

Entergy Arkansas, Inc. 2018 Integrated Resource Plan



Follow-Up Materials
June 18, 2018
entergy-arkansas.com/IRP

Follow-up Materials to the 2018 IRP Stakeholder Meeting

The following information is provided as a supplement to the information presented during the June 6th Stakeholder Meeting and in response to stakeholder questions and feedback received.

Responses are grouped by category as presented and discussed during the Stakeholder Meeting.

Any additional requests for information may be sent to EAI at EAIRP@entergy.com.

2018 Integrated Resource Plan

FOLLOW-UP MATERIALS - RESPONSE SET 3

Resource Planning

- Can EAI provide details and data on the cost/benefit analysis for current DR programs and either provide a breakdown of methodology or point to all reference documents that describe this?
 - The economic evaluation of the current portfolio of programs can be found in the documents filed under Docket No. 07-085-TF, available at apscservices.info.
- How does the IRP account for meeting MISO Resource Adequacy?
 - MISO Resource Adequacy requirements are short-term in nature and change for each Planning Year. Since the objective of the IRP is a long-term assessment which looks out to 2039, EAI assumes a 12% reserve margin requirement on EAI's projected annual non-coincident peak for modeling purposes.

Resource Planning

- How does the money spent in the EE budget compare to what Entergy would have spent if they simply purchased the kWh saved by the EE programs?
 - A key component of that calculation would be the value of the LMPs had EAI not deployed the EE measures, which would require significant additional modeling to estimate. Also, the comparison of purchasing energy from the MISO market versus investing in EE does not account for the capacity benefit and the non-energy benefits provided by EE but not provided through market purchases. Taking into account the totality of the benefits and the costs, EAI's programs have shown a benefit cost ratio in excess of 1.0.
 - However, for a high-level estimate, if the approximately 265,000 MWh savings achieved in the 2017 program year were instead purchased from the market using the average hourly LMP from the most recent evaluation and a program life of 10 years is assumed, the equivalent purchases would come in just under \$100M, compared to the \$55M spent in 2017.

Resource Planning

- Please describe EAI's preferred method for evaluating carbon emission regulation and how such a position will be modeled.
 - Each of the IRP futures assumes a different CO₂ price curve which is representative of three different possible regulatory/legislative outcomes. The utilization of multiple scenarios helps EAI assess resource portfolios in light of uncertainty in input variables, such as CO₂ costs.
- Compare avoided capacity cost in EE to other dockets (like Union).
 - EAI uses the same avoided capacity cost curve for evaluation of both its EE portfolio as well as supply-side resource investments. The avoided capacity cost curve is based on the MISO auction clearing price for capacity in MISO South in the near-term and transitions to the cost of a new-build peaking resource in the long-term.

Resource Planning

- Since TRC is 1.8 why don't you ramp up and do more energy efficiency?
 - As discussed during the Stakeholder meeting, EAI's EE current programs are cost effective on average, but they are not necessarily cost effective at expanded levels. EAI has aggressively pursued capacity and energy savings through its EE programs over the last 10 years. As a result, there is significant market saturation that translates into diminishing returns for expanding programs. In addition, an increasing number of C&I customers have chosen to opt out as potential program participants, which reduces program expansion opportunities. As a direct result, the cost to acquire new customers for these programs has increased substantially. That said, EAI continually assesses new marketing approaches and offerings to manage its programs in a cost effective manner.

Resource Planning

- Will the AURORA model select a low cost energy resource if no capacity need exists?
 - No; AURORA only selects/builds resources based on capacity need. However note that DSM resources have been set up to allow selection in AURORA if deemed to be economic, regardless of capacity need because they are only available with three discrete start dates.
- What is the import capacity from SPP? How much is currently imported from SPP?
 - No import capacity from external regions (e.g. SPP) is modeled in AURORA. As a MISO Market Participant, EAI does not import capacity directly from SPP.

