

## RFP #GAL0021 for INDEPENDENT REVIEW OF RESOURCE GENERATION PLAN

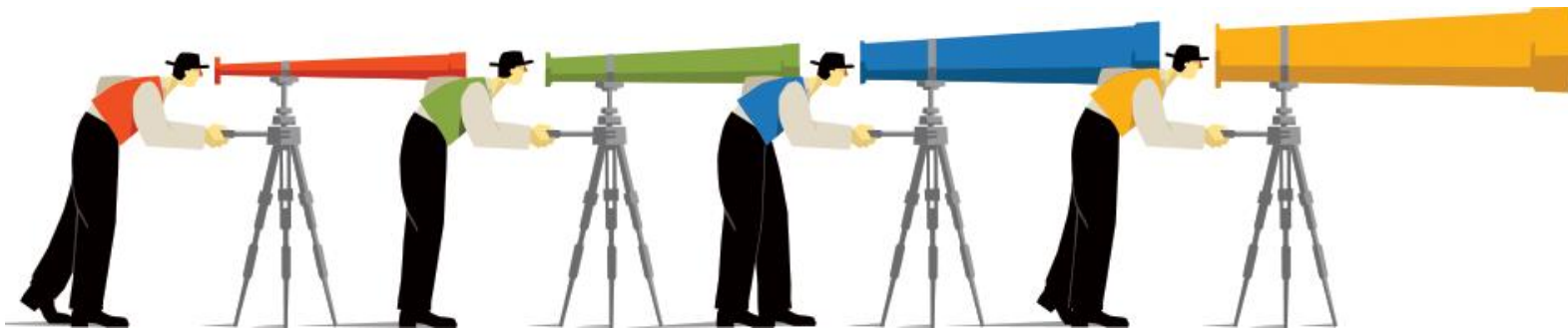
Summary of Findings and Recommendations

Prepared for the Electric Utility Commission (EUC)

11/16/2015



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## **The purpose of this presentation is to present the key findings and summary of recommendations from our independent review.**

- » Austin Energy's ("AE") 2014 Resource Plan ("Plan") update identifies potential retirements and additions to its generation fleet.
- » In particular, the 2014 Resource Plan projects the construction of a new combined cycle gas unit with a nominal rating of 500 MW ("Gas Plant").
- » As part of its plan, AE committed to sponsoring this independent economic, financial and environmental review of a new Gas Plant and other options.
- » Austin City Council awarded the contract to perform an independent "economic and financial assessment of the costs and benefits of a nominal 500 MW natural gas combined cycle plant to AE's portfolio to be constructed in the Austin area at either the Decker Creek plant site or the Sand Hill Energy Center site" to the Navigant team which includes two subcontractors: Quality Power, LLC and Energy Utility Group, LLC.
- » Navigant presented an overview of our methodology and assumptions to the EUC on September 21, 2015.

# 2015 Generation Plan Summary

**Our review focused primarily on the addition of a Gas Plant or alternative resources. We assume AE pursues the other elements of it's plan.**

Action	Capacity	Resource	Description	Timing
Retire	735 MW	Natural gas (ST)	Decker Steam Unit	2018
	602 MW	Coal	AE's share of the Fayette Power Project	By end of 2023
Add	500 MW	Varies	7 different portfolios of either a Gas Plant or alternative resources*	By beg. of 2018
	100 MW	Demand Response/Demand-Side Management	Incremental	By 2025
	450 MW (minimum)	Wind	Contracts for coastal and western wind resources	By 2025
Maintain	800 MW	Energy efficiency and Demand Response	Current goal	By 2020
Increase	950 MW (minimum)	Solar	<ul style="list-style-type: none"> <li>Reaching the City's goal of 200 MW of local solar including at least 100 MW of customer-sited local solar</li> <li>Adding 600 MW of utility-scale solar from its RFP (2)</li> <li>Assuming the full build-out of the announced 150 MW of solar power currently contracted with Recurrent Energy</li> </ul>	By 2025
Obtain	30 MW (minimum)	Thermal and electrical storage	Local	by 2025

(1) All alternative portfolios are 500MW nominal capacity to be comparable to the 500 MW gas plant (e.g., matching energy, solar would be ~1,340 MW)

(2) Note that modeling was completed *before* Austin City Council approved 438MW of solar PPA procurement.

