



NorthWestern Energy – ETAC Meeting

October 19, 2021

1. Intro and Welcome (1:00-1:10)
2. Price Forecasting (1:10-2:30)
3. Capacity Accreditation Update (2:30-3:00)
 - Updated ELCC Values
- Break (5 min)
4. Resource Cost Update (3:05-3:35)
5. Portfolio Construction (3:35-4:15)
 - Stakeholder Requested Portfolios
6. NorthWestern Supply Planning Website (4:15-4:30)

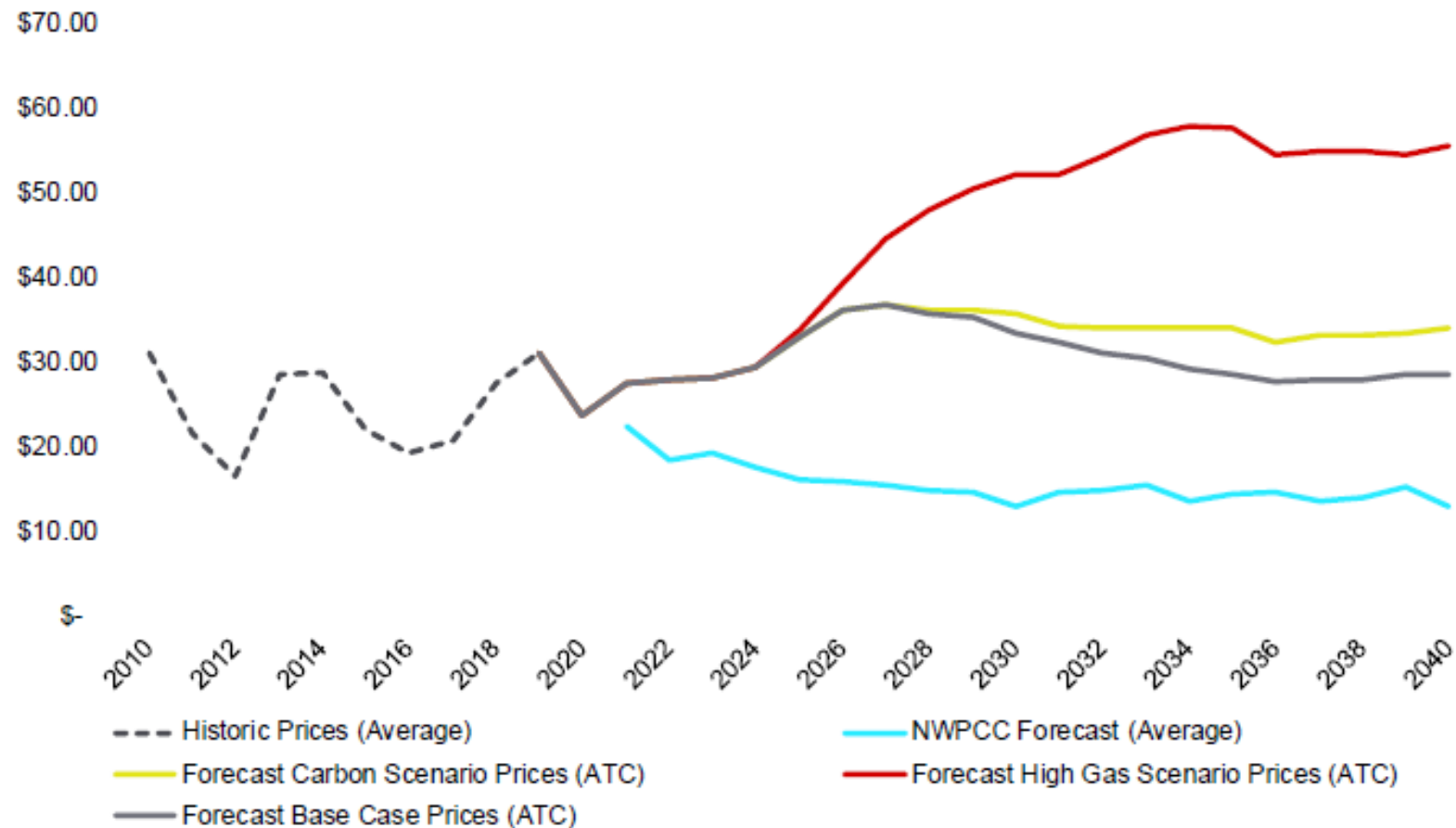


Price Forecasts



Price Forecast used in 2020 Supplement

Figure 24. Historic and Forecast Power Prices, 2010 – 2040



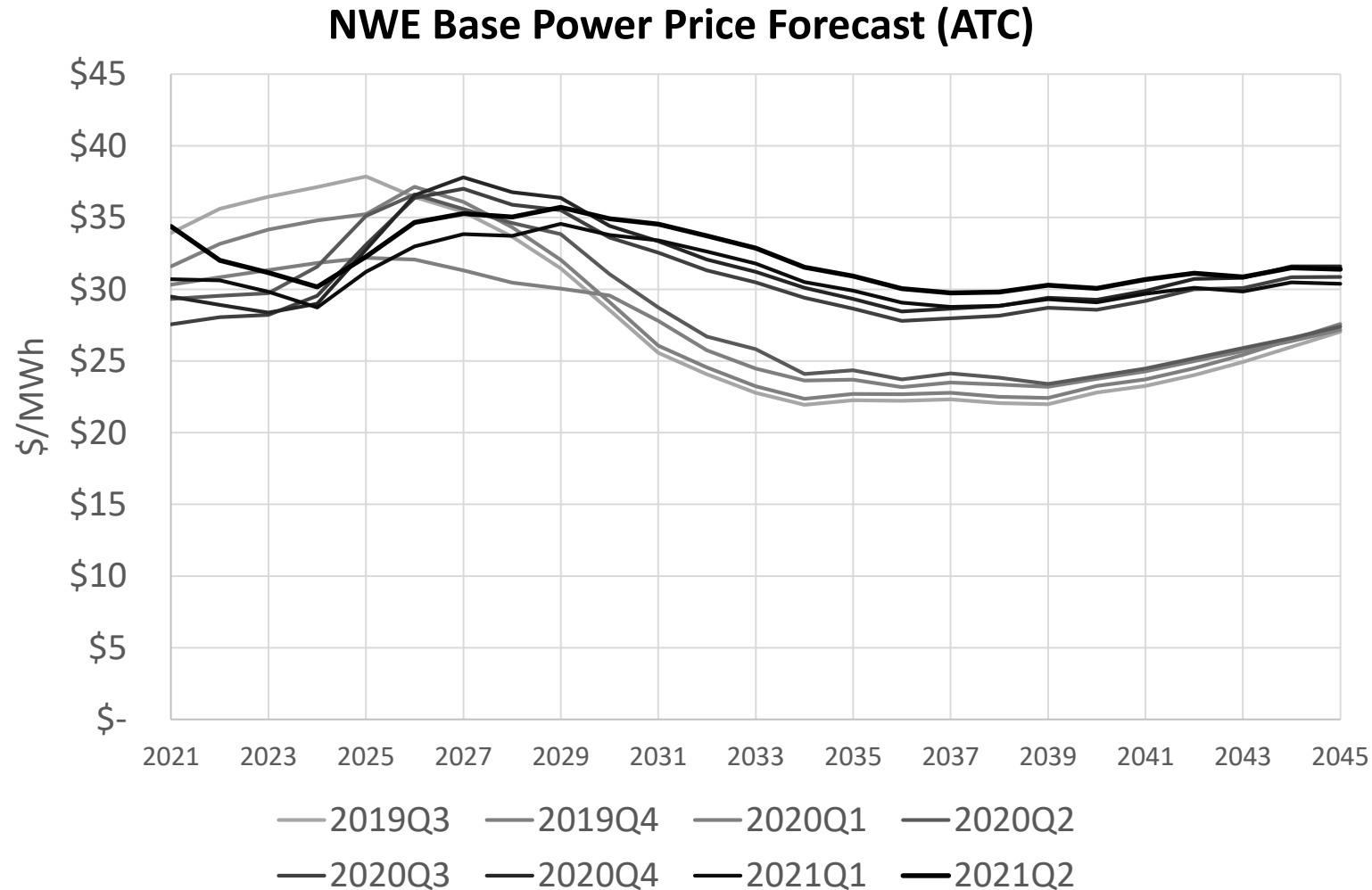


Power Price Forecast - Construction

- NorthWestern's Power Price Forecast has 3 main components:
 1. Futures Prices for power at Mid-C (source: ICE)
 2. Long-term forecast of market heat rates (source: Ascend)
 3. Forecast of natural gas prices (source: ICE, EIA)
- These are combined for the full forecast:
 - Years 1-4: Futures Prices (1)
 - Years 5-7: Weighted average transition from (1) to (2) x (3)
 - Years 7+: (2) x (3) (The product of Heat Rate x Gas Price forecasts)



Power Price Forecasts – updated Quarterly





Power Price Forecasts – updated Quarterly

