MONTANA-DAKOTA
UTILITIES CO.
A Subsidiary of MDU Resources Group, Inc.

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November 9, 2023

Executive Secretary
North Dakota Public Service Commission
State Capitol Building
Bismarck, ND 58505-0480

Re: Electric Service Agreement – MISO Market Study Report
Case No. PU-22-371

Montana-Dakota Utilities Co. (Montana-Dakota) herewith electronically submits to the North Dakota Public Service Commission (Commission) the MISO Market Study report pursuant to Paragraph 4 of the Settlement Agreement in the above noted proceeding which states "The Settling Parties agree Montana-Dakota will work with the Commission Staff to conduct a one-time informational MISO Market study regarding the area LMP pricing impacts of the 180 MW of data center load addition into the Ellendale area on ND ratepayers' fuel and purchased power costs. The details of the study will be worked out and agreed upon between Montana-Dakota and Commission Staff within 90 days of acceptance of this Settlement Agreement by the Commission."

As noted in its September 6, 2023 compliance filing, Montana-Dakota entered into an agreement with 1898 & Co. (1898) on August 11, 2023 to conduct the informational MISO Market Study regarding the MISO LMP pricing impacts of the 180 MW Applied Digital Ellendale Data Center load addition on Montana-Dakota's other North Dakota ratepayers' fuel and purchase power costs as described above. Adam Renfandt with the Commission staff was involved in the process to identify a consultant to conduct the study.

1898 used a MISO MTEP 2021 Future 1 2025 model, reverted to 2024, to represent the MISO System in Montana-Dakota's electric service territory. PROMOD was used to run the economic study to produce a with and without data center MISO 2024 LMP cost for Montana-Dakota's other integrated system load. The study results are included as Exhibit A.

Montana-Dakota utilized the 1898 study results with its Plexos economic dispatch software to calculate a 2024 fuel and purchase power cost for Montana-Dakota's other North Dakota ratepayers. See Exhibit B for the results with and without the 180 MW Applied Digital Ellendale Data Center. Two additional sensitivities were prepared as part of the 1898 study to include (1) an additional 180 MW data center load at

Ellendale; and (2) an additional 180 MW data center load at Ellendale plus a 100 MW data center load located at the Tatanka Wind Project.

In summary, as shown in Exhibit B and the table below, the modeled integrated system cost of fuel and purchased power costs reflect an increase due to the data center load addition. However, the addition of the Ellendale data center is expected to a provide transmission revenue of more than $7.6 million on an integrated system basis as provided for in the Company's 2023 TCA update filed with the Commission on July 14, 2023 in Case No. PU-23-268 and approved on September 27, 2023. This revenue credit will reduce the cost to customers. Therefore, the increase of approximately $122,000 is more than offset by the additional transmission revenue due to the Ellendale data center load. While the Ellendale expansion and any potential South Dakota data center loads noted below will add additional integrated system fuel and purchase power costs, these costs will continue to be offset by incremental transmission revenue.

Cases	Total Cost ($)
Base	$89,953,900
Existing DC	$90,075,870
Expansion DC	$90,765,670
SD DC	$91,269,430

Please contact me at (701) 222-7855 or at travis.jacobson@mdu.com with any questions regarding this filing.

Sincerely,

/s/ *Travis R. Jacobson*

Travis R. Jacobson
Director of Regulatory Affairs

Exhibit A
Market Study Report
1898 & Co.

Montana-Dakota Utilities Co. & 1898 & Co.

Data Center Load Increase Study

10/19/2023

Background

- MDU serves nearly 431,000 customers across 271 communities[1], that have a cumulative expected load forecast* of ~3,800 GWh for the year 2024

- Data Center Change Case 1 (Existing Datacenter) explores the 2024 effects of siting a 170MW datacenter in MDU's territory

- Data Center Change Case 2 (Expansion Datacenter) explores the 2024 effects of siting a second 170MW datacenter in MDU's territory

- Data Center Change Case 3 (SD DC) explores the 2024 effects of siting an additional 90MW datacenter in MDU's territory in addition to the two 170MW datacenters from Change Case 1 and Change Case 2

