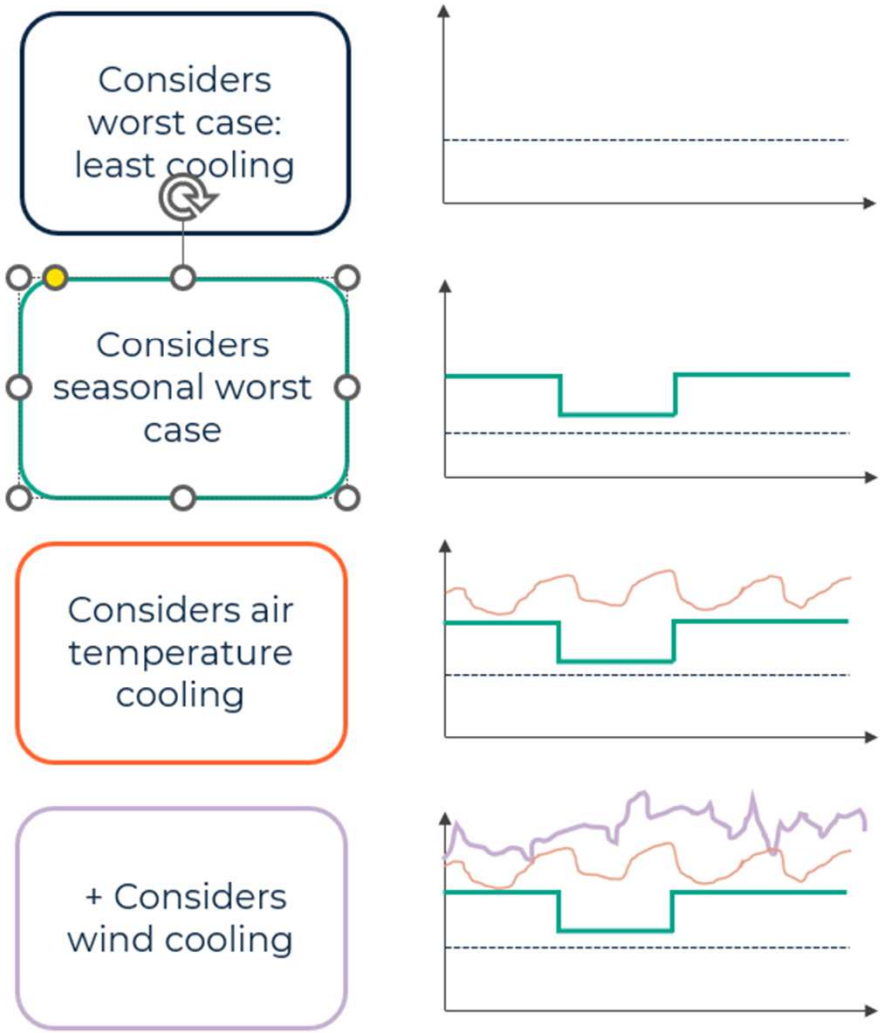
Ampacimon-Basin Electric DLR Experience
DTECH Midwest 2025

Jeremy Severson (Basin) and Corey Hauser (Ampacimon)

Various Types of Line Ratings



Static Line Rating (SLR)

Seasonally Adjusted Rating (SAR)

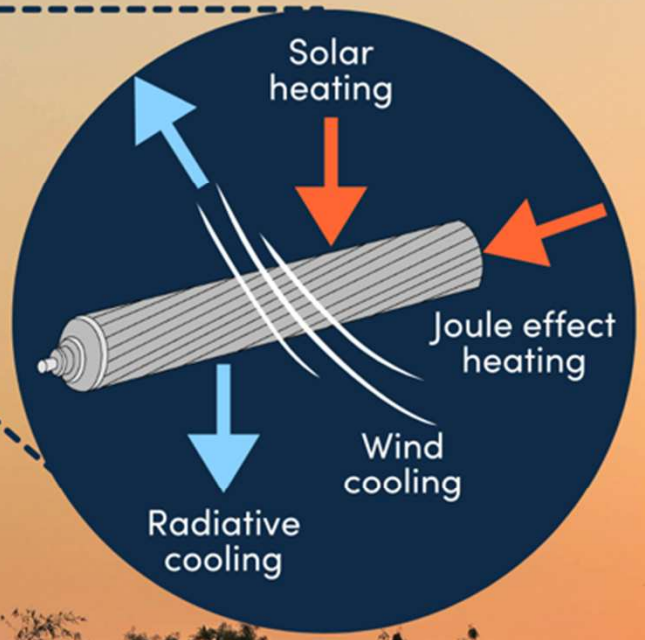
Ambient Adjusted Rating (AAR)
5-10% gains

Dynamic Line Rating (DLR)
10-50% gains

Importance of Wind on Ratings

Operating Conditions	Change in Conditions	Impact on Capacity
Ambient temperature	2 °C decrease 10 °C decrease	+ 2% + 11%
Solar radiation	Cloud shadowing Total eclipse	+/- a few percent + 18%
Wind	3 ft./s increase, 45° angle 3 ft./s increase, 90° angle	+ 35% + 44%

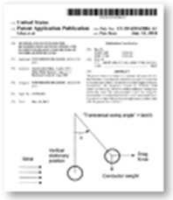
Source: Dynamic Line Rating Systems for Transmission Lines Topical Report, US Dept of Energy, April 25, 2014



Ampacimon ADR Sense Sensor

Direct Measurement | Wind Speed | Easy Installation | High Accuracy | High Data Availability

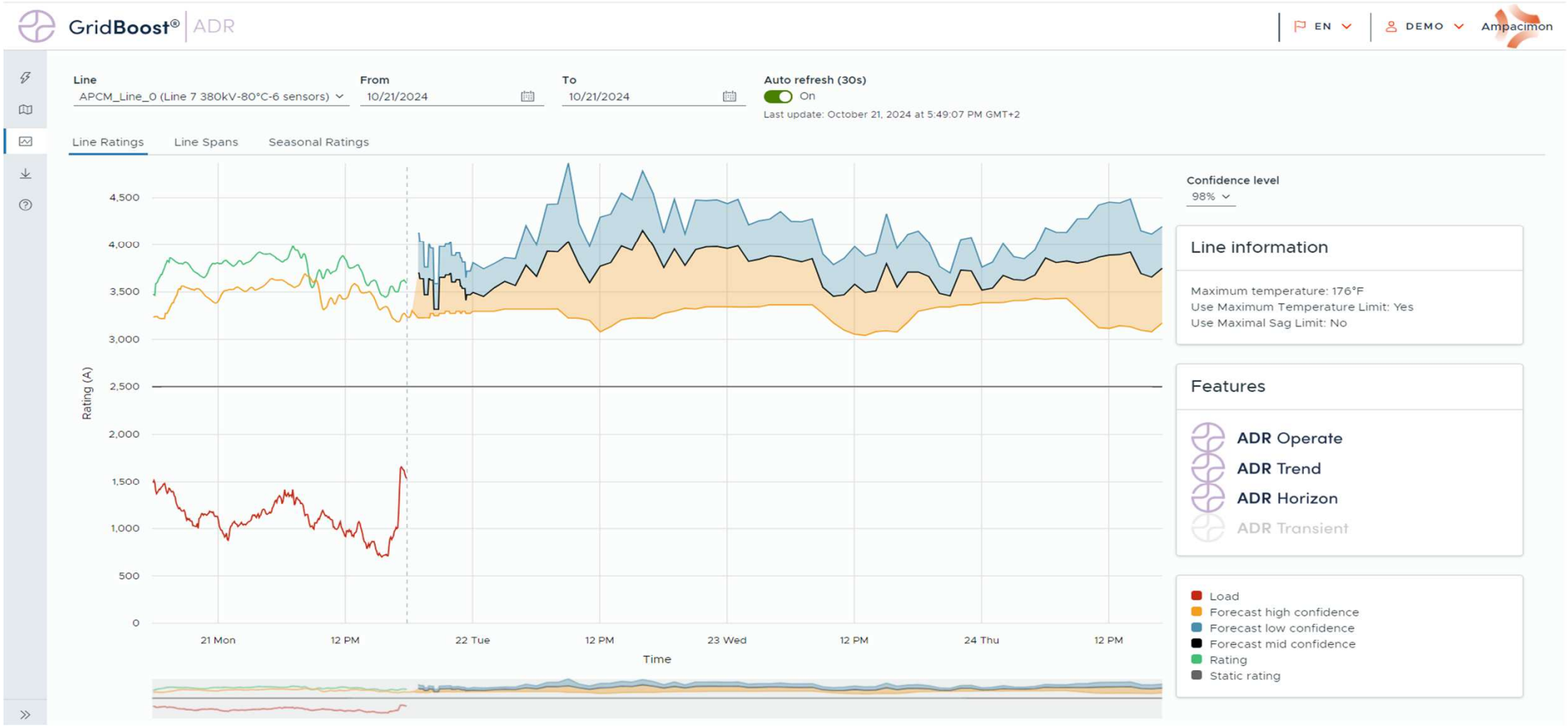
- Vibration-based metrology requires no calibration
- Direct Measurement of Perpendicular Wind Speed
- Machine learning for highest accuracy ratings forecasts
- High Accuracy Sag and Clearance Measurements at all conductor elevations
- Cellular or Satellite Communications
- Measurement of Mean Conductor Temperature
- EMS Integration Through DNP3
- Self-Powered on 10 kV – 700 kV lines
- Live line installation in less than 5 minutes
- Embedded Tension Sensor for Ice Detection and Conductor Health



Protected by 3 patents

ADR SENSE Ampacimon

Ampacimon DLR User Interface



PPL Use Case

	Reconductor	Rebuild	Dynamic Line Rating
			
Time to Implement	2 – 3 Years	3 – 5 Years	~1 Year
Downtime	Extended Outages	Extended Outages	No Outages
Cost	$0.5 M per mile	$2 - 3 M per mile	<$50k per mile*
Est Capacity Benefit	+ 34%	+ 106%	+ 10 – 30%