Resource Planning

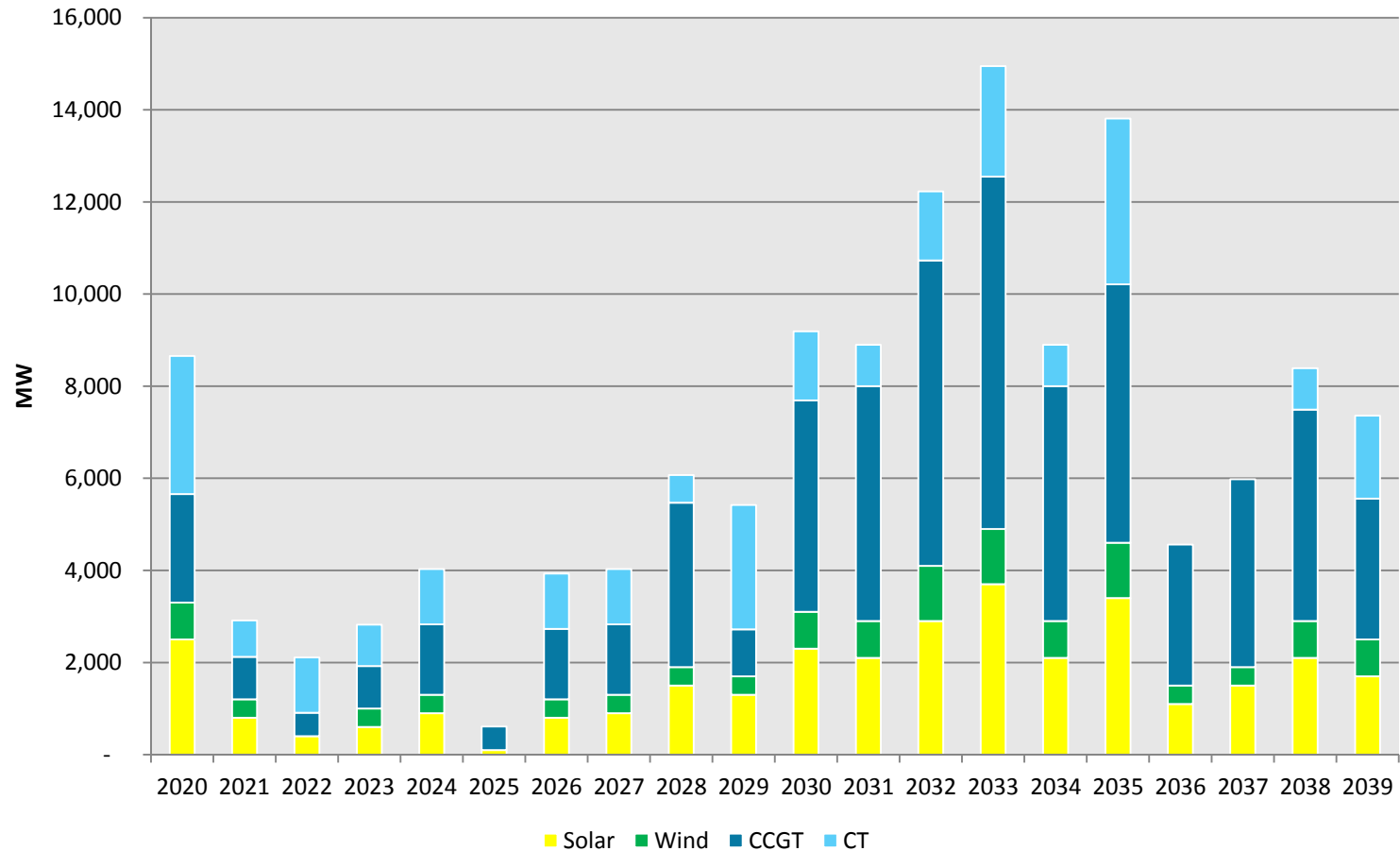
- Smart meter roll-outs should enable new opportunities for DSM participation. Are new rate design options being considered that would impact customer load profiles (ex. TOU rates) and are the impacts to potential load profile changes being accounted for within the modeling? Regardless, if these are to be considered within the modeling, only the incremental costs of any DSM add-ons should be reflected in the modeling, seeing as the smart meter investment has already been authorized.
- No specific assumptions for new rate design options are assumed in the IRP modeling; however, potential load profile changes, including reductions due to the implementation of AMI, are accounted for within each of the IRP's sales and load forecasts and are not assigned any cost in the IRP analysis.