[1] Website link

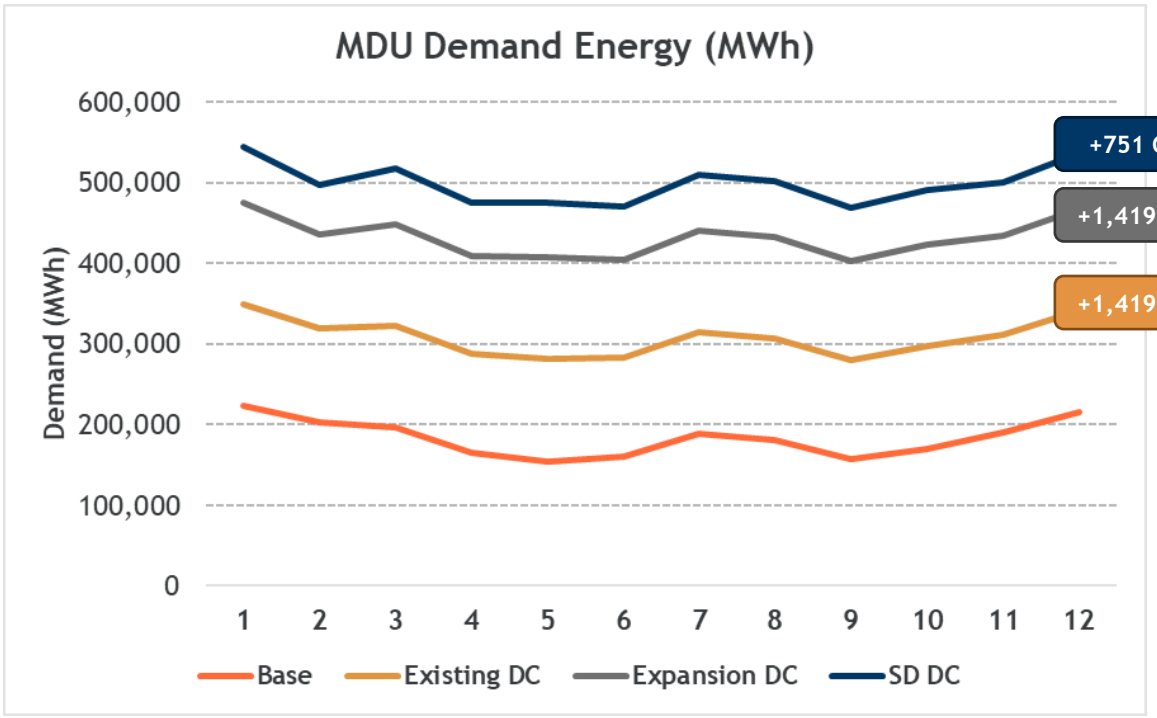
Summary of Results

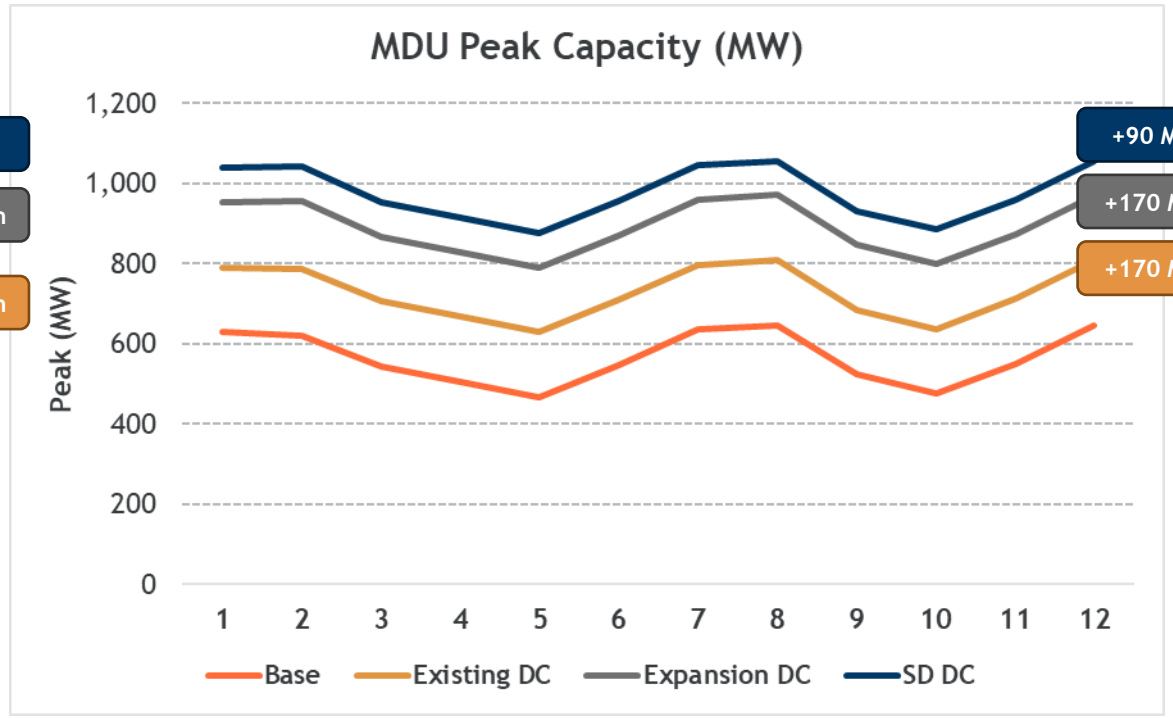
- Without data centers, MDU native load buses experience average LMPs for the year of 2024 between $21-$23/MWh
- Increasing data center load in the Ellendale area causes…
  - Native load buses to experience marginal increases in LMP prices. With the highest load datacenter scenario raising average native load bus LMP's by approximately $2/MWh annually
  - Datacenter load buses however experience a more aggressive rise in LMP's as wind curtailment declines
- The additional load reduces curtailment in region… additional estimated $230k in annual wind production tax to North Dakota
- MDU resources are being more heavily utilized as data centers are added

Assumptions

MDU Demand Energy and Peak Capacity

Base Case MDU demand was sourced from the 2024 forecast within the MTEP 21 PROMOD model

