



KENTUCKY MUNICIPAL ENERGY AGENCY

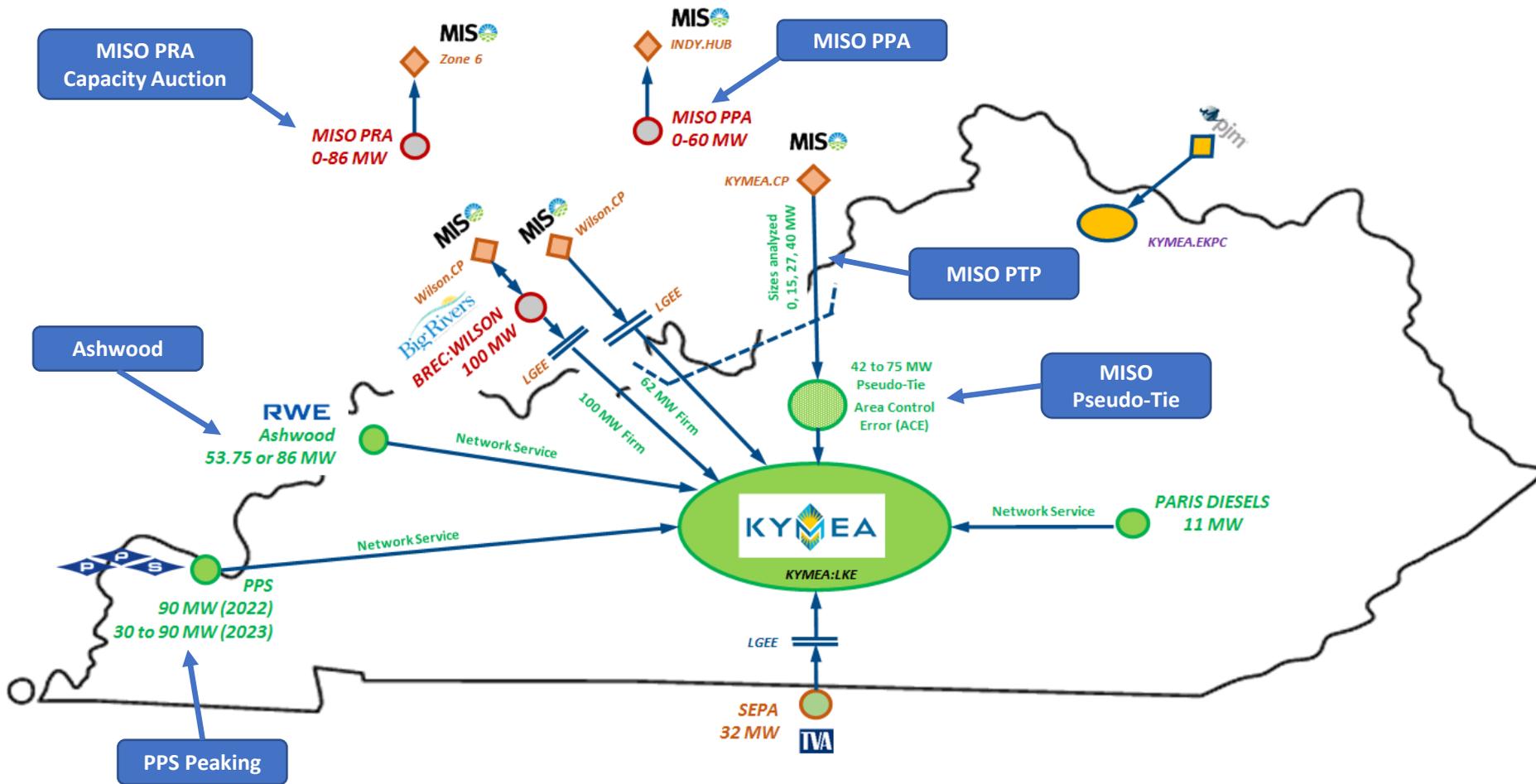


# KYMEA Short-Term Action Plan Discussion

December 16, 2020

1. **Six (6) Short-Term Decision Elements**
  - a) **PPS Peaking Capacity (30 to 90 MW)**
  - b) **Ashwood Solar Size (53.75 or 86 MW)**
  - c) **MISO PPA (0 to 60 MW) / MISO PRA (0 to 85 MW)**
  - d) **MISO Point-to-Point Transmission / Pseudo-Tie**
    - i. **MISO point-to-point transmission options for each plan (15 or 40 MW)**
    - ii. **Plan B has three PTP options (0, 15, or 40 MW)**
    - iii. **Pseudo-tie Ashwood 54 MW: 42 MW pseudo-tie (+/- 2 stdev)**
    - iv. **Pseudo-tie Ashwood 86 MW: 67 MW pseudo-tie (+/- 2 stdev)**
2. **Eleven (11) Short-Term Plans**
  - a) **Each plan is a combination of the six decision elements**
3. **Plan Selection: Decision Criteria**
  - a) **Expected Cost**
  - b) **Market Exposure**
    - i. **Low Market Opportunity**
    - ii. **High Market Price Risk**
  - c) **Operating Risk**
    - i. **Seasonal (Summer/Winter)**
    - ii. **Time of Day**
4. **Plan Recommendation**

# Six Short-Term Decision Elements



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# Eleven Short-Term Plans

	Firm Capacity and Reserve Margin					MISO PRA, MISO Point-to-Point Transmission, Operating Reserves					Levelized Cost millions \$ (6/2019 - 5/2027)			Levelized Cost ¢ per kWh (6/2019 - 5/2027)		
	Firm Capacity	PPS Peaking	Ashwood Solar	MISO PPA	Reserve Margin	MISO PRA	Pseudo Tie	MISO PTP	Operating Margin	N-1 OP Margin	Low Market	Base Market	High Market	Low Market	Base Market	High Market
Plan A	159	30	54	0	-17.4%	86 15.3%	75 (42 min)	185 (27) 202 (40)	1.8% 12.0%	-10.4% -0.2%	64.933 66.044	70.391 71.499	73.188 74.294	5.019 5.105	5.441 5.526	5.657 5.742
Plan B	159	90	54	0	5.5%	48 23.7%	42 (42 min)	177 (0) 177 (15) 202 (40)	20.1% 26.2% 36.4%	-16.5% -10.4% -0.2%	64.913 65.603 67.275	69.945 70.626 72.295	71.969 72.641 74.308	5.017 5.070 5.200	5.406 5.459 5.588	5.562 5.614 5.743
Plan C	159	30	54	60	5.5%	26 15.3%	74 (42 min)	177 (15) 202 (40)	1.8% 12.0%	-10.4% -0.2%	66.474 68.147	70.103 71.770	70.881 72.545	5.138 5.267	5.418 5.547	5.478 5.607
Plan D	159	45	54	45	5.5%	26 15.3%	62 (42 min)	177 (15) 202 (40)	7.9% 18.1%	-10.4% -0.2%	66.280 67.953	70.173 71.840	71.154 72.819	5.123 5.252	5.424 5.553	5.499 5.628
Plan E	159	60	54	30	5.5%	26 15.3%	49 (42 min)	177 (15) 202 (40)	14.0% 24.2%	-10.4% -0.2%	66.081 67.754	70.245 71.914	71.431 73.096	5.107 5.237	5.429 5.558	5.521 5.650
Plan F	159	30	86	0	-11.3%	77 17.9%	67 (67 Min)	177 (15) 202 (40)	1.8% 12.0%	-10.4% -0.2%	64.576 66.249	69.603 71.270	72.010 73.676	4.991 5.120	5.380 5.508	5.566 5.694
Plan G	159	75	86	0	5.9%	77 35.1%	67 (67 min)	177 (15) 202 (40)	20.1% 30.3%	-10.4% -0.2%	65.641 67.314	70.620 72.289	72.861 74.528	5.073 5.203	5.458 5.587	5.631 5.760
Plan H	159	30	86	45	5.9%	32 17.9%	67 (67 min)	177 (15) 202 (40)	1.8% 12.0%	-10.4% -0.2%	66.203 67.875	69.830 71.499	70.701 72.368	5.117 5.246	5.397 5.526	5.464 5.593
Plan I	159	45	86	30	5.9%	47 23.7%	67 (67 min)	177 (15) 202 (40)	7.9% 18.1%	-10.4% -0.2%	66.078 67.750	70.123 71.791	71.420 73.086	5.107 5.236	5.420 5.549	5.520 5.649
Plan J	159	40	86	60	15.5%	17 21.8%	67 (67 min)	177 (15) 202 (40)	5.9% 16.1%	-10.4% -0.2%	66.915 68.588	70.105 71.774	70.460 72.125	5.172 5.301	5.418 5.547	5.446 5.575
Plan K	159	60	86	30	11.7%	47 29.4%	67 (67 min)	177 (15) 202 (40)	14.0% 24.2%	-10.4% -0.2%	66.433 68.106	70.463 72.131	71.704 73.370	5.135 5.264	5.446 5.575	5.542 5.671

