COMMERCE DEPARTMENT

February 9, 2022

Will Seuffert
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, Minnesota 55101-2147

RE: **Letter of the Minnesota Department of Commerce, Division of Energy Resources**
Docket No. E002/M-21-814

Dear Mr. Seuffert:

Attached is a letter from the Minnesota Department of Commerce, Division of Energy Resources (Department) and a Report from Synapse Energy Economics, Inc. on Review and Assessment of Grid Modernization Plans in the following matter:

> In the Matter of Northern States Power Company d/b/a Xcel Energy's Petition for Approval of the Transmission Cost Recovery Rider Revenue Requirements for 2021 and 2022, Tracker True-up, and Revised Adjustment Factors

The Petition was filed on November 24, 2021 by:

> Holly Hinman
> Regulatory Manager
> Xcel Energy
> 414 Nicollet Mall, 401 – 7th Floor
> Minneapolis, MN 55401

The Department is available to answer any questions the Minnesota Public Utilities Commission may have.

Sincerely,

/s/ MATTHEW LANDI
Rates Analyst

ML/ja
Attachment

Before the Minnesota Public Utilities Commission

Comments of the Minnesota Department of Commerce
Division of Energy Resources

Docket No. E002/M-21-814

I. INTRODUCTION TO THE GUIDANCE DOCUMENT

Order Point No. 10 of the Minnesota Public Utilities Commission's (Commission) September 27, 2019 Order in Xcel Energy's (Xcel, or the Company) 2017 and 2018 TCR Rider Petition (Docket No. E002/M-17-797) requested that "the Commissioner of the Commerce seek authority from the Commissioner of the Minnesota Management and Budget to incur costs for specialized technical professional investigative services under Minn. Stat. §216B.62, subd. 8, to investigate the potential costs and benefits of grid modernization investments proposed for recovery by Xcel in its next rate case or [Transmission Cost Recovery] Filing and to assist the [Minnesota Department of Commerce (Department)] in providing recommendations to the Commission regarding any such investments."[1]

On October 19, 2020, the State of Minnesota's Executive Branch of government announced a request for proposal (RFP) for 2020 Grid Modernization Technologies on behalf of the Department. The announcement described the RFP as follows:[2]

> This Request for Proposal (RFP) is seeking technical expertise on advanced electric-distribution system investments and technologies. The Department is seeking assistance with regulatory proceedings before the Commission involving Northern States Power Company, d/b/a Xcel Energy's (Xcel Energy or NSP-MN) cost recovery for investments in distribution Grid Modernization technologies, specifically Advanced Metering Infrastructure and Field Area Network.

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[1] *In the Matter of the Petition of Northern States Power Company for Approval of the Transmission Cost Recovery Rider Revenue Requirements for 2017 and 2018, and Revised Adjustment Factor,* Docket No. E002/M-17-797, Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements (September 27, 2019). Accessed at: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7b90C2736D-0000-C01D-9089-5F9E7FB89DA6%7d&documentTitle=20199-156134-01.

[2] Minnesota State Register, Volume 45, Number 16, dated October 19, 2021, at 389-390. Reference Number: COMM-EPA-02-20201019. Accessed at: https://mn.gov/admin/assets/SR45_16%20-%20Accessible_tcm36-450207.pdf.

The RFP process culminated with the selection of Synapse Energy Economics, Inc. The Department negotiated a contract with Synapse to evaluate Xcel's investments in distribution Grid Modernization technologies, specifically its Advanced Metering Infrastructure (AMI) and Field Area Network (FAN) projects.

On July 23, 2020 the Minnesota Public Utilities Commission (Commission) issued its Order in Xcel's 2019 Integrated Distribution Plan (IDP) and Request for Certification of its Advanced Grid Intelligence and Security (AGIS) Initiative and its Advanced Planning Tool (APT) proceeding (Docket No. E002/M-19-666) (July 23, 2020 Order),[3] pursuant to Minn. Stat. §216B.2425, subd. 2 (e) (the Grid Modernization Statute).[4] In this Order, the Commission certified only a few of the projects contained in Xcel's AGIS Initiative: the AMI, FAN, and APT projects.