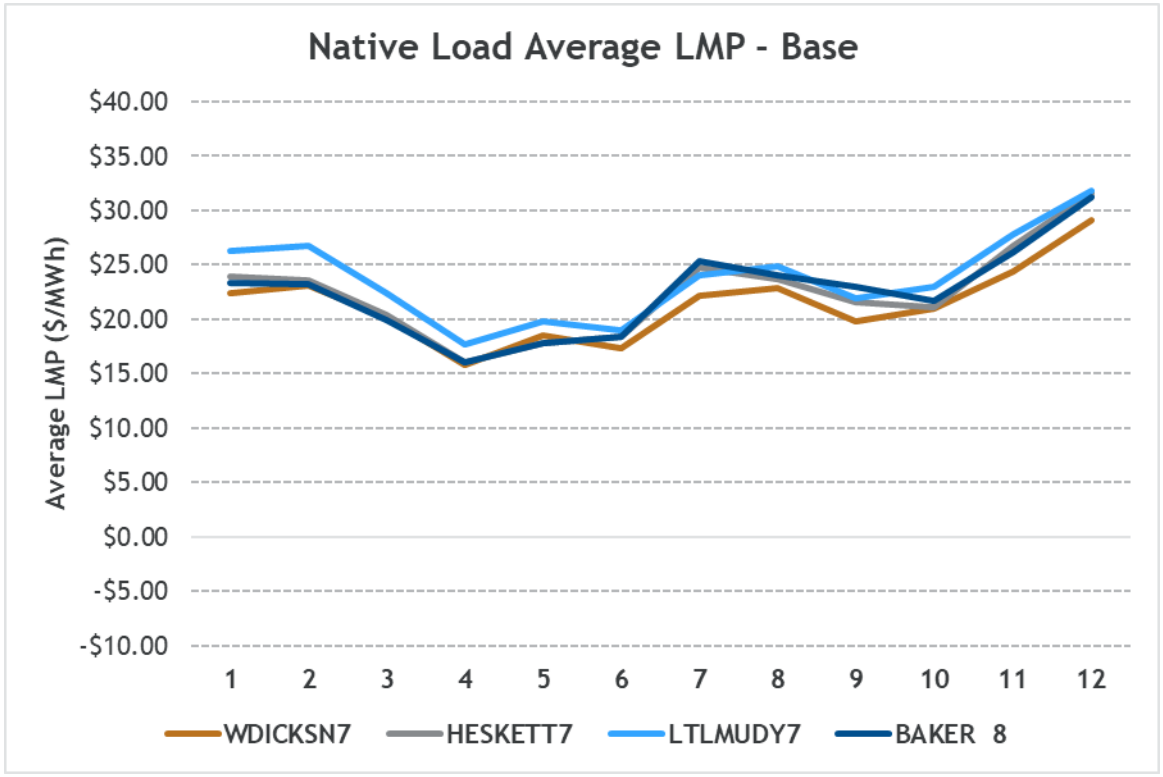


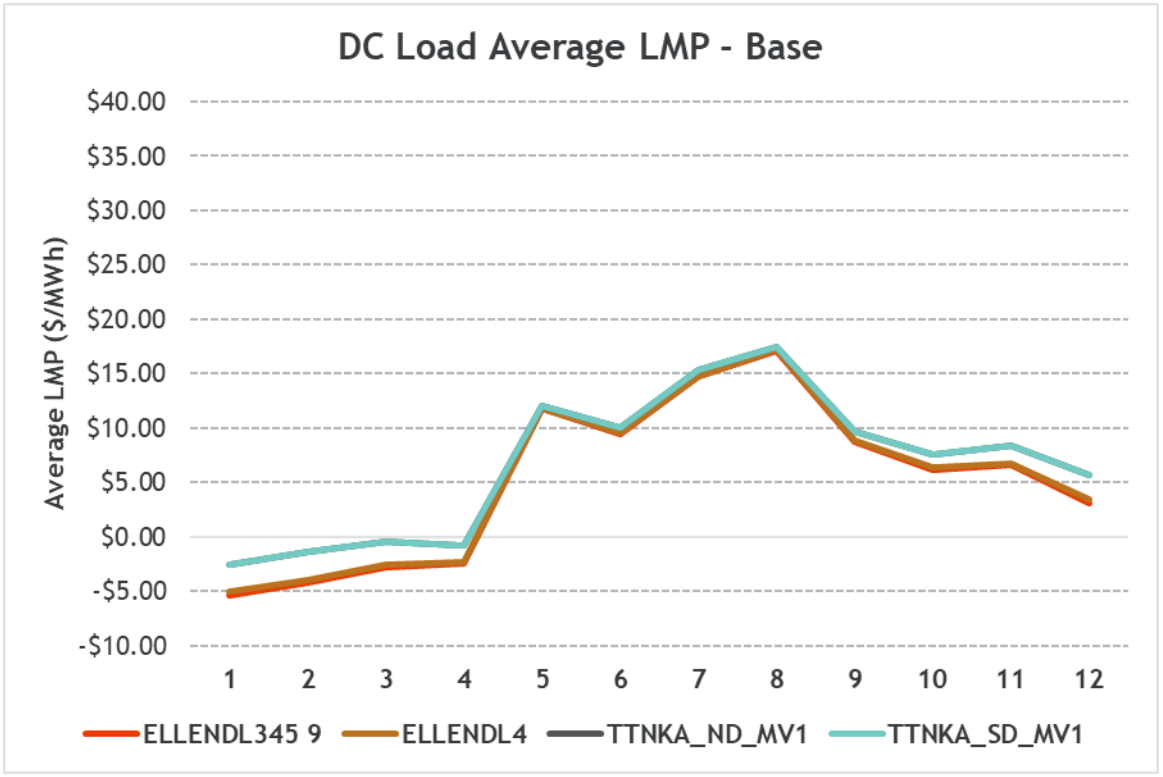


Adding all three data centers results in an 64% increase in peak-demand and an 144% increase in annual-energy requirements for MDU.