NWE Base Price Forecast, by Forecast Vintage
20 year Levelized All-hours Price





Price Forecasting

Ascend Presentation



Capacity Accreditation



E3 ELCCs from 2020 Supplement

Figure 20. ELCCs of Incremental Resource Additions to NorthWestern's Resource Portfolio

Incremental ELCC Provided by Different Resources, 2020					A	B	C	D	E
Additional Nameplate Capacity (MW)		Charging From	25 MW	50 MW	100MW	200MW	300MW	400MW	500MW
Standalone Storage	3hr	Grid	100%	100%	99%	82%	65%	54%	47%
	4hr	Grid	100%	100%	100%	91%	72%	61%	53%
	6hr	Grid	100%	100%	100%	98%	84%	70%	59%
	8hr	Grid			100%	100%	92%	76%	65%
	10hr	Grid			100%	100%	97%	81%	69%
Solar PV	Simulated			5%	4%	3%	2%		
	Simulated With Snow Losses			4%	3%	3%	2%		
	Historical			2%	2%	1%	1%		
Wind	Historical			6%	5%	5%	5%		
	Simulated			11%	10%	9%	8%		
4-Hr Storage + Solar	25% of Solar PV	Grid			29%				
	50% of Solar PV	Grid			54%				
	100% of Solar PV	Grid			100%				
	100% of Solar PV	Solar			66%				
4-Hr Storage + Wind	50% of Wind	Grid			54%				
	25% of Wind	Grid			30%				
	50% of Wind	Wind			46%				
Note: values in red boxes were used as the basis for modeling new resource additions.									