Resource Planning

- Provide MW values of market coal/gas deactivations, and MW values of incremental market resources, including on a unit level (Slide 80).
 - Refer to the charts on the following slides:
 - Reference Future Market Additions
 - Low Future Market Additions
 - High Future Market Additions
 - Reference Future Market Deactivations
 - Low Future Market Deactivations
 - High Future Market Deactivations

Resource Planning

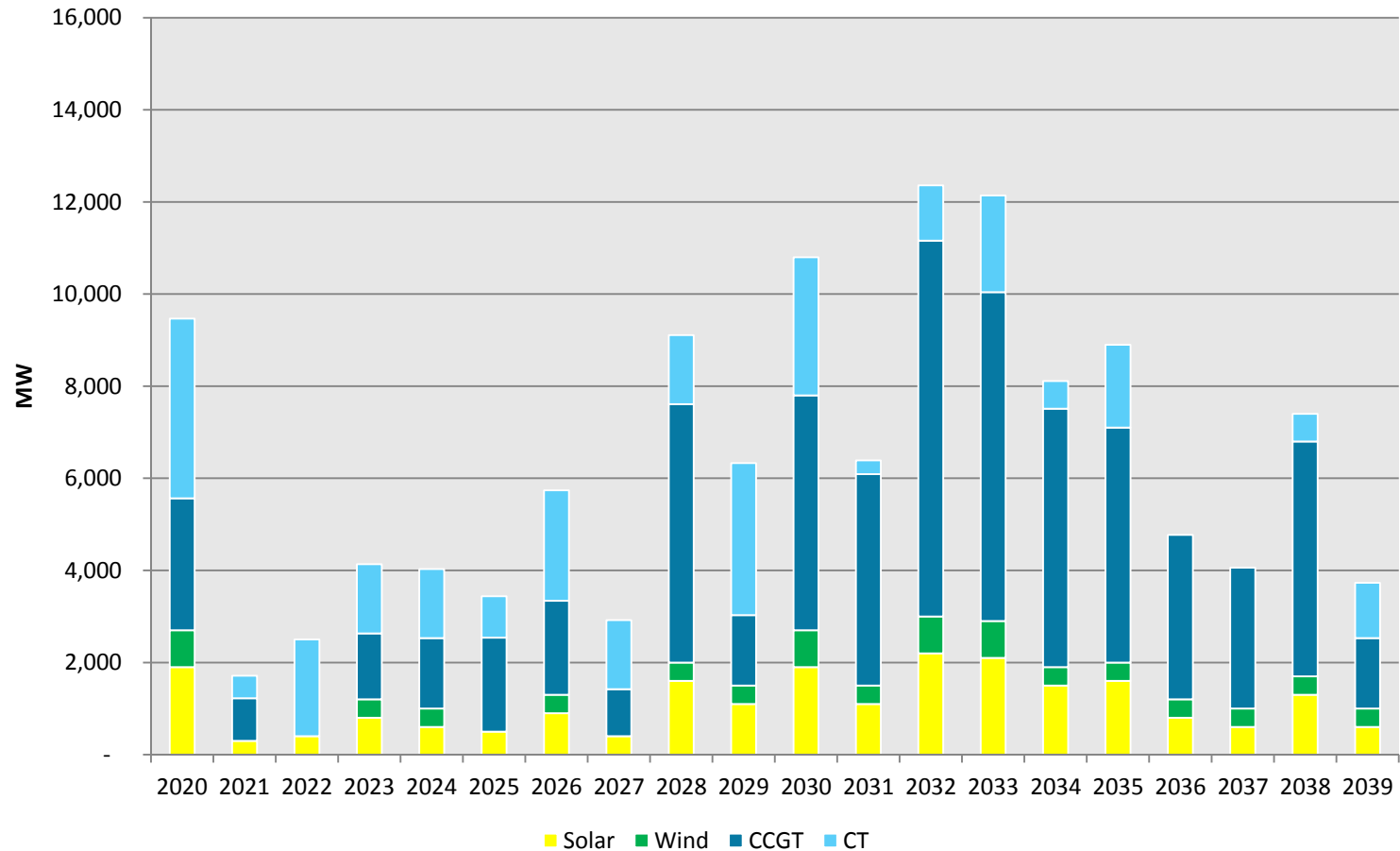
MISO Market (Non-EAI) Incremental Additions
Reference Future (60 Year Life)



Note: Solar and Wind are displayed at installed capacity.