Pricing Impacts

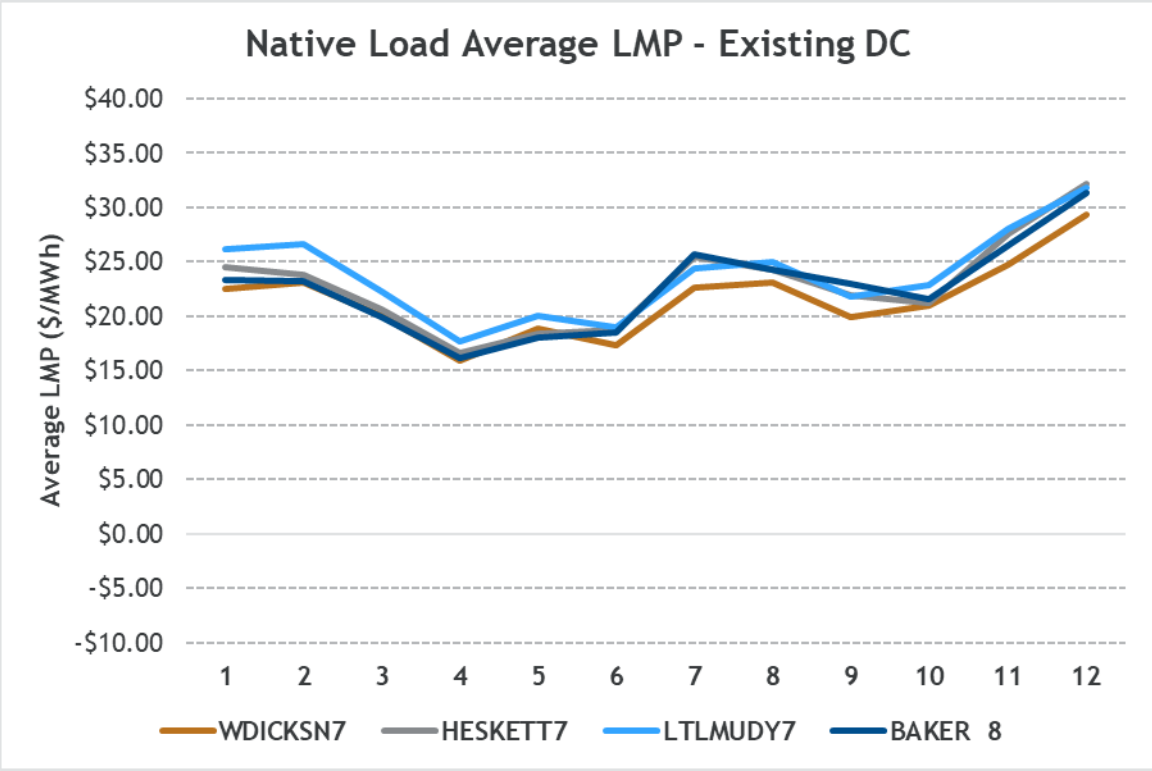
LMP Average Pricing - Base

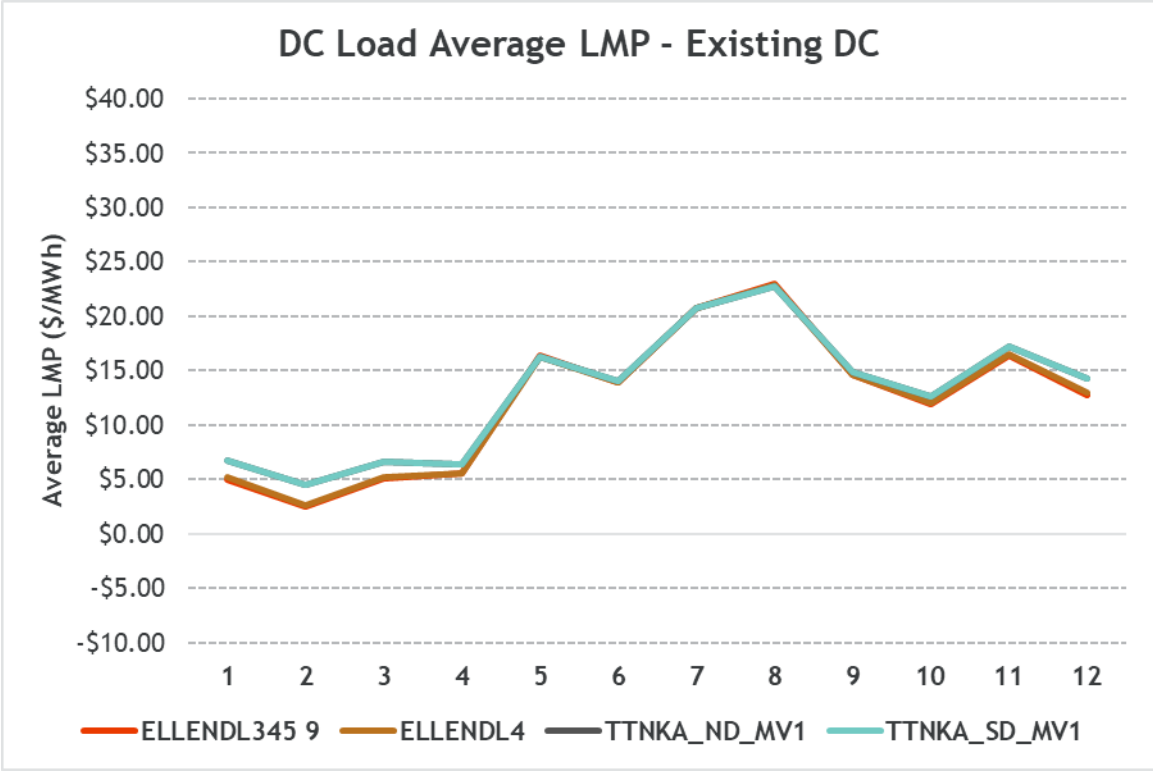




Marginal Energy Cost (MEC) is consistent between load and data center busses. Data Center load busses are experiencing about -$21/MWh of congestion annually before adding any load.