## Navigant modeled 7 portfolios in 4 ERCOT market scenarios to assess risk for each of the alternative portfolios.

- The portfolios are incremental to the approved Plan and represent a range of supply and demand resources.
- The scenarios address uncertainty of natural gas prices and impact of increased grid-tied solar PV.
- Note that modeling was completed *before* Austin City Council approved 438MW of solar PPA procurement.

### Resource Portfolios

#	Name	Description
C0	All Market	AE current 10-year plan without the addition of a 500 MW CC
C1	Decker CC	C0 + 500 MW CC addition at Decker
C2	Sand Hill CC	C0 + 500 MW CC addition at Sand Hill
C3	500 MW Solar	C0 + 500 MW of additional solar
C4	500 MW Wind	C0 + 500 MW of additional wind
C5	Alternative Mix	C0 + portfolio of renewable resources and DR with energy storage (200 MW wind, 200 MW solar, 50 MW DR, and 50 MW EE)
C6	Accelerated Solar	AE current 10-year plan with 600MW solar additions coming online in 2017

### ERCOT Market Scenarios

	Name	Description
1	Base Gas	Navigant's reference gas price forecast
2	Low Gas	Navigant's low gas price forecast
3	High Gas	Navigant's high gas price forecast
4	High ERCOT Solar	Consistent with recent trends and forward-looking wind costs, the High ERCOT Solar penetration case tests the portfolios' value with high solar penetration layered on top of the wind build.

## Analysis Results: Net Cost

Our analysis results shown below show total cost to serve load over the 20-year study period net of revenue from AE owned or contracted generation.

### Portfolio Net Cost (Net Present Value 2014 \$MM)

Portfolio	Base	High Gas	Low Gas	High Solar
All Market	8,025 (452)	8,682 (691)	7,419 (429)	8,024 (314)
C1: Decker CC	<b>7,573 (0)</b>	8,097 (106)	<b>6,990 (0)</b>	7,754 (44)
C2: Sand Hill CC	7,574 (1)	8,097 (106)	6,991 (1)	7,754 (44)
C3: 500 MW Solar	7,608 (35)	8,025 (34)	7,158 (168)	7,775 (65)
C4: 500 MW Wind	7,639 (66)	<b>7,991 (0)</b>	7,240 (250)	<b>7,710 (0)</b>
C5: Alternative Mix	7,830 (257)	8,235 (244)	7,392 (402)	7,931 (221)
C6: Accelerated Solar	7,866 (293)	8,502 (511)	7,278 (288)	7,869 (159)

Source: Navigant

Results in yellow are the low cost in each scenario and results in parenthesis show the difference between each result and the low cost portfolio

Note that the NPVs are limited to the 20-year study period and do not consider the residual value of the portfolios and so is a conservative view of the system costs.

## AE is exposed to the risks of higher ERCOT market costs in the AE load zone with the retirement of ~1,300 MW of local generation

- » Navigant included estimates of these costs in its results; however, these costs can vary greatly and there is no historic data to benchmark against as the plants have not been retired.
- » The table below shows our estimate of added risk that these local ERCOT market costs could reasonably add in the AE load zone.
- » These revenues could be earned in the form of increased revenues to the Gas Plant, which reduces the financial risk to AE.

