Cost-Benefit Analysis of On-Site Energy Storage in MN

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Energy Storage Study

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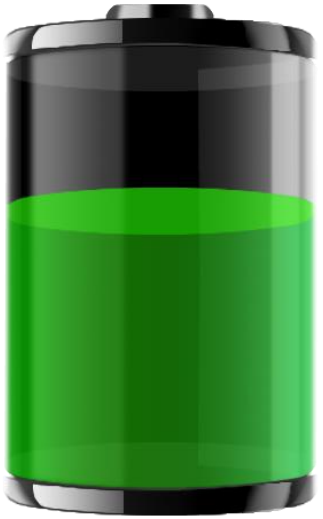
- Completed by Strategen Consulting and the Electric Power Research Institute for the Department of Commerce.
- Investigates the potential costs and benefits of installing utility-managed, grid-connected energy storage devices in residential and commercial buildings in Minnesota



MN Energy Storage Study: Scope

Scope of Work (Laws 2013 Ch. 85, Art. 12, Sec. 5):

- **Cost-Benefit Analysis**: estimate the potential value of on-site energy storage devices as a load-management tool to reduce costs for individual customers and for the utility, including but not limited to reductions in energy, particularly peaking, costs, and capacity costs;
- **PV Interaction**: examine the interaction of energy storage devices with on-site solar photovoltaic devices; and
- **Analyze Barriers**: analyze existing barriers to the installation of on-site energy storage devices by utilities, and examine strategies and identify potential economic incentives to overcome those barriers.

MN Energy Storage Study: Cost-Benefit analysis

Four use-cases modeled:

1: Customer controlled for bill savings

- Reducing peak demand charges;

2: Utility controlled for distribution

- deferring investment in distribution upgrades;
- Improving customer reliability and power quality;

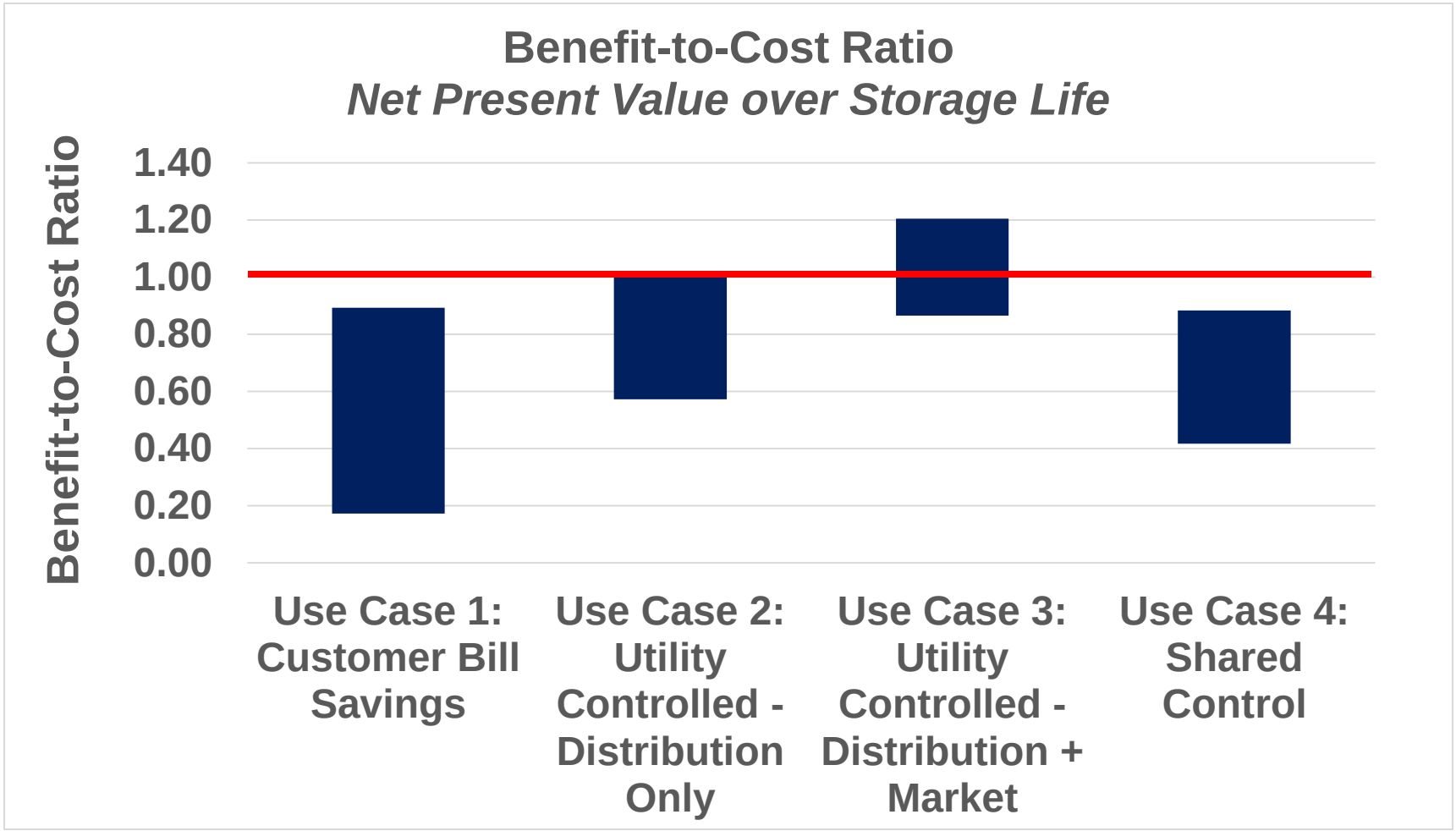
3: Utility controlled for distribution and market benefits (case 2 + MISO market participation)

- Supporting both distribution and transmission grid services

4: Shared customer and utility controlled for bill savings and market revenue (hybrid of 1 & 3)

- Providing additional value for unused storage capacity

MN Energy Storage Study:
Key Findings



MN Energy Storage Study: Key Findings

- Case 3: Utility-controlled storage with market participation showed the highest benefit to cost ratio by capturing more value streams:
    - Deferral of distribution upgrade cost
    - Reduced wear and tear on peaking power plants
    - Additional financial incentives by combining energy storage with solar PV

MN Energy Storage Study: Strategen Conclusions

Conclusion: This preliminary, short-term study shows potential value to utilities and ratepayers from energy storage projects.

Key Barriers identified by Strategen Consulting:

1) Customers unable to monetize energy storage benefits
2) Utility planning process does not account for storage value
3) Role of energy storage in MISO market is unclear

Strategen Key Recommendations:

1) Perform further study and pilot projects in Minnesota to provide greater confidence for financing and utility planning;
2) Clarify the role of energy storage in state policy and establish goals to fit state needs.