Once certified under the Grid Modernization Statute, utilities may seek recovery of the costs of their certified projects under subd. 7b(b)(5) of the Transmission Cost Recovery Rider (TCR) Rider Statute, which authorizes the Commission to approve a tariff that "allows the utility to recover costs associated with distribution planning required under section 216B.2425," including those projects certified by the Commission under the Grid Modernization Statute. Included in Xcel's 2021-2022 TCR Rider Petition, filed on November 24, 2021 in the instant proceeding (Docket No. E002/M-21-814), is a request for cost recovery of the ongoing Advanced Distribution Management System (ADMS) project (previously certified in Docket No. E002/M-15-962), cost recovery of the AMI, FAN, and APT projects, a Residential Time-of-Use (TOU) Pilot, and the Huntley-Wilmarth 345 kV Transmission Line project. Synapse is tasked with evaluating relevant portions of Xcel's 2021-2022 TCR Rider petition.

To support the analysis of grid modernization investments in Minnesota, Synapse developed a document called *Review and Assessment of Grid Modernization Plans: Guidance for Regulators, Utilities, and Other Stakeholders* (Guidance Document).

The Guidance Document's purpose is three-fold: first, it is intended to distill related Commission Orders into recommended filing requirements for utility grid modernization proposals to ensure that core elements of economic evaluation are satisfied by the utility and that necessary information is available to the Commission to establish whether investments are in the public interest; second, it is intended to describe best practices for conducting economic evaluations of grid modernization investments; and third, it is also intended to complement and incorporate the Department's December

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[3] *In the Matter of Xcel Energy's Integrated Distribution Plan and Advanced Grid Intelligence and Security Certification Request,* Docket No. E002/M-19-666, Order Accepting Integrated Distribution Plan, Modifying Reporting Requirements, and Certifying Certain Grid Modernization Projects (July 23, 2020). Accessed at: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={F00E7D73-0000-CD15-B6E0-EA73F0AC037E}&documentTitle=20207-165209-01.

[4] Minn. Stat. §216B.2425, subd. 2 (e). Accessed at: https://www.revisor.mn.gov/statutes/cite/216B.2425.

2020 Report called *Methods for Performance Evaluations, Metrics, and Consumer Protections for AMI and FAN,* filed in Docket No. E999/DI-20-627.[5]. The Guidance Document is intended to be generally applicable to any utility grid modernization proposal regardless of which regulatory pathway a utility takes.

The Department recognizes the opportunities and challenges of grid modernization investments in Minnesota. In recent years, aging infrastructure and the growth of distributed energy resources (DER) such as small-scale solar photovoltaics (PV), battery storage, and electric vehicles (EV) have drawn attention to the distribution system. Accordingly, it has become clear that significant distribution system investment, including investment in grid modernization, may be needed to accommodate these changes and ensure that these technologies are optimally and efficiently integrated with legacy distribution system investments and infrastructure.

The Department contends that regulatory review of a utility's economic analysis of its grid modernization investments require clear methods of economic evaluation in order to ensure that utilities, regulators, and stakeholders ensure that the public interest is paramount in the evolving landscape of utility system planning and grid modernization. The Guidance Document is intended to provide the Commission, utilities, and stakeholders with such methods of economic evaluation.

II. THE GRID MODERNIZATION PATHWAYS

In Minnesota, there are at least three pathways for utilities to propose grid modernization investments, referred to here as the Grid Modernization Pathways. The Grid Modernization Pathways are as follows:

[5] Department of Commerce Report to the Public Utilities Commission, *Methods for Performance Evaluations, Metrics, and Consumer Protections for AMI and FAN*, Docket No. E999/DI-20-627 (December 1, 2020). Accessed at: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={40E01F76-0000-C315-BCEB-8FA8FCD03CC2}&documentTitle=202012-168688-01.

1. Path 1: together, the Certification Request Process; [6]
    a. Path 1a: Pursuant to the Grid Modernization Statute, a utility operating under a Multi-Year Rate Plan can request certification of grid modernization project and the Commission is required to certify, certify as modified, or deny certification of proposed grid modernization project(s);
    b. Path 1b: Pursuant to Minn. Stat. §216B.16, subd. 7b(b)(5) [7], if a grid modernization project is certified or certified as modified, then that utility is authorized to request cost recovery in the Transmission Cost Recovery (TCR) Rider proceeding;
2. Path 2: a general utility rate case; and
3. Path 3: an Electric Utility Infrastructure Cost (EUIC) Rider pursuant to Minn. Stat. §216B.1636, subd. 2.[8]

Path 1 is applicable to utilities in Minnesota operating under a Multi-Year Rate Plan (MRP).[9] Xcel recently filed its 2022-2024 MRP proposal in Docket No. E002/GR-21-630. Since the Minnesota Legislature amended the Grid Mod Statute and amended the TCR Rider Statute, Xcel has requested certification of certain grid modernization investments, first in 2015 with its ADMS grid modernization project, and again in 2019, with its AGIS Initiative proposal, which included the Fault Location, Isolation, and Service Restoration (FLISR) project, Integrated Volt-Var Optimization (IVVO) project, as well as the APT, AMI, and FAN projects. The Commission's July 23, 2020 Order subsequently certified