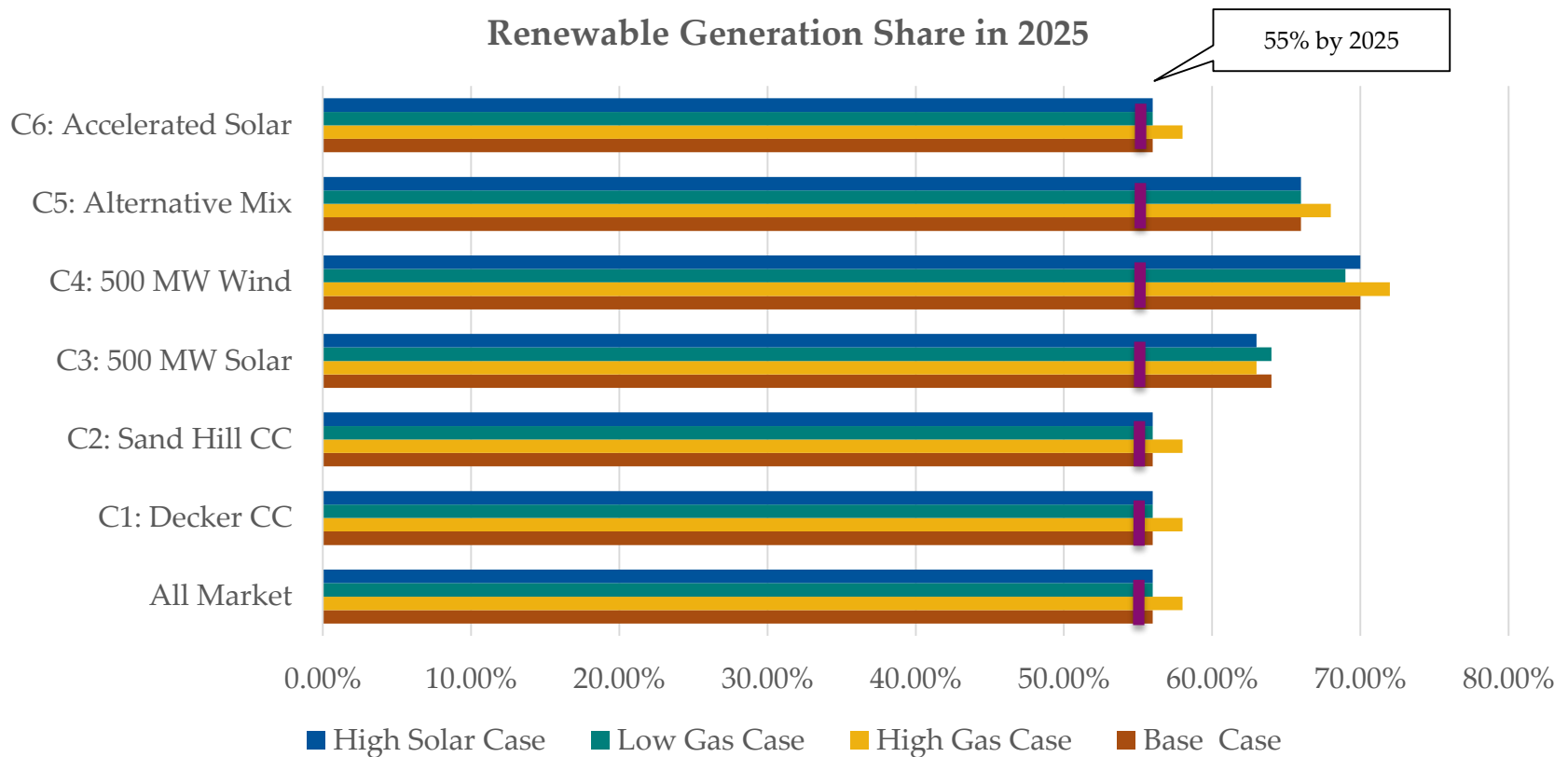
### Financial Risks for Non-Local, Non-Dispatchable Generation (NPV 2014 \$MM)

Local ERCOT Market Costs	Description	Cost Estimated in Study	Estimated Added Risk
<b>Local Congestion</b>	Costs due to transmission limitations into and out of the AE load zone largely occur during peak times and months when the ERCOT system is stressed.	70	130
<b>Real-Time Price Volatility</b>	Volatility of costs in the ERCOT real time market without local dispatchable generation.	0	16 – 32
<b>Ancillary Services</b>	Provided by dispatchable generation and the costs of these increase with greater renewable penetration in ERCOT.	84 – 102	42 – 51
<b>Total</b>		<b>154 – 172</b>	<b>188 – 213</b>

