Stakeholder Working Group Meeting 2

July 10th, 2025

SWG Meeting # 1 Agenda

- **10:00 – 10:20**: Welcome
- **10:20 – 11:15**: Balanced Portfolio
- **11:15 – 11:25 Break**
- **11:25 – 12:00**: Transmission Overview Part II
- **12:00 – 1:00**: Lunch
- **1:00 – 2:00**: Activity
- **2:00 – 2:30**: Social Cost of Carbon
- **2:30 – 3:00**: Scenarios and Sensitivities
- **3:00 – 3:30**: Feedback Review
- Questions/Comments

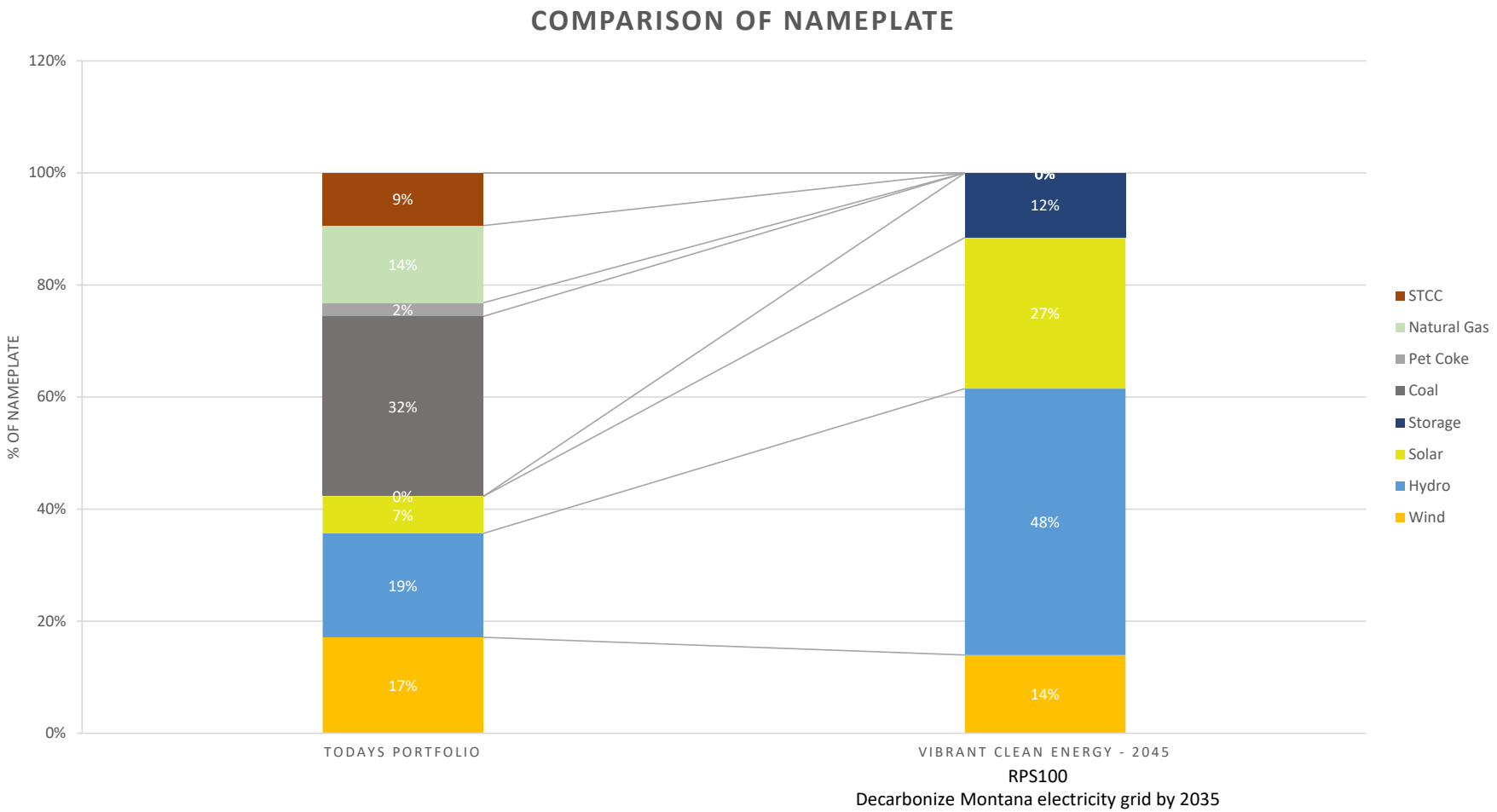
WELCOME!

Updates

- Any new members?
- Website Updates
  - Review library
  - Review input form

Balanced Portfolio…

What is a balanced portfolio (NWE Current vs. Vibrant Proposed)?



RPS100
Decarbonize Montana electricity grid by 2035

Why did Clean Energy Study have such a large hydro portfolio?