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[6] On July 1, 2015, the Minnesota Legislature amended Minn. Stat. § 216B.2425 (the Grid Modernization Statute) and Minn. Stat. §216B.16, subd. 7b (the Transmission Cost Recovery (TCR) Rider Statute). The Grid Modernization Statute directs utilities, including public utilities that own or operate electric transmission lines in Minnesota, to file by November 1 of each odd-numbered year a transmission projects report. Under subd. 2(e) of Minn. Stat. §216B.2425, a utility such as Xcel that is operating under a multi-year rate plan must also:

> …identify in its report investments that it considers necessary to modernize the transmission and distribution system by enhancing reliability, improving security against cyber and physical threats, and by increasing energy conservation opportunities by facilitating communication between the utility and its customers through the use of two-way meters, control technologies, energy storage and microgrids, technologies to enable demand response, and other innovative technologies.

Under subdivision 3 of the Grid Modernization Statute, the Commission must decide whether to certify, certify as modified, or deny certification any of the transmission and distribution projects proposed in the Report.

[7] Minn. Stat. §216B.16, subd. 7b(b)(5). Accessed at: https://www.revisor.mn.gov/statutes/cite/216B.16#stat.216B.16.7b.

[8] Minn. Stat. §216B.1636, subd. 2. Accessed at: https://www.revisor.mn.gov/statutes/cite/216B.1636.

[9] In response to an information request that the Department submitted in Xcel's 2021 Integrated Distribution Plan (Docket No. E002/M-21-694) in which Xcel is requesting certification of its Distributed Intelligence project and Resilient Minneapolis Project, Xcel argued that the Grid Modernization Statute can be interpreted to allow utilities not operating under a MRP to nonetheless request certification. The Department offers no analysis on the merits of Xcel's position here, and is merely attempting to summarize the Grid Modernization Statute. The Commission may wish to decide on whether Xcel's interpretation of the statute has merit in the instant proceeding or in Xcel's 2021 IDP proceeding.

only Xcel's AMI, FAN, and APT projects. Recently, as part of Xcel's 2021 IDP Report in Docket No. E002/M-21-694, Xcel has requested certification of a Distributed Intelligence (DI) proposal and the Resilient Minneapolis Project.[10]

Path 2 is available to all public utilities in Minnesota. Recently, as part of Xcel's 2022-2024 MRP, Xcel again proposed the FLISR project. Xcel's 2022-2024 MRP is currently pending before the Commission.

Path 3 is available to all public utilities in Minnesota, pursuant to Minn. Stat. §216B.1636 (EUIC Rider Statute). On May 8, 2018, the Commission approved Dakota Electric Association's proposed Advanced Grid Infrastructure rider in Docket No. E111/M-17-821 under the EUIC Rider Statute.[11] On June 7, 2021, Otter Tail Power proposed the creation of a EUIC Rider in Docket No. E017/M-21-382.[12] That matter is currently pending before the Commission.

The Guidance Document is applicable to all three Grid Modernization Pathways.

III. PROMOTING THE PUBLIC INTEREST IN GRID MODERNIZATION

Grid modernization investments are novel and emergent phenomenon in utility distribution systems. They are driven in part by advancements in technology that have the potential to achieve valuable economic efficiencies and further decarbonize the electric grid for the benefit of utility ratepayers and society writ large.

The scale of the grid modernization investments already proposed by Xcel and other utilities, and investments anticipated over the coming years equally demand that extraordinary consideration, evaluation, and opportunity for careful and thorough review of proposed grid modernization

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[10] *In the Matter of Xcel Energy's Integrated Distribution System Plan and Request for Certification of Distributed Intelligence and the Resilient Minneapolis Project,* Docket No. E002/M-21-694 (November 1, 2021). Accessed at (public version): https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={2018DC7C-0000-C41B-992F-7ED95D99A9EE}&documentTitle=202111-179347-01.

[11] *In the Matter of Dakota Electric Association's Petition to Implement Tracker Recovery for Advanced Grid Infrastructure Investments*, Docket No. E111/M-17-821, Order Approving Recovery of Grid Modernization Costs (May 5, 2018). Accessed at: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={30464163-0000-C816-ABC8-AE65969FF9EF}&documentTitle=20185-142844-01.