Source: Navigant

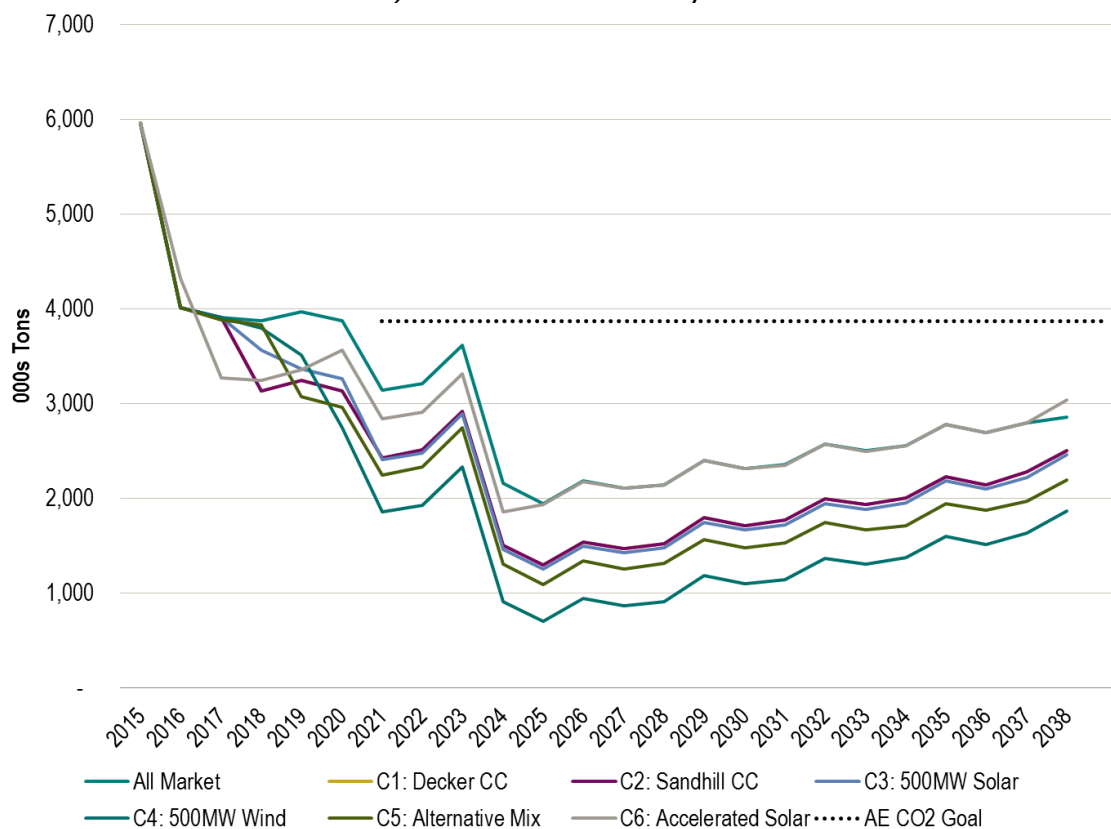
## Analysis Results: Renewable Generation %

**All portfolios meet AE's goal of 55% renewable generation by 2025 since the starting point is the approved Plan (with and without the Gas Plant). Wind, Solar and Alternative Mix increase the % above 60%**



**AE's current goal requires reduction of total CO<sub>2</sub> by 20% from 2005 levels (~4.8mil tons) by 2020.**

## CO<sub>2</sub> Emissions by Year



Source: Navigant

Note: the study holds the AE-owned generation resources constant after 2025 even though in reality more would likely be procured.



