



# Resource Plan Stakeholder Working Group

November 2016



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# Austin Energy Methodology



- AE uses integrated modeling tools to simulate market data, AE's load and generation assets, financial data along with emission modeling to assess resource plans
  - Uses UPLAN simulation modeling well suited to ERCOT's market design, risk analysis using Monte Carlo techniques as well as one-off scenarios
  - Inputs include: cost of gas, coal, nuclear, oil, carbon, cost of new build of various technologies, fixed and variable O&M for ERCOT generation
  - Calculates cost & revenues of ERCOT assets and pricing at each node – 6,600 data output points
  - Results modeled for rate impact and financial metrics
  - This approach in line with industry practices, Brattle endorsed AE methodology in 2015
  - Well trained highly experienced economists & engineers

# Recap of Goals & Directives from 2014 Update



- 2014 Austin Energy Resource Plan (Progress to date)
  - 55% renewables by 2025 (31%)
  - 900 MW Demand Side Management by 2025 (576MW)
    - 700 MW energy efficiency by 2020
    - Demand Response 100 MW by 2020 and additional 100 MW by 2025 (54MW)
  - 950 MW solar by 2025
    - 110 MW Local Solar by 2020 and additional 90 MW by 2025 if affordable (74MW)
    - 750 MW Utility Scale Solar by 2025 (157.5MW Operational/450 under contract)
  - CO2 emissions
    - 20% reduction from 2005 levels by 2020 (Meeting)
    - Retirement of Fayette Coal Plant beginning in 2023 (in progress)
  - Affordability
    - 2% limit per year (meet)
    - Rates should be in the lower 50th percentile statewide (slightly above trending lower)
  - 10 MW (lithium ion batteries) local storage by 2025 + 20 MW of thermal storage (17MWt/3 MWe in progress)
  - Retire Decker steam units by 2019 and replace with 500 MW efficient combined-cycle (pending) – subject to a third party study (complete)



# Baseline Assumptions

## ERCOT Market

- Current nodal market design
- Load forecast per December 2015
- Generators per ERCOT's Capacity Demand & Reserves Report (Dec. 2015)
  - Adjusted per AE's UPLAN vendor's database
  - Unit characteristics (i.e. capacity, fuel type, heat rate, emissions, etc.)
  - Fuel price forecasts
    - Natural gas (New York Mercantile Exchange futures first 2 years, Wood Mackenzie balance of curve)
    - Coal and lignite from SNL (market pricing provider)
    - Nuclear from AE estimates
  - Remove mothballed units
  - Retire 3000 MW of coal units in ERCOT per ERCOT analysis of Regional Haze Rule (***Regional Haze Rule has been stayed by 5<sup>th</sup> Circuit Court of Appeals***)
  - Combined Cycle units & solar added to maintain economic reserve margin (RM)
- Emission costs focused on carbon
  - Carbon cost included as a sensitivity
  - ERCOT long term study CO2 cost assumptions



# Baseline Assumptions (Cont'd)

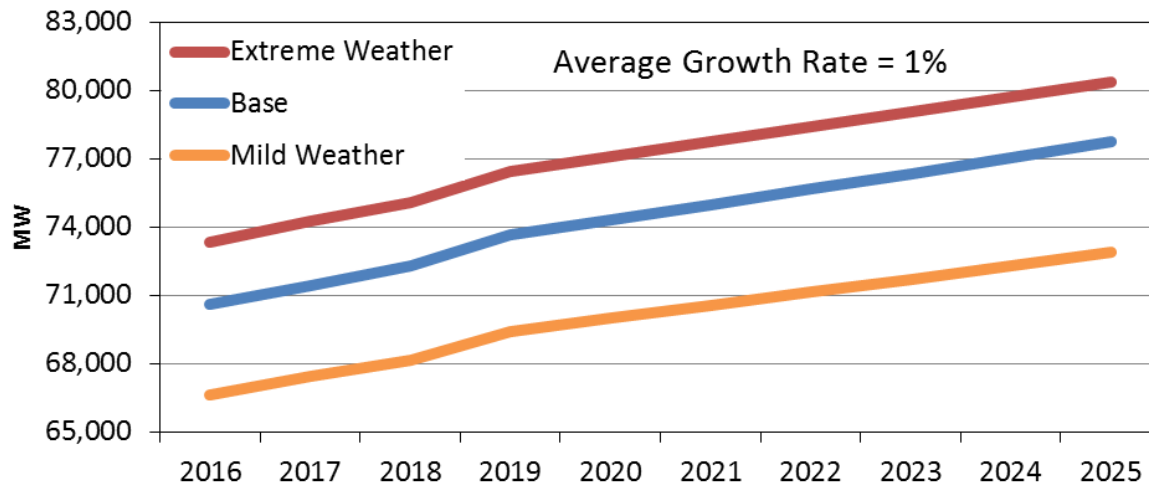
## Austin Energy system

- Current FY2017 budget load forecast
- AE unit characteristics and contracts
- Fuel price forecasts
  - Natural gas (NYMEX gas futures first 2 years, Wood Mackenzie Fall 2015)
  - Coal per AE
  - Nuclear per AE