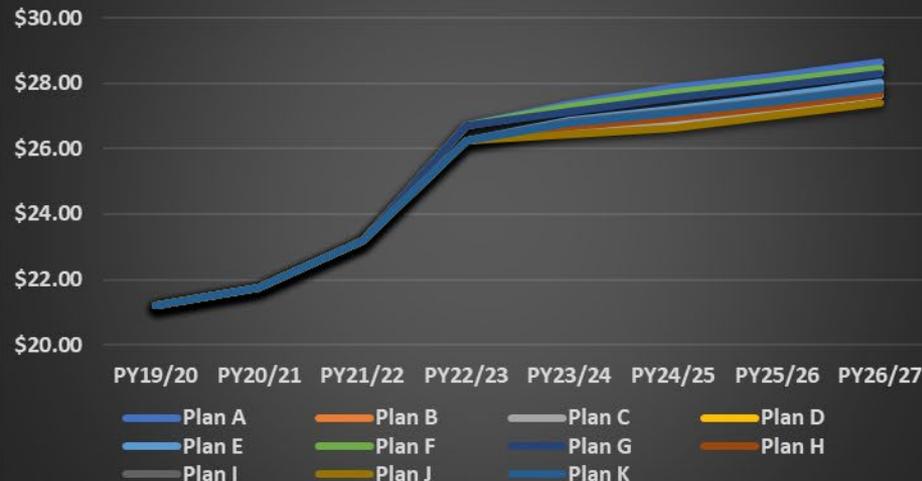
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# Base Market Results

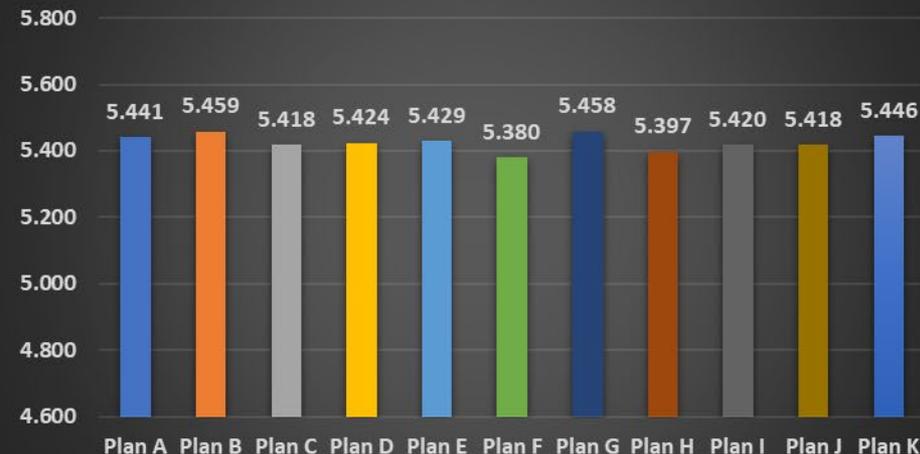
### Average Production Cost (¢ per kWh)



### Native Load Energy Cost (\$ per MWh)



### PY 19/27 Levelized Ave Cost (¢ per kWh)



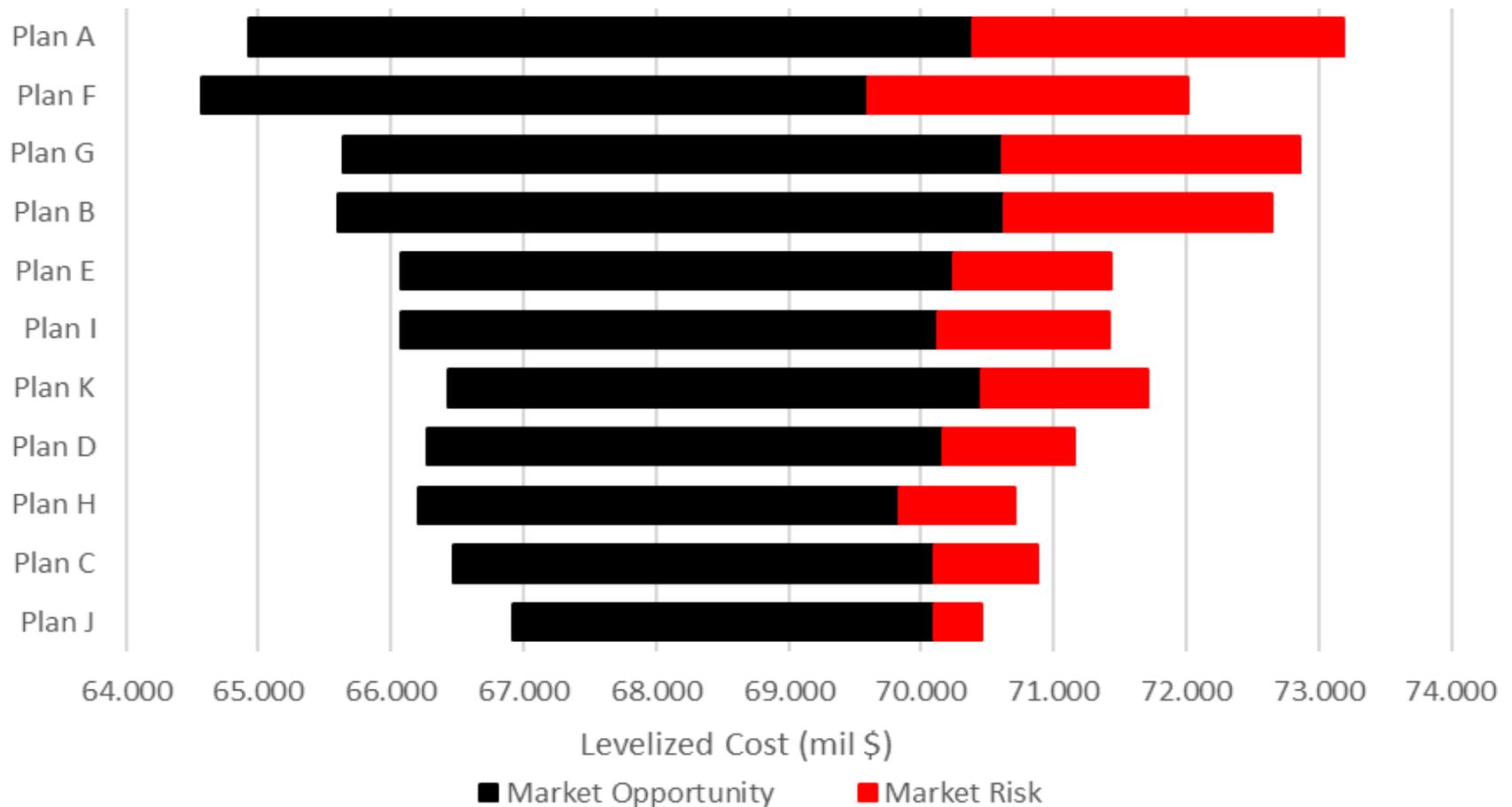
### Production Fixed (\$ per kW-MO)