*< $1 M Total cost on 20-mile line & longer lines are cheaper

Basin Electric Snapshot

139 Members in 9 States

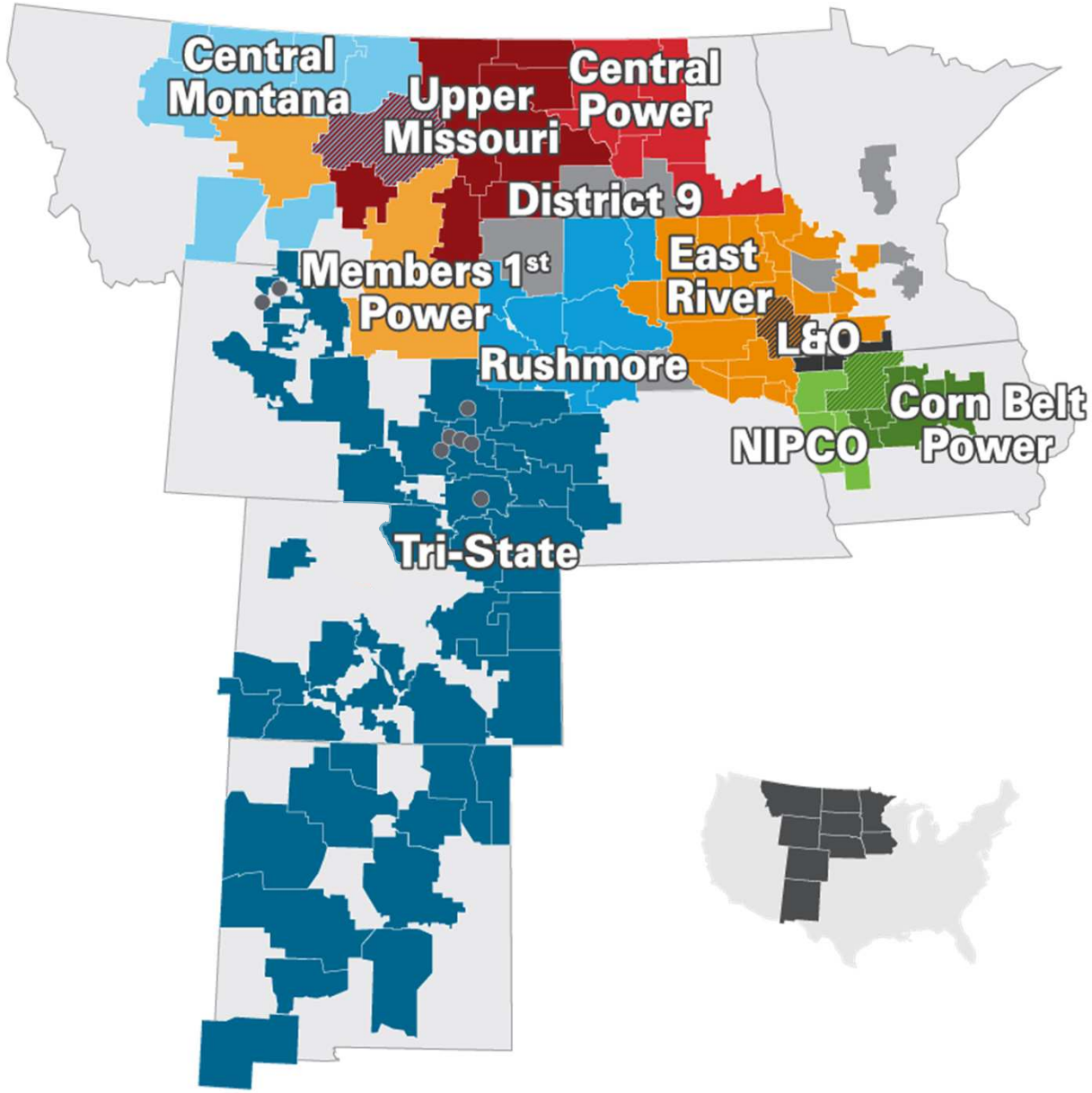
3 million member-owners

Nearly 8,500 megawatts of winter capacity

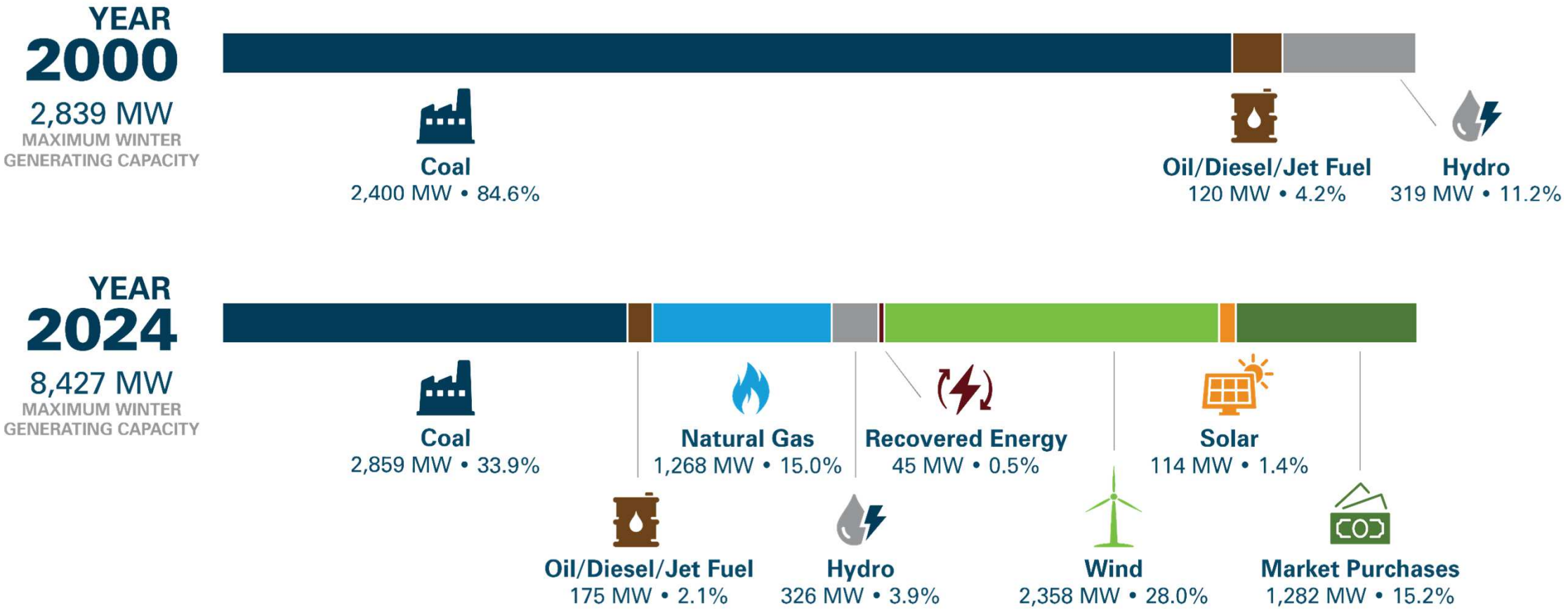
Largest G&T:
- Total MWh sales
- Member sales
- Total Operating Revenue
- Geographic territory served