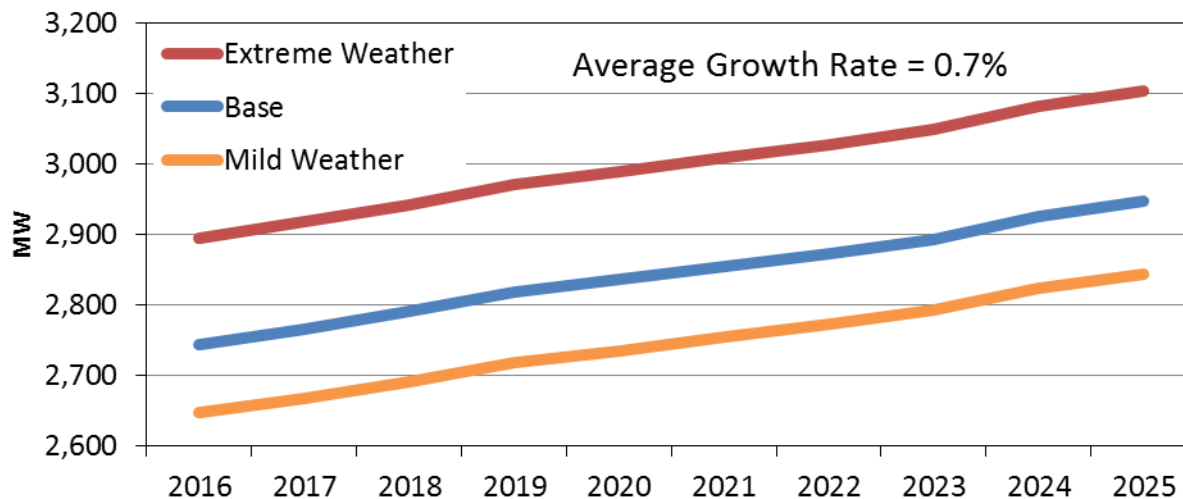
# ERCOT vs. AE Peak Load Forecast

## ERCOT Peak



Energy forecast follows similar trend with average growth rates of 1% for ERCOT and 0.7% for AE.