Resource Planning

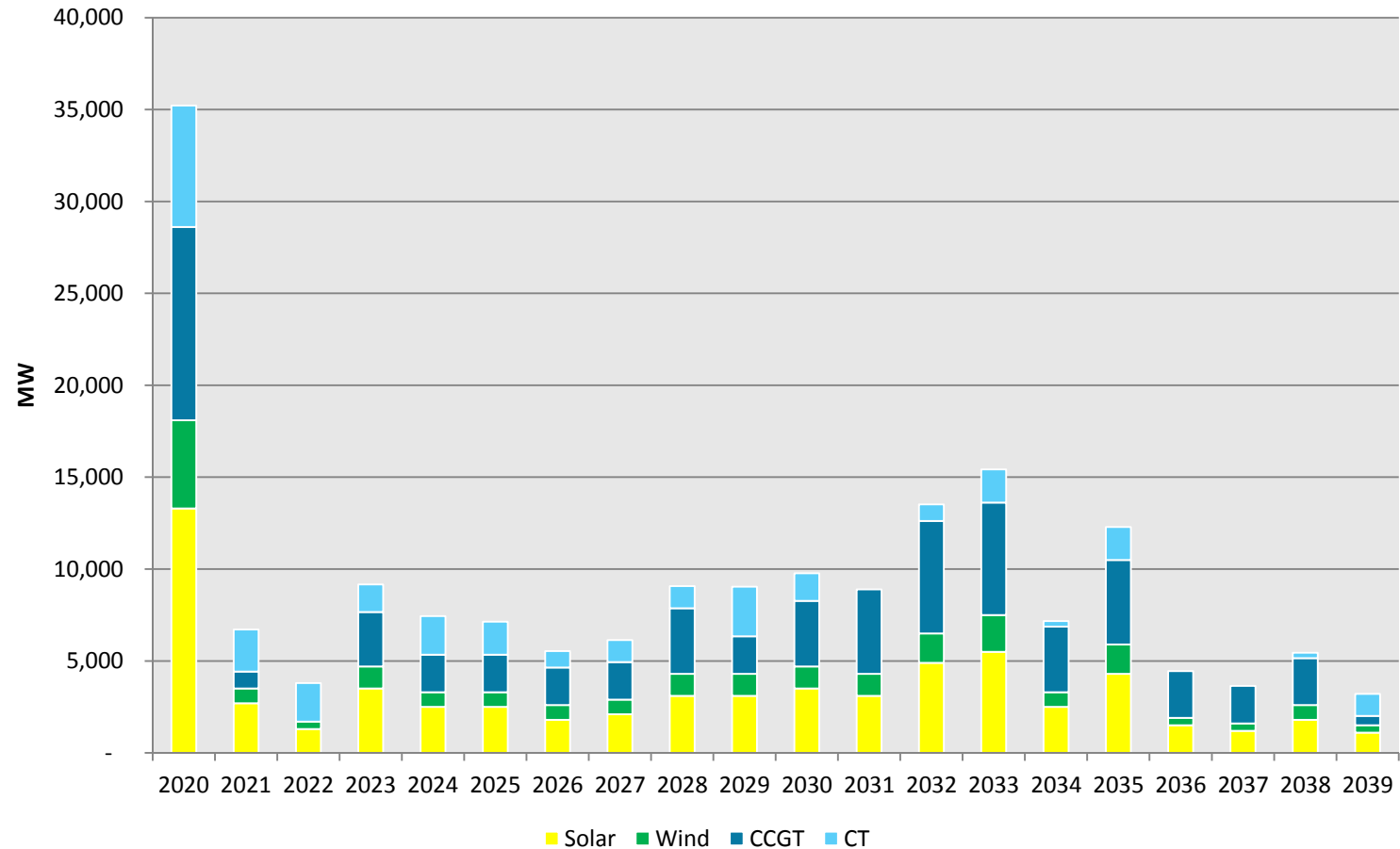
**MISO Market (Non-EAI) Incremental Additions
Low Future (55 Year Life)**



Note: Solar and Wind are displayed at installed capacity.