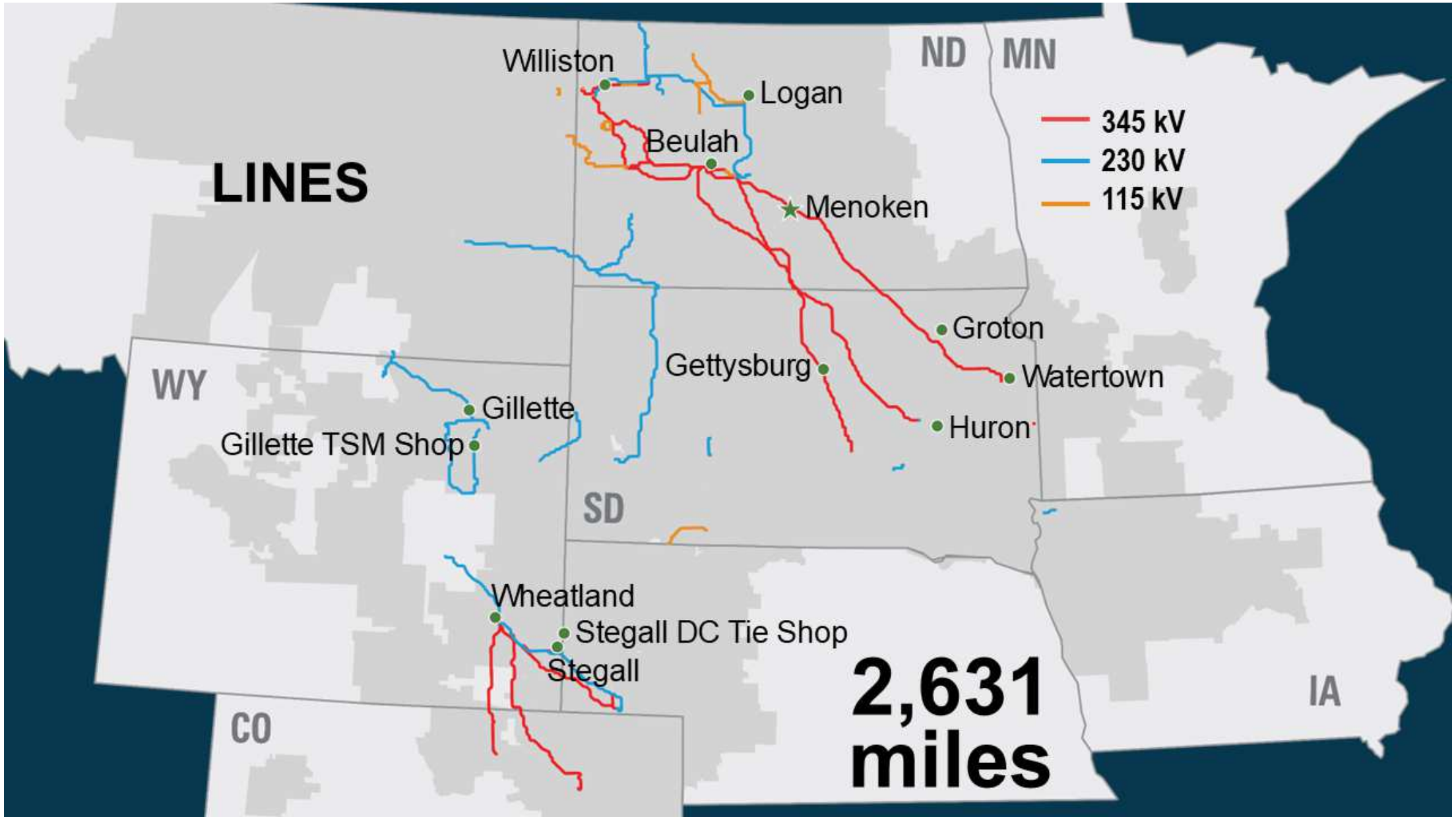
2nd largest G&T by assets

January 2025 Billing Peak Demand Record – 5,150 MW

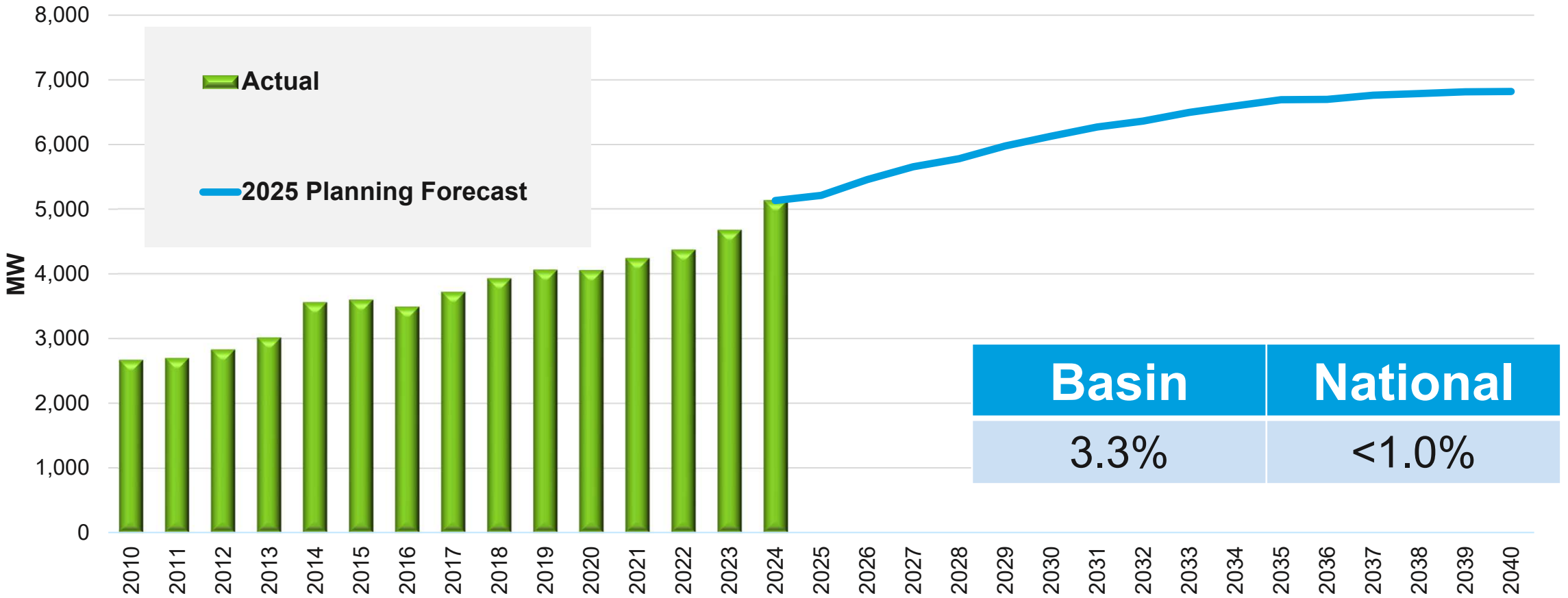


Annual Generating Capacity



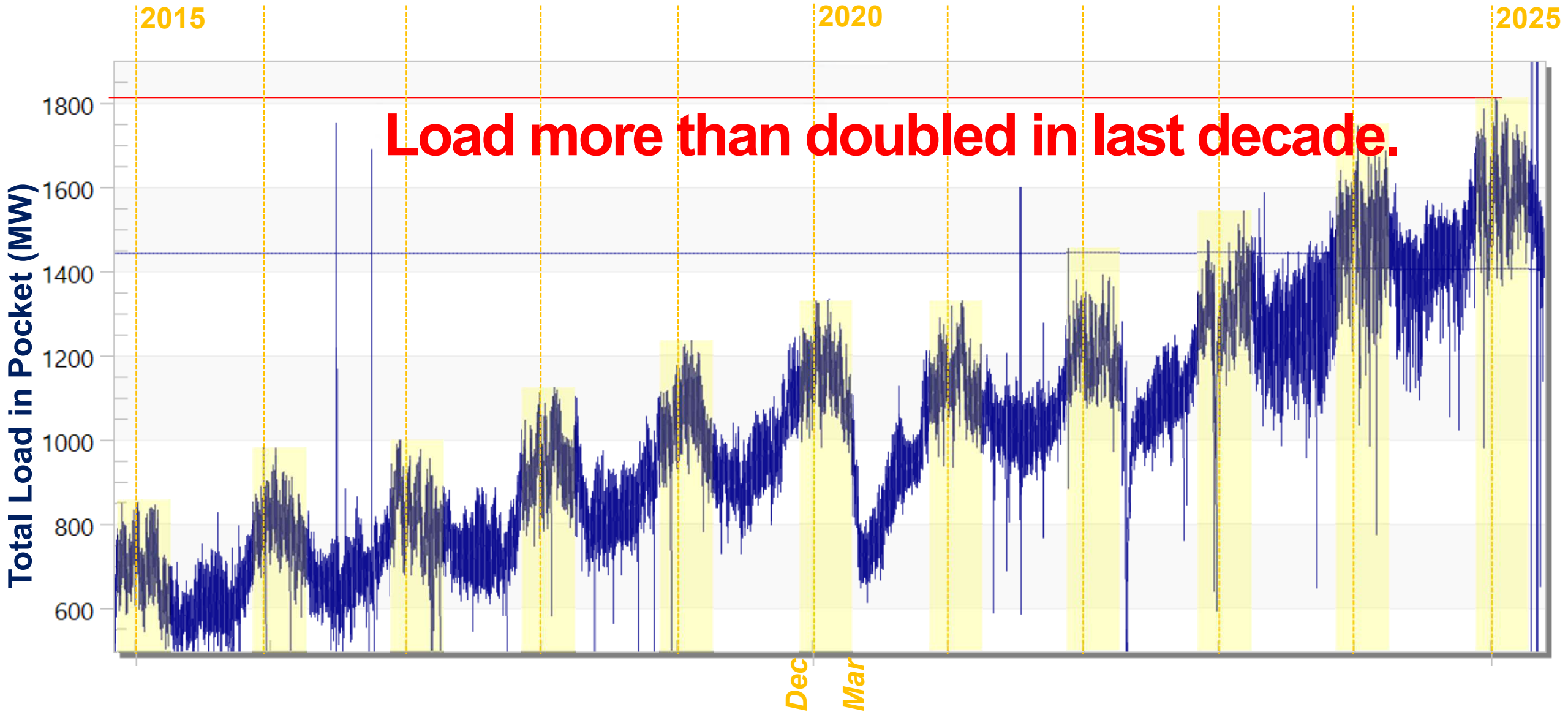

LINES
Williston
Logan
Beulah
Menoken
Groton
Watertown
Gettysburg
Huron
Gillette
Gillette TSM Shop
Wheatland
Stegall DC Tie Shop
Stegall
345 kV
230 kV
115 kV
2,631
miles
ND
MN
WY
SD
IA
CO