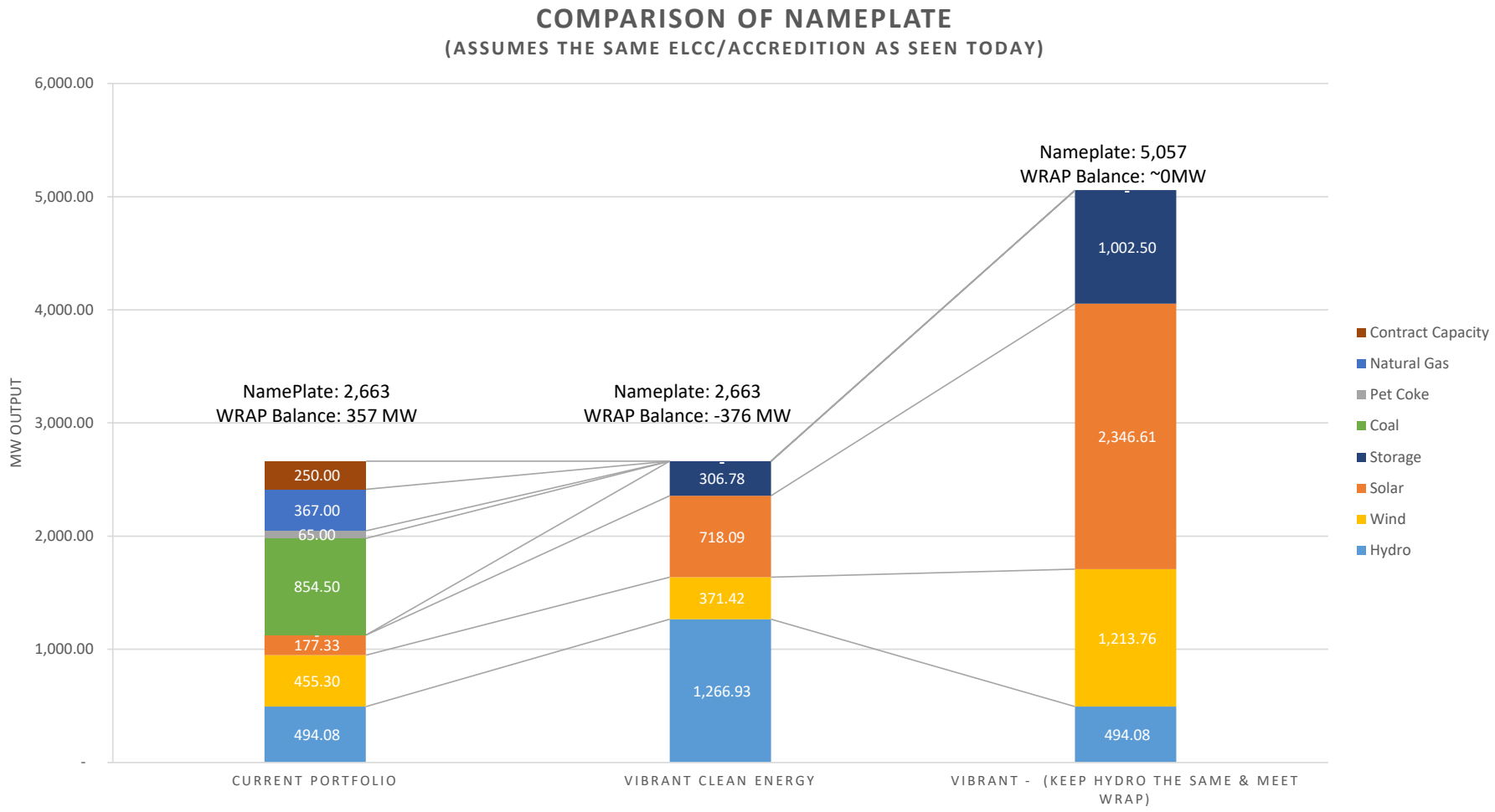
Dam	Capacity (MW)	County In MT	Owner / Operator	Where the Energy Goes
Noxon Rapids Dam	562–580	Sanders County	Avista	Pacific NW grid via Avista
Libby Dam	525–600	Lincoln County	U.S. Army Corps of Engineers (via BPA)	BPA-marketed to multiple Western states
Hungry Horse Dam	428	Flathead County	U.S. Bureau of Reclamation (via BPA)	BPA-marketed to Pacific NW utilities
Yellowtail Dam	250–278	Big Horn County	U.S. Bureau of Reclamation (via WAPA)	WAPA-marketed within regional grid
Séliš Ksanka Q̓lispé Dam	~206	Lake County	Confederated Salish & Kootenai Tribes (Energy Keepers)	WAPA and tribal/residential supply
Fort Peck Dam	185	McCone County	U.S. Army Corps of Engineers (via WAPA)	WAPA / regional grid
Canyon Ferry Dam	~50	Lewis & Clark County	U.S. Bureau of Reclamation (via WAPA)	WAPA / regional grid
NorthWestern Energy total owned	**~494**		NorthWestern Energy (10 facilities + 1 storage)	Serves Montana customers (~35–36% of MT load)

A rough estimate is that ~50% of the capacity benefits of MT Hydo generators stay in MT.
Vibrant seems to assume that 100% of installed capacity on the Montana grid stays to serve MT loads.

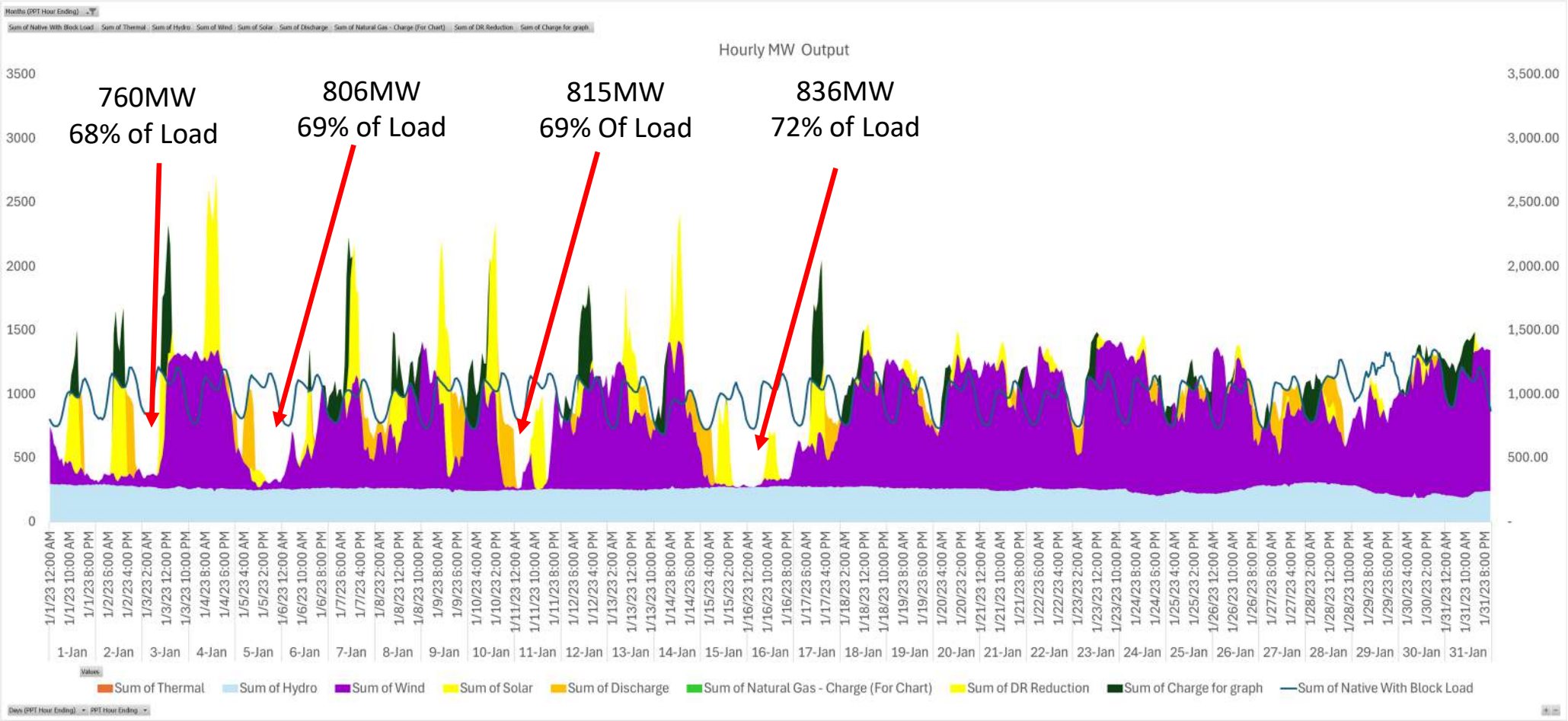
What would this mean to serve load + PRM in 2045?

Winter Accreditation				
	Existing Accreditation Average WRAP (% of Nameplate)	**Current Portfolio**	**Vibrant Clean Energy RPS100 @ 2045 Scaled to NWE Nameplate**	**Adjusted Value (Keep Hydro the same & Meet Wrap**
Total Nameplate		**2663**	**2663**	**5056**
Wind	23.94%	109	89	291
Solar	7.89%	14	57	185
Hydro	65.98%	326	836	326
Coal	98.65%	843	-	-
Pet Coke	84.92%	55	-	-
Natural Gas	98.91%	363	-	-
Storage	80.00%	-	245	802
Contract Capacity	100.00%	250	-	-
Winter Accreditaiton		1960	1,227	1604
Load + PRM 2044		1,603	1,603	1,603
Resource Sufficient		357.20	(376.03)	0.84

Name plate capacities of portfolios?