**Both SO<sub>2</sub> and NO<sub>x</sub> emissions are reduced in all portfolios that add generating resources**

## SO<sub>2</sub> Emissions (000s tons)

Portfolio	Base Case	High Gas Case	Low Gas Case	High Solar Case
<i>All Market</i>	139	150	129	140
<i>C1: Decker CC</i>	90	100	76	91
<i>C2: Sand Hill CC</i>	90	100	76	90
<i>C3: 500 MW Solar</i>	123	138	112	124
<i>C4: 500 MW Wind</i>	110	121	101	111
<i>C5: Alternative Mix</i>	118	128	107	117
<i>C6: Accelerated Solar</i>	135	146	126	136

*Source; Navigant*

## NO<sub>x</sub> Emissions (000s tons)

Portfolio	Base Case	High Gas Case	Low Gas Case	High Solar Case
<i>All Market</i>	37	39	34	37
<i>C1: Decker CC</i>	20	22	16	20
<i>C2: Sand Hill CC</i>	20	22	16	20
<i>C3: 500 MW Solar</i>	30	35	28	30
<i>C4: 500 MW Wind</i>	25	28	23	26
<i>C5: Alternative Mix</i>	28	31	26	28
<i>C6: Accelerated Solar</i>	35	37	33	35

*Source; Navigant*

## The gas plant water use rate is 65% less per MWh than the retiring steam units at Fayette and Decker

- » Replacing the Decker steam units with a Gas Plant results in ~15% more water usage over other portfolios.

### Water Usage Results (ACFT)

Portfolio	Base Case	High Gas Case	Low Gas Case	High Solar Case
<i>All Market</i>	228,425	228,786	231,305	225,121
<i>C1: Decker CC</i>	267,782	268,767	274,013	265,016
<i>C2: Sand Hill CC</i>	267,780	268,770	274,020	265,019
<i>C3: 500 MW Solar</i>	227,156	228,057	230,581	224,402
<i>C4: 500 MW Wind</i>	227,320	228,265	230,781	224,632
<i>C5: Alternative Mix</i>	227,163	228,159	230,750	224,948
<i>C6: Accelerated Solar</i>	227,705	228,711	231,102	225,018

Source: Navigant

## » *Land Use Impacts*

- There are no identifiable land use impacts for the All Market option. For both of the Gas Plant build options (C1: Decker and C2: Sand Hill), the existing sites have more than adequate land available.

## » *Local Economic Impacts*

- For the gas plant, total local/regional construction spending is estimated to be roughly \$74 million, of which 75% is assumed to be labor (\$55 million).
- This corresponds to about 400 full-time equivalent construction-related jobs (including support).
- Approximately 20 full-time jobs will be added for O&M after the Gas Plant begins commercial operation.

# Observations and Recommendation

- » Owning generation and in particular, local generation, mitigates ERCOT market price risks.
- » All portfolios assessed produce benefits for AE and its customers compared with the All Market portfolio which assumes no 500 MW resource(s) addition of any kind.
- » The results between the portfolios assessed are very close which is why it is important to consider the range of risks to AE and its customers that can be mitigated by the Gas Plant
- » The portfolios with the Gas Plant (at Decker or Sand Hill) resulted in the best mix of value and risk mitigation among the portfolios studied.
- » The Gas Plant portfolios:
  - are the lowest-cost portfolio in two of the four scenarios and not catastrophic in any scenario.
  - support the planned retirement of ~1,300 MW of local generation in the AE load zone.
  - mitigate locational market risks while supporting Plan goals such as 55% renewable portfolio by 2025, reduction of total CO<sub>2</sub> by 20% from 2005 levels (~4.8mil tons) by 2020.
  - uses less water per megawatt hour than either Decker or FPP
  - provide positive local economic impacts from the construction and operation of the plant.
- » Our recommendation to Council on the basis of the benefits and costs and impacts of each of the scenarios we assessed is that AE build the Gas Plant in the AE load zone to replace the Decker Creek Power Station's steam units when they are retired, and to support the planned retirement of FPP.