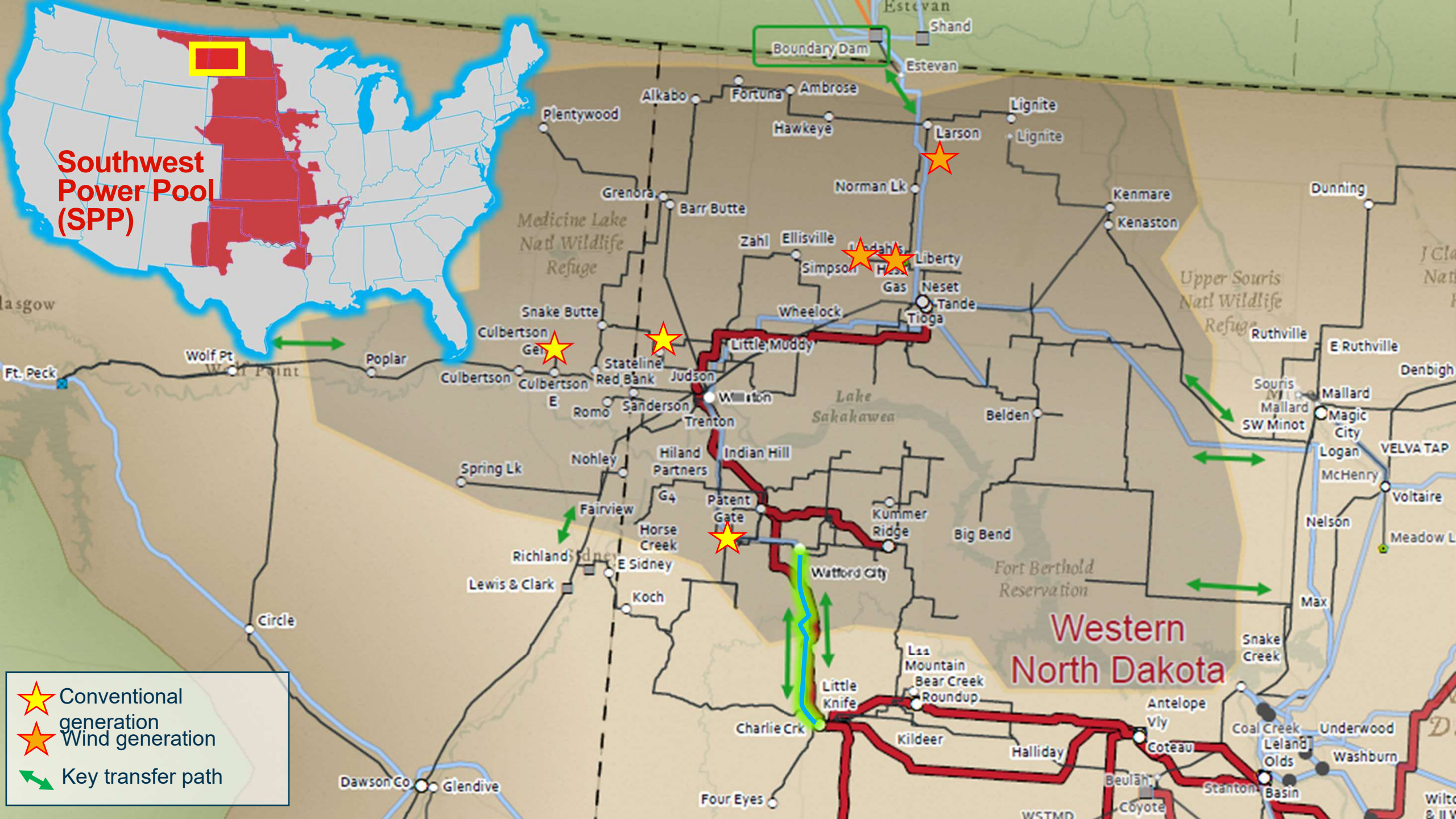
2025 Basin Electric Load Forecast



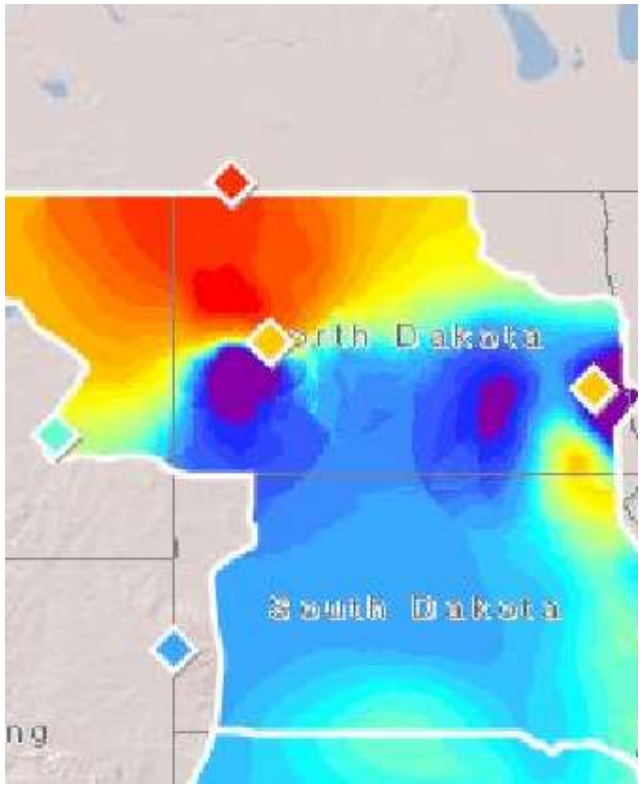
Basin	National
3.3%	<1.0%

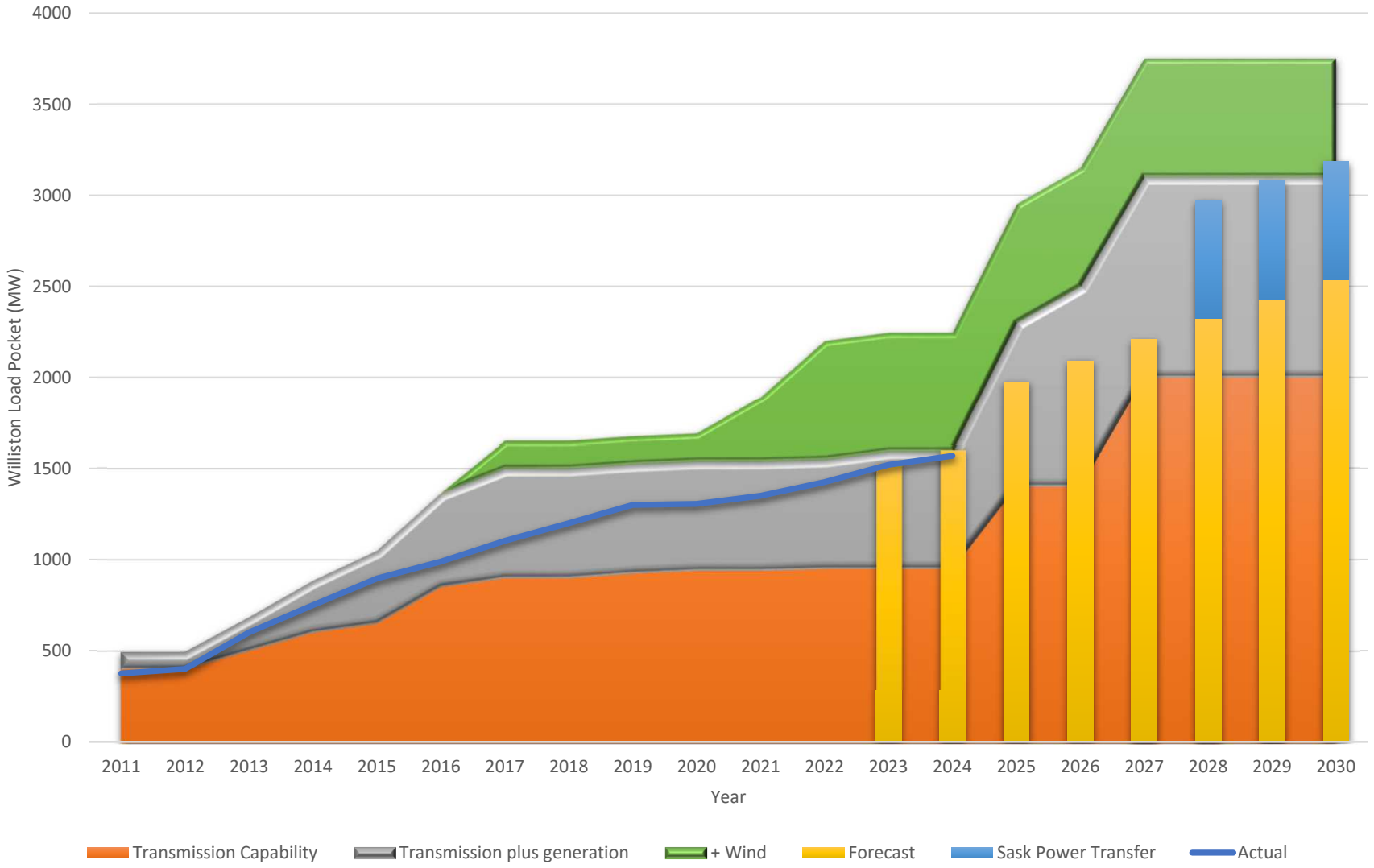
Northwest North Dakota (NWND) Load Area

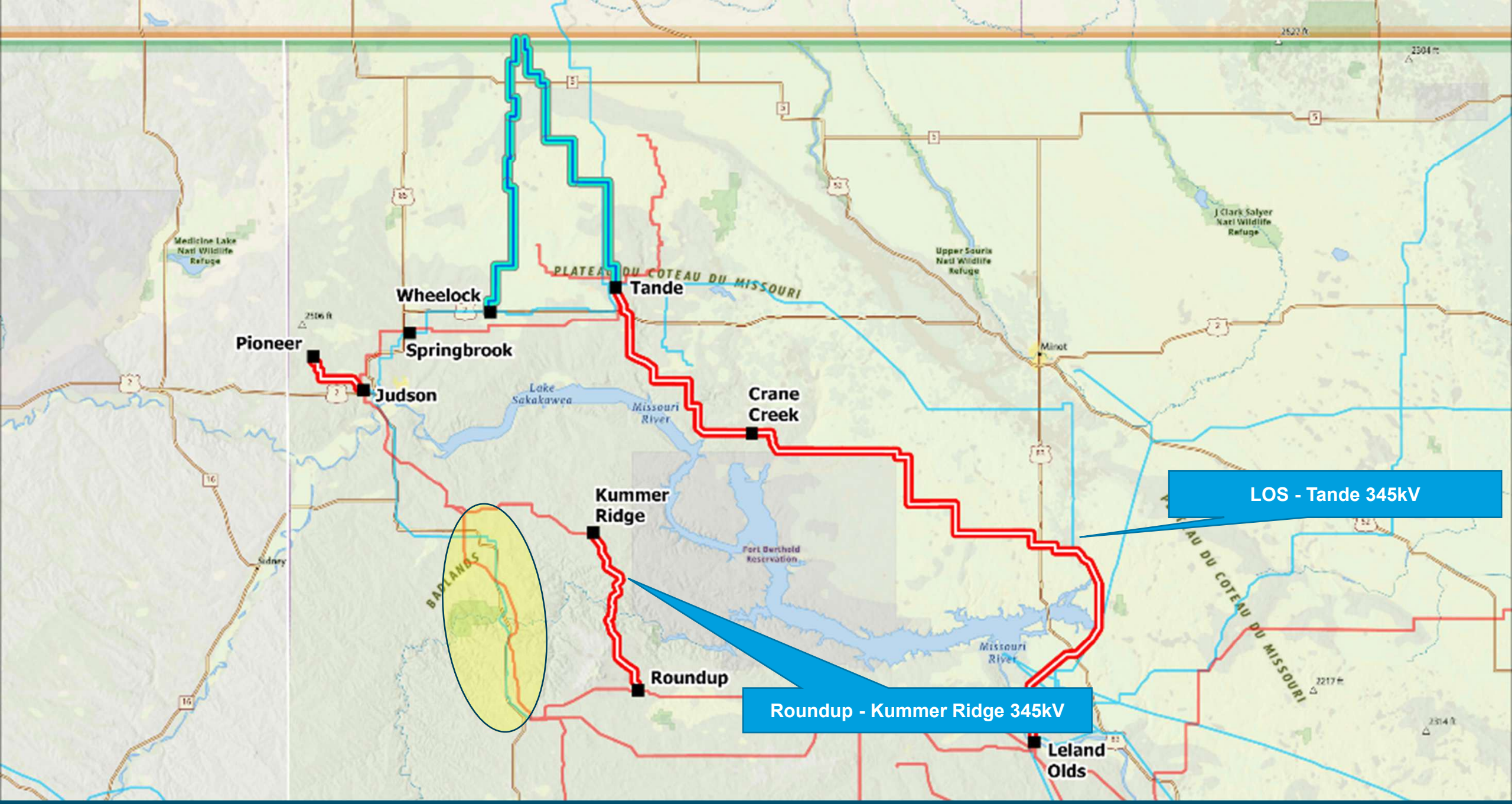



Southwest Power Pool (SPP)
Western North Dakota
Boundary Dam
Estevan
Shand
Alkabo
Fortuna
Ambrose
Plentywood
Hawkeye
Lignite
Larson
Norman Lk
Grenora
Barr Butte
Kenmare
Kenaston
Dunning
Medicine Lake Natl Wildlife Refuge
Zahl
Ellisville
Simpson
Liberty
Gas
Neset
Tande
Tioga
Wheelock
Upper Souris Natl Wildlife Refuge
Ruthville
E Ruthville
Snake Butte
Culbertson Gen
Little Muddy
Wolf Pt
Poplar
Ft. Peck
Culbertson
Culbertson E
Stateline
Red Bank
Judson
Romo
Sanderson
Trenton
Lake Sakakawea
Belden
Souris
Mallard
SW Minot
Magic City
Denbigh
Logan
VELVA TAP
McHenry
Voltaire
Nelson
Meadow L
Spring Lk
Nohley
Hiland Partners
Indian Hill
Fairview
G4
Patent Gate
Kummer Ridge
Big Bend
Horse Creek
Richland
E Sidney
Watford City
Fort Berthold Reservation
Lewis & Clark
Koch
Circle
Max
Snake Creek
Lost Mountain
Bear Creek
Roundup
Little Knife
Charlie Crk
Kildeer
Halliday
Antelope Vly
Coteau
Coal Creek
Underwood
Leland Olds
Washburn