Resource Planning

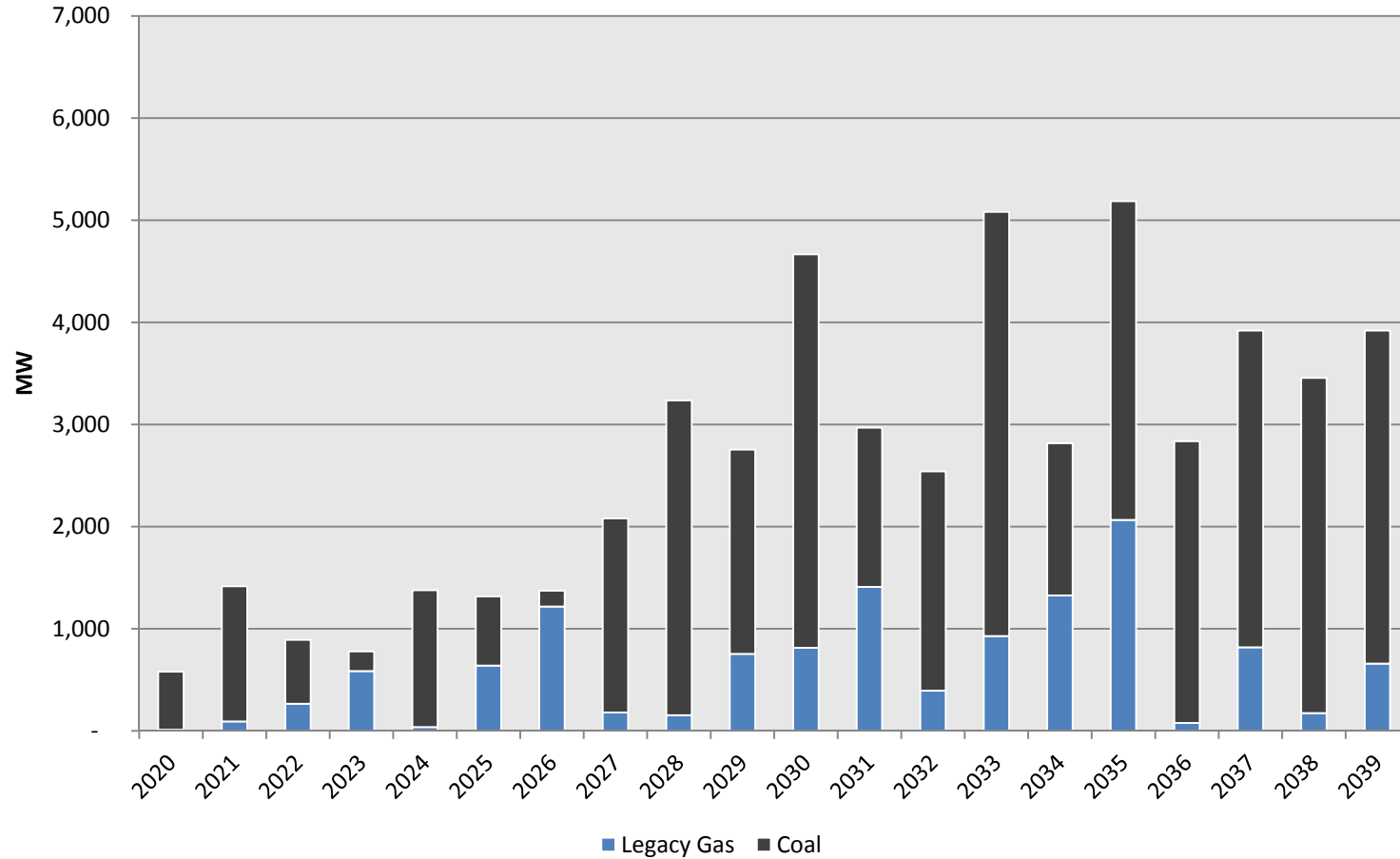
**MISO Market (Non-EAI) Incremental Additions
High Future (50 Year Life)**



Note: Solar and Wind are displayed at installed capacity.