## Additional Observations

- » Selecting solar early produces benefits.
  - Subsequent to the start of our analysis 438MW was approved by the city. Our study results support this decision.
- » Given the pace of change in renewable and storage costs, AE should continue to monitor and consider these resources.
- » EE and DR resources are often highly valuable if they can be procured cost-effectively.
- » AE should consider other quick-starting generating technologies that were not in this scope of work to address evolving ERCOT market.

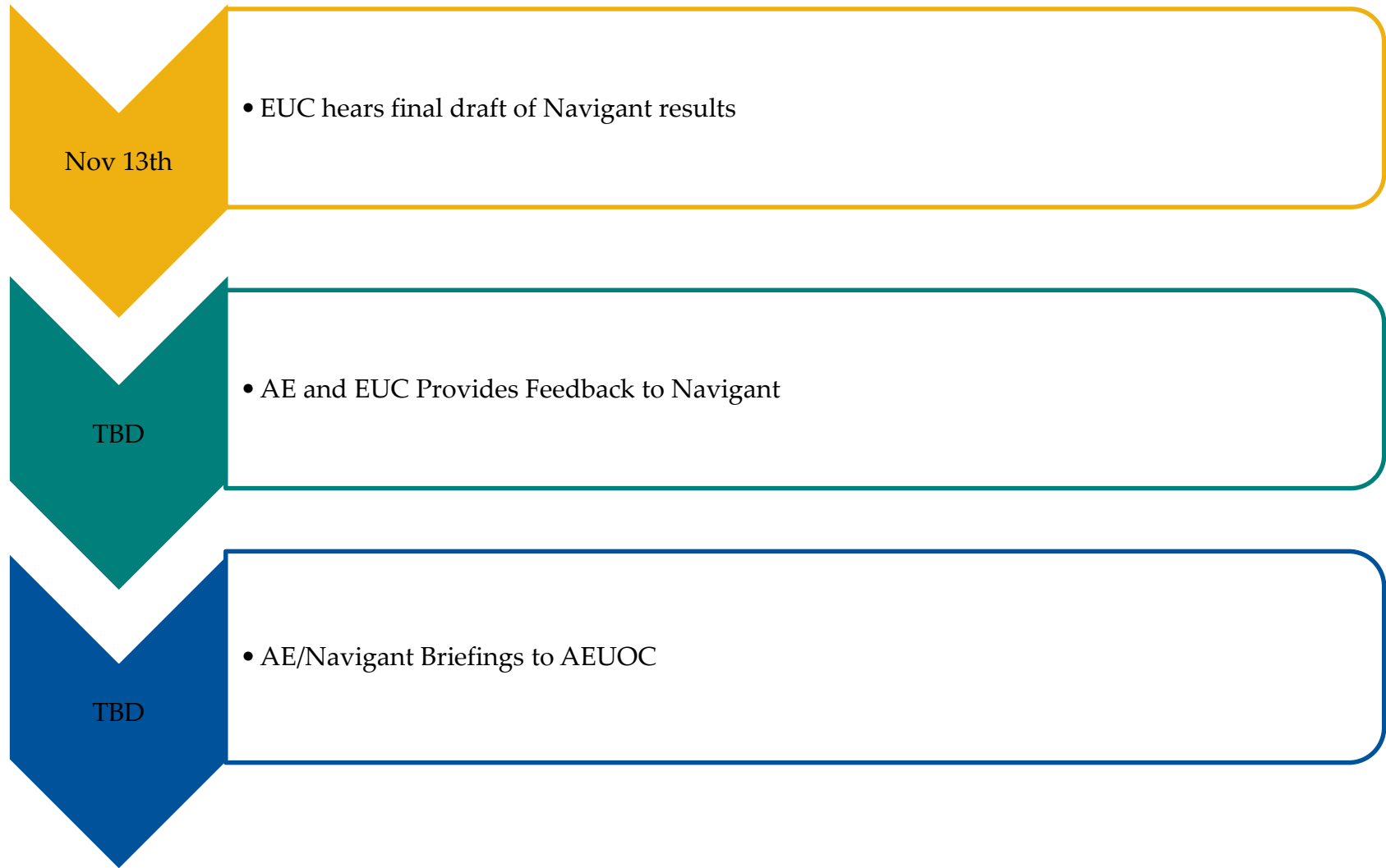
# Key CONTACTS



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# Schedule



# Acronyms

Acronym	Definition
LMP	Locational marginal price
ST	Steam turbine
CC	Combined cycle
PPA	Power purchase agreement
CO <sub>2</sub>	Carbon dioxide
SO <sub>2</sub>	Sulfur dioxide
NO <sub>x</sub>	Nitrogen oxide
O&M	Operations and maintenance