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Capacity Accreditation Review

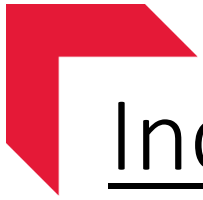
- ELCCs calculated by E3 with RECAP for 2020 Supplement
- Refreshed by NorthWestern with RECAP in 2021
 - Updated Portfolio and Load Forecast
 - Laurel Natural Gas (175 MW)
 - Powerex Contract (100 MW)
 - Expected QFs
 - 305 MW Wind (Teton, Pondera, Wheatland, Jawbone, CBC 2&3)
 - 240 MW Solar (MT Sun, Apex, Trident)
 - 150 MW of 4hr-equivalent storage (Beartooth, Trident, CBC 2&3)
- Next: Validate Ascend LOLP Model



2021 Updated RECAP ELCCs

Effective Capacity Provided by Different Resources, 2021					A	B	C	D	E
Additional Nameplate Capacity (MW)		Charging From	25 MW	50 MW	100MW	200MW	300MW	400MW	500MW
Standalone Storage	3hr	Grid	63%	60%	53%	42%	35%	31%	28%
	4hr	Grid	68%	65%	58%	48%	41%	35%	32%
	6hr	Grid	76%	73%	68%	59%	49%	43%	38%
	8hr	Grid			73%	66%	56%	49%	44%
	10hr	Grid			76%	71%	63%	55%	49%
Solar PV	Simulated			12%	10%	7%	6%		
Wind	Historical			5%	5%	4%	4%		

Note: Values reflect saturation effects within resource types, but not across different resource types.



Incremental Effective Capacity

Incremental Effective Capacity (MW)					
Additional Nameplate Capacity (MW)	100MW	200MW	300MW	400MW	500MW
Incremental Nameplate Capacity (MW)	+100MW	+100MW	+100MW	+100MW	+100MW
Standalone 4-hr Storage	58	38	27	18	16
Standalone 10-hr Storage	76	66	46	33	26
Solar PV (Simulated)	10	5	3	2	1
Wind (Historical)	5	4	4	3	3

Incremental ELCCs show the value of each successive 100 MW addition of a resource type.



Cumulative Effective Capacity

Cumulative Effective Capacity (MW)					
Cumulative Nameplate Capacity (MW)	100MW	200MW	300MW	400MW	500MW
Standalone 4-hr Storage	58	96	124	142	158
Standalone 10-hr Storage	76	142	188	221	247
Solar PV (Simulated)	10	15	18	20	21
Wind (Historical)	5	9	12	16	19

Cumulative ELCCs show the value of total addition of 100 MW, 200 MW, 300 MW, etc., addition of a resource type.