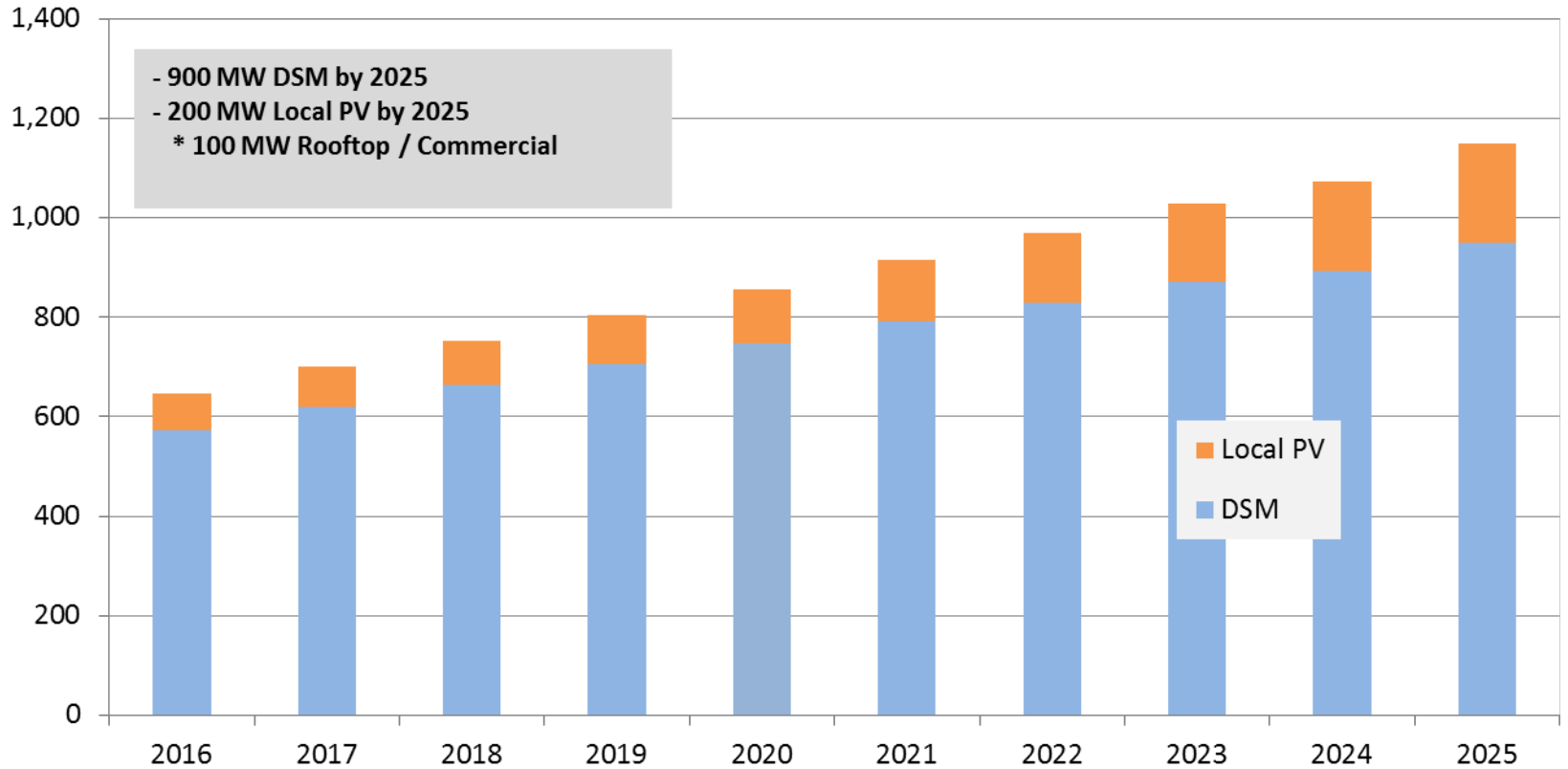
## AE Peak



# DSM & Local PV Forecast



## DSM and Local PV Goals

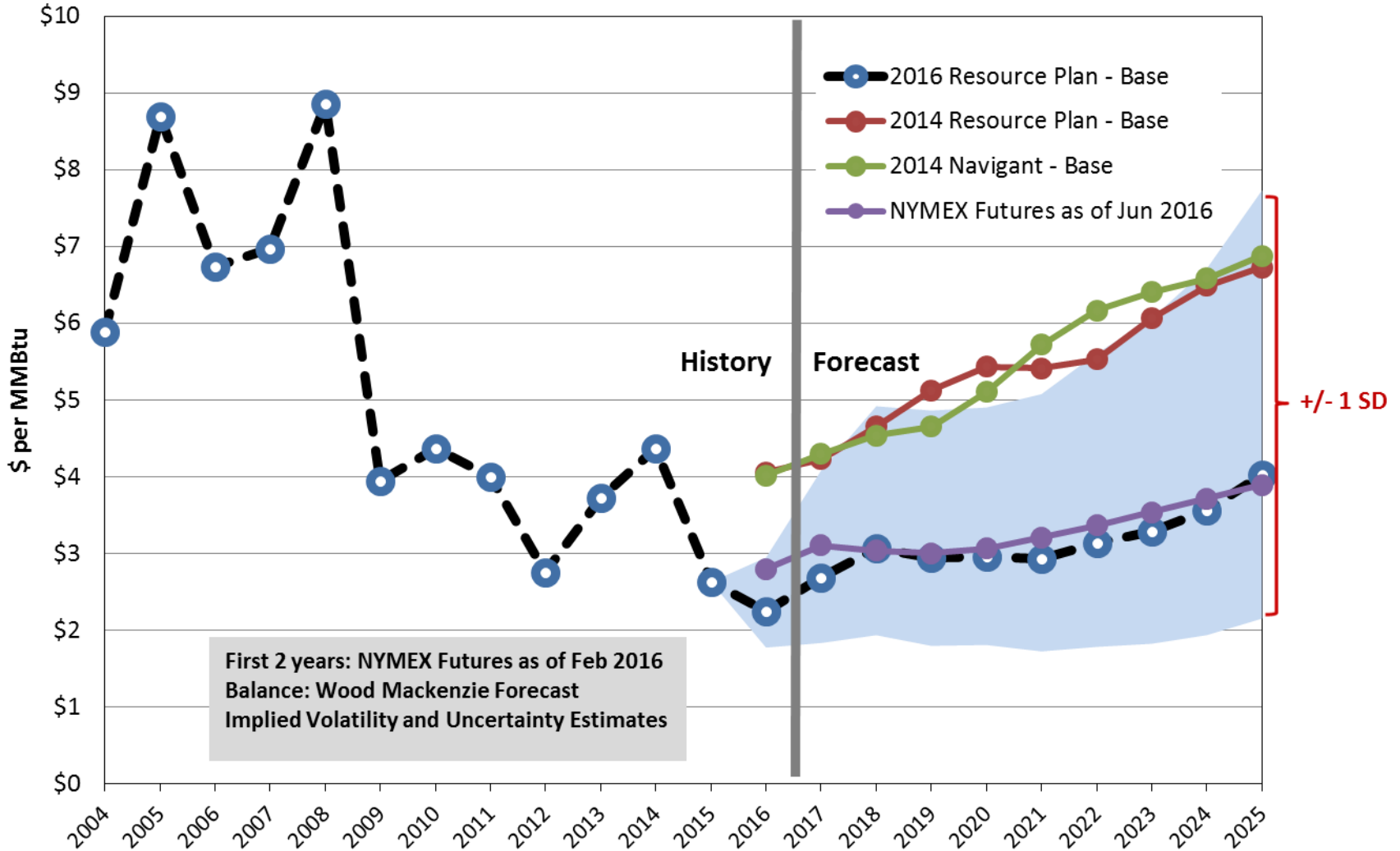




# Gas Price Forecasts

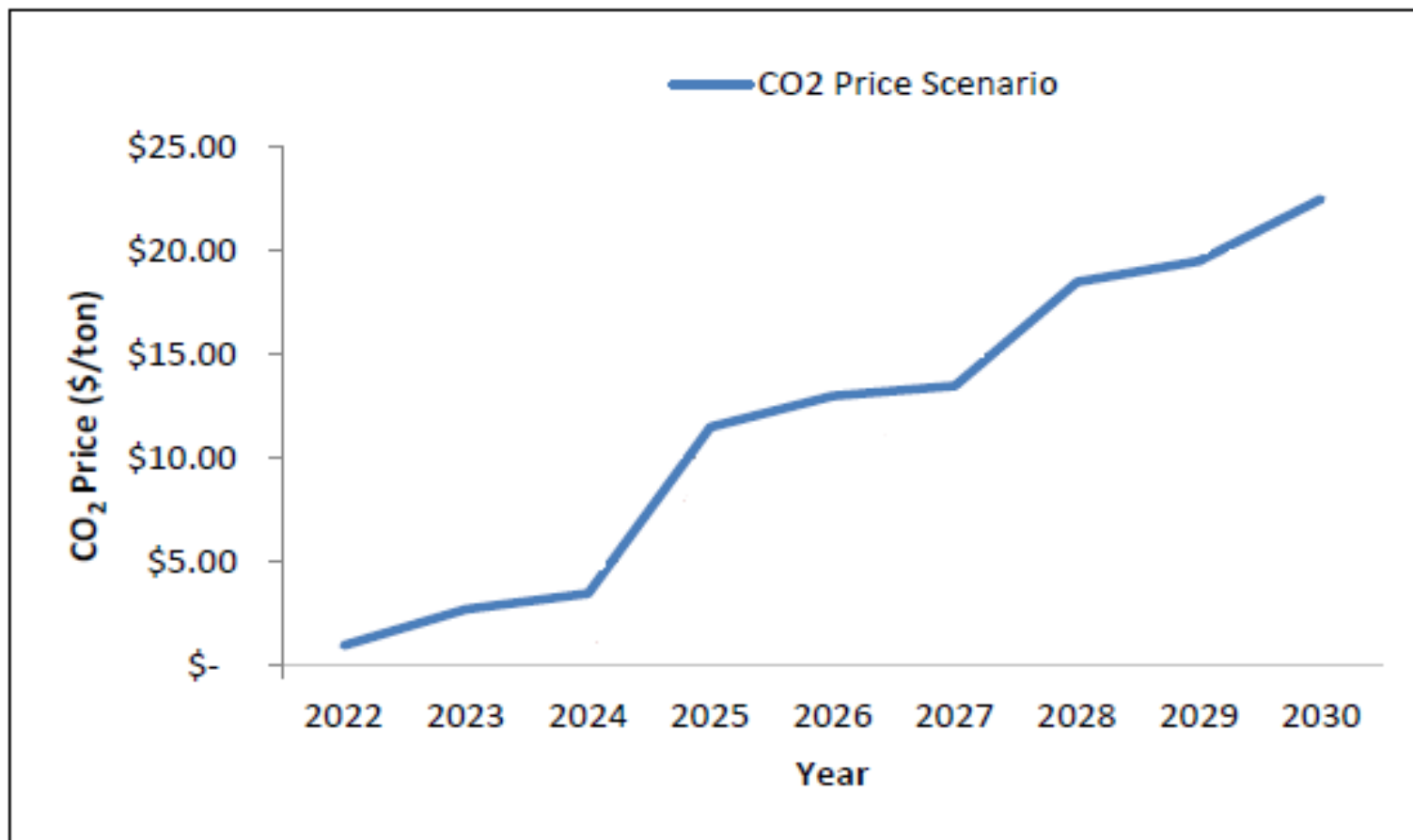


## 2016 Resource Plan - Natural Gas Price Forecast Range



First 2 years: NYMEX Futures as of Feb 2016  
 Balance: Wood Mackenzie Forecast  
 Implied Volatility and Uncertainty Estimates