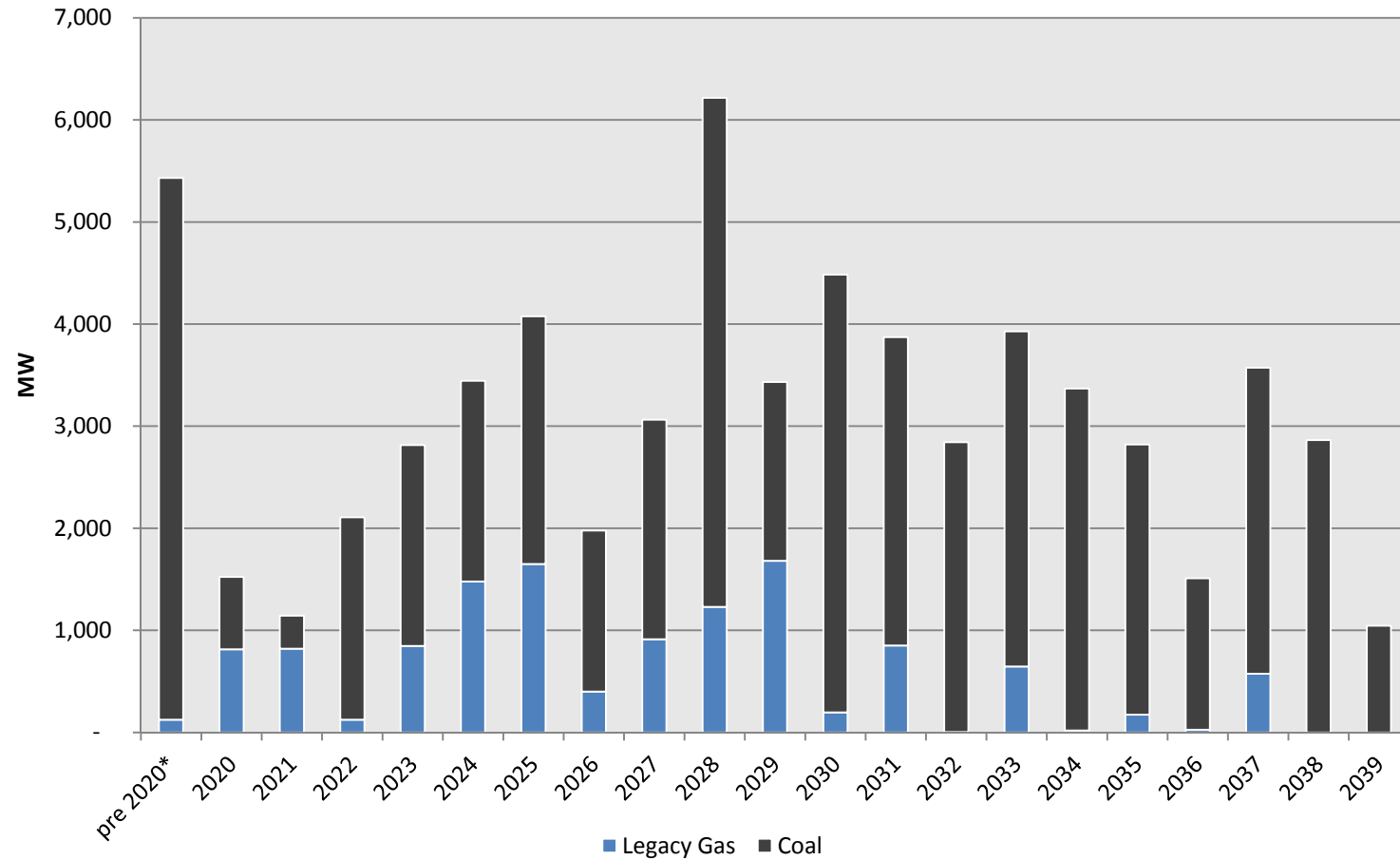
Resource Planning

MISO Market (Non-EAI) Legacy Gas and Coal Unit Deactivations
Reference Future (60 Year Life)