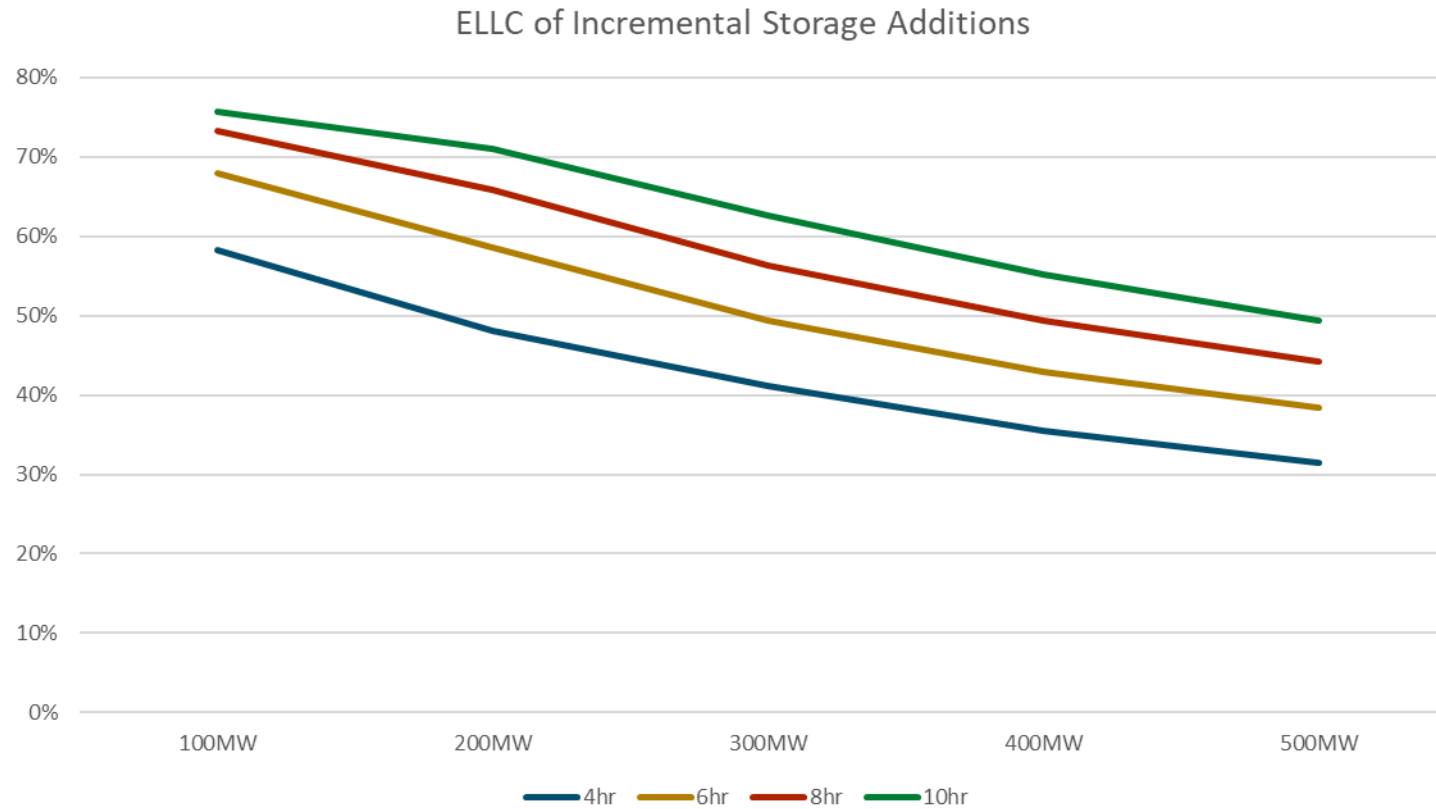
2021 Updated RECAP ELCCs

1. Saturation from storage in base portfolio moves down the curve.
2. Other portfolio updates shift the curve.

Effective Capacity Provided by Different Resources, 2021					A	B	C	D	E
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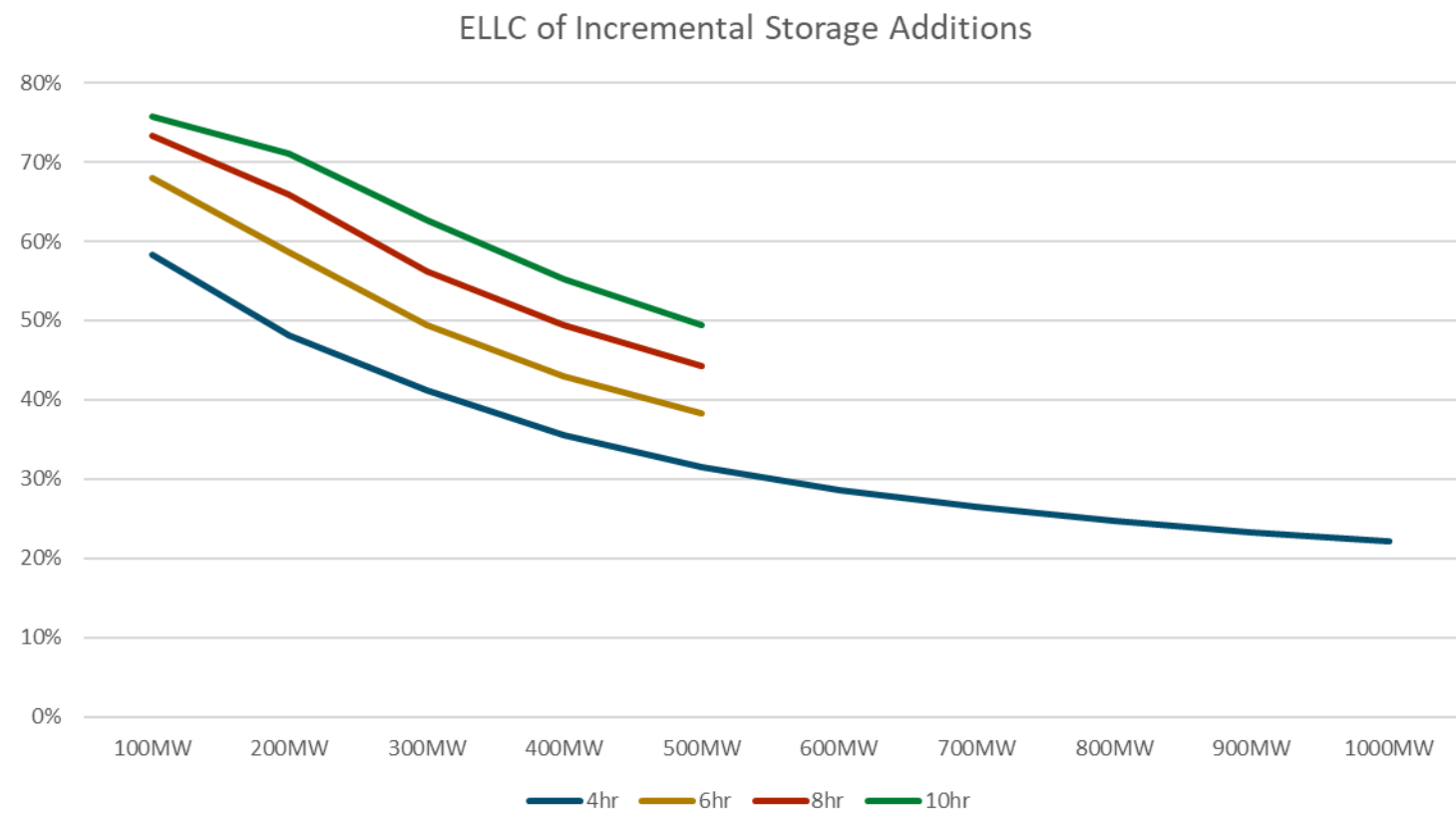


Diminishing ELCC of Storage Additions





Diminishing ELCC Curve Flattens Eventually





2021 Updated RECAP ELCCs

1. Synergistic relationship with storage in base portfolio.
2. Summer peaks in load update.

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Resource Costs



Resource Costs –2022 Plan Update

Costs information for portfolio modeling to be drawn from two sources:

1. NREL Annual Technology Baseline (ATB)
2. RFP Bids/Engineering Estimates

Cost estimates are informational only. Actual resource acquisition decisions are made through actual offers.