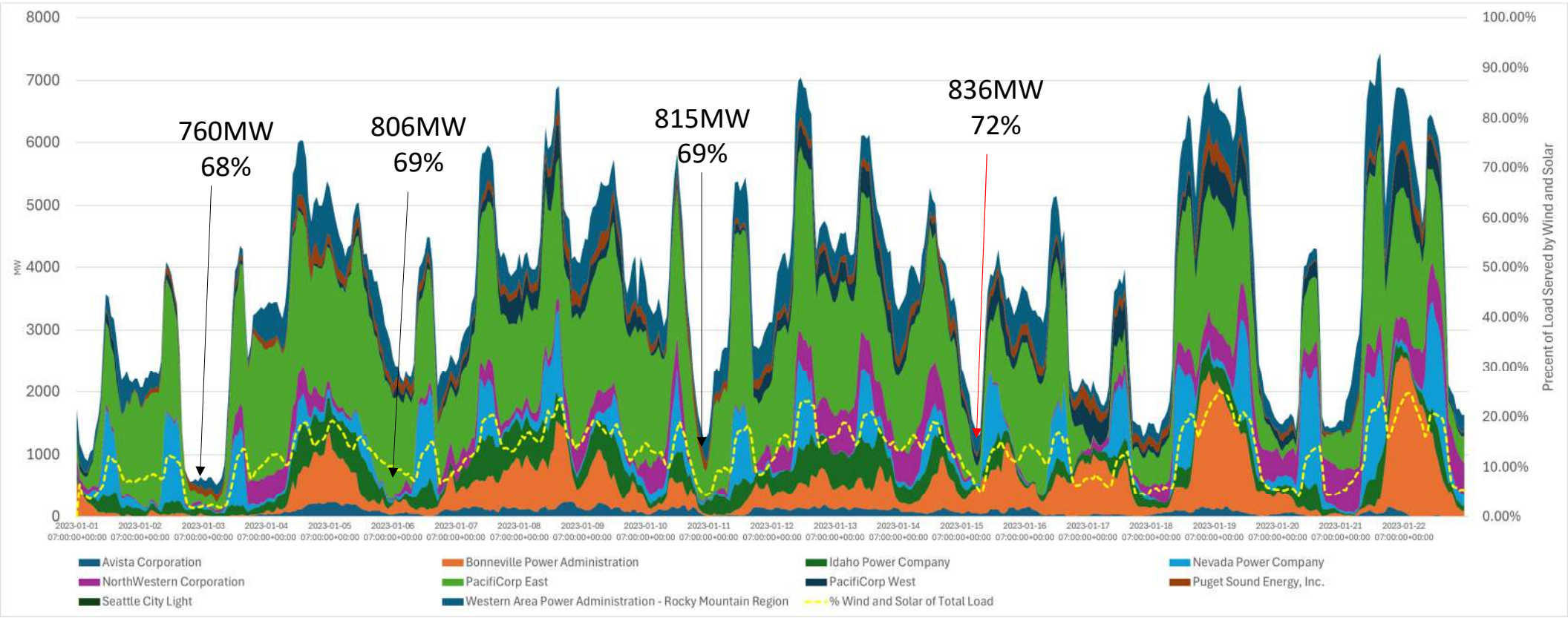


How much reliance should you be on the market (at any cost)?



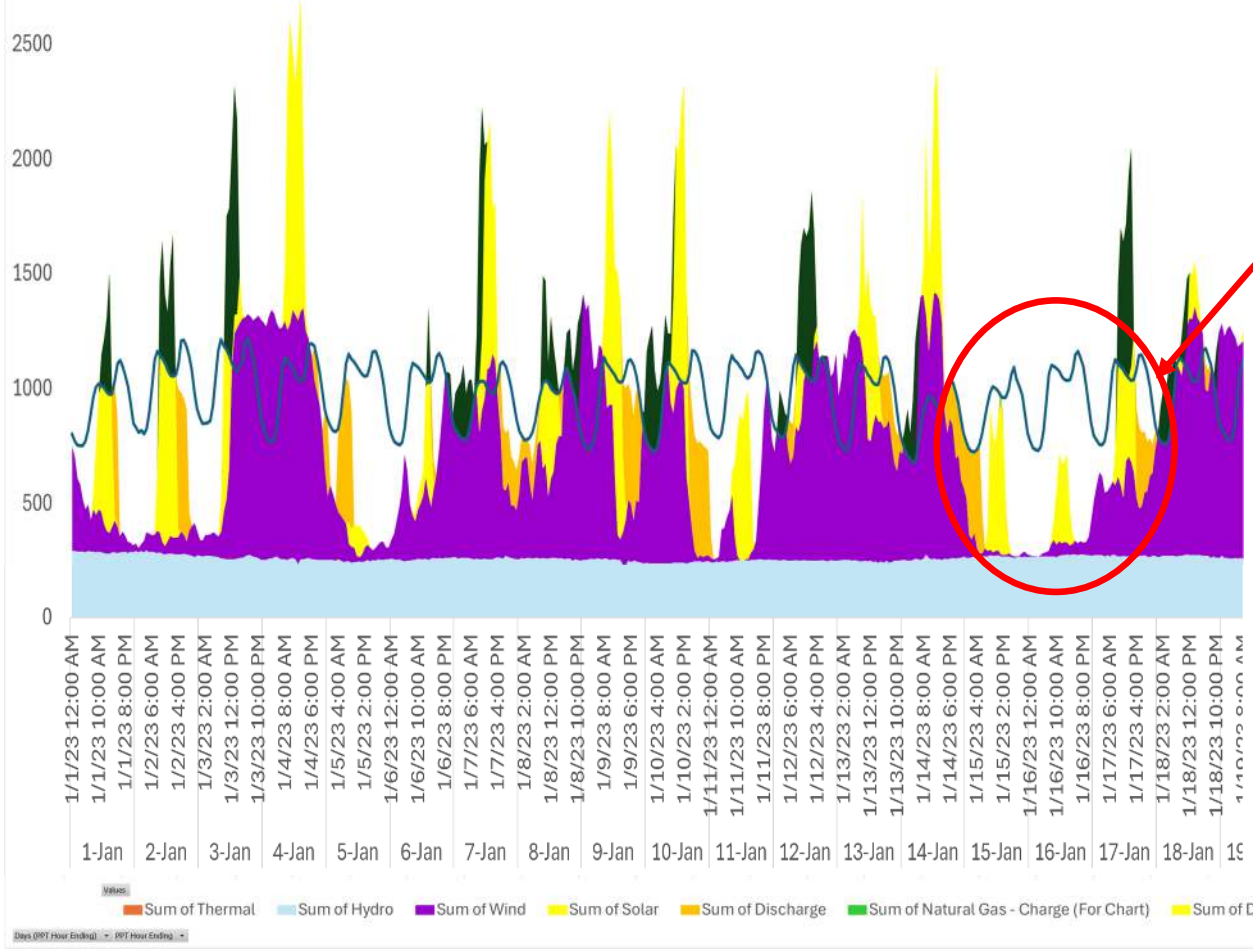
Scaled 2023 Generation data to 2044 load per IRP Capacity Forecast

Regional: Wind and Solar Output vs. % of Regional Load



What would happen to market prices? Where would the market get its energy?