Beulah
Stanton
Basin
Coyote
Four Eyes
Dawson Co
Glendive
Conventional generation
Wind generation
Key transfer path

Transmission Limits

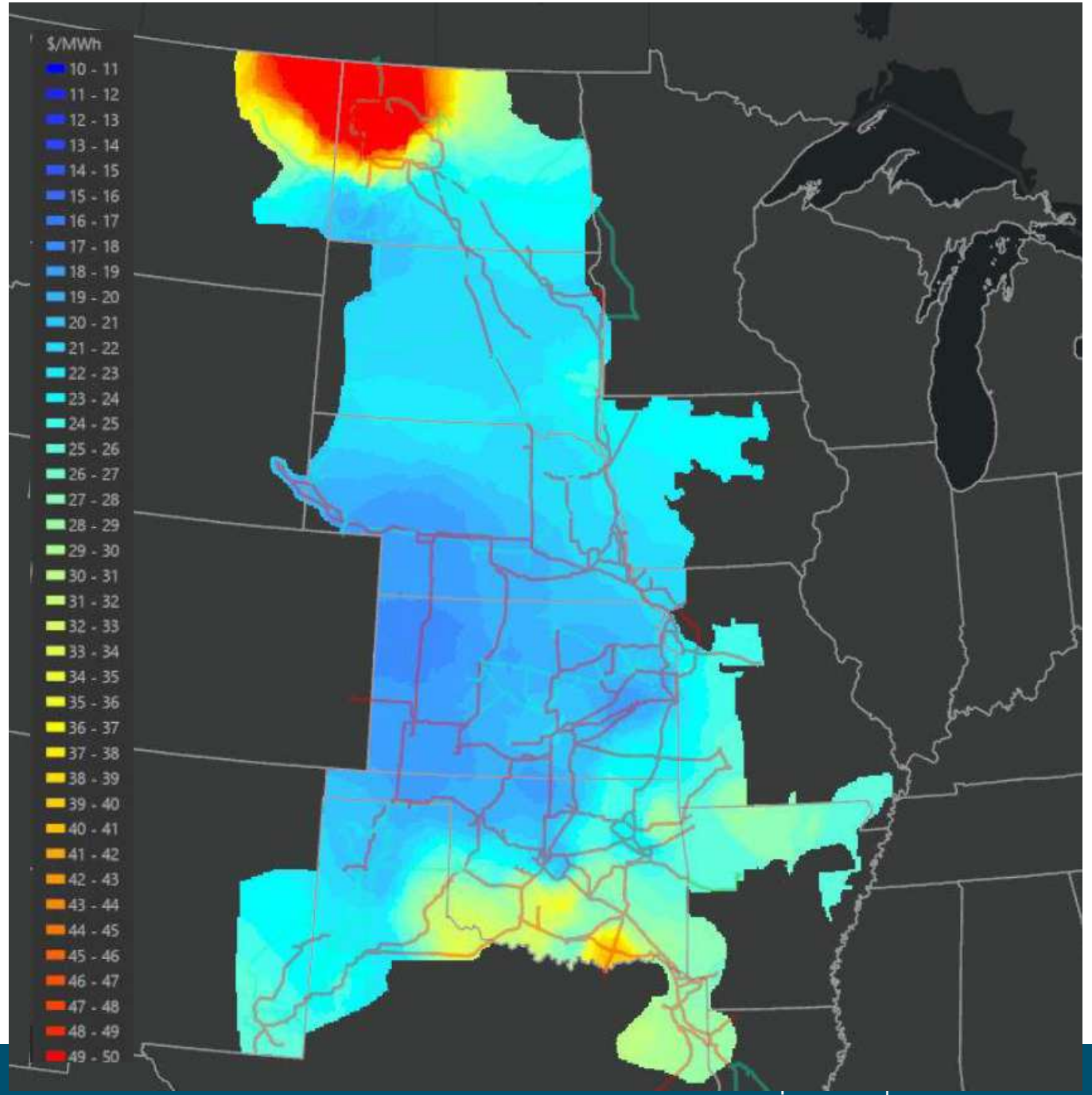





Wheelock
Tande
Pioneer
Springbrook
Judson
Crane Creek
Kummer Ridge
Roundup
Leland Olds
Minot
Sidney
Lake Sakakawea
Missouri River
Fort Berthold Reservation
BADLANDS
PLATEAU DU COTEAU DU MISSOURI
Medicine Lake Natl Wildlife Refuge
Upper Souris Natl Wildlife Refuge
J Clark Salyer Natl Wildlife Refuge
LOS - Tande 345kV
Roundup - Kummer Ridge 345kV

Congestion = Friction

- In 2023, the single most congested transmission line in **all of SPP** was in northwestern North Dakota.
- Accrued $126M of congestion costs between June and October alone.
- Earliest expected relief from new transmission was 18 months away.



Project

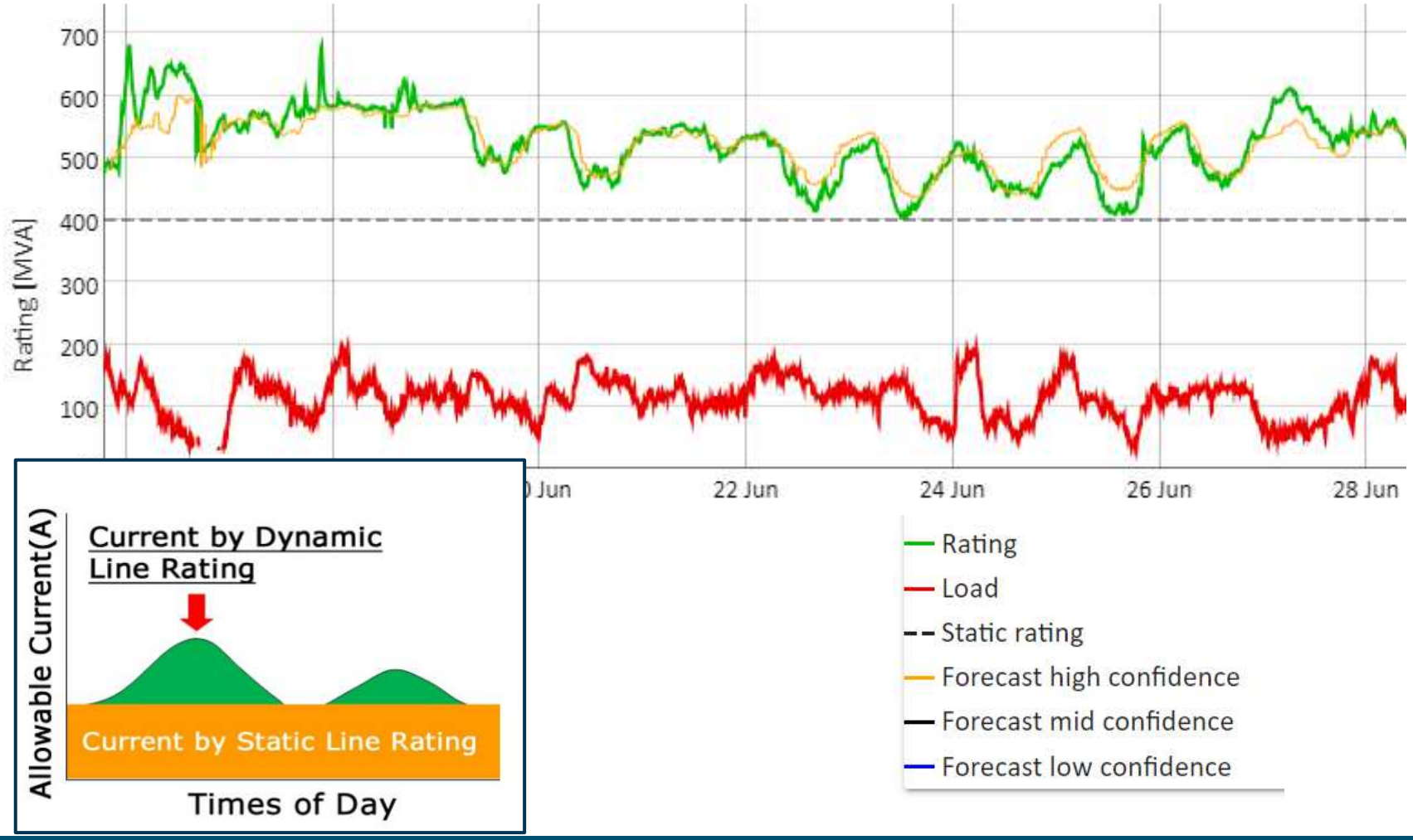
- System Need:
  - Thermal rating issue during peak load situations
  - Long term mitigation (new transmission) under construction

- Options:
  - TOP historically been utilizing temperature adjusted operating guides.
    - Inefficient and difficult for day ahead and real time analysis
  - Opportunity for Dynamic Line Rating (DLR) efficiencies