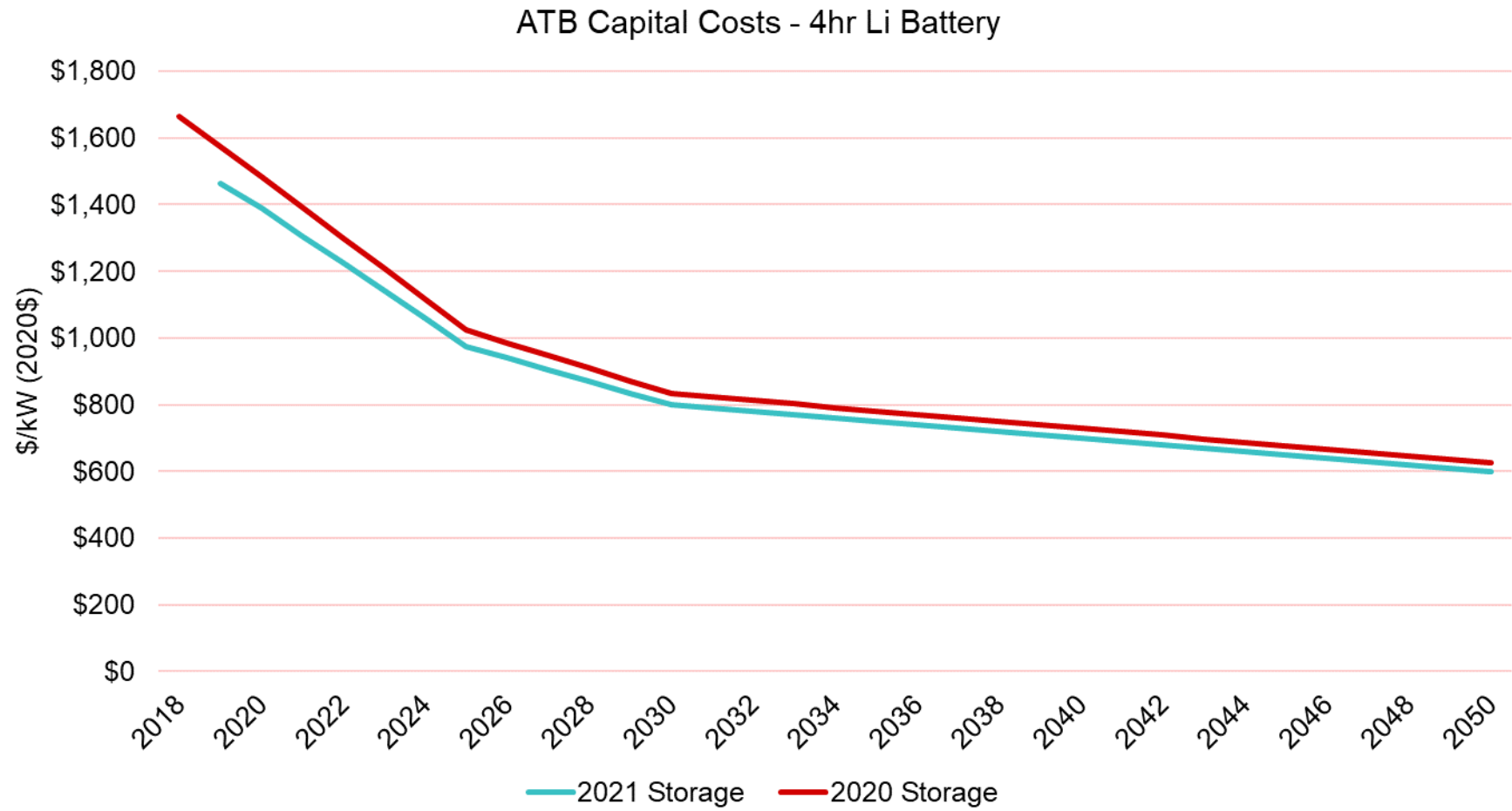


Resource Types and Data Sources

Resource Type	Data Source	
	NREL ATB	RFP/Engineering
Wind	●	●
Solar	●	●
Geothermal	●	●
NG Combined Cycle	●	●
NG Simple Cycle	●	●
NG RICE		●
Nuclear	●	●
Battery Storage	●	●
Pumped Hydro		●
Solar + Storage Hybrid	●	●
Wind + Storage Hybrid		●