Long Duration Storage?



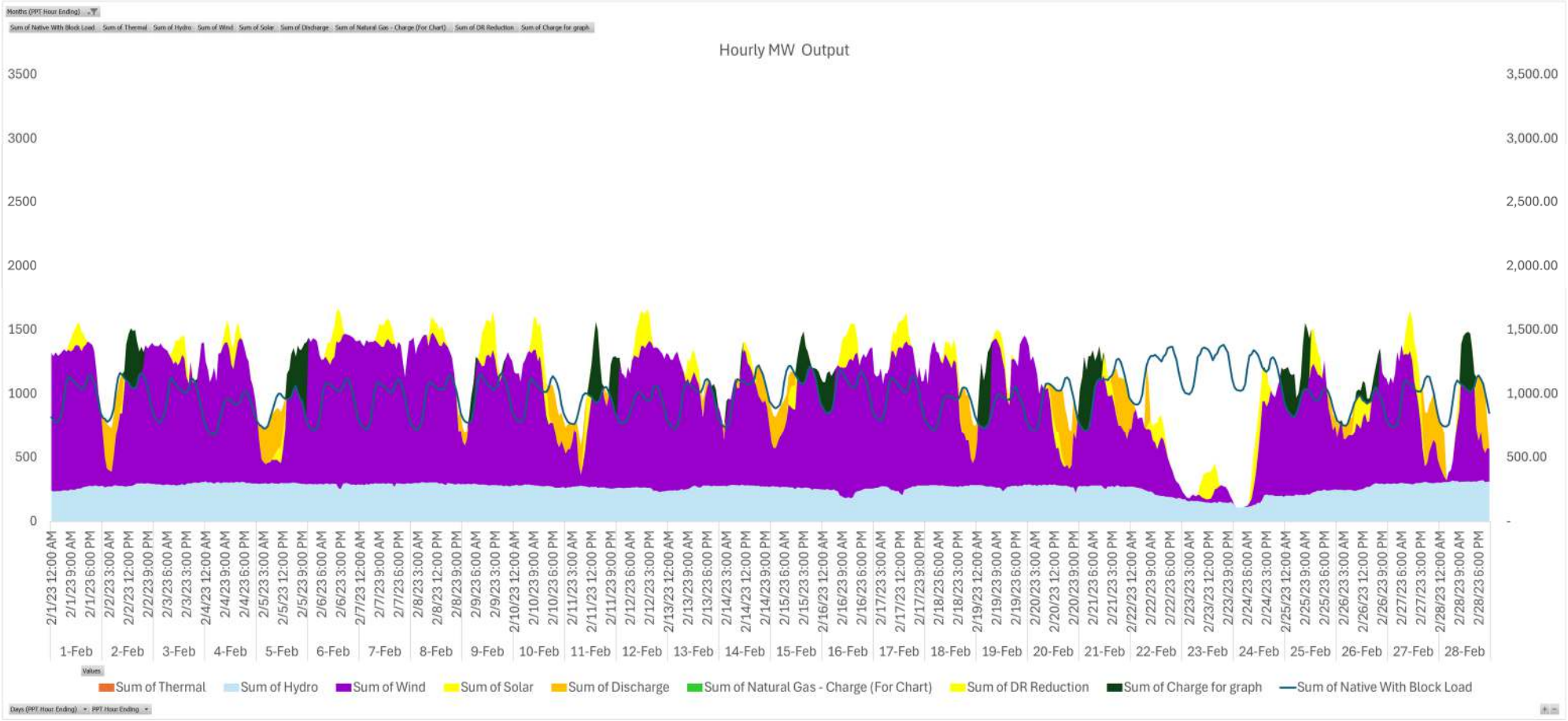
Long Duration Storage Analysis		
start date	1/1/2023	
end date	1/18/2023	

Market Purchases	80,087	MWhr
Market Sales	49,922	MWhr
Largest load period without any excess generation	23,360	MWh

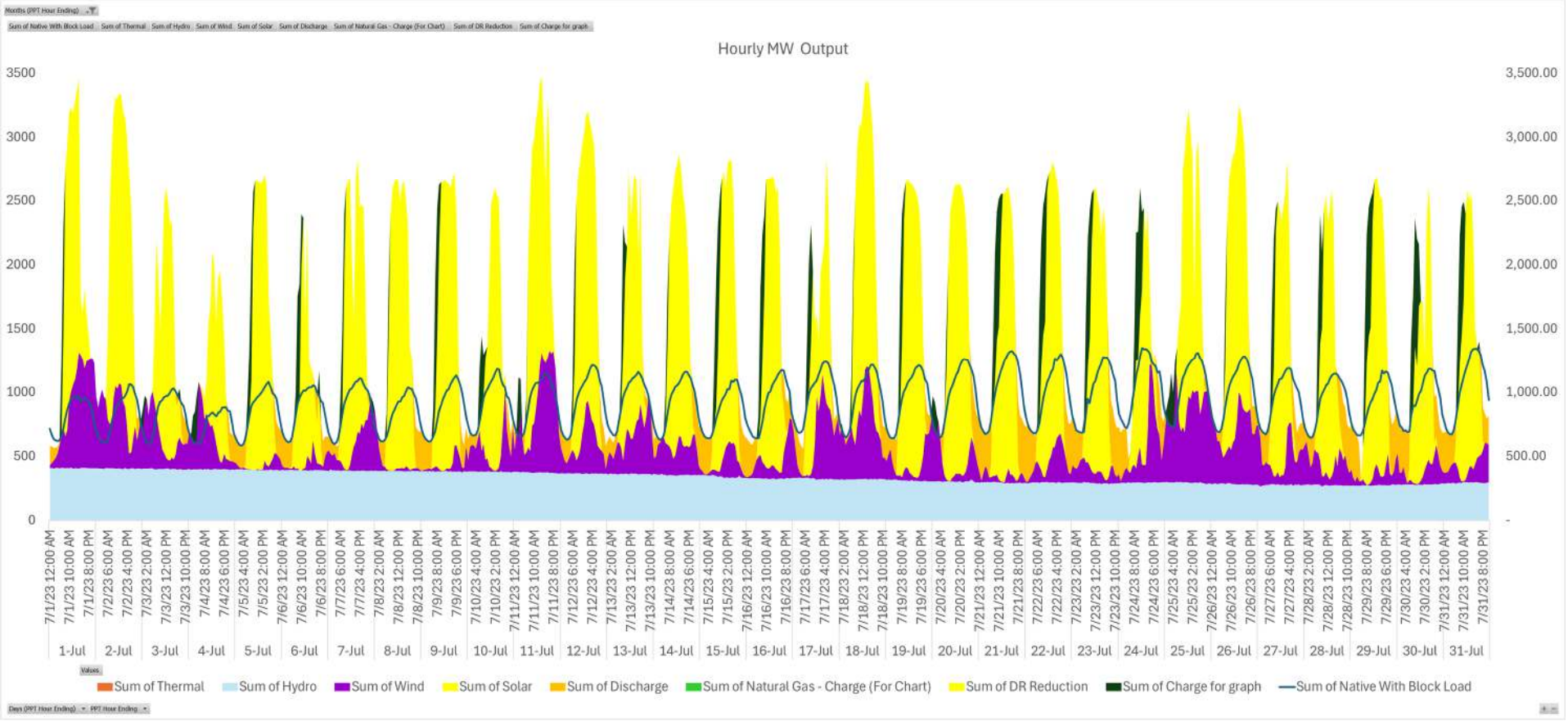
Example Energy Storage Sizing		
Energy Required to Serve Laod	80,087	
Market Sales Directed to Storage	49,922	MWh
Efficiency	45%	
Total Available Charging Energy	22,465	MWh
Required Energy Storage Size (Required Energy - Available Energy to Charge)*	57,622	MWh
Required Long Duration Storage (100 Hrs)	576	MW