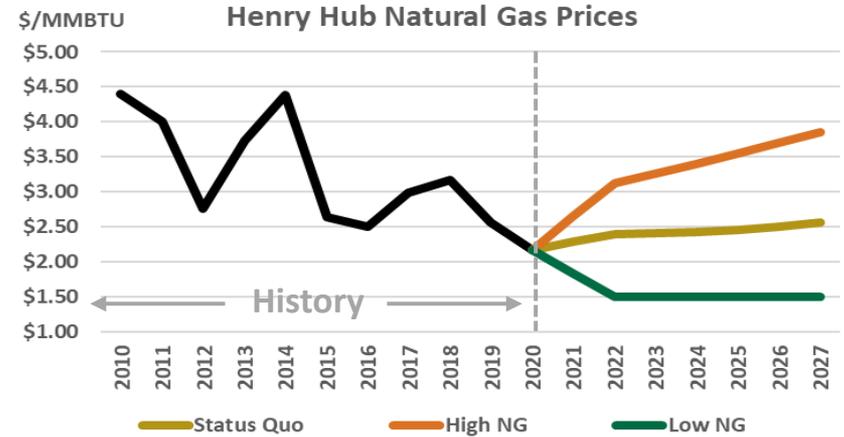
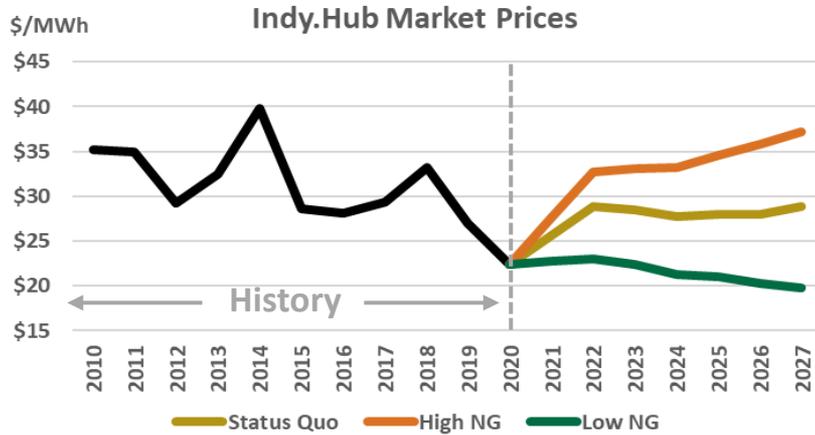
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# Expected Value and Market Risk

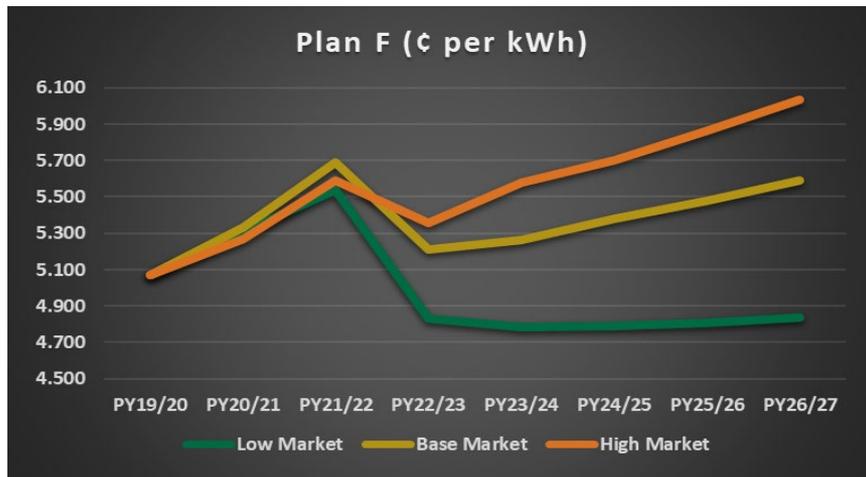
## Plan(s) Expected Value and Market Risk



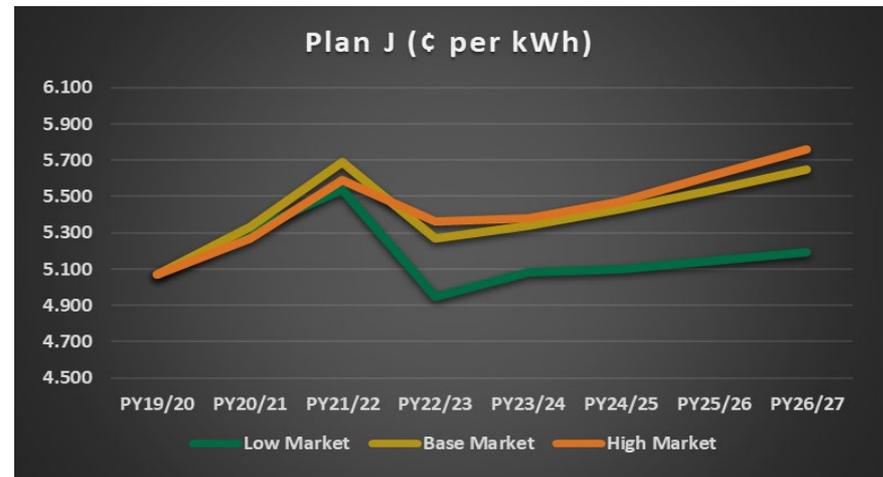
# Market Uncertainty



## Lowest Expected Value Plan



## Lowest Risk Plan

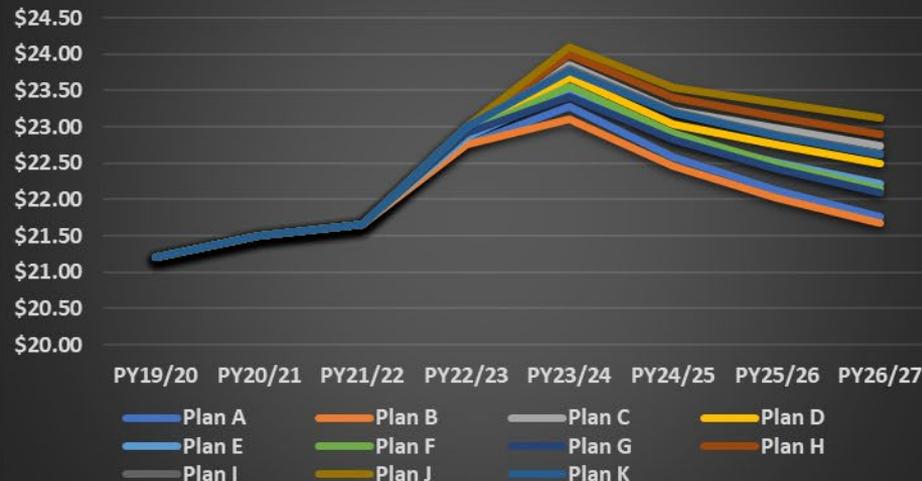


# Low Market Results

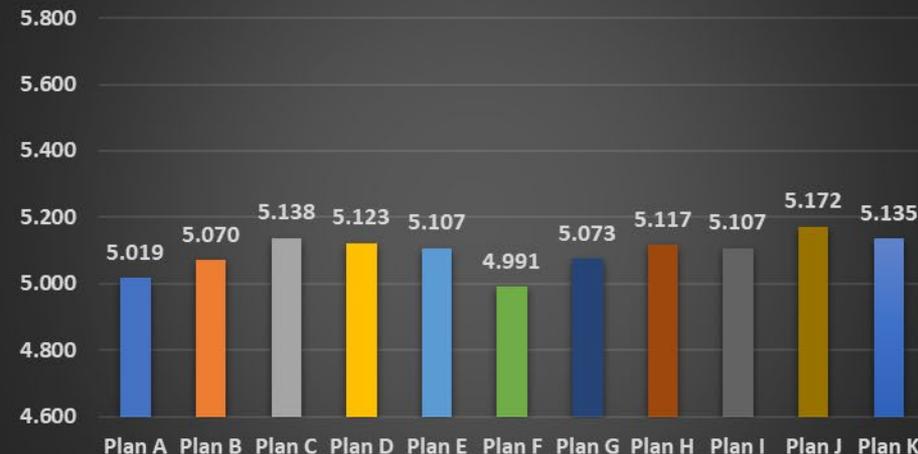
### Average Production Cost (¢ per kWh)