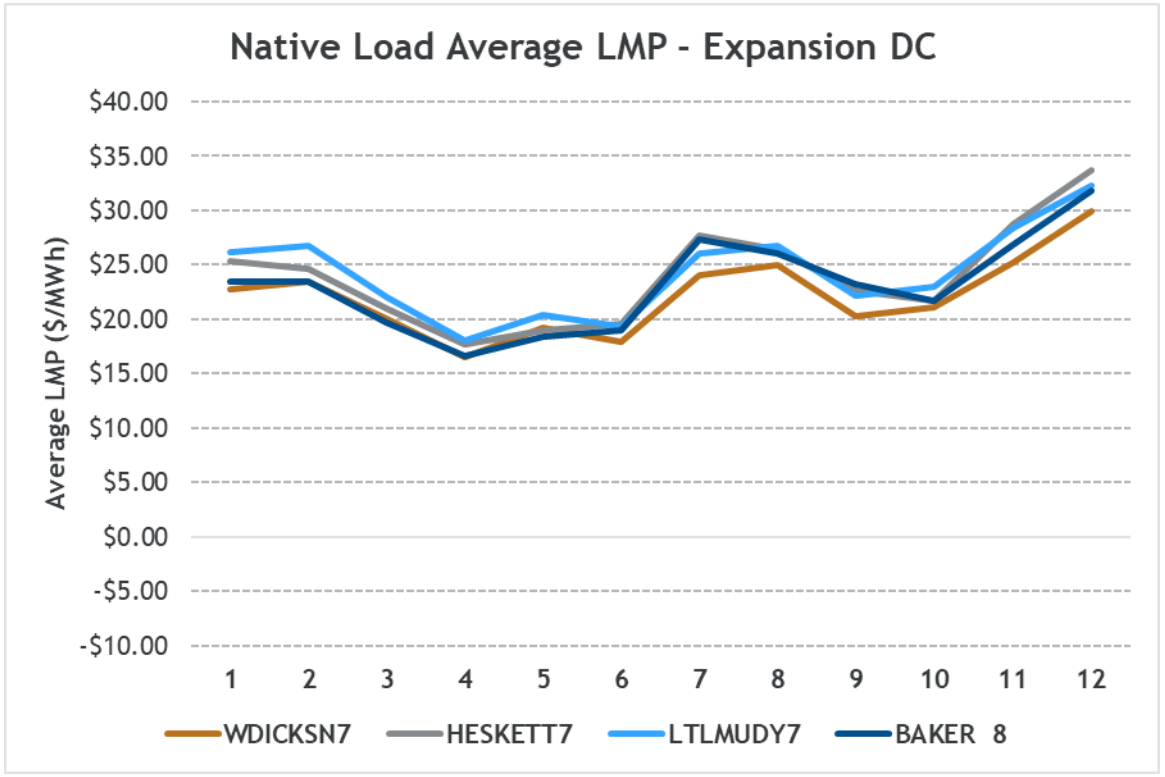
LMP Average Pricing - Case 1: Existing DC

