The Potential for Load Flexibility in Northern States Power’s Service Territory

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Why assess load flexibility potential?

Regulatory mandate
- Procure 400 MW by 2023
- Explore 1,000 MW by 2025

2019 Integrated Resource Plan

Rapidly emerging DR opportunities

Note: Required DR procurement levels differ from stated amounts in the PUC Order due to several factors. For further discussion, see “The Potential for Load Flexibility in Northern States Power’s Service Territory,” prepared by The Brattle Group, January 2019.
Key Challenges

- What is the optimal participation level?
- How to account for “stacked benefits”?
- How to model advanced value streams?
  - Ancillary services
  - Geo-targeted distribution deferral
Participation

Customer surveys determined sensitivity of enrollment to incentive payments

Likely New Enrollment – Direct Load Control

Summer Monthly Incentive Payment

DLC Participation Function

### Summer Monthly Incentive Payment

- $5: 17%
- $9: 20%
- $14: 24%
- $18: 28%
- $25: 34%
Impacts were derived from 70+ studies and simulated using the LoadFLEX model

40+ load flexibility measures analyzed:

Conventional
- Direct Load Control
- Interruptible Tariffs
- Etc.

Emerging
- Smart water heating
- Time-varying rates
- Behavioral DR
- Etc.
Load Flexibility Supply Curve

Measures & incentives are organized into a “supply curve” for Resource Planning

![Graph showing the Load Flexibility Supply Curve with two scenarios: Conventional Only and Conventional + Emerging. The x-axis represents Incremental DR Potential (MW) and the y-axis represents Annual Costs ($/kW-year). The graph includes data points for 2023, 2025, and 2030.]
Cost-effective Potential (2030)

Expanding conventional programs would increase DR capability by 37%
Emerging load flexibility programs could further increase DR capability by 18%
Alternative market conditions could result in higher potential

**Base Conditions**
- New Emerging: 153 MW
- New Conventional: 316 MW
- Existing (2017): 850 MW

**Alternative Conditions**
- New Emerging: 261 MW
- New Conventional: 413 MW
- Existing (2017): 850 MW

**Illustrative alternative conditions:**
- Higher avoided capacity cost
- Increased energy price volatility
- Greater need for freq. regulation
- Reduced DR technology cost
Benefits

- Load flexibility benefits and potential are system-specific

- Considerations include:
  - AMI deployment
  - Renewables adoption
  - Electrification
  - Supply mix
  - Existing DR capability
  - Technology cost
  - Customer experience
  - Capacity needs
  - Etc...

**NSP Annual Load Flexibility Benefits (2030)***

- Generation Capacity ($51MM)
- Energy ($11MM)
- Frequency Regulation ($1MM)
- T&D Deferral ($3MM)
The Potential for Load Flexibility in Xcel Energy’s Northern States Power Service Territory

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