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### PY 19/27 Levelized Ave Cost (¢ per kWh)



### Production Fixed (\$ per kW-MO)

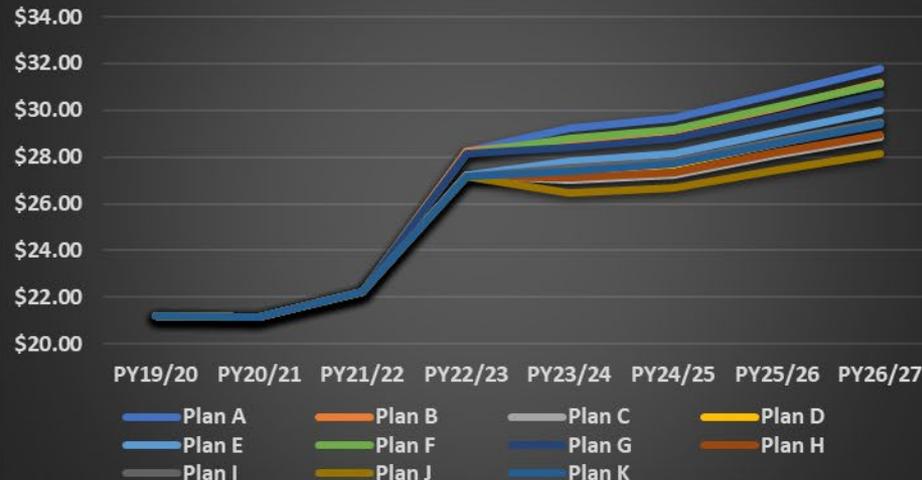


# High Market Results

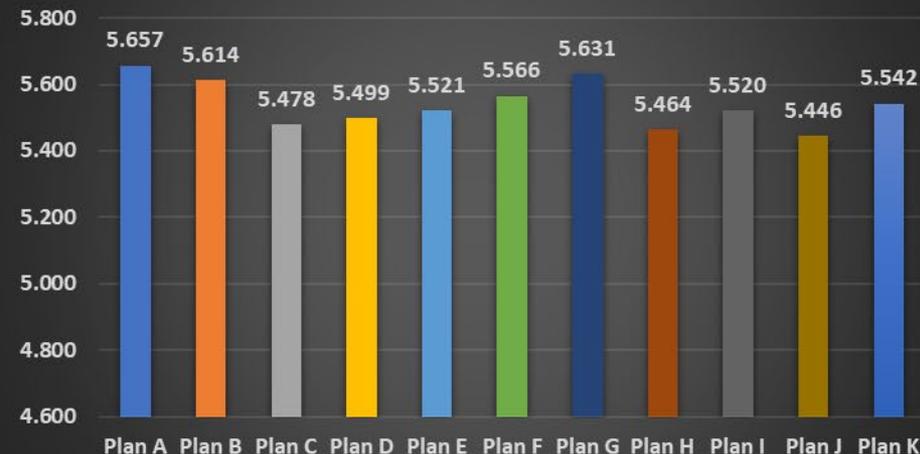
### Average Production Cost (¢ per kWh)



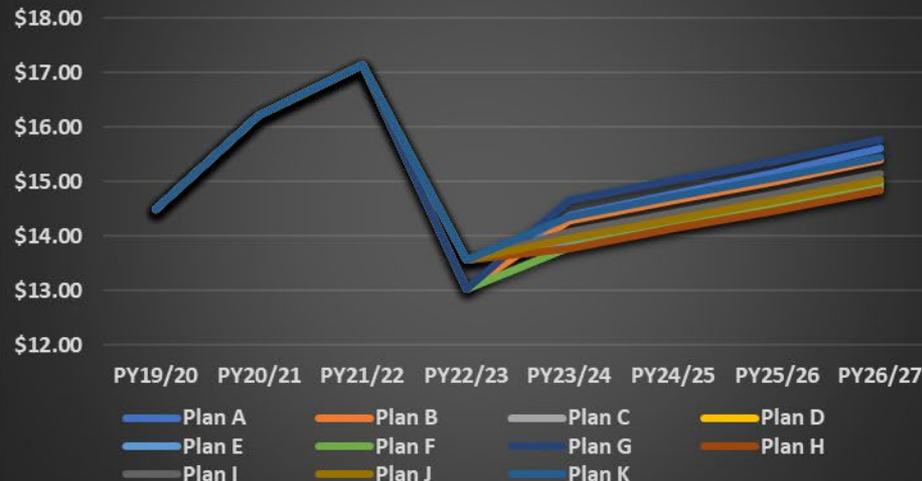
### Native Load Energy Cost (\$ per MWh)



### PY 19/27 Levelized Ave Cost (¢ per kWh)



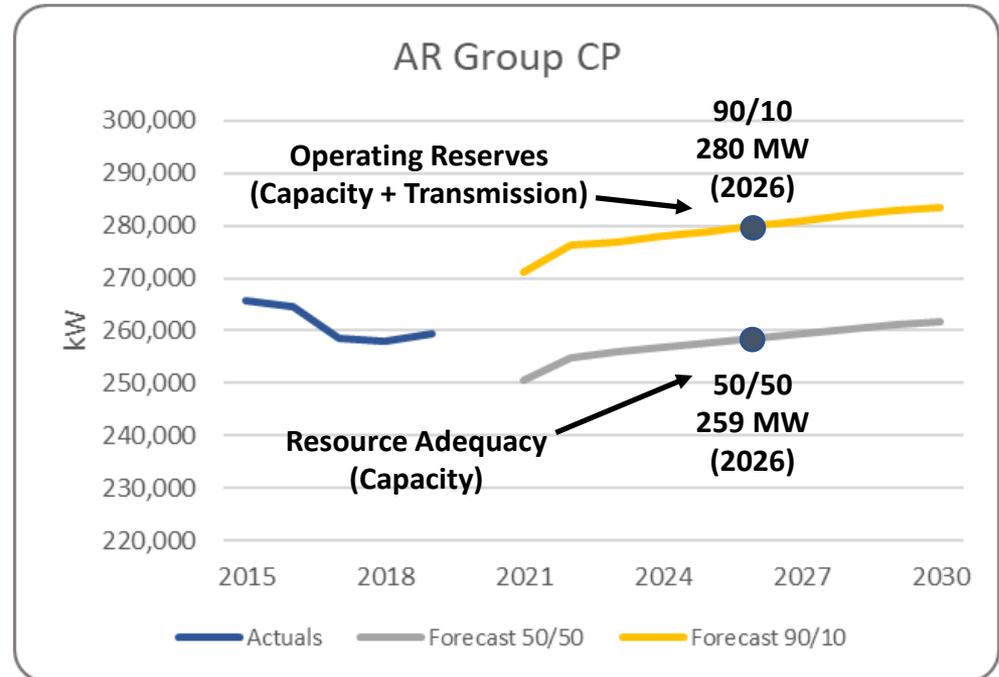
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# Load Forecast(s)

- The Forecast 50/50 is used for the fuel and purchase power budget, to establish wholesale rates, for hedging, etc.
- The Forecast 50/50 budget is also used when determining the amount of steel-in-the-ground and PRA capacity to maintain the target 15% reserve margin.
- The Forecast 90/10 is used for 1-in-10 contingency planning to determine the appropriate amount of power supply and transmission to serve load under extreme conditions with an N-1 contingency.