Resource Planning

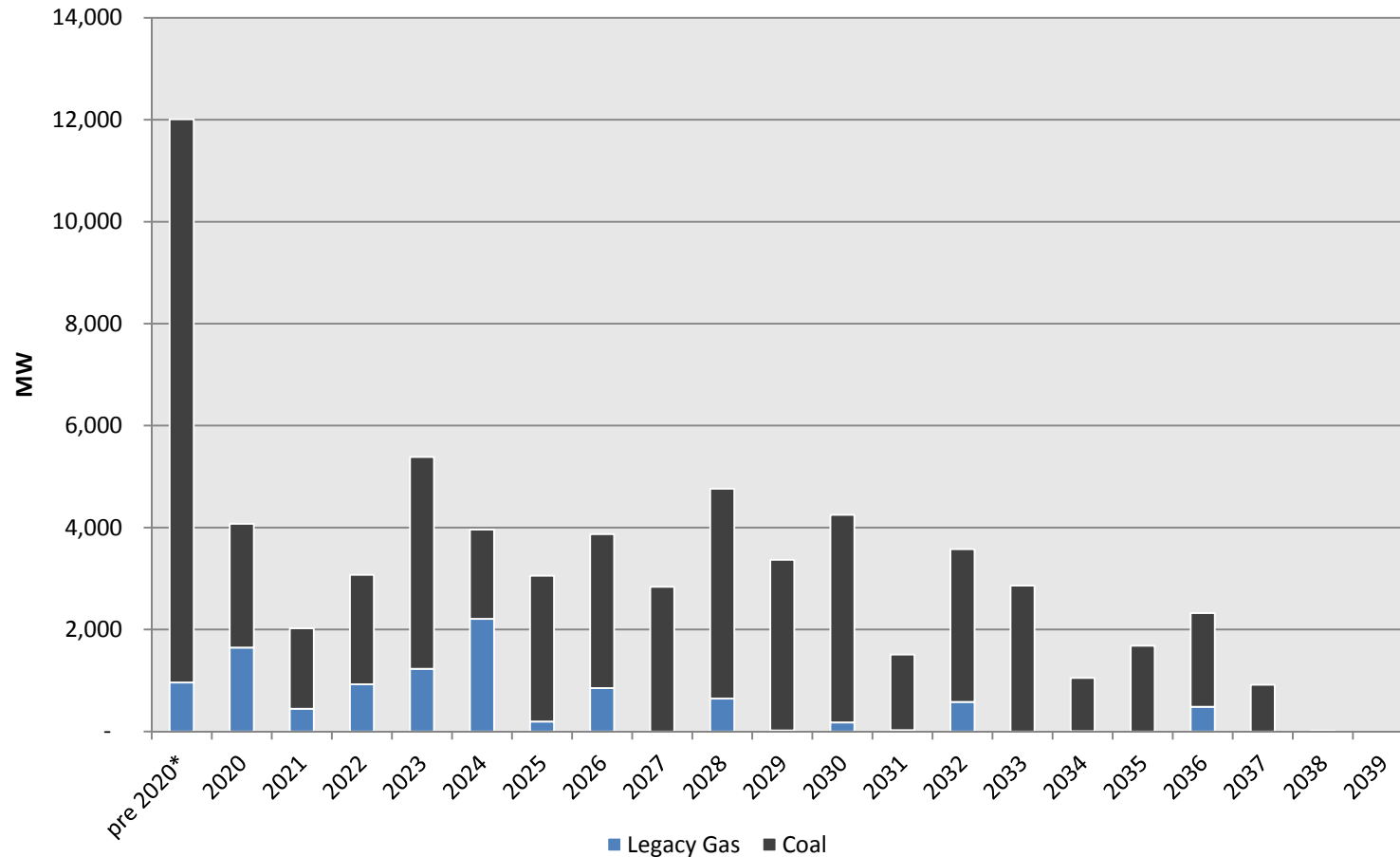
**MISO Market (Non-EAI) Legacy Gas and Coal Unit Deactivations
Low Future (55 Year Life)**



*Capacity deactivating prior to 2020 as a result of earlier deactivation assumption.

Resource Planning

**MISO Market (Non-EAI) Legacy Gas and Coal Unit Deactivations
High Future (50 Year Life)**



*Capacity deactivating prior to 2020 as a result of earlier deactivation assumption.

Resource Planning

EAI committed to providing updates to the Levelized Real Cost values for Renewables and Battery Resources on Slides 69-70 of the Stakeholder Materials from June 6th. Refer to the following two slides for these updates.

- Follow-Up Materials - Set 2, Slide 17 Update:
 - What is EAI's assumed capital cost on Slide 69?
 - Given that the data requested is vendor produced and commercially sensitive, EAI requested permission from IHS Markit and received the following response:
 - "The capital cost assumptions are based on a confidential IHS Markit forecast. The costs are assumed to be near the \$1/W-DC range and the trend reflects a steadily decreasing cost and increasing efficiency for solar panels throughout the study period (2020 – 2039)."

Slide 69 - Renewable Resource Assumptions (Solar PV & Wind)