# Environmental Assumptions – CO<sub>2</sub>



- Source: ERCOT Analysis of The Impact of The Clean Power Plan

# Financial and Economic Assumptions

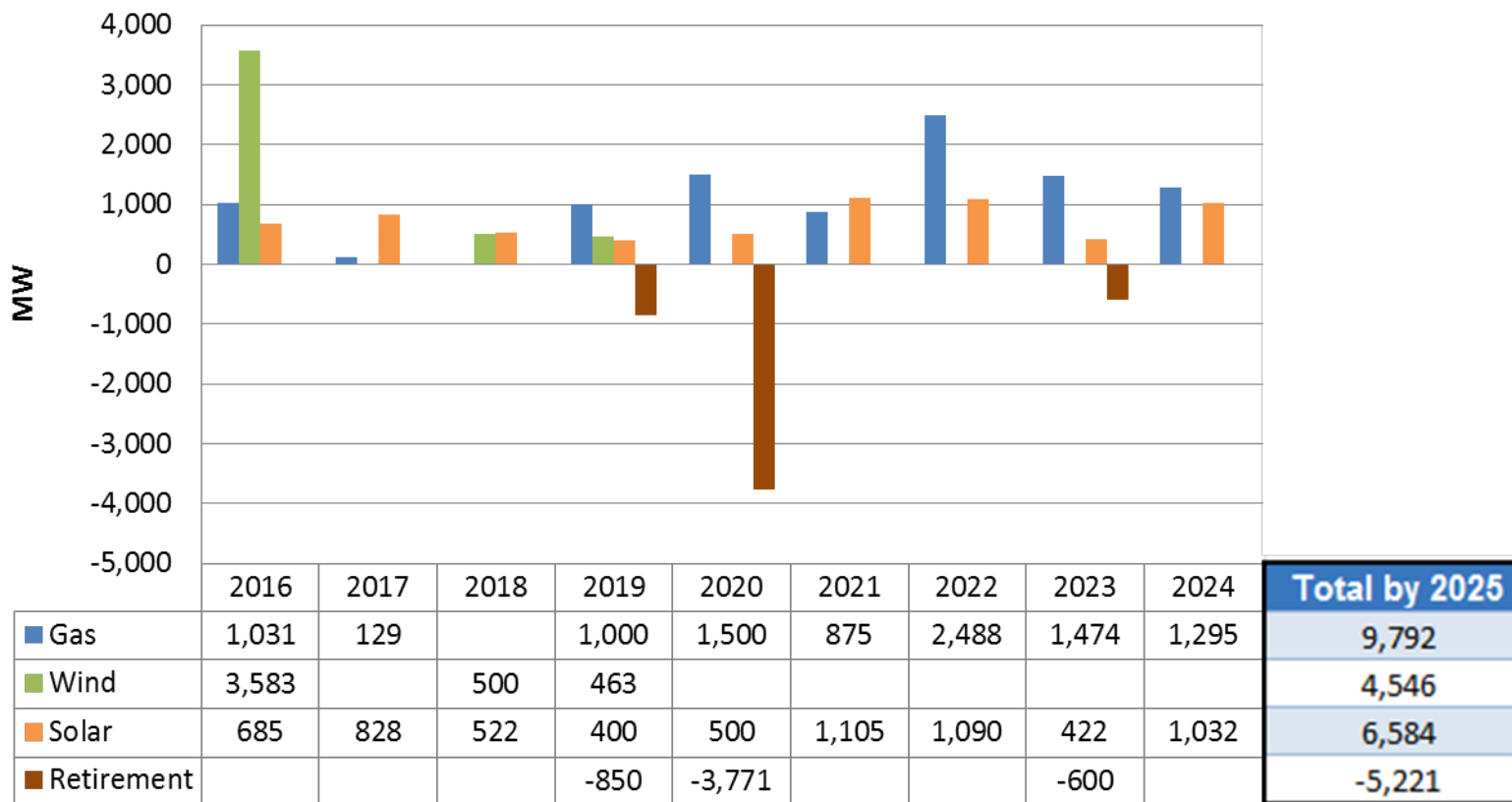


- Capital
  - 30 year 100% debt financing
  - 5% interest rate (near term: 5 years)
  - 5.5% interest rate (beyond year 6)
  - Applies to CIP for current plants as well
  
- Economic parameters
  - General inflation @ 2%
  - Discount Rate @ 10% (i.e. AE WACC)