- Solution:
  - Implement DLR by the Summer of 2024

DLR Sensor Installation

Dynamic Line Rating Impact



Assess Operational Value of DLR

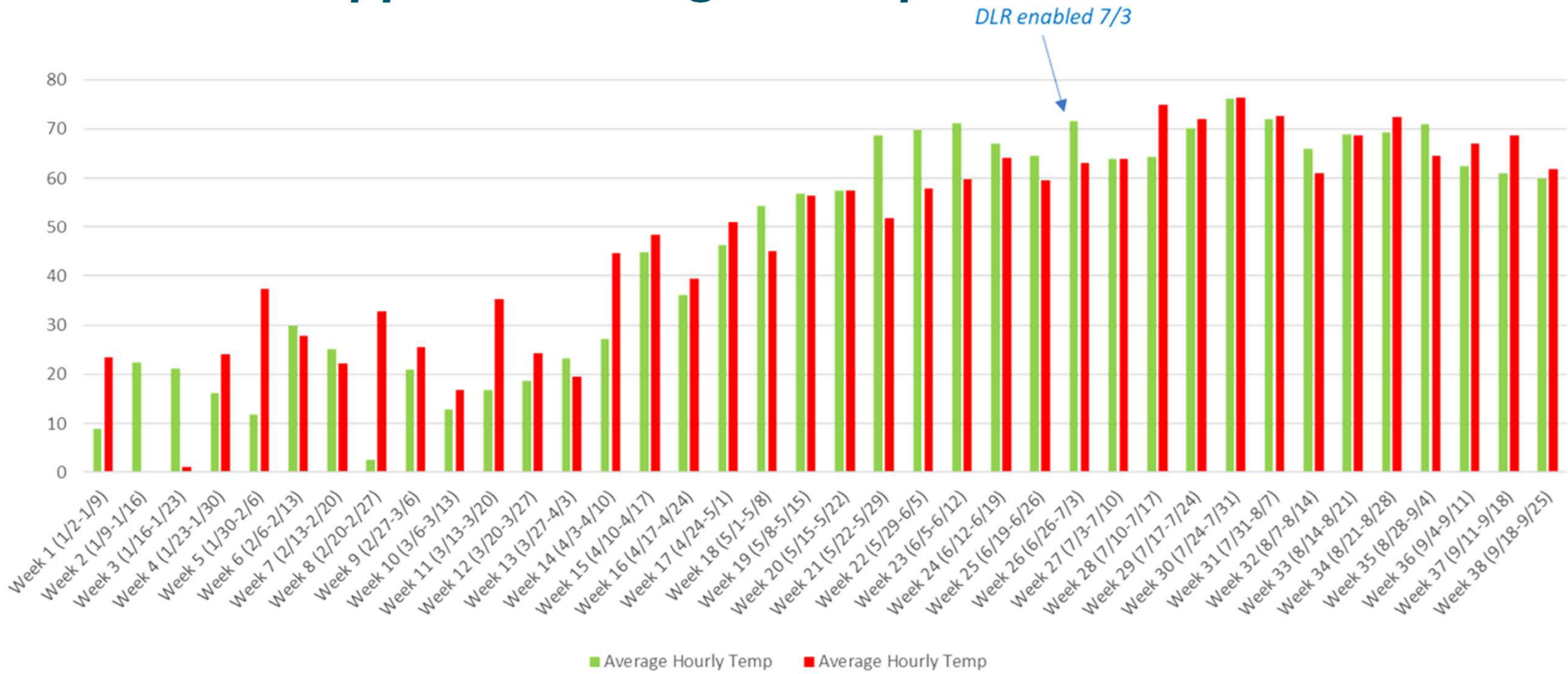
Apples-to-oranges comparison

- DLR was immediate solution to severe market constraints for summer 2024.
- Difficult to make direct comparison of before & after DLR.
- Why?
  - Ambient conditions vary.
  - Load grew.
- Let's review the conditional differences 2023 & 2024.

  → *Focus on summer after DLR enabled (7/3/2024).*

Average air temperatures (weekly basis)

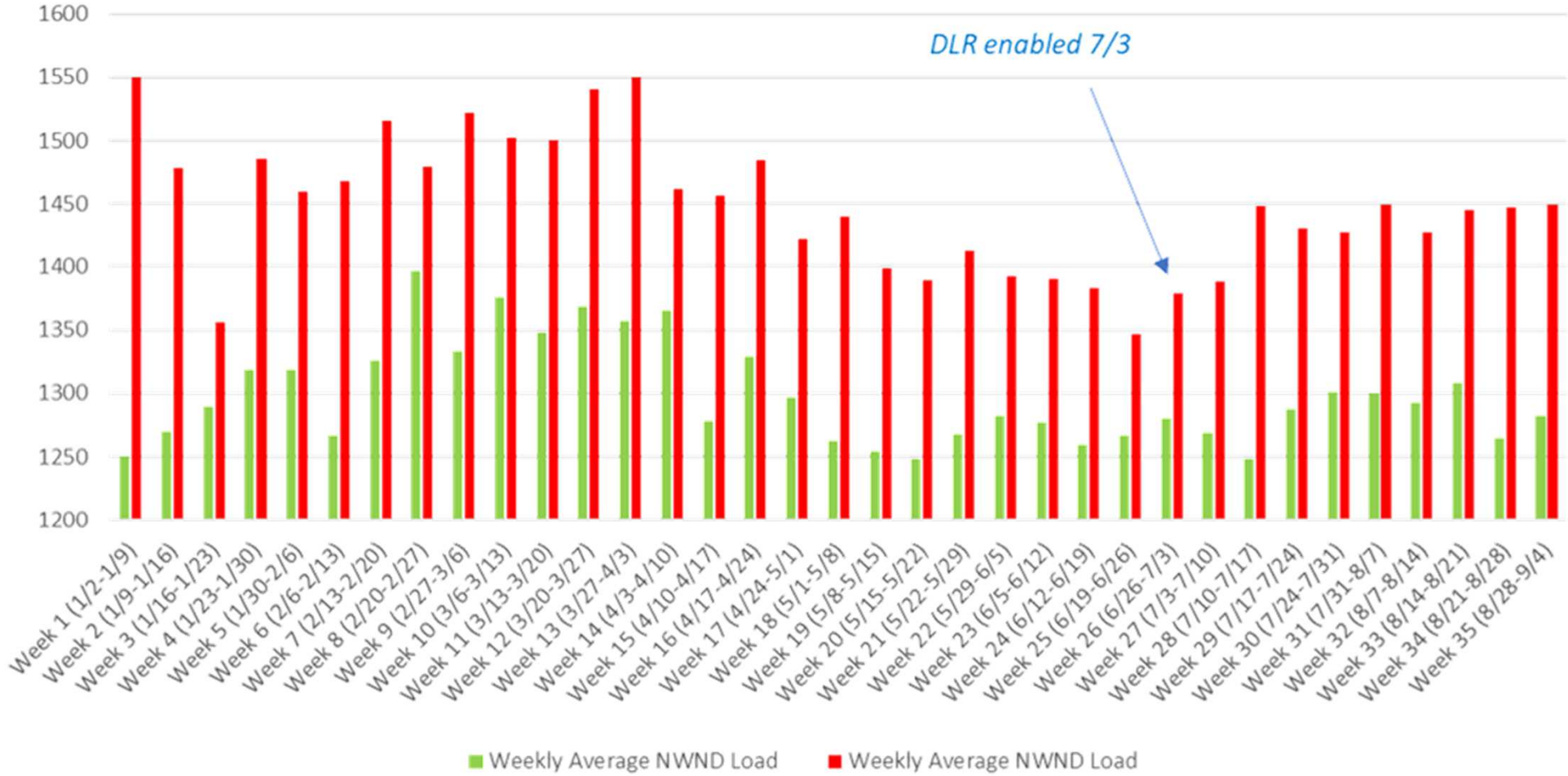
Apples-to-oranges comparison



2023 and 2024 are reasonably comparable.

Average NWND loading (weekly basis)

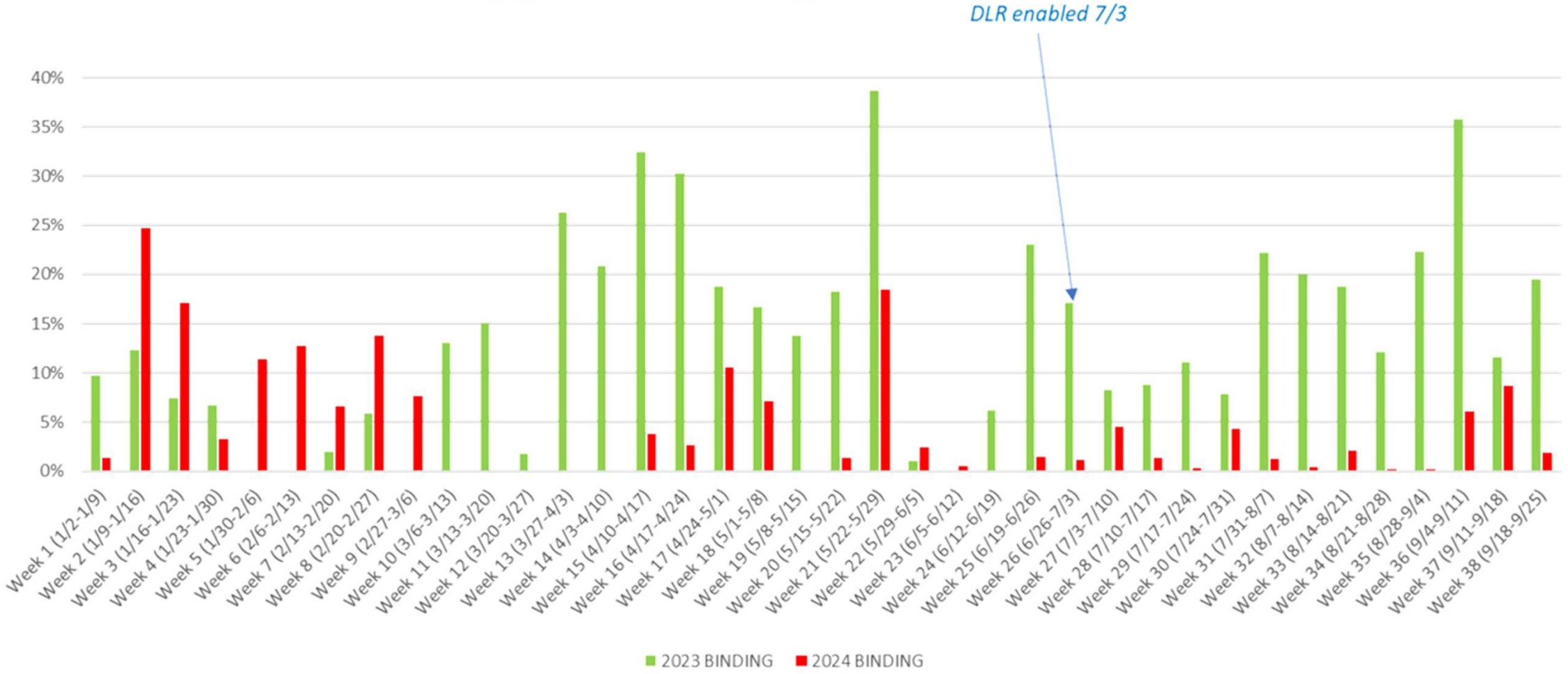
Apples-to-oranges comparison



Significantly more load in 2024.