# Operating Reserve

	Firm Capacity + PRA and Reserve Margin (Planning Year 2026/2027)					90/10 Peak		Operating Reserve All Units Available			Operating Reserve PPS FO, Ashwood 20% Derate		
	50/50 Peak	Capacity	PRA	Capacity + PRA	Reserve Margin	Summer	Winter	Summer Daylight	Summer Evening	Winter	Summer Daylight	Summer Evening	Winter
Plan A	262	216	86	302	15.4%	280	246	8.4%	25.4%	1.8%	-6.1%	8.6%	-10.4%
Plan B	262	276	48	324	23.8%	280	246	29.8%	50.1%	26.2%	-6.1%	8.6%	-10.4%
Plan C	262	276	26	302	15.4%	280	246	8.4%	25.4%	1.8%	-6.1%	8.6%	-10.4%
Plan D	262	276	26	302	15.4%	280	246	13.8%	31.6%	7.9%	-6.1%	8.6%	-10.4%
Plan E	262	276	26	302	15.4%	280	246	19.1%	37.8%	14.0%	-6.1%	8.6%	-10.4%
Plan F	262	232	77	309	18.1%	280	246	19.9%	38.7%	1.8%	3.1%	19.2%	-10.4%
Plan G	262	277	77	354	35.3%	280	246	36.0%	57.2%	20.1%	3.1%	19.2%	-10.4%
Plan H	262	277	32	309	18.1%	280	246	19.9%	38.7%	1.8%	3.1%	19.2%	-10.4%
Plan I	262	277	47	324	23.9%	280	246	25.3%	44.9%	7.9%	3.1%	19.2%	-10.4%
Plan J	262	302	17	319	22.0%	280	246	23.5%	42.8%	5.9%	3.1%	19.2%	-10.4%
Plan K	262	292	47	339	29.6%	280	246	30.6%	51.1%	14.0%	3.1%	19.2%	-10.4%

*Last 10-Year Extremes (Summer 2012) 285 258 (Winter 2014)*

# AGENDA

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# Ashwood Decision

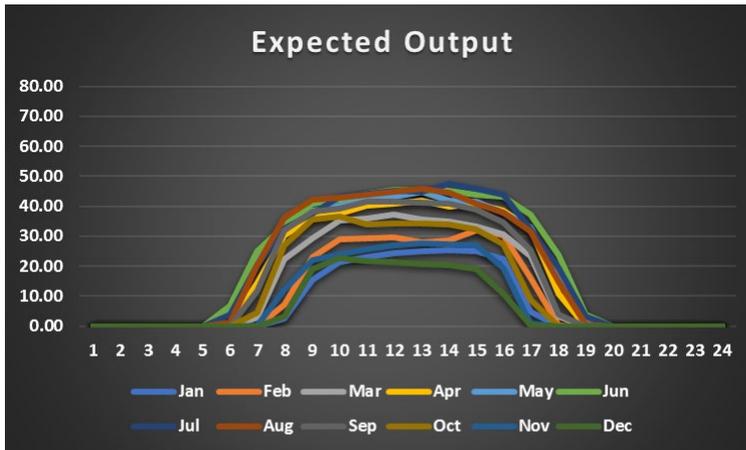
Ashwood Solar: Ashwood is scheduled to come on-line December 1, 2022. KYMEA's share is 53.75 MW.

1. OMU Ashwood Termination: Due to depancaking uncertainty, OMU terminated their 32.35 MW share of Ashwood on December 10, 2020.
2. The KYMEA Board has the unilateral right of first refusal (RoFR) to take the additional 32.25 MW to be decided in a 30-day window. Assumed RoFR window: December 10, 2020 thru January 9, 2021.
3. If KYMEA Board does not exercise its RoFR, RWE (seller) has the right to remarket the 32.25 MW.
4. If RWE is unsuccessful in remarketing "all or a portion of the 32.25 MW, then RWE will notify KYMEA between May 31, 2021 and November 30, 2021 as to the amount remarketed. KYMEA has a 30-day option after receipt of the notification to commit to purchase the unremarketed portion."
5. If KYMEA Board does not take the 32.25 MW, the Ashwood final site size will be 53.75 MW.

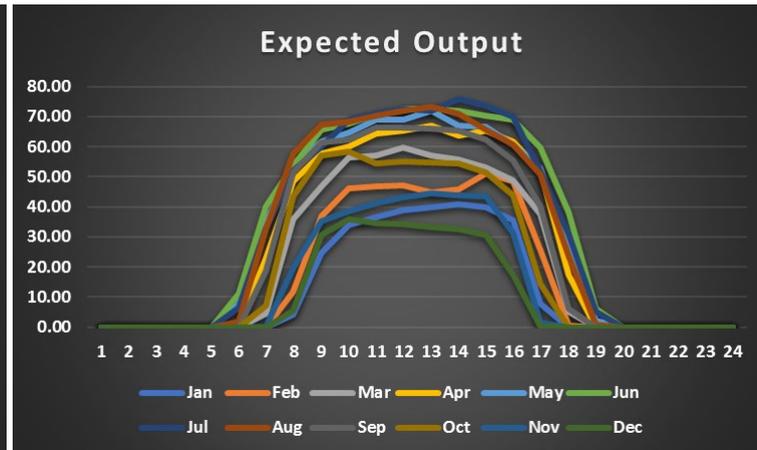
# Ashwood Intermittency

Staff is currently studying the intermittency of solar generation and the agency's ability to maintain an area control error (ACE) of zero (balance of load and resources).