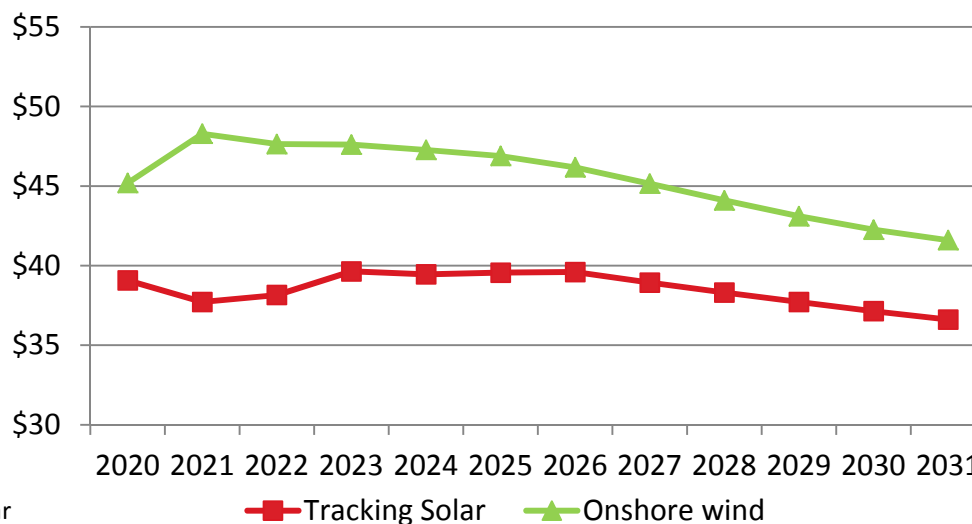
Levelized Real Cost of Electricity (2020\$/MWh-AC) ¹

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Solar Tracking ²	\$39	\$38	\$38	\$40	\$39	\$40	\$40	\$39	\$38	\$38	\$37	\$37
Onshore Wind ³	\$45	\$48	\$48	\$48	\$47	\$47	\$46	\$45	\$44	\$43	\$42	\$42

Other Modeling Assumptions

	Solar	Wind
Fixed O&M (2017\$/kW-yr-AC)	\$16	\$23.46
Useful Life (yr)	30	25
MACRS Depreciation (yr)	5	5
Capacity Factor	26%	41%
DC:AC	1.35	N/A
Hourly Profile Modeling Software	PlantPredict	NREL SAM

Levelized Real Cost of Electricity (2020\$/MWh) ¹



1. Year 1 levelized real cost for a project beginning in the given year
2. ITC normalized over useful life and steps down to 10% by 2023
3. PTC steps down to 40% by 2020 and expires thereafter

Slide 70 - Battery Storage Assumptions

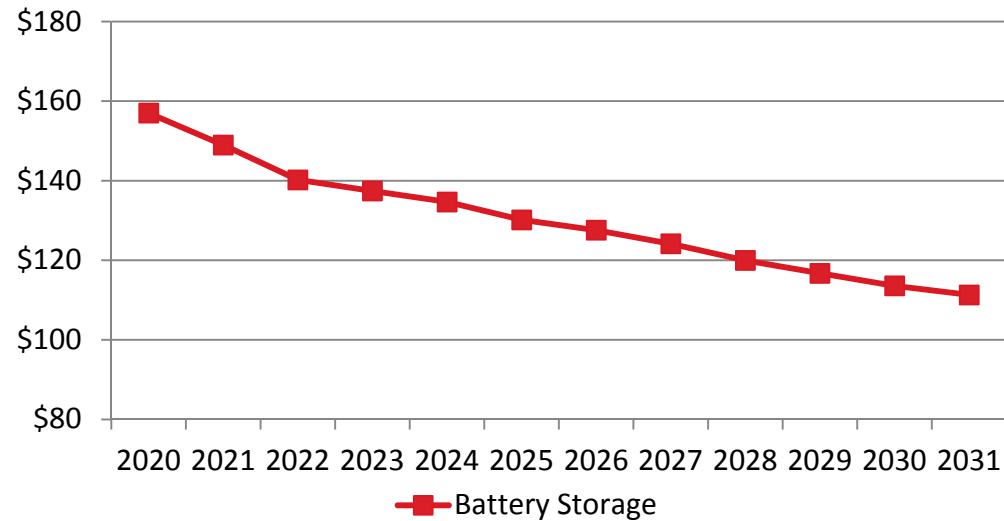
Levelized Real Fixed Cost (2020\$/kW-yr) ¹

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Battery Storage	\$157	\$149	\$140	\$137	\$135	\$130	\$128	\$124	\$120	\$117	\$114	\$111

Other Modeling Assumptions

	Battery Storage
Energy Capacity : Power ²	4:1
Fixed O&M (2017\$/kW-yr)	\$9.00
Useful Life (yr) ³	10
MACRS Depreciation (yr)	7
AC-AC efficiency	90%
Hourly Profile Modeling Software	Aurora

Levelized Real Fixed Cost (2020\$/kW-yr) ¹



1. Year 1 levelized real cost for a project beginning in the given year
2. Current MISO Tariff requirement for capacity credit
3. Assumes daily cycling, no module replacement cost, full depth of discharge