*Assumes Fully Charged on 1/1

February 2023



July


Hourly MW Output
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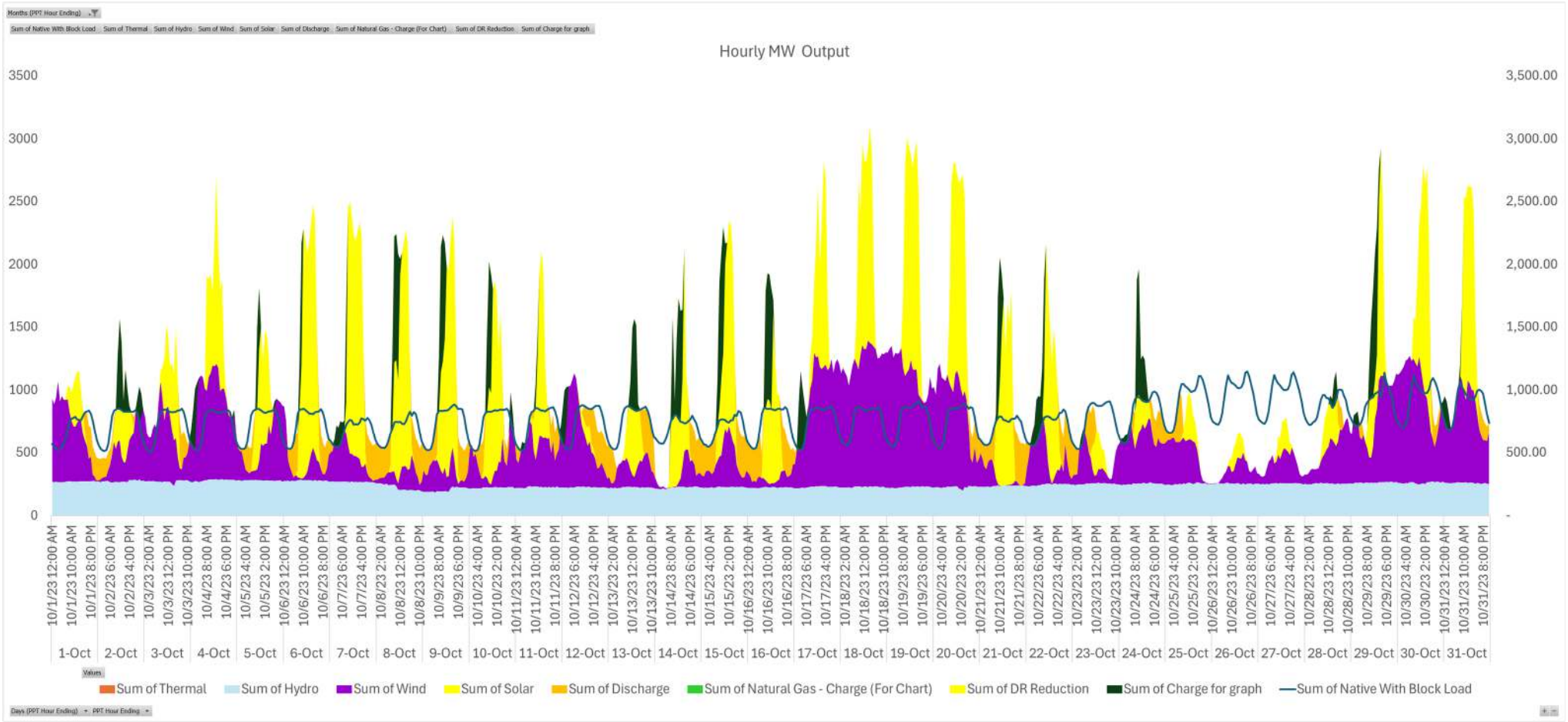
Sum of Thermal
Sum of Hydro
Sum of Wind
Sum of Solar
Sum of Discharge
Sum of Natural Gas - Charge (For Chart)
Sum of DR Reduction
Sum of Charge for graph
Sum of Native With Block Load