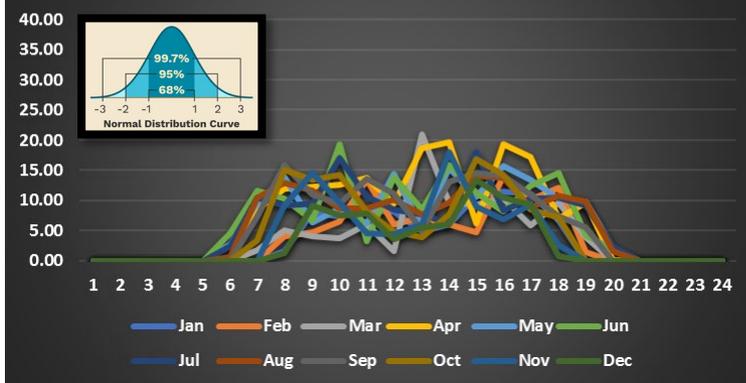
Ashwood at 53.75 MW



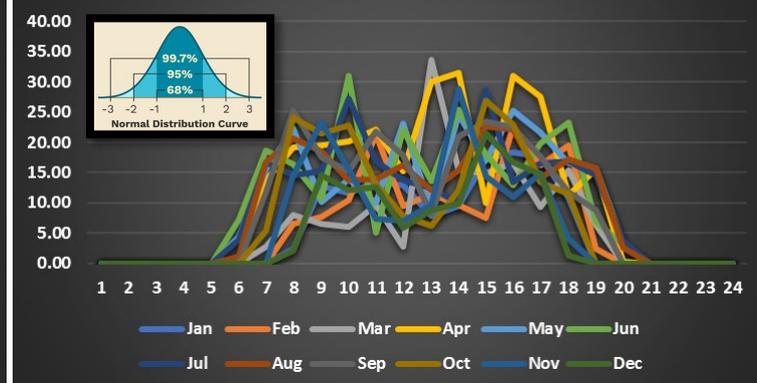
Ashwood at 86 MW



Two Standard Deviations



Two Standard Deviations



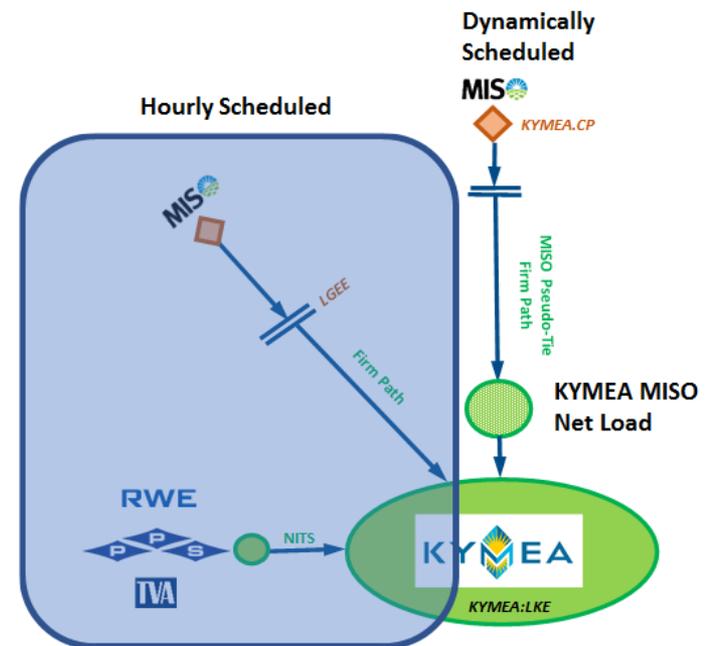
# MISO Pseudo-Tie

## Overview

1. The MISO pseudo-tie provides dynamic real-time scheduling which occurs  $\approx 4$  seconds.
2. The “KYMEA MISO net load” is dynamically scheduled.
3. KYMEA is required to provide ZRCs in the voluntary MISO PRA, or KYMEA could choose to self supply via a Fixed Resource Adequacy Plan (FRAP).

## Process

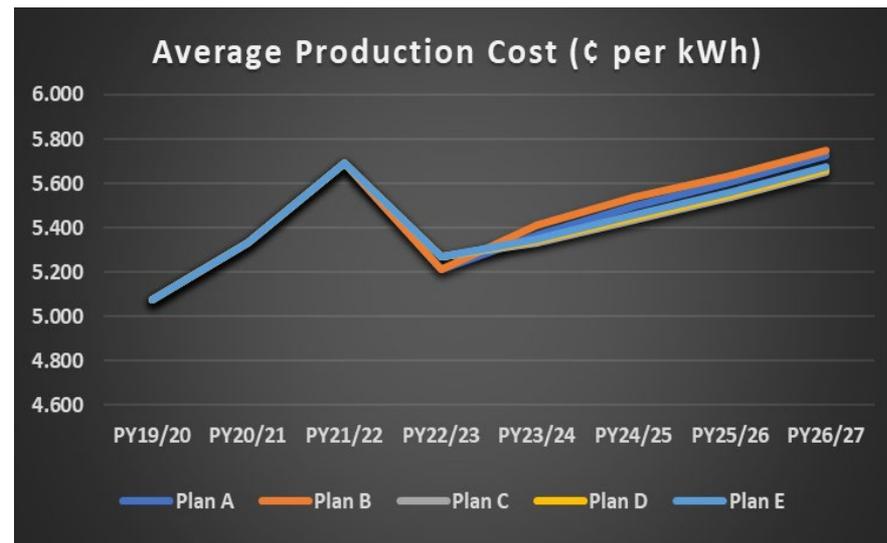
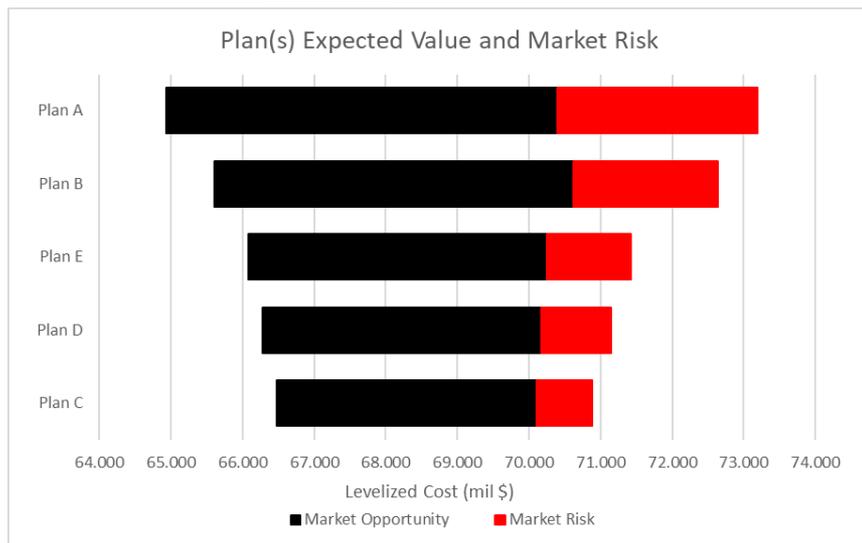
- OATIWeb provides the e-tag information to the KYMEA PME server.
- The 4 second KYMEA MISO Net Load is communicated to MISO.
- The dynamic scheduling is one-way (load only), so KYMEA will schedule hourly “short” of the KYMEA load and the MISO dynamic scheduling will make-up the shortfall.
- The market price is the real-time price at a newly created KYMEA.CP Node.



1. Given KYMEA has not been able to fully investigate and analyze the ability to pseudo-tie a portion of its LG&E/KU net load to MISO, staff recommends the Board not exercise its right to the additional 32.25 MW during the ROFR period.
2. KYMEA is dependent on other entities (OATI, MISO, LG&E/KU, and TVA); plus, must address hardware, software, and communications issues to make the pseudo-tie a reality.
3. Depending RWE's remarketing efforts, the KYMEA Board will have an opportunity to take the unremarketed portion of Ashwood (0 to 32.25 MW) at some point in 2021.
4. The recommendation to wait will provide the KYMEA staff more time to continue its analysis and feasibility of the MISO pseudo-tie. Staff will provide more information to the Board as it is known.

# Six 54 MW Short-Term Plans

	Firm Capacity and Reserve Margin					MISO PRA, MISO Point-to-Point Transmission, Operating Reserves					Levelized Cost millions \$ (6/2019 - 5/2027)			Levelized Cost ¢ per kWh (6/2019 - 5/2027)		
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								202 (40)	36.4%	-0.2%	67.275	72.295	74.308	5.200	5.588	5.743
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								202 (40)	24.2%	-0.2%	67.754	71.914	73.096	5.237	5.558	5.650



# PPS Peaking/PTP Decisions

1. PPS Peaking Capacity: KYMEA has the option to nominate down its take of the PPS peaking capacity from 90 MW to as low as 30 MW beginning on June 1, 2023.
  2. PPS Peaking considerations
    - a) Over reliance on the PPS Peakers poses a risk of too much exposure to a single generating station.
    - b) Under reliance on the PPS Peakers poses a risk of too little generation inside the LG&E/KU control area where the KYMEA load resides.
- 
3. Additional MISO Point-to-Point (PTP) transmission (15 or 40 MW)
  4. MISO PTP considerations
    - a) Too little MISO PTP produces an over reliance on the PPS Peakers where the runtime hours operationally (staffing and unit stress) and environmentally (air permits limits) become a concern.
    - b) Further, too little MISO PTP could hinder KYMEA's ability to serve load under extreme weather conditions.
    - c) Conversely, too much MISO PTP is an expensive insurance policy.