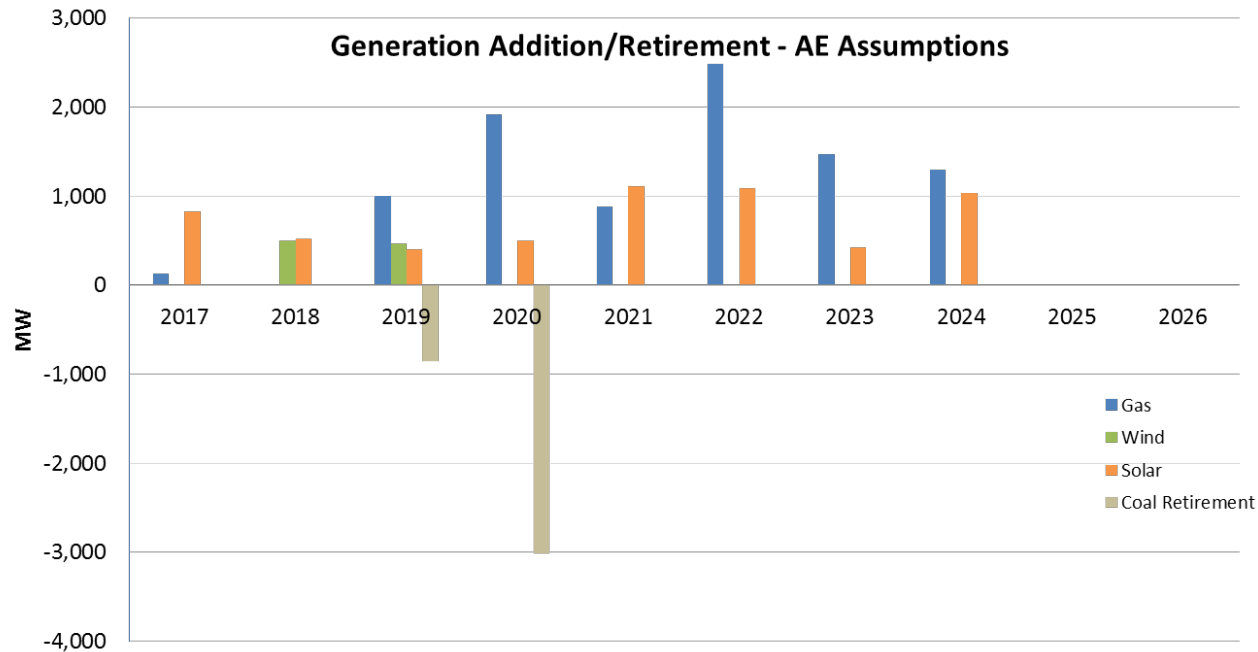
# Generation Additions/Retirements for ERCOT

## ERCOT Market Capacity Additions/Retirements



- Gas and wind additions are based on ERCOT CDR (released December 2015), market projection, and ERCOT Clean Power Plan report
  - The timing of additions adjusted to reflect more realistic expectations
  - For wind only resources with sufficient financial guarantee are considered
- Solar additions are based on ERCOT CDR and AE projections