October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Discussion Items

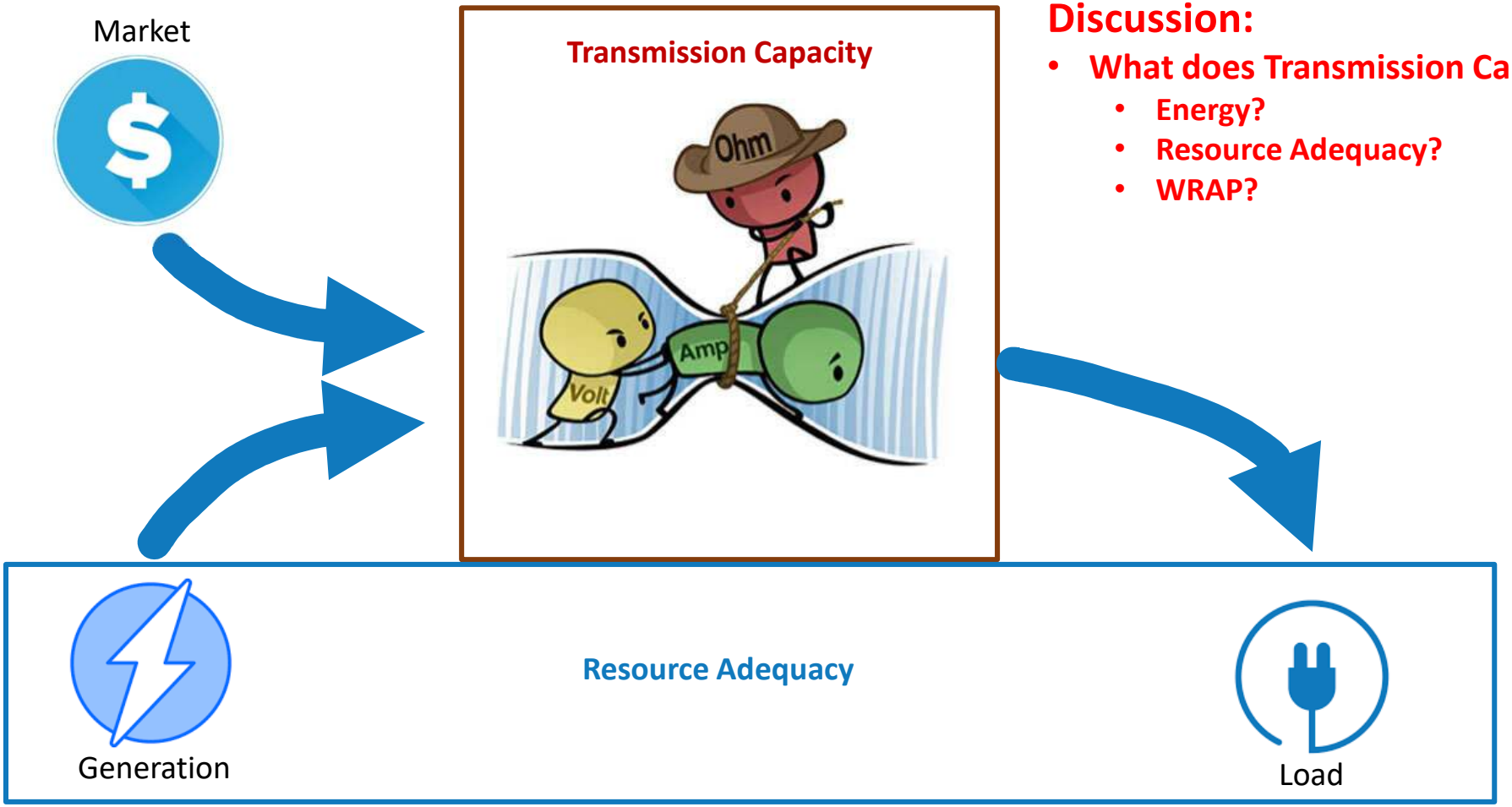
Adding generation to the fleet

- Needed for reliable service
- Part of a least-cost plan
- In the public interest

How do we transition? What are your thoughts? What is a “balanced portfolio”

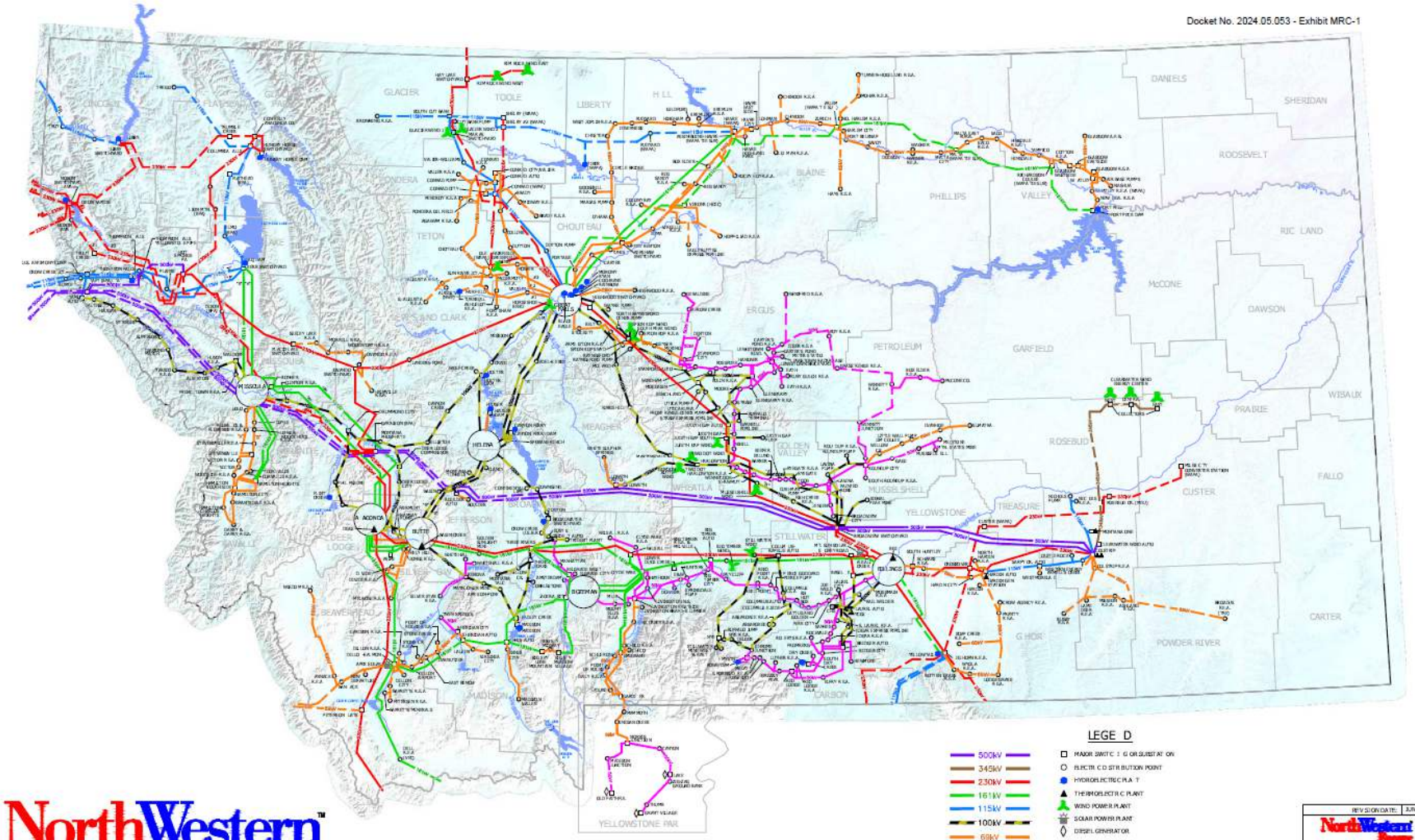
Transmission

Transmission and Resource Adequacy



Discussion:

- **What does Transmission Capacity Do?**
  - **Energy?**
  - **Resource Adequacy?**
  - **WRAP?**