Real-time market flowgate binding (weekly basis)

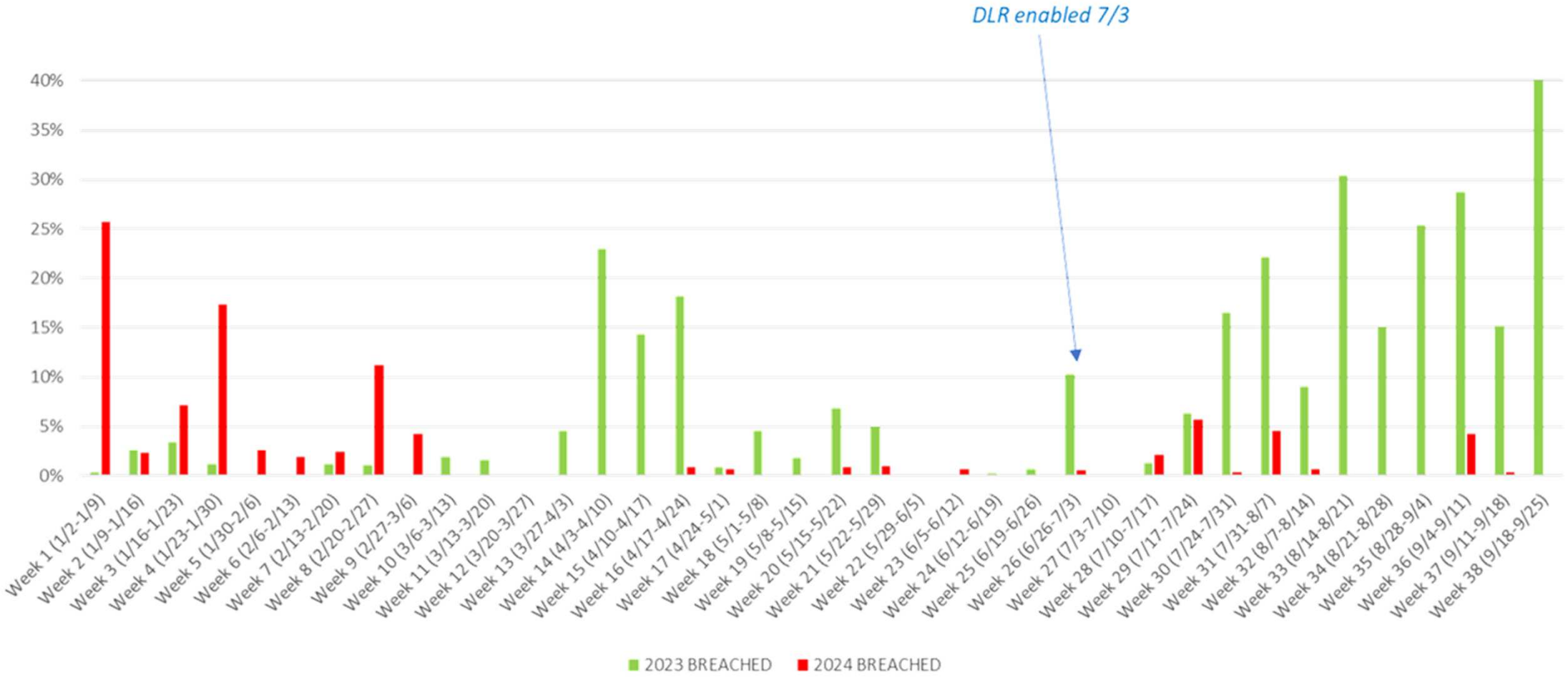
Apples-to-oranges comparison



Dramatically reduced flowgate binding in summer 2024.

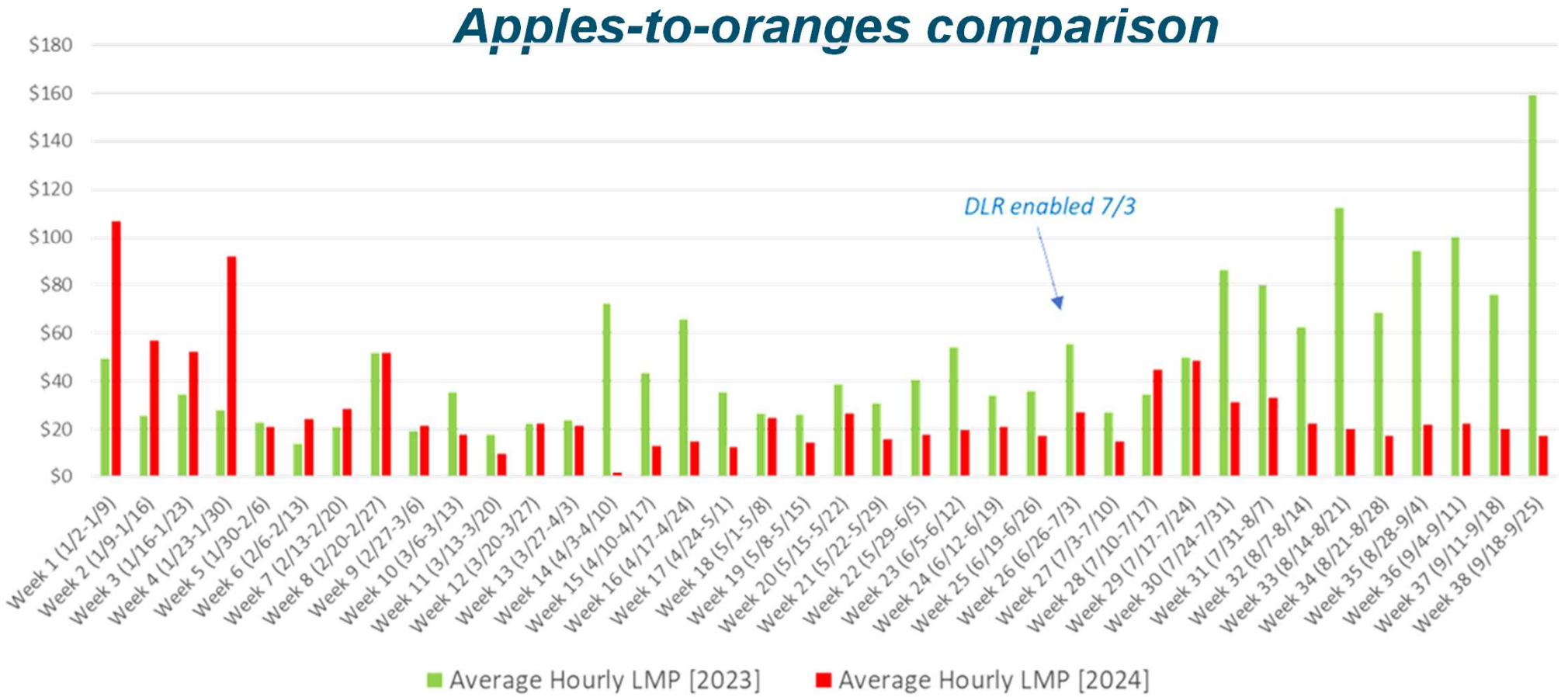
Real-time market flowgate breaching (weekly basis)

Apples-to-oranges comparison



Virtually eliminated flowgate breaches in summer 2024.

Average Real-time energy prices (5-min LMP; weekly basis)



Significantly lower delivered energy costs for load customers in summer 2024.