# AE Assumptions vs. ERCOT (Generation Additions/Retirements for ERCOT)

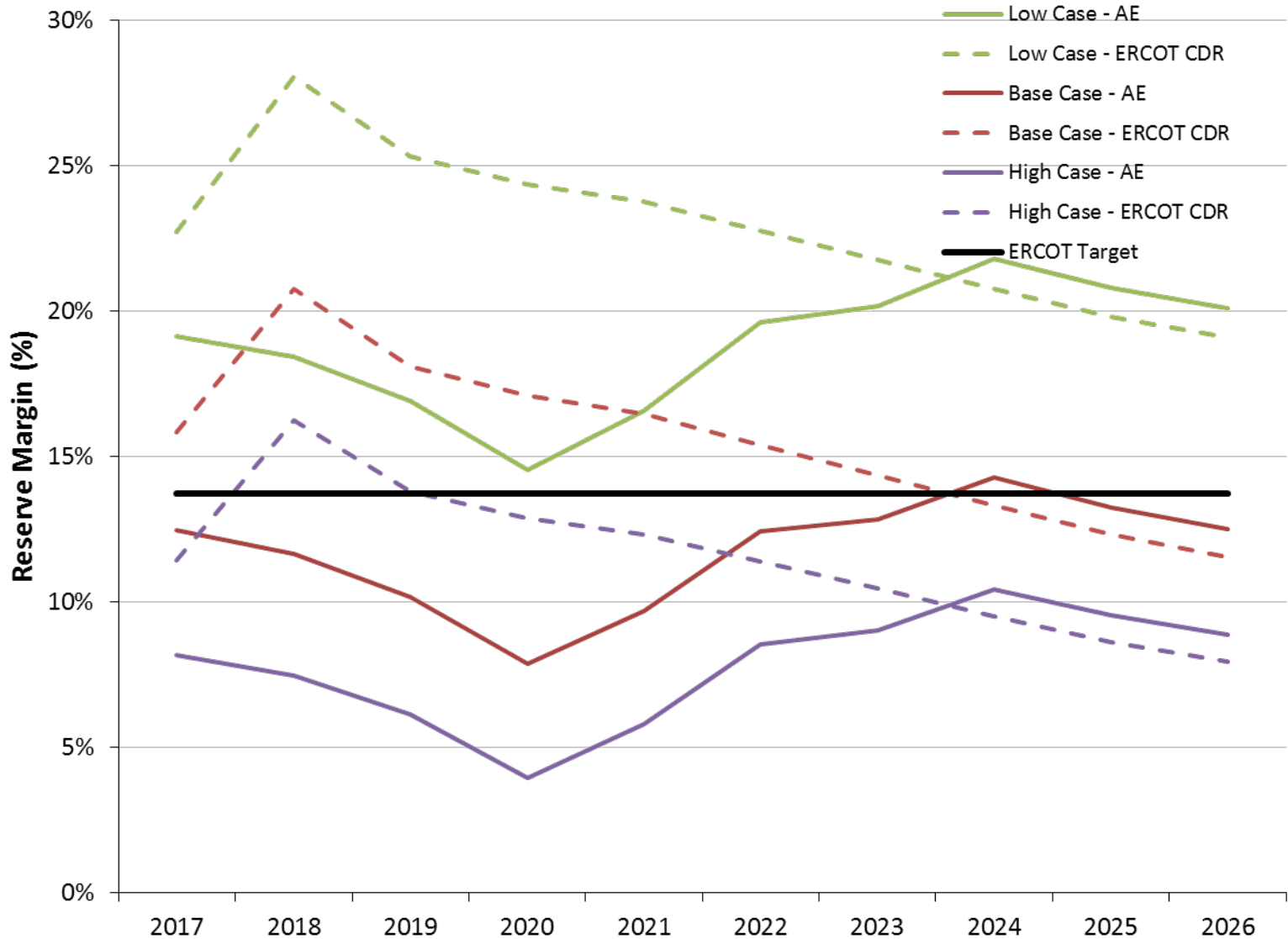


## Resource addition/retirement differences (ERCOT CDR - AE assumptions)

|                 | 2,017 | 2018  | 2019 | 2020   | 2021   | 2022   | 2023   | 2024   | 2025 | 2026 | Total  |
|-----------------|-------|-------|------|--------|--------|--------|--------|--------|------|------|--------|
| Gas             | 484   | 4,177 | -436 | -1,920 | -875   | -2,488 | -1,474 | -1,295 | 0    | 0    | -3,827 |
| Wind            | 7,732 | 258   | -463 | 0      | 0      | 0      | 0      | 0      | 0    | 0    | 7,527  |
| Solar           | 666   | -414  | -400 | -500   | -1,105 | -1,090 | -422   | -1,032 | 0    | 0    | -4,297 |
| Coal Retirement | 0     | 0     | 10   | 3,018  | 0      | 0      | 0      | 0      | 0    | 0    | 3,028  |

- Gas and wind additions are based on ERCOT CDR (released December 2015), market projection, and ERCOT Clean Power Plan report
  - The timing of additions adjusted to reflect AE expectations
  - Only resources with sufficient financial guarantee are considered for wind generators
- Solar additions are based on ERCOT CDR and AE projections

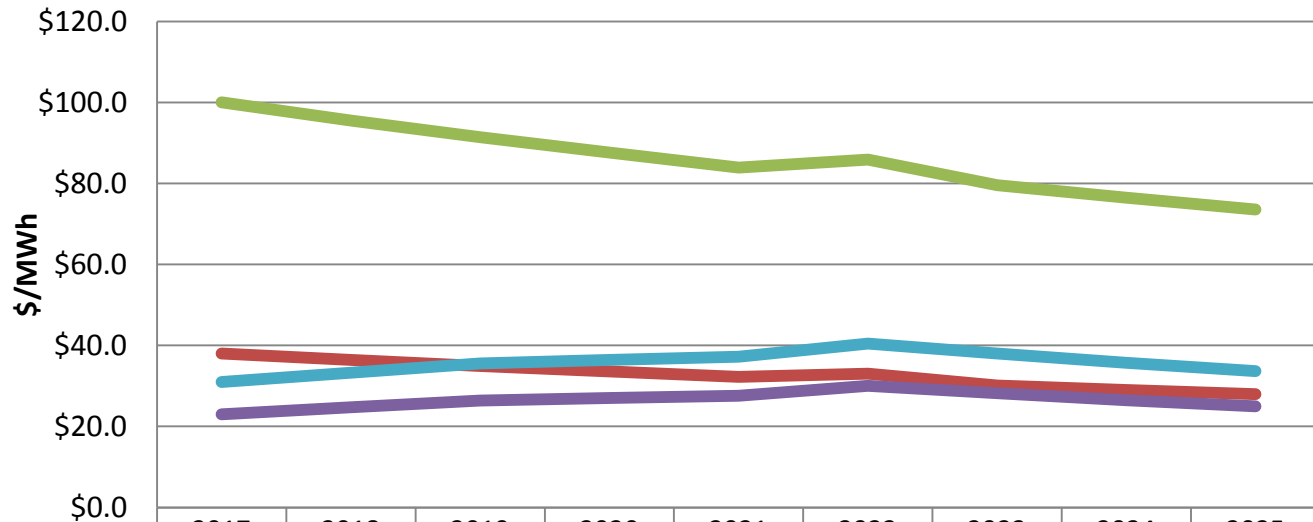
# ERCOT Reserve Margin Projections



# PPA/Levelized Cost Assumptions



## PPA/Levelized Cost Assumptions



|                 | 2017    | 2018   | 2019   | 2020   | 2021   | 2022   | 2023   | 2024   | 2025   |
|-----------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| Utility Solar   | \$38.0  | \$36.4 | \$34.9 | \$33.6 | \$32.3 | \$33.0 | \$30.1 | \$29.0 | \$28.0 |
| Community Solar | \$100.0 | \$95.5 | \$91.4 | \$87.6 | \$83.9 | \$85.9 | \$79.6 | \$76.5 | \$73.6 |
| West Wind       | \$23.0  | \$24.7 | \$26.4 | \$27.0 | \$27.6 | \$30.0 | \$28.2 | \$26.5 | \$25.0 |
| Coastal Wind    | \$31.0  | \$33.3 | \$35.6 | \$36.4 | \$37.2 | \$40.4 | \$38.0 | \$35.7 | \$33.7 |

| Commence Construction | 2017    | 2018    | 2019    | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|-----------------------|---------|---------|---------|------|------|------|------|------|------|
| Solar ITC             | 30%     | 30%     | 30%     | 26%  | 22%  | 10%  | 0%   | 0%   | 0%   |
| Wind ITC/PTC          | 24%/80% | 18%/60% | 12%/40% | 0%   | 0%   | 0%   | 0%   | 0%   | 0%   |