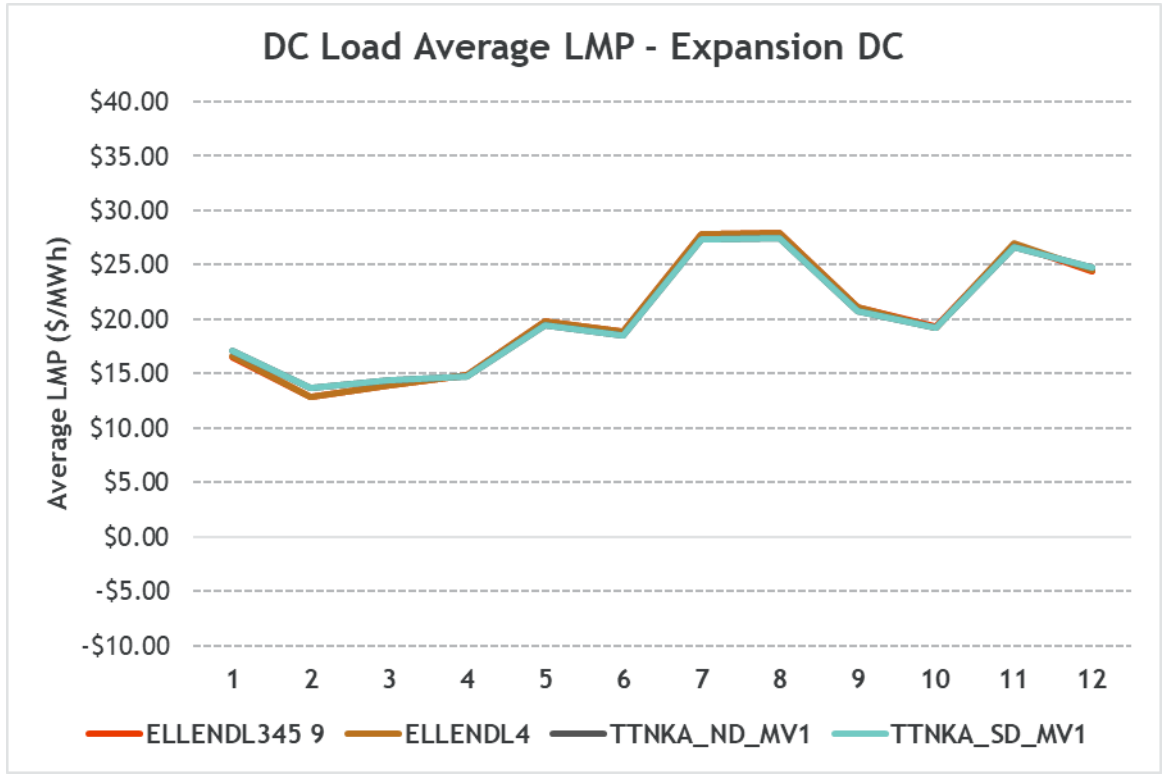




The introduction of data center load (+170 MW) into the system results in LMP price uplift. Data Center load busses are experiencing about -$13/MWh of congestion annually after the first DC addition.

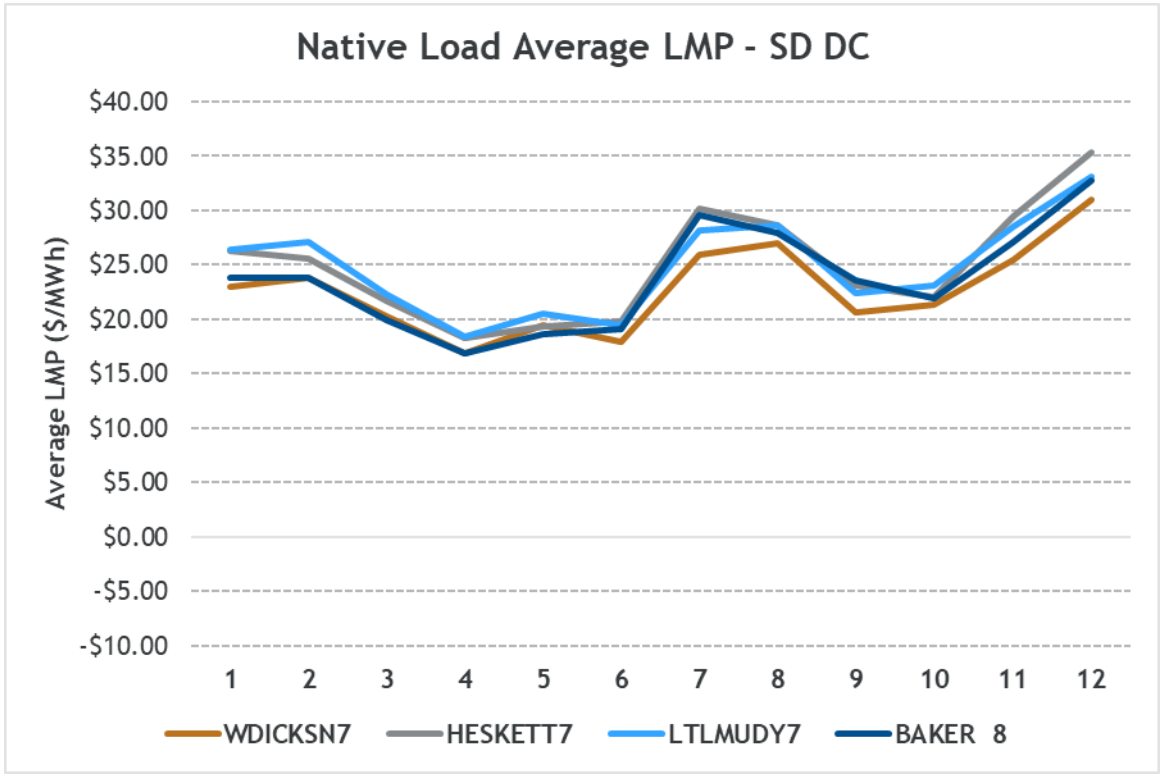
LMP Average Pricing - Case 2: Expansion DC