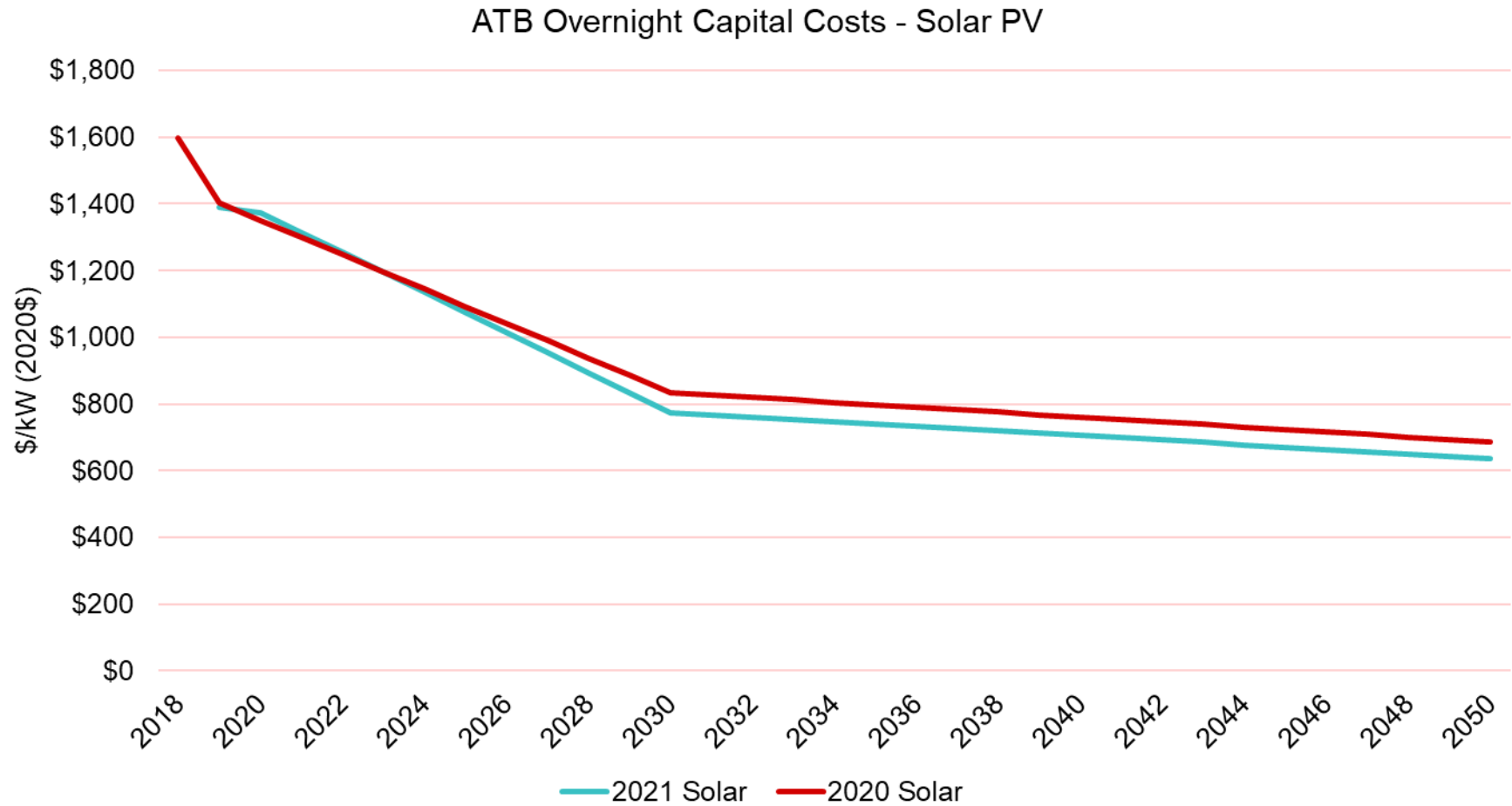


2021 ATB Cost Curve Update - Storage



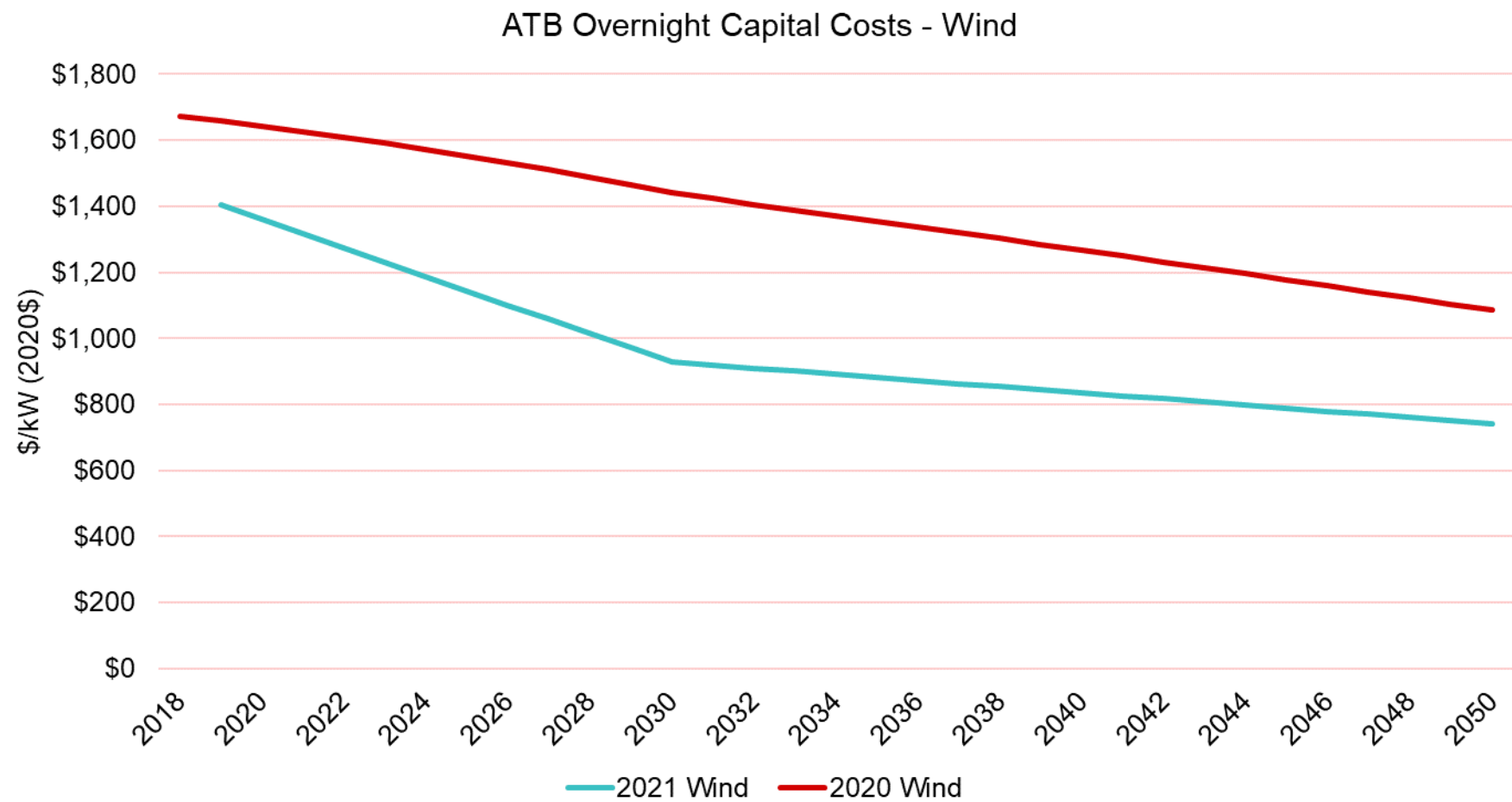


2021 ATB Cost Curve Update - Solar





2021 ATB Cost Curve Update - Wind





Portfolio Requests

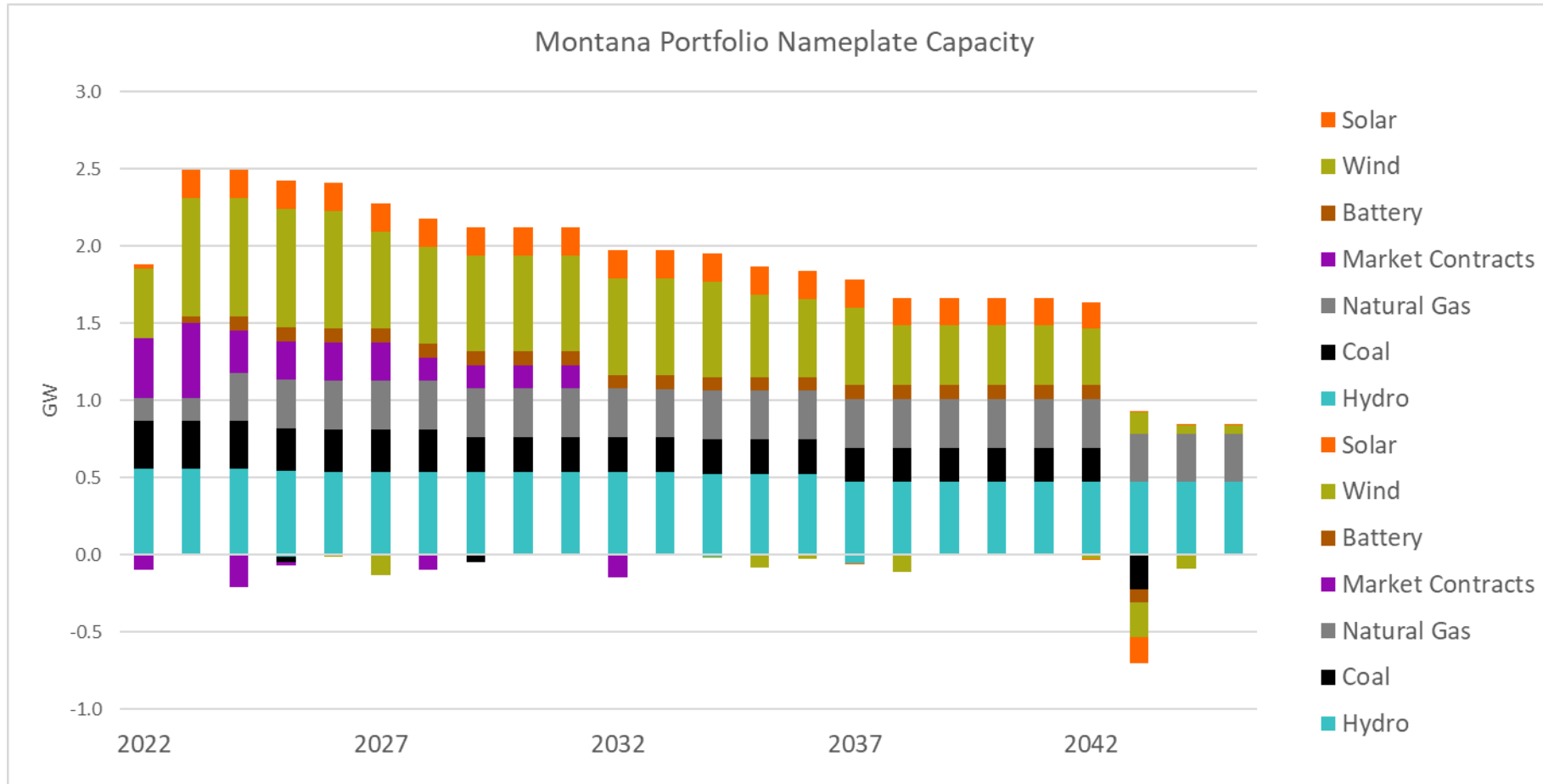


Stakeholder Portfolio Requests

- Submit requests by Dec 1 using new feedback form (link [here](#) and below)
 - We will review and follow up with any questions (can discuss at Dec mtg)
- Key factors to consider:
 - To be comparable, portfolios must have the same level of reliability (capacity contribution)
 - The capacity contribution of resources...
 - ...decreases as more of a given type is added to the portfolio
 - ...can have interactive effects
- Please be specific about quantity/timing of changes to the portfolio

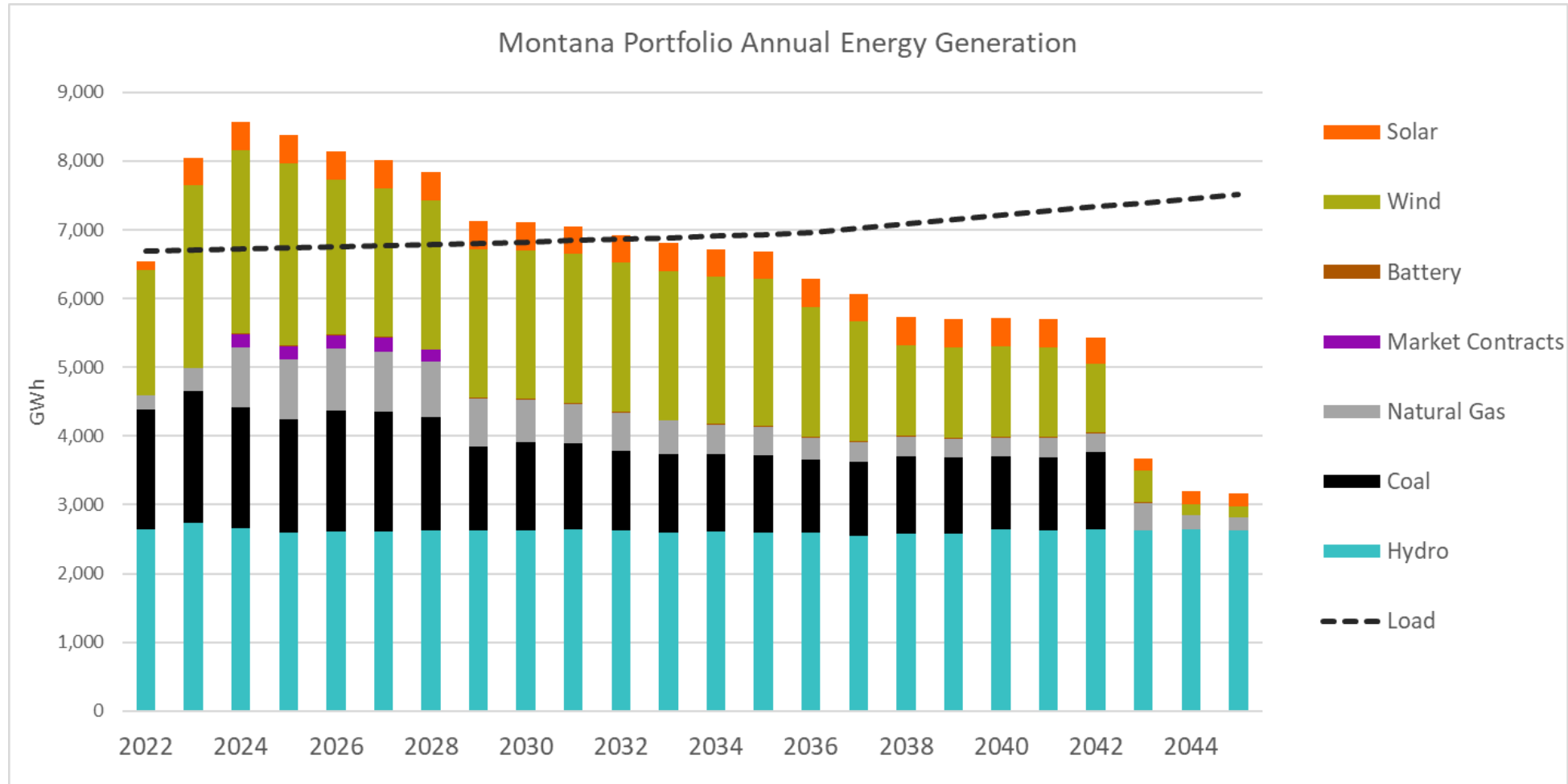


Portfolio Capacity





Portfolio Energy





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New Website

- Supply Planning Website:
 - <https://www.northwesternenergy.com/about-us/gas-electric/electric-supply-resource-procurement-plan>
- Please sign up for the email distribution list:
 - <https://lp.constantcontactpages.com/su/XE0SdNG>
- Submit portfolio requests and other feedback via the new feedback form:
 - [Electric Supply Planning Feedback Form \(northwesternenergy.com\)](#)



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August 4, 2021

Thank you.