NorthWestern™ Energy

Electric Transmission System

REVISION DATE: JUN 2024

NorthWestern Energy

ELECTRIC TRANSMISSION SYSTEM ONE-LINE DIAGRAM

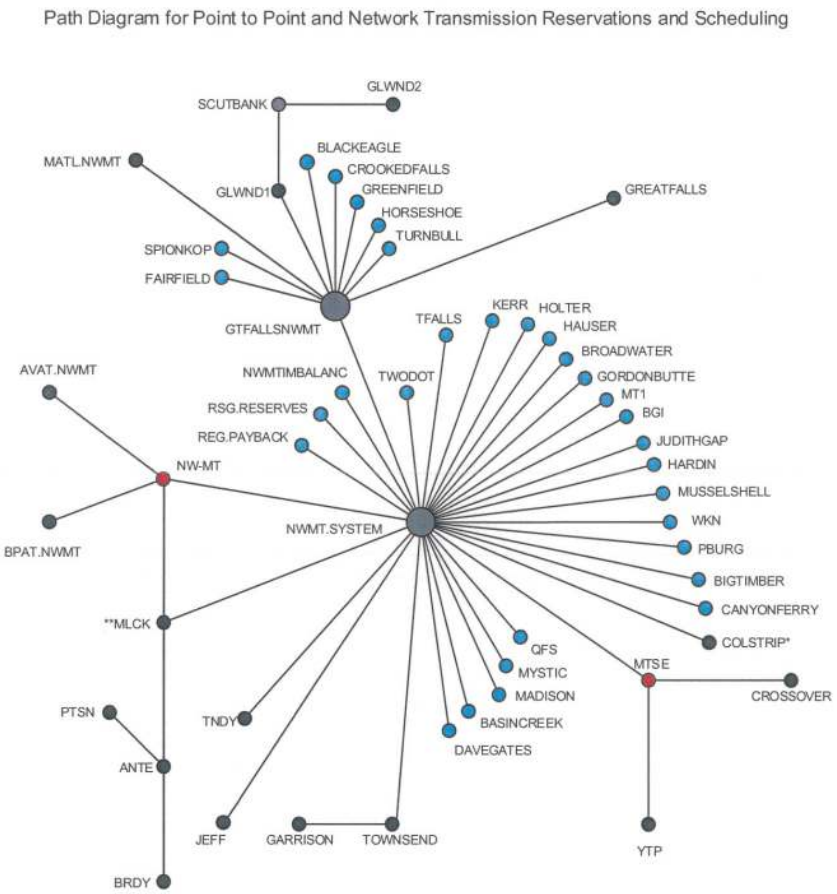
DRAWING NUMBER 41735-C2 REV 42

SHEET 1A ACAD

41735-C002-19 REV 42

Transmission Ownership

Transmission Reservations and scheduling (simplified)



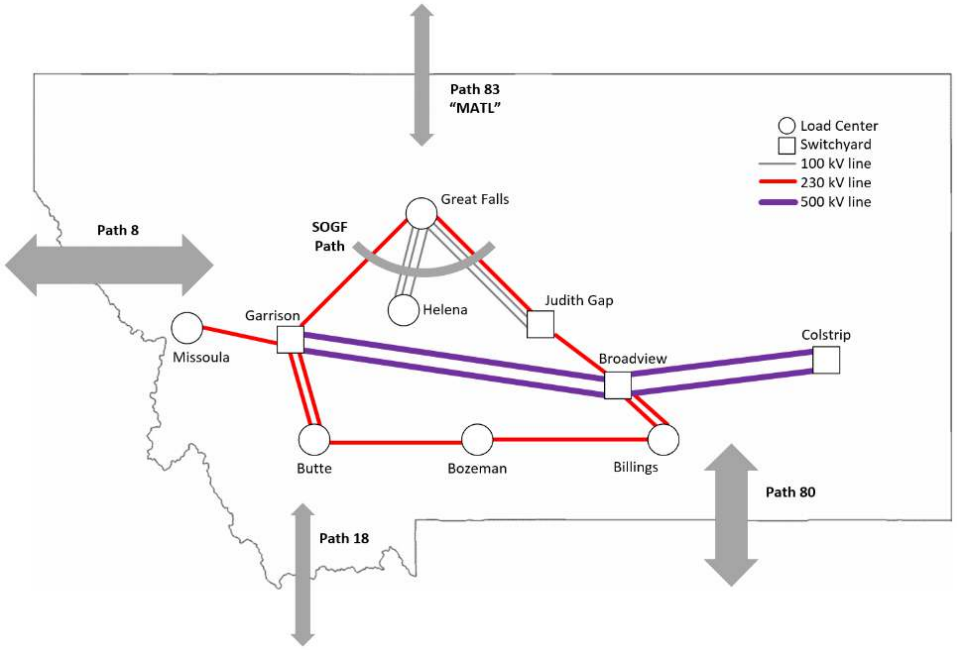
- OATT:
  - Open Access Transmission Tariff. It's a foundational document in U.S. electricity markets that outlines the terms and conditions under which electric transmission service is provided by a transmission-owning utility to others (e.g., generators, load-serving entities, marketers).
- TTC:
  - Total Transfer Capability (TTC): total designed and approved transfer capability of a transmission path.
- ATC:
  - Available Transfer Capability (ATC): available transfer capability is the amount of transfer capability left after considering firm commitments of the Transmission provider.
- Firm
  - Firm services are commitments that can sum up to the total transfer capacity. Firm transmission is released if not scheduled. This becomes available non-firm transmission. This service, whether used or not, comes with a cost.
- Non-Firm:
  - Energy that is scheduled at a lower priority that has not been reserved.

Generators are scheduled to load (ie. NWEMT.SYSTEM)

Do NWE customers automatically get Firm Capacity?

PowerSIMM and Draft Constraints

- PowerSIMM is *not* a powerflow model.
  - It is modeling a signal node for generation and a signal node for load.
  - Sets limits to buy/sell energy.



Year	Import MW[1,2]	Export MW[1,2]
2026	178	530
2027	178	580
2028	228	610
2029	226	610
2030	226	610
2031+	306	610

Note 1 – Yearly firm available transfer capability (ATC) by year (as of 4/29/2026)
Note 2 – Import and export capacity on a non-firm basis can be greater than firm capacity.

Northern Plains Connector

- Discussion:
  - What are your comments on the benefits of the Northern Plains Connector?

Concepts

- How do you feel that transmission should be used?
- Capacity, Reliability, Energy?…

LUNCH

Activity

Social Cost of Carbon

Discussion

- What are the intended outcomes?

Scenarios and Sentivities

Proposed Scenarios for 2026 MT IRP (as understood today)

A. Base Case – Colstrip retires December 31, 2042.

B. Colstrip retires June 30, 2029, according to MATS.

C. Colstrip complies with MATS using baghouse on July 1, 2030. Colstrip retires December 31, 2042.

D. Colstrip retires December 31, 2031, according to GHG.

Proposed Base Case Sensitivities for 2026 MT IRP

F. ARS (Automatic Resource Selection) allows carbon emitting resources to be selected after 2035. (per MPSC comments from 2023 IRP)