For Solar assumed PPA through 2022 and ownership afterwards due to PTC/ITC expiration

# Technology Costs



| Resource Characteristics        | Gas Plant          |                    | Solar           |                  | Wind            |                 | Battery Storage    | CAES                | EE                | DR                      |
|---------------------------------|--------------------|--------------------|-----------------|------------------|-----------------|-----------------|--------------------|---------------------|-------------------|-------------------------|
|                                 | Combined Cycle     | Simple Cycle/Recps | Utility         | Community        | West            | Coastal         |                    |                     |                   |                         |
| 2015-2040                       | \$800 - \$1,089/KW | \$400 - \$900/KW   | \$28 - \$38/MWh | \$74 - \$100/MWh | \$23 - \$30/MWh | \$31 - \$40/MWh | \$861 - \$2,000/KW | \$1,500- \$2,000/KW | \$783 - \$3849/KW | \$102 - \$603/KW-yr     |
| Fixed O&M (\$/KW-yr)            | 16                 | 7.5                | N/A             | N/A              | N/A             | N/A             |                    | 19                  | N/A               | N/A                     |
| Heat rate (Btu/KWh)             | 6,300 - 6,900      | 8,200 - 10,500     | N/A             | N/A              | N/A             | N/A             | N/A                | 4,227               | N/A               | N/A                     |
| Capacity factor (%)             | 55%                | 10%                | 33%             | 20%              | 40%             | 30%             | 5-10%              | 30-40%              | 50%               | N/A                     |
| Water usage (Gal/MWh)           | 300                | 0 - 300            | 0               | 0                | 0               | 0               | 0                  | 0                   | 0                 | 0                       |
| Economic lifespan of asset (yr) | 25                 | 25                 | 25              | 25               | 25              | 25              | 10                 | 30                  | Reduction in Load | Contracted Year to Year |

## Notes:

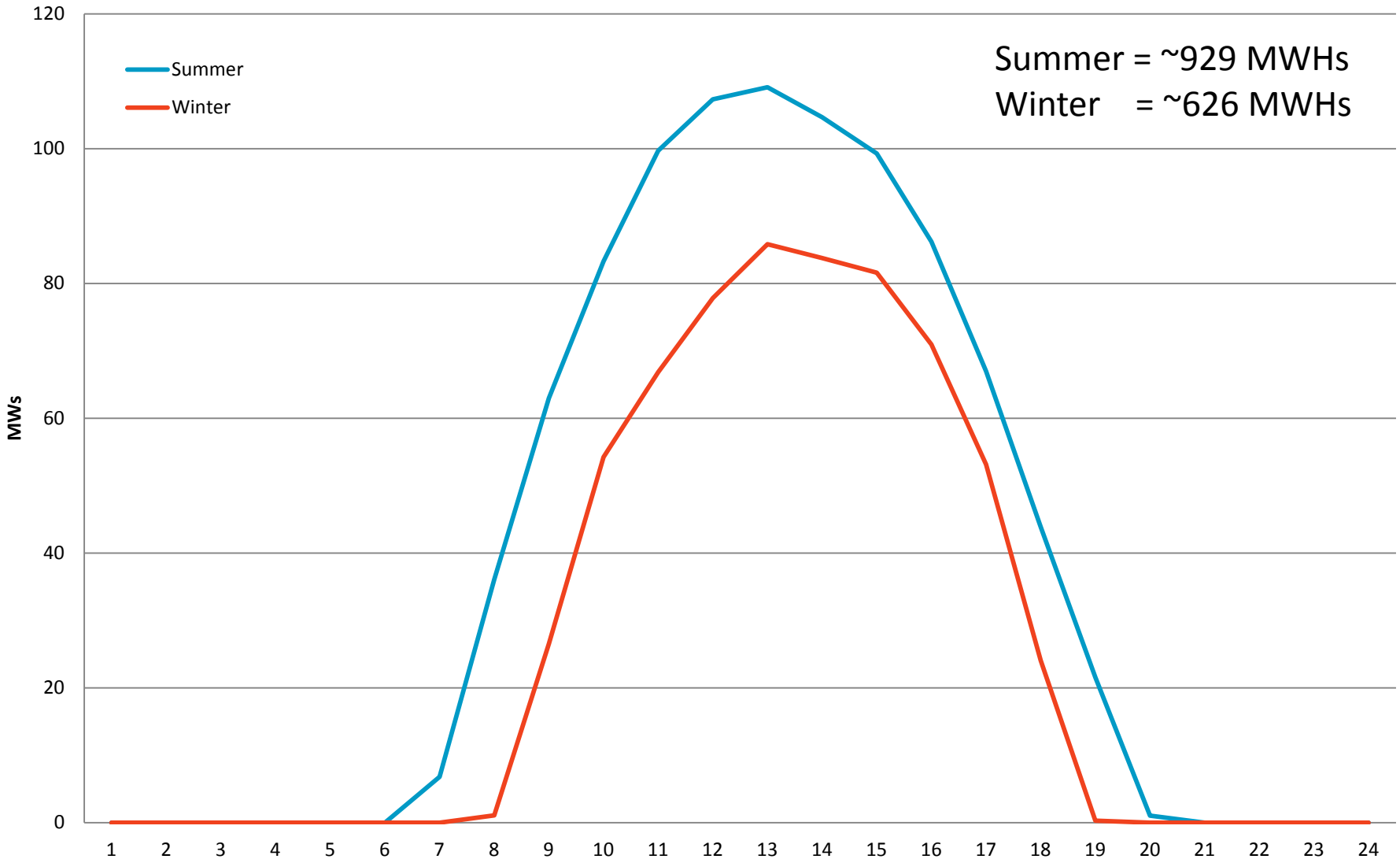
- (1) Cost for conventional plant is based on AE estimates and on various discussions with vendors
- (2) Solar/Wind is based upon AE estimates and recent Power Purchase Agreements
- (3) Battery storage per AE estimates with an assumption that the capital cost of battery will decline by 10% per year
- (4) Compressed air energy storage per market indicative offers in ERCOT
- (5) EE & DR per AE estimates