# Operating Reserve

## 15 MW MISO PTP

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Plan E	262	276	26	302	15.4%	280	246	19.1%	37.8%	14.0%	-6.1%	8.6%	-10.4%

## 40 MW MISO PTP

	Firm Capacity + PRA and Reserve Margin (Planning Year 2026/2027)					90/10 Peak		Operating Reserve All Units Available			Operating Reserve PPS FO, Ashwood 20% Derate		
	50/50 Peak	Capacity	PRA	Capacity + PRA	Reserve Margin	Summer	Winter	Summer Daylight	Summer Evening	Winter	Summer Daylight	Summer Evening	Winter
Plan A	262	216	86	302	15.4%	280	246	17.3%	35.7%	12.0%	2.8%	18.9%	-0.2%
Plan B	262	276	48	324	23.8%	280	246	38.7%	60.4%	36.4%	2.8%	18.9%	-0.2%
Plan C	262	276	26	302	15.4%	280	246	17.3%	35.7%	12.0%	2.8%	18.9%	-0.2%
Plan D	262	276	26	302	15.4%	280	246	22.7%	41.9%	18.1%	2.8%	18.9%	-0.2%
Plan E	262	276	26	302	15.4%	280	246	28.0%	48.1%	24.2%	2.8%	18.9%	-0.2%

# Staff Recommendation – Plan E

1. To balance cost and risk, staff recommends the Board reduce the PPS peaking capacity down to 60 MW coupled with an additional 15 MW of MISO PTP transmission. **PLAN E**
2. Need for additional MISO PTP in the future
  - a) Staff will continually assess the availability of the PPS peaking units and natural gas fuel supply to determine if addition MISO PTP is necessary.
  - b) Further, staff will assess the need for additional MISO PTP when the KYMEA 10-year load forecast is updated annually.

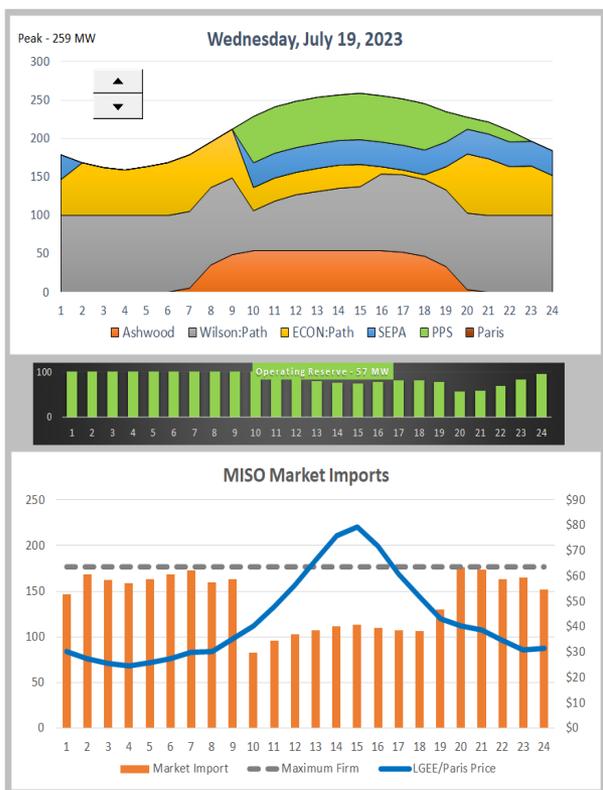
	Firm Capacity and Reserve Margin					MISO PRA, MISO Point-to-Point Transmission, Operating Reserves					Levelized Cost millions \$ (6/2019 - 5/2027)			Levelized Cost ¢ per kWh (6/2019 - 5/2027)		
	Firm Capacity	PPS Peaking	Ashwood Solar	MISO PPA	Reserve Margin	MISO PRA	Pseudo Tie	MISO PTP	Operating Margin	N-1 OP Margin	Low Market	Base Market	High Market	Low Market	Base Market	High Market
Plan A	159	30	54	0	-17.4%	86 15.3%	75 (42 min)	185 (27) 202 (40)	1.8% 12.0%	-10.4% -0.2%	64.933 66.044	70.391 71.499	73.188 74.294	5.019 5.105	5.441 5.526	5.657 5.742
Plan B	159	90	54	0	5.5%	48 23.7%	42 (42 min)	177 (0) 177 (15) 202 (40)	20.1% 26.2% 36.4%	-16.5% -10.4% -0.2%	64.913 65.603 67.275	69.945 70.626 72.295	71.969 72.641 74.308	5.017 5.070 5.200	5.406 5.459 5.588	5.562 5.614 5.743
Plan C	159	30	54	60	5.5%	26 15.3%	74 (42 min)	177 (15) 202 (40)	1.8% 12.0%	-10.4% -0.2%	66.474 68.147	70.103 71.770	70.881 72.545	5.138 5.267	5.418 5.547	5.478 5.607
Plan D	159	45	54	45	5.5%	26 15.3%	62 (42 min)	177 (15) 202 (40)	7.9% 18.1%	-10.4% -0.2%	66.280 67.953	70.173 71.840	71.154 72.819	5.123 5.252	5.424 5.553	5.499 5.628
Plan E	159	60	54	30	5.5%	26 15.3%	49 (42 min)	177 (15) 202 (40)	14.0% 24.2%	-10.4% -0.2%	66.081 67.754	70.245 71.914	71.431 73.096	5.107 5.237	5.429 5.558	5.521 5.650