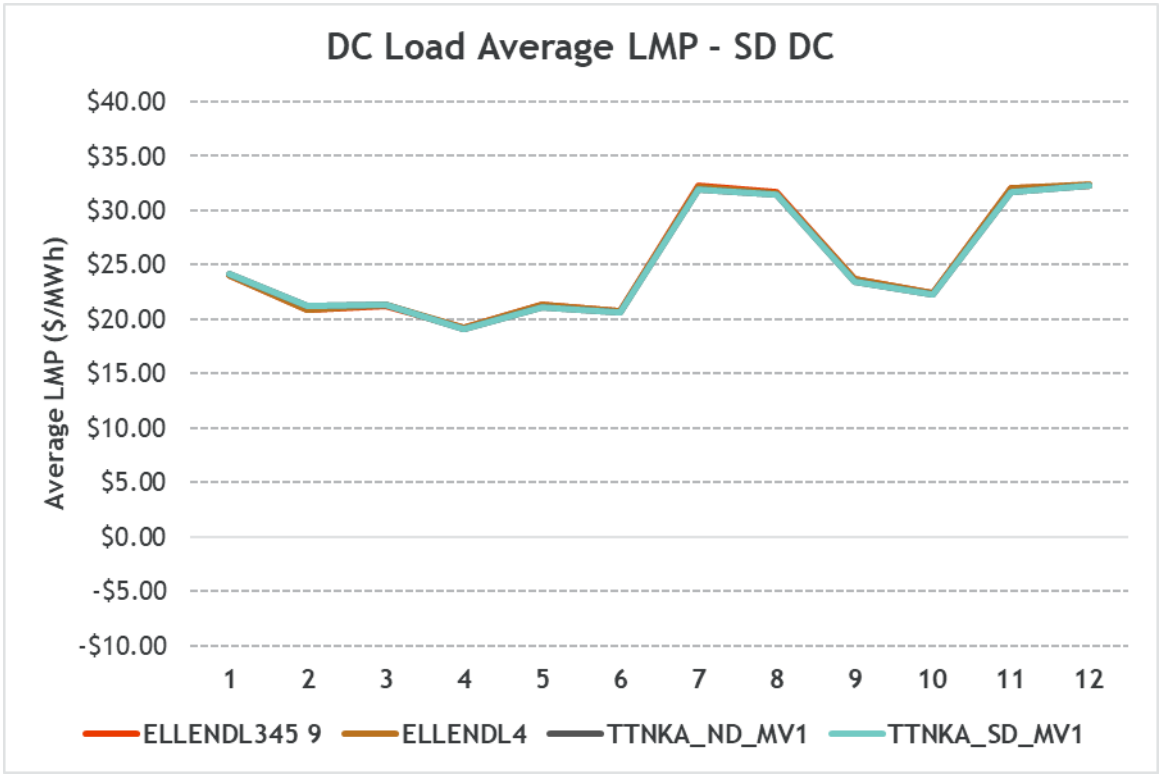




With the continued data center expansion (170MW + 170MW), LMP prices at the data center busses are converging towards the patterns observed at the native load buses.

LMP Average Pricing - Case 3: SD DC

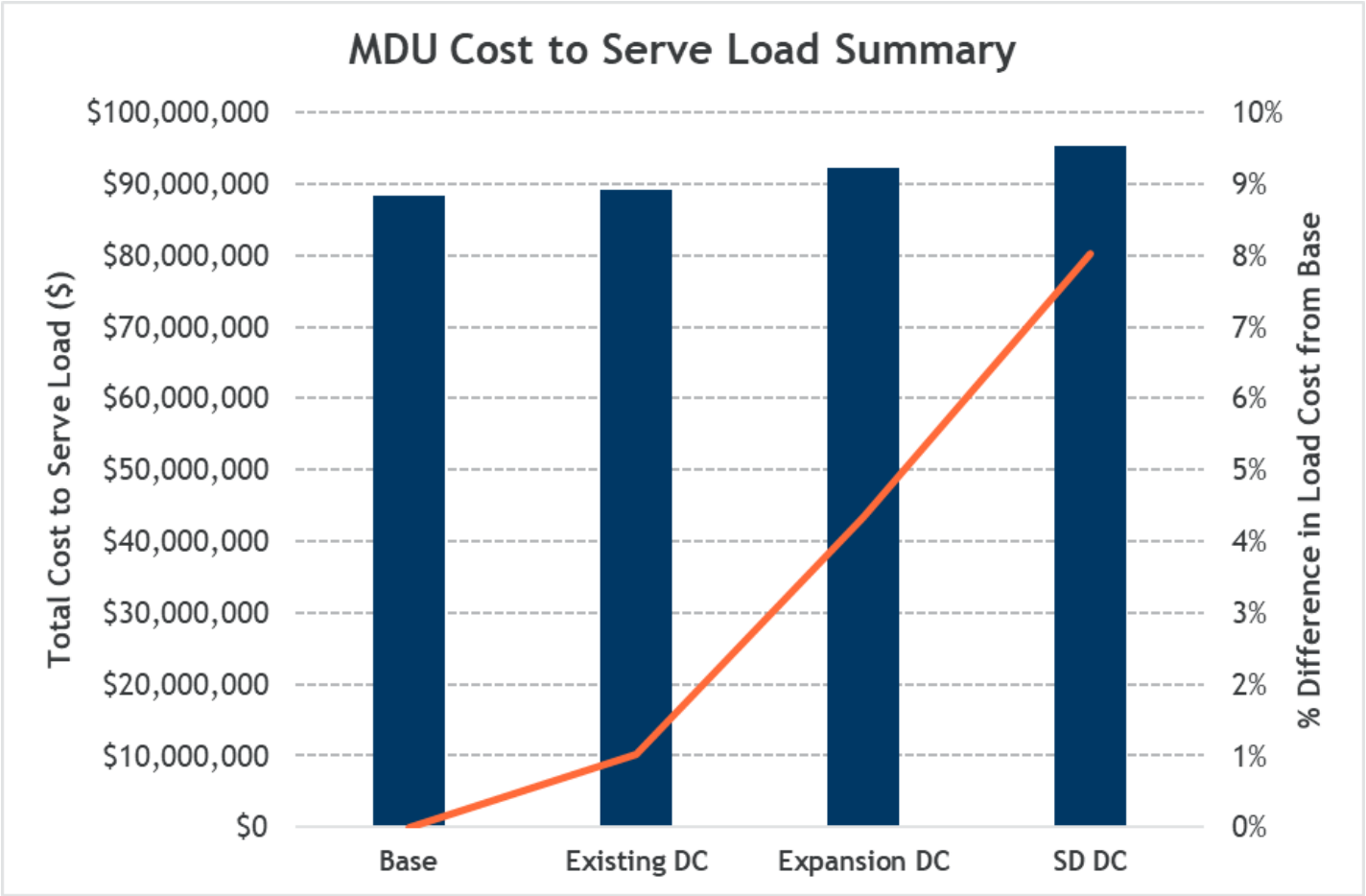




With the third DC added in the model, we see near parity between native load and data center load busses from an LMP perspective. Value proposition of adding additional load in the wind rich pocket around Ellendale is virtual eliminated.