# ROSEROCK – COD 11.23.2016



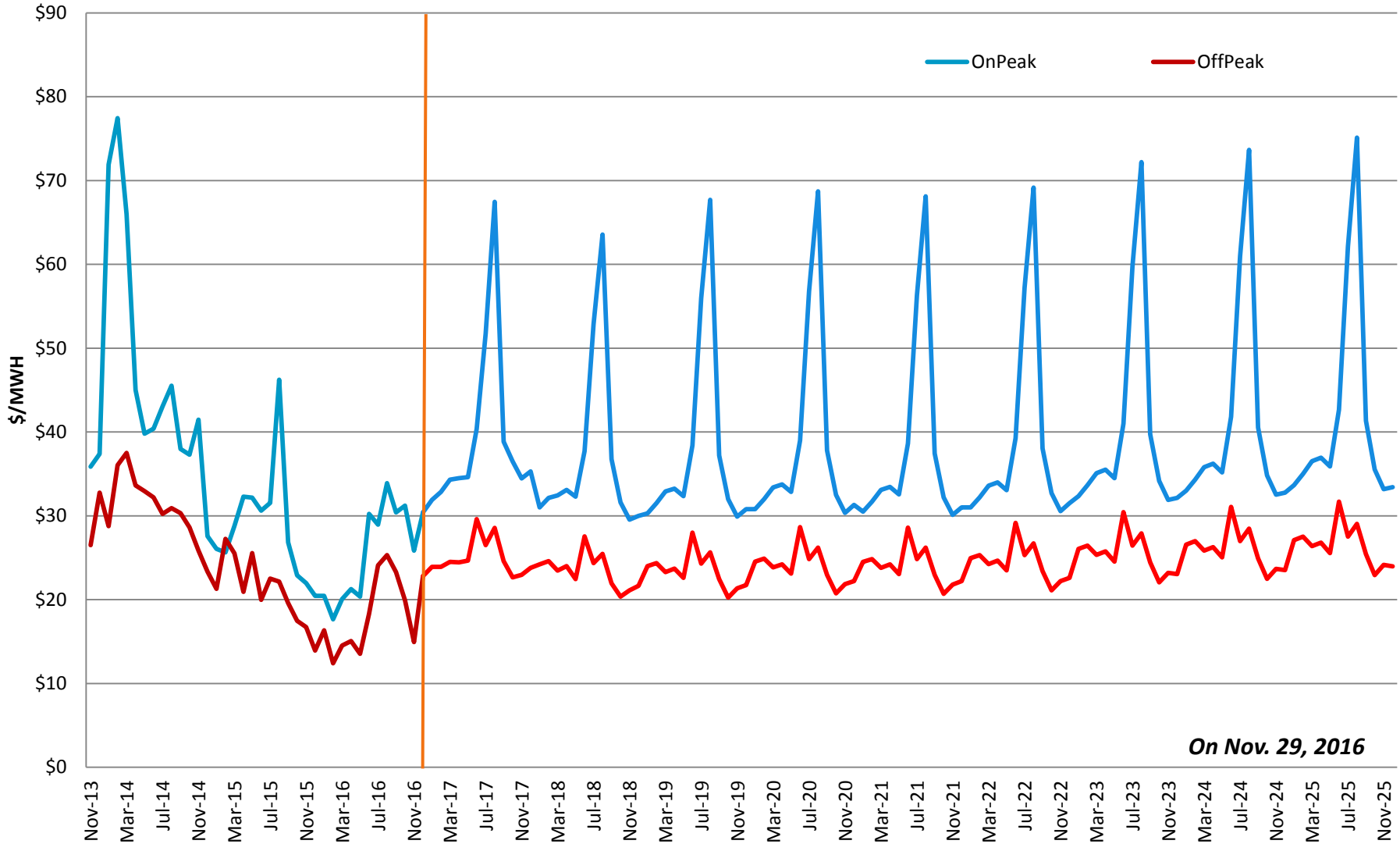
## Roserock Forecasted Average Generation Profile



# ERCOT Historical & Forward Prices – 2014 thru 2025



## LZ\_AEN Prices



# AE Green Choice Participation



| Enrollment : GreenChoice Dashboard |             |             |             |             |             |                         |
|------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------------------|
| GC Subscriber Growth               |             | 2014        | 2015        | 2016        | 2017 (EST)  |                         |
|                                    | Residential | 6,584       | 7,459       | 10165       | 11182       |                         |
|                                    | Commercial  | 1,214       | 1,092       | 1,336       | 1376        |                         |
|                                    | Total       | 7,798       | 8,551       | 11,501      | 12,558      |                         |
| GC kWh Growth                      |             | 2014        | 2015        | 2016        | 2017 (EST)  |                         |
|                                    | Residential | 56,759,766  | 58,781,488  | 77,067,374  | 84,774,111  |                         |
|                                    | Commercial  | 627,226,841 | 578,793,670 | 642,747,091 | 707,021,800 |                         |
|                                    | Total       | 683,986,607 | 637,575,158 | 719,814,465 | 791,795,912 |                         |
|                                    |             |             |             |             |             | GreenE Wind Available t |
|                                    |             |             |             |             |             | 1,035,044,000 kWh       |
| GC GreenCharge \$                  |             | 2014        | 2015        | 2016        | 2017 (EST)  |                         |
|                                    | Residential | 3,310,449   | 2,745,694   | 3,071,546   | 3,378,701   |                         |
|                                    | Commercial  | 27,144,738  | 23,628,448  | 28,761,615  | 31,637,776  |                         |
|                                    | Total       | 30,455,186  | 26,374,142  | 31,833,161  | 35,016,477  |                         |