Takeaways

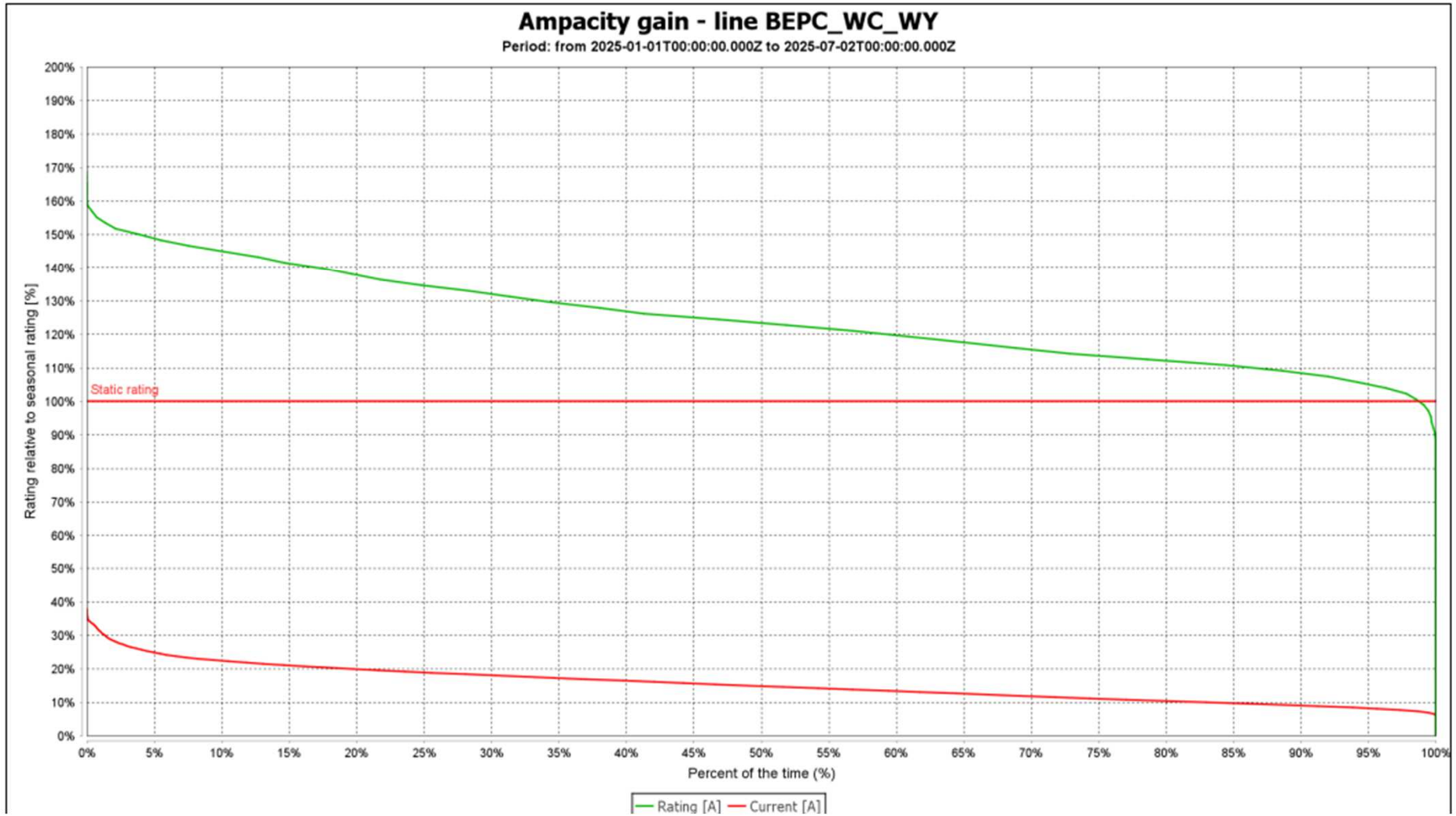
DLR Implementation: Between July & December 2024

- Yielded capacity above static rating 90% of the time.
- Avoided 500 hours of congestion (12% of period).
- Paid back full capital cost after just 38 days of operation.
- Over $20M of realized savings from congestion in 2024 alone.

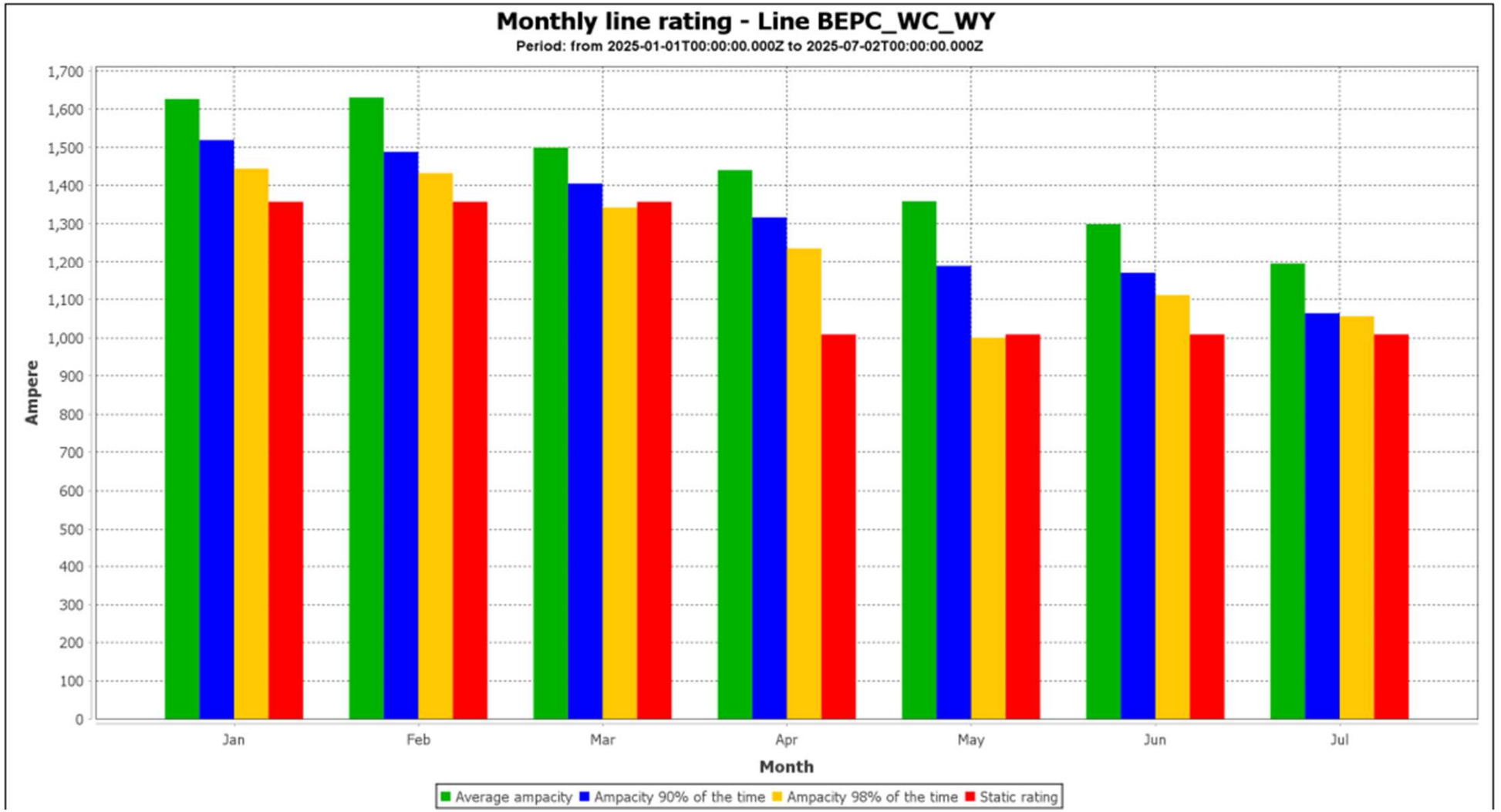
Other:

- Placed the Roundup to Kummer Ridge 345 kV line in service on December 17th 2024.

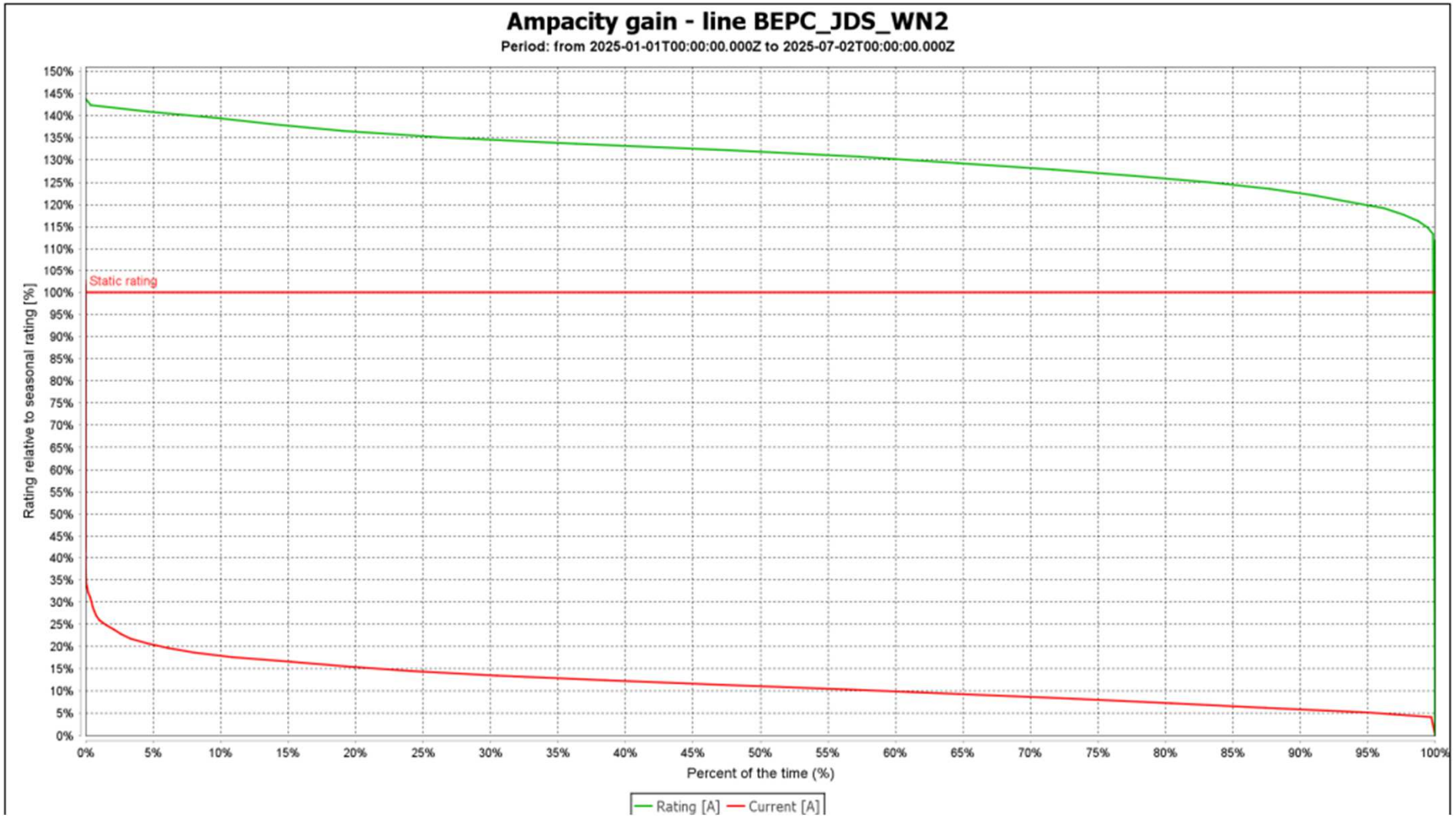
Line 1 Example – Ampacity Gained



Line 1 Example – Monthly Line Rating



Line 2 Example – Ampacity Gained



Questions