# Plan E (PPS 60, Ashwood 54, PTP 15) 23/24 Summer Operating Reserves

**Operating Reserves: 57 MW**

**50/50 Peak Summer Day**

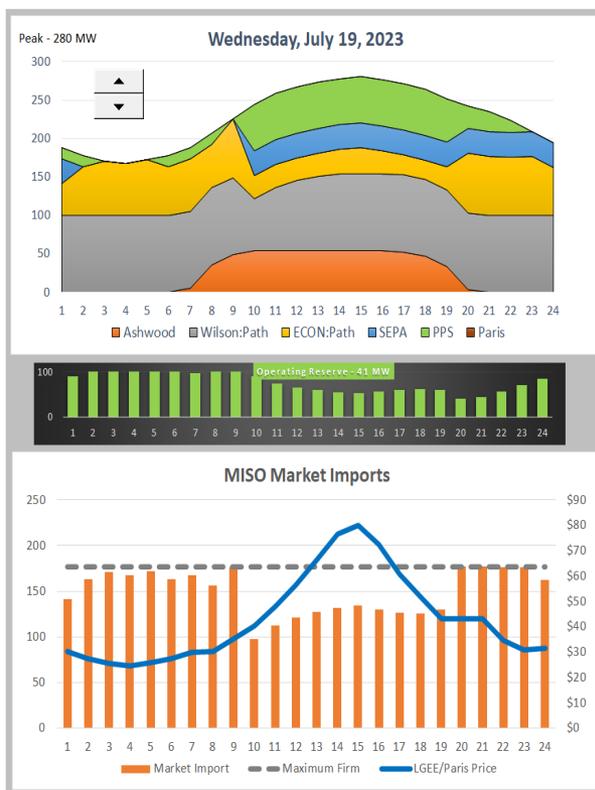
All Units Available



**Operating Reserves: 41 MW**

**90/10 Peak Summer Day**

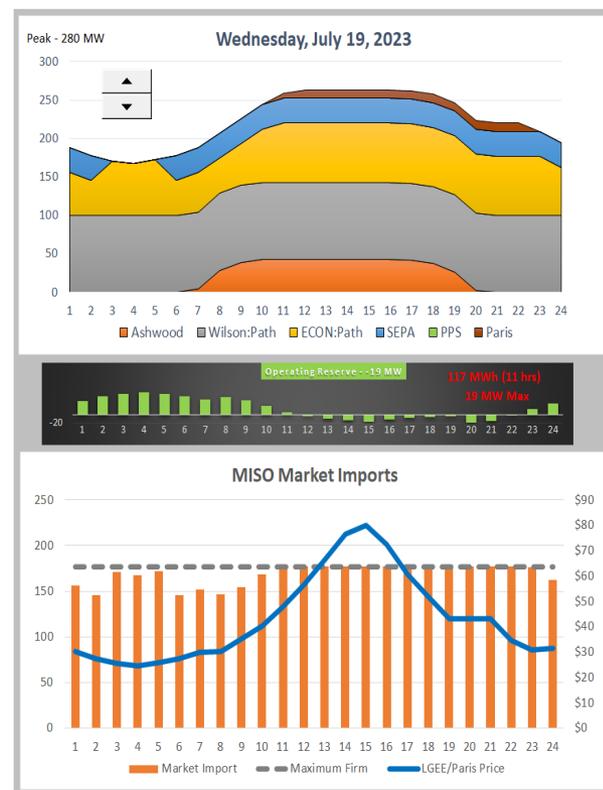
All Units Available



**Operating Reserves: -19 MW**

**90/10 Peak N-1 Contingency**

PPS FO, Ashwood 20% Derate

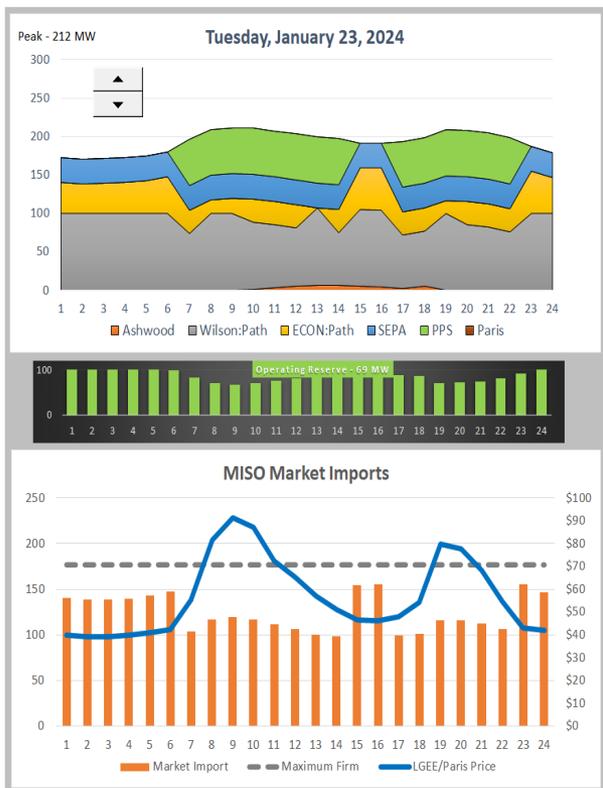


# Plan E (PPS 60, Ashwood 54, PTP 15) 23/24 Winter Operating Reserves

**Operating Reserves: 69 MW**

**50/50 Peak Winter Day**

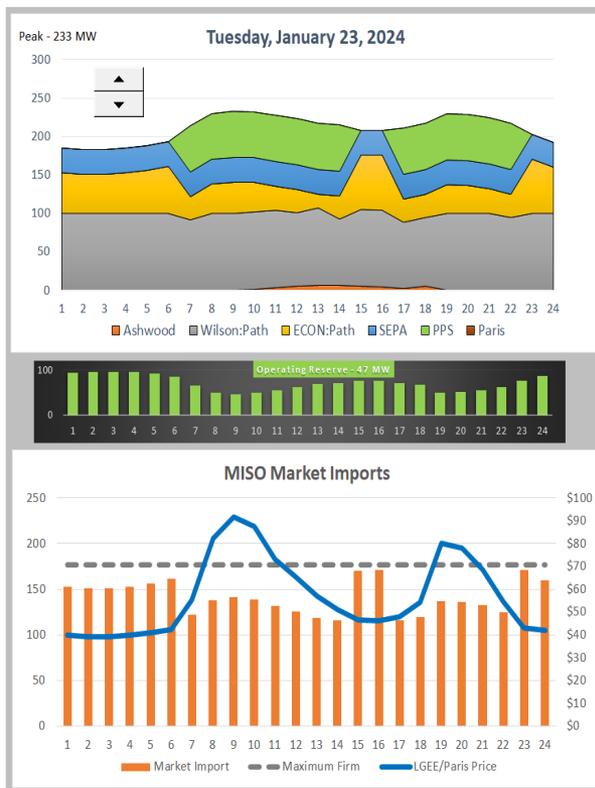
All Units Available



**Operating Reserves: 47 MW**

**90/10 Peak Winter Day**

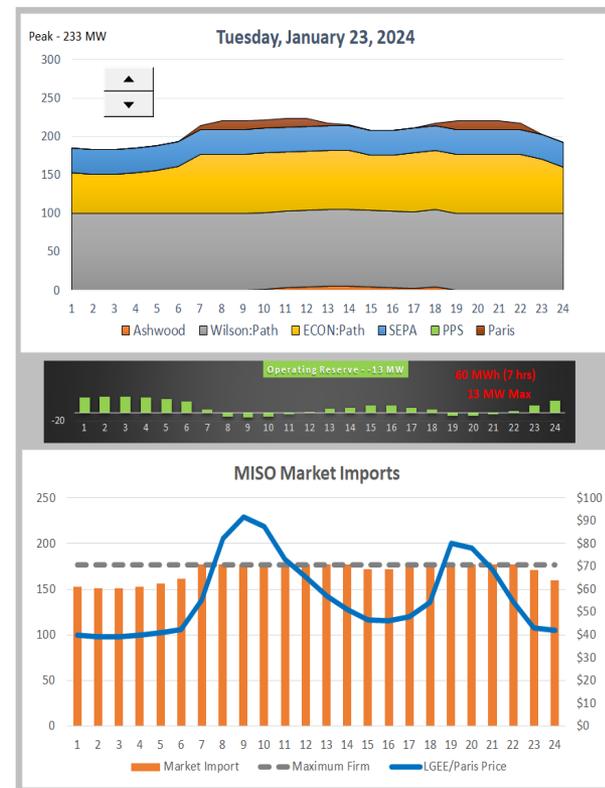
All Units Available



**Operating Reserves: -13 MW**

**90/10 Peak N-1 Contingency**

PPS FO, Ashwood 20% Derate

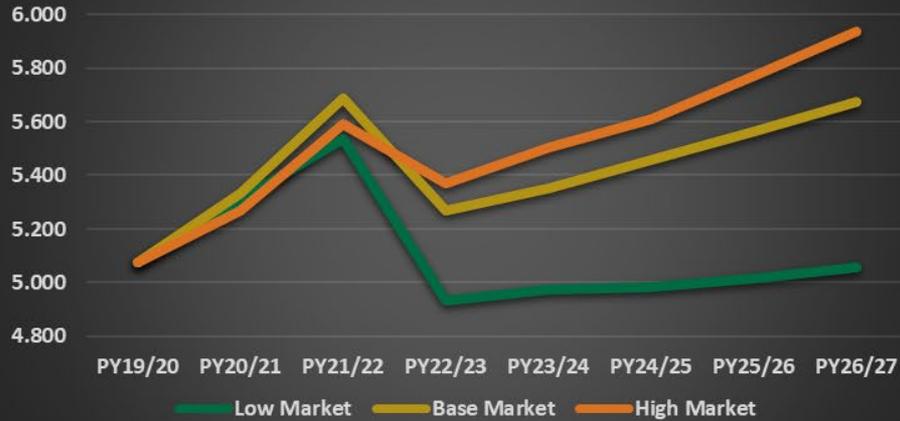


# Addressing Market Risk

1. Plan E includes 30 MW of an hourly dispatchable MISO PPA which provides a hedge against some of the market price exposure and volatility. The 30 MW PPA provides a portion of the capacity required for the MISO pseudo-tie.
2. The rest of the market exposure will be a balance of unhedged positions for capacity and energy combined with standard block products (e.g. 5x16 and 7x24).
3. If the KYMEA Board determines they would like to exercise their right to any available Ashwood Solar after the remarketing period, the addition Ashwood will provide a further hedge against high market prices, a possible future carbon tax, as well as provide additional capacity and operating reserves inside the LG&E/KU control area. In this instance, the KYMEA Board pivots from Plan E to Plan K.

# Plan E Market Exposure

### Average Production Cost (¢ per kWh)



### Native Load Energy Cost (\$/MWh)



### PY22/27 Levelized Ave Cost (¢ per kWh)



### Production Fixed Cost (\$/kW-MO)



1. KYMEA Board Discussion
2. The KYMEA Board will vote on which Plan they would like the KYMEA staff to implement at a special meeting to be held on December 29<sup>th</sup> at 11:00 am eastern time.