MDU Gross* Native Load Cost

Cases	Total Cost ($)	Percent Increase (%)
Base	$88,322,973	
Existing DC	$89,223,770	1.02%
Expansion DC	$92,160,442	4.34%
SD DC	$95,404,300	8.02%



*Gross indicates that this load cost is not considering any cost reduction coming from MDU owned generation energy market profit

Native
Load Bus Congestion

Native Load Bus Congestion* Summary

Load Buses	WDICKSN7	HESKETT7	LTMUDY7	BAKER8	Avg. Congestion
Base	-$3.02	-$1.43	-$2.12	-$1.65	*-$2.06*
Existing DC	-$2.31	+$0.38	-$1.53	-$0.55	*-$1.52*
Expansion DC	-$1.22	-$1.09	-$0.46	-$3.14	*-$1.86*
SD DC	-$0.01	+$0.74	+$0.77	-$1.92	*-$0.57*

- Similar total LMP pricing across all native load nodes (see pricing impacts section)
- Increased datacenter load in Ellendale area on the system generally results in increasing congestion experienced by load center buses (increased cost of load)

**Congestion on this slide is shown as the 2024 average congestion component attributed to LMP's for the nodes shown above*

Data Center
Load Bus Congestion

Data Center Load Bus Congestion* Summary

DC Buses	ELLENDL345	ELLENDL4	TTNKA_ND_MV1	TTNKA_SD_MV1	Avg. Congestion
Base	-$22.62	-$22.44	-$20.58	-$20.58	*-$21.56*
Existing DC	-$13.48	-$13.39	-$12.38	-$12.38	*-$12.91*
Expansion DC	-$1.65	-$1.59	-$1.56	-$1.56	*-$1.59*
SD DC	+$5.70	+$5.72	+$5.54	+$5.54	*+$5.63*

- Buses where the datacenters are sited see changes in congestion as more DC load comes online, reducing generation curtailment and contributing to increasing bus LMPs

- The increased load in wind rich areas impacts the duration and severity of binding constraints seen in the region…
  - …from the perspective of load, this is increasing the cost to serve new Data Center(s) located in the Ellendale area

**Congestion on this slide is shown as the 2024 average congestion component attributed to LMP's for the nodes shown above*

Summary of Results

- Without data centers, MDU native load buses experience average LMPs for the year of 2024 between $21-$23/MWh

- Increasing data center load in the Ellendale area causes…
  - Native load buses to experience very marginal increases in LMP prices. With the highest load datacenter scenario raising average native load bus LMP's by approximately $2/MWh annually
  - Datacenter load buses however experience a more aggressive rise in LMP's as wind curtailment declines

- The additional load reduces curtailment in region… additional estimated $230k in annual wind production tax to North Dakota

- MDU resources are being more heavily utilized as data centers are added

Summary of Results… Continued

- Congestion impacts in the Ellendale area result in increasing bus LMPs wiping out the financial advantage seen by the DC customers by the time all three data centers are added.
- Increased datacenter load in Ellendale area on the system generally results in lower congestion experienced by load center buses (increased cost of load).
- Increasing datacenter load has minimal impact on the congestion observed at Big Stone and provides a small price improvement at Coyote.

Exhibit B
PLEXOS Economic Dispatch Results

MDU Native Customer Fuel and Purchase Power Impact Analysis

10/31/2023

Assumptions

- Calculated average LMPs from the 1898 Report Base Case and three Change Cases based upon a weighting of 40% Heskett7, 20% WDicksn7, 20% LTLMUDY7, and 20% Baker 8.
- Utilized Montana-Dakota's Plexos Model for the 2024 financial plan.
- Calculated Fuel and Purchase Power Price for the Base Case and three Change Cases utilizing the average LMPs from the 1898 Report substituted for the MISO Energy Forecast Price in the Plexos Model.

MISO Energy Average LMPs ($/MWh)

Month	Base	Existing 180	Expansion 180	Additional 100
1	$25.13	$25.30	$25.98	$26.33
2	$24.35	$24.30	$25.07	$25.54
3	$21.72	$21.90	$22.14	$22.46
4	$18.07	$18.34	$18.90	$19.13
5	$19.31	$19.56	$19.99	$20.35
6	$19.13	$19.38	$19.72	$20.10
7	$24.81	$25.26	$26.79	$29.29
8	$25.12	$25.38	$27.33	$29.41
9	$22.09	$22.42	$22.81	$22.92
10	$22.19	$22.25	$22.54	$22.82
11	$27.21	$27.62	$28.40	$28.91
12	$31.06	$31.42	$32.55	$33.79

2024 Plexos Output Results
MDU Fuel and Purchase Power Costs

Cases	Total Cost ($)	Percent Increase (%)
Base	89,953,900	-
Existing DC	90,075,870	0.25
Expansion DC	90,765,670	1.01
SD DC	91,269,430	1.58