# Navigant's Approach

- » Navigant evaluated the financial impacts, risks, and impacts on other AE goals for 7 resource portfolios across 4 alternate market scenarios.
  - Note that portfolios are defined as resource options that AE controls and scenarios are defined as market outcomes that are driven by the broader energy market.
- » For the study, Navigant modeled the operation and resultant market prices for ERCOT using PROMOD IV, an industry standard production cost model.
  - AE is fully integrated into ERCOT in the sense that units receive revenues from the ERCOT LMPs at the plant node and AE pays for wholesale power at the customer node.
  - The simulation incorporates the nodal structure of ERCOT and any forecasted congestion in the AE load zone or in other ERCOT zones.
- » Navigant solicited input from AE to ensure that the model fully represented the AE system including:
  - AE plant operating parameters
  - AE hourly load
  - New resource procurement costs

# Technology Assumptions

- » Our analysis compares the investment costs, revenues and risks from different technologies based on their performance characteristics. This section describes the assumptions underlying the comparison.
- » The values are the result of independent analysis by Navigant.

## Study Technology Assumptions (\$ Real 2014)

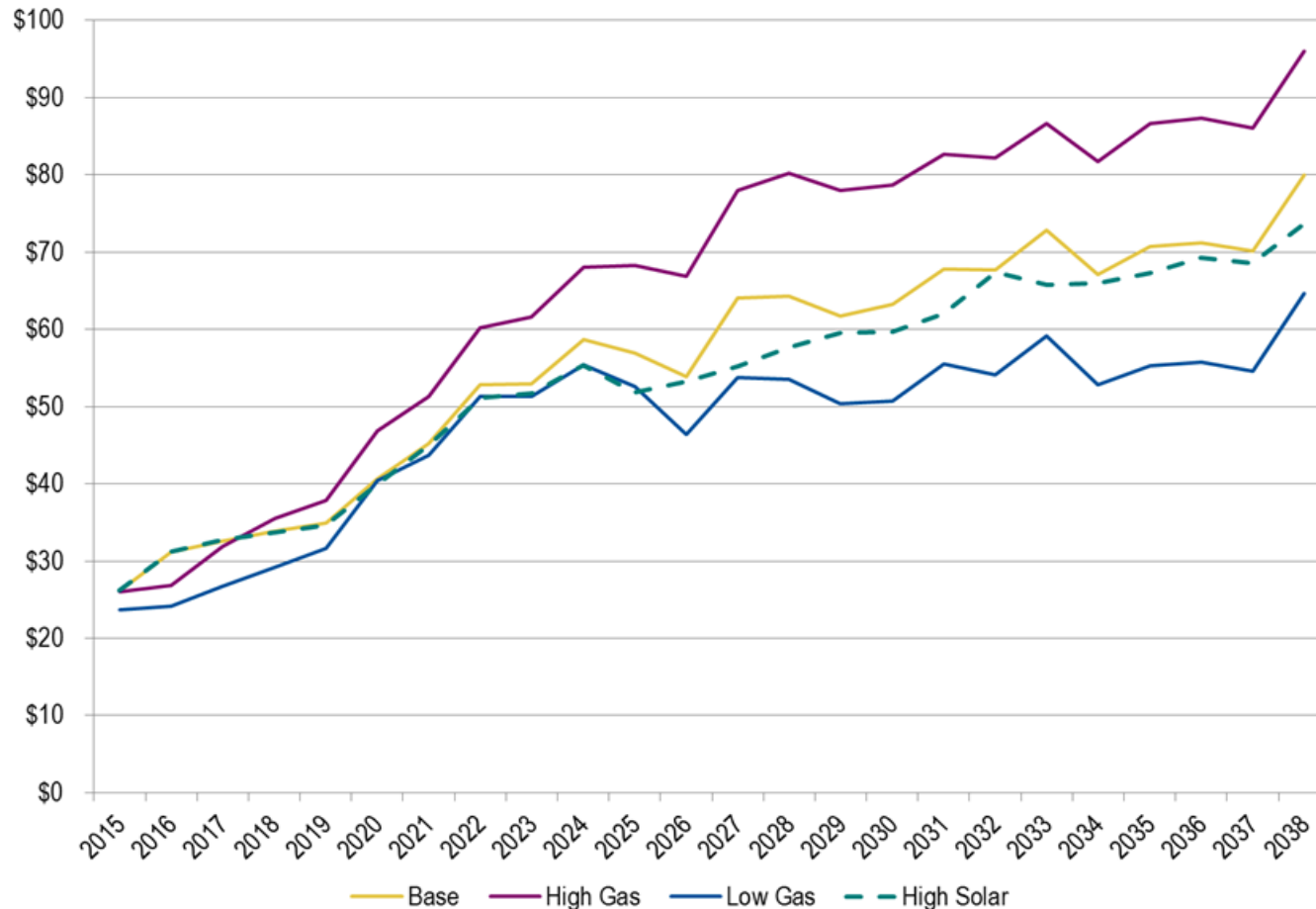
Resource Characteristics	Gas Plant	Solar PV	Wind	EE	DR
<b>Technology / Location</b>	500 MW Combined Cycle	Single Axis Tracking	PPA in	50 MW Load Modifier	50 MW Dispatchable Load Modifier