G. 50% power costs.

H. 150% power costs.

I. 50% natural gas costs.

J. 150% natural gas costs.

K. Proposed data center load(s).

L. Add 300 MW of North Plains Connector

M. Double the amount of forecasted DSM and NEM

N. Only allow carbon free resources to be selected in ARS

Feedback and Reviews

Feedback/Comments

- **Review Tracker Sheet**

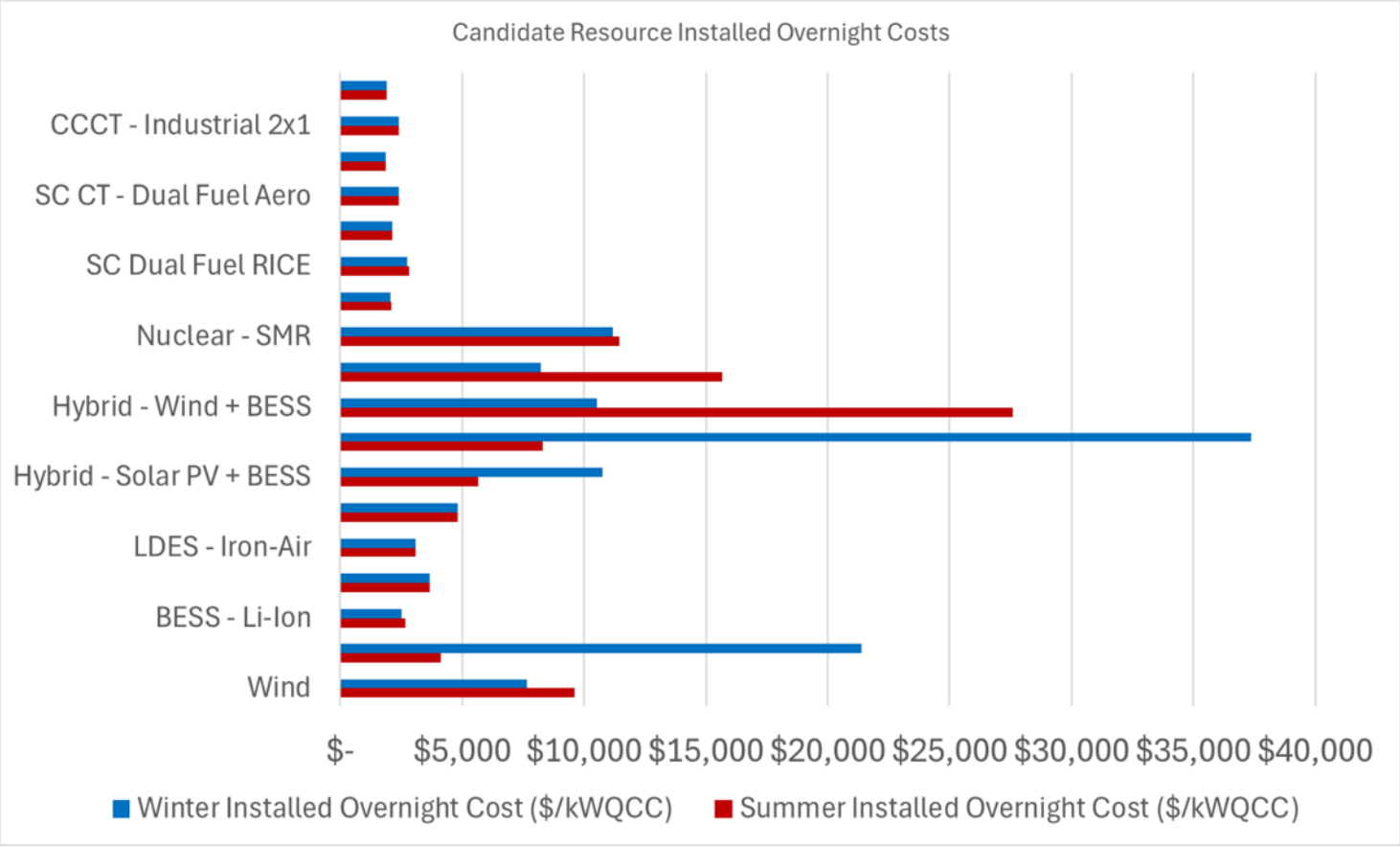
Feedback/Comments

- **Online Form (preferred method):**
  - IRP Feedback Form posted on NorthWestern's Montana electric supply planning website (link below)
    - **https://www.northwesternenergy.com/about-us/gas-electric/montana-electric-supply-planning/feedback-form-electric-supply-meeting**
  - Each submission should include:
    - Name and affiliation
    - Contact information
    - Specific question or comment
    - Reference to category (e.g., Planning Process, Forecast, Markets, Transmission, Modeling Inputs, Candidate Resources, Cost Analysis, etc.)
    - Indication if a response is requested
- **Email:**
  - Preferred for ETAC and Stakeholder Comments Only
  - Email**:** **nweetac@northwestern.com**

Candidate Resource Installed Overnight Costs

Resource	Size (MW)	Storage (h)	Installed Overnight Cost ($/kW)	Fixed O&M ($/kW-year)	Summer Accreditation (%)	Winter Accreditation (%)	Summer Installed Overnight Cost ($/kW$_{QCC}$)	Winter Installed Overnight Cost ($/kW$_{QCC}$)
Wind	300	NA	$ 1,871	$ 45.02	19.5	24.5	$ 9,595	$ 7,637
Solar PV	300	NA	$ 1,732	$ 26.26	41.9	8.1	$ 4,134	$ 21,383
BESS - Li-Ion	100	4	$ 2,071	$ 31.63	77.2	82.1	$ 2,683	$ 2,523
BESS - Li-Ion	100	8	$ 3,649	$ 58.28	100	100	$ 3,649	$ 3,649
LDES - Iron-Air	50	100	$ 3,090	$ 19.58	100	100	$ 3,090	$ 3,090
PHES - Closed Loop	100	8	$ 4,800	$ 22.00	100	100	$ 4,800	$ 4,800
Hybrid - Solar PV + BESS	50	4	$ 2,960	$ 43.27	52.2	27.5	$ 5,670	$ 10,764
Hybrid - Solar PV + BESS	100	4	$ 3,960	$ 58.99	47.6	10.6	$ 8,319	$ 37,358
Hybrid - Wind + BESS	50	4	$ 3,145	$ 66.64	11.4	29.9	$ 27,588	$ 10,518
Hybrid - Wind + BESS	100	4	$ 4,118	$ 82.40	26.3	50.1	$ 15,658	$ 8,220
Nuclear - SMR	320	NA	$ 11,015	$ 131.07	96.1	98.5	$ 11,462	$ 11,183
SC RICE	100	NA	$ 2,026	$ 23.56	96.1	99.2	$ 2,108	$ 2,042
SC Dual Fuel RICE	50	NA	$ 2,727	$ 41.71	96.1	99.2	$ 2,838	$ 2,749
SC CT - Aero	100	NA	$ 2,085	$ 18.44	98.5	98.5	$ 2,117	$ 2,117
SC CT - Dual Fuel Aero	50	NA	$ 2,379	$ 27.97	98.5	98.5	$ 2,415	$ 2,415
SC CT - F Class	200	NA	$ 1,817	$ 10.08	98.5	98.5	$ 1,845	$ 1,845
CCCT - Industrial 2x1	150	NA	$ 2,359	$ 17.27	98.5	98.5	$ 2,395	$ 2,395
CCCT - F Class 1x1	320	NA	$ 1,888	$ 9.43	98.5	98.5	$ 1,917	$ 1,917
		Color scaling min	$ 1,732	$ 9.43	11.4	8.1	$ 1,845	$ 1,845
		Color scaling min	$ 11,015	$ 131.07	100	100	$ 27,588	$ 37,358

Candidate Resource Installed Overnight Costs



Tax Credits for Candidate Resources

- Investment Tax Credits
  - Li-ion and iron-air batteries
  - Hybrids (battery portion only)
  - Pumped hydro
- Production Tax Credits
  - Nuclear SMR
- Solar and wind resources will not be modeled with either ITC or PTC given the recently passed HR 1 spending bill
  - *"Qualified solar and wind facilities must now be placed in service (PIS) by 2028 (no later than Dec. 31, 2027) unless such facilities begin construction within 12 months after the date of enactment of the bill."*
- IRA tax credits do not apply to natural gas units

Questions?

NorthWestern Energy
Delivering a Bright Future