Next Steps


November 5, 2019
Next Steps

• Crystalize scenarios today

• Next Working Group meeting (11/21) complete assumption review

• Timeline Refresh
# Crystalize Scenarios

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<thead>
<tr>
<th>ID</th>
<th>Scenarios</th>
<th>Description</th>
<th>Load Purchase</th>
<th>Renewable Sales</th>
<th>STP Gen Sales</th>
<th>Gas Sales (DGT,SHGT,SHCC)</th>
<th>Time Frame</th>
<th>Storage Purchase or Sale</th>
<th>Local Solar MW</th>
<th>DSM MW</th>
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* One Carbon Free 2025 scenario chosen given administrative challenges with manifesting 2025 closure dates.

** Please note concerns discussed with scenario 11 being highly risk seeking. Given utility’s position, request removal.
2019 - 2020 Resource Planning Refresh Timeline

- Working group kicks off and establishes charter
- Studies directed from 2017 Resource Plan walked thru

Oct 2019
- Resource Plan topics discussed (affordability, etc.)
- Scenarios prioritized with Working Group

Nov - Dec 2019
- Scope, input assumptions discussed with Working Group
- Modeling and scenario analysis performed

Jan 2019
- Scenarios presented to Working Group
- Resolution recommendations formed

Feb 2020

• Refreshed timeline shifts December Working Group meetings to January 16th and January 30th. No December mtgs to be held.
Assumptions
LTSA vs Wood Mackenzie Projections

- LTSA Battery costs were based on 1 hour duration whereas Wood Mackenzie is based on 4 hour duration.
• Load forecast from AE finance
  • Statistically Adjusted End-use (SAE) model is used for residential and commercial sales forecast
  • Industrial energy forecast is based on an econometric model
• Peak load grows by 0.4% and energy by 0.4% in the next 10 years
• High and low forecast based on weather sensitivity
• Load forecast from ERCOT
• Peak load grows by 2% and energy by 2.6% in the next 10 years
  • Historically peak load has grown at 1.6% and energy at 2.9% from 2009-2018
  • Higher forecasted peak load growth due to strong energy demand in far west Texas
• High and low forecast based on ERCOT SARA methodology
Gas Price Forecast

- Gas prices have moved minimally from last runs, no changes in gas pricing
Other Fuel Price Forecast

Source: Nuclear and Coal(FPP) from AE internal; Coal(ERCOT-Sub) and Coal(ERCOT-Lig) from SNL

- No Changes from studies run
ERCOT Resource Additions

- For 2020 resources with sufficient financial guarantee in ERCOT’s GIS report are considered
- Beyond 2020 resource type and timing adjusted to reflect the historical trend
- Storage for the time being not included in reserve margin calculation