<b>Location</b>	Austin, TX	West TX	West and Coastal Regions	Austin, TX	Austin, TX
<b>2015-2035</b>	\$700-\$900/kW	\$1,130 - \$1,350/kW	\$45/MWh - \$50/MWh PPA	\$783 - \$3849/kW	\$102 - \$603/kW-yr
<b>FOM (\$/kW-yr)</b>	\$13.20	\$26.00 (1)	N/A	N/A	N/A
<b>Variable O&amp;M (\$/MWh)</b>	\$3.50	\$0	N/A	N/A	N/A
<b>Heat rate</b>	6,631 Btu/kWh	N/A	N/A	N/A	N/A
<b>Capacity Factor</b>	Model Output	28%	47%	50%	N/A

Source: Navigant

1. Solar PV FOM includes inverter replacement that occurs at year 10-15 and projected maintenance costs for the tracking equipment.

## Analysis Results: All Scenarios Project Rising ERCOT Power Prices

**Navigant analysis projects rising wholesale power prices in all ERCOT market scenarios driven by the Clean Power Plan implementation, tightening capacity reserves and natural gas price rising in real terms.**



Source: Navigant

## Scorecard for Base Case

Base Case	Net System Cost (\$MM)	Renewable Generation Share in 2025 (%)	Renewable Generation (GWh)	Austin Energy CO2 Emissions (000s Tons)	Austin Energy CO2 Emissions (lbs/MWh)	Austin Energy NOx Emissions (000s Tons)	Austin Energy SO2 Emissions (000s Tons)	Water Usage
All Market	8,025	56%	191,997	71,925	394	37	139	228,425
C1: Decker CC	7,573	56%	191,991	58,917	323	20	90	267,782
C2: Sandhill CC	7,574	56%	191,991	58,917	323	20	90	267,780
C3: 500MW Solar	7,608	64%	214,294	58,818	322	30	123	227,156
C4: 500MW Wind	7,639	70%	231,753	48,453	265	25	110	227,320
C5: Alternative Mix	7,830	66%	217,839	54,992	305	28	118	227,163
C6: Accelerated Solar	7,866	56%	196,945	69,013	378	35	135	227,705