[12] *In the Matter of Otter Tail Power Company's Petition to Implement Electric Utility Infrastructure Cost Recovery Rider for Advanced Metering Infrastructure / Outage Management System / Demand Response System, Rate Schedule 13.11*, Docket No. E017/M-21-382 (June 7, 2021). Accessed at (public version): https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={603CE879-0000-CB17-BCC0-F256CF1C134F}&documentTitle=20216-174849-01.

investments be provided in order to protect the interests of utility ratepayers and promote the public interest.

While grid modernization investments may be novel, the regulatory paradigm created in response need not be. The Guidance Document draws from the experience of other jurisdictions in the U.S. with grid modernization investments, a review of grid modernization requirements and practices in Minnesota, and a review of the best practices for conducting economic evaluations of utility investments.

By providing clear methods of economic evaluation of grid modernization investments regardless of the path a utility takes to obtain approval, the Guidance Document can help the Commission and stakeholders ensure that the extolled benefits and virtues of these promising technologies actually materialize.

IV. A STANDARD OF REVIEW FOR GRID MODERNIZATION INVESTMENTS IS NEEDED

Currently, as the Commission has recognized, there are no clear statutory standards nor Minnesota Rules that detail how to evaluate distribution system investments, such as grid modernization proposals, that is analogous to the planning and evaluation processes that precede the issuance of a Certificate of Need in proceedings for new generation facilities and transmission lines, and. In the Commission's July 23, 2020 Order, the Commission made the following observation in relation to Certification Request Process:[13]

> [D]istribution projects do not require certificates of need, and many of the criteria set out in the certificate of need statute are not relevant to distribution projects; therefore, there is no clear statutory standard for assessing certification requests.

The IRP process in Minnesota and the transmission planning processes that occur at Midcontinent Independent System Operator (MISO) are deliberate, complex, and thoroughly reviewed planning processes that can culminate in a utility proposal to address needs identified, whether the need is for a new generating resource or a new transmission line.

Once a general need is established in the IRP process or at MISO, utilities propose specific projects subject to clear, well-defined Minnesota Rules that establish a standard of review that require utilities to consider alternatives and demonstrate that the least-cost option has been selected, and often, a project is approved in part based upon a finding that it will result in net benefits to utility ratepayers and society.

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[13] July 23, 2020 Order, at 11.

The Department's October 16, 2020 Comments in Docket No. E002/M-20-680 offered a comparison of the Certification Request Process and Certificate of Need proceedings:[14]

> [I]n most rider review processes (renewable energy, transmission projects, CIP, etc.) there is a clear path and process for an eligibility determination. For example, transmission projects are subject to a rigorous certificate of need evaluation and/or have been determined to be beneficial to the utility or integrated transmission system by the Midcontinent Independent System Operator (MISO). In either case, need has been determined based on cost assumptions; those cost assumptions enable the Commission to set clear bounds and parameters around an investment's purpose and expected cost compared to alternatives, and constitutes the Commission's 'pre-authorization' of what is deemed rider-eligible.
>
> The need/certification process and outcome provide the framework for future cost and project prudency analysis in the TCRR – determining whether a project is still within the bounds of the Commission-certified investment and therefore, should be entitled to continued favorable rate treatment through the rider, or, in the case of significant changes or cost increases, whether the project costs, or a portion of the costs, should be removed from rider recovery and potentially considered in the utility's next general rate case proceeding[4]

[4] The requirement of cost certification is echoed in the Commission's implementation of the statute, such as ordering paragraph 4 of the Commission's April 27, 2010 Order in E002/M-09-1048, which stated: In setting guidelines for evaluating project costs going forward, the TCR project costs recovered through the rider should be limited to the amounts of the initial estimates at the time the projects are approved as eligible projects, with the opportunity for the Company to seek recovery of excluded costs on a prospective basis in a subsequent rate case. A request to allow cost recovery for project costs above the amount of the initial estimate may be brought forward for Commission review only if unforeseen and extraordinary circumstances arise on the project.

[14] Department Comments, *In the Matter of North States Power Company for Approval of the Transmission Cost Recovery Rider Revenue Requirements for 2021 and Revised Adjustment Factors*, Docket Nos. E002/M-19-666 and E002/M-20-680 (October 16, 2020). Accessed at: https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={C0F03275-0000-C612-B678-57674EA4A873}&documentTitle=202010-167412-01.

> As the Department has argued previously, the grid modernization and distribution certification process does not have a rigorous process surrounding the eligibility determination; there is no certificate of need, no competitive bidding process, or other process to delineate the project's purpose and cost compared with alternatives – these are foundational considerations that are used by the Department in its analysis to evaluate prudency of investments during the rider review.
>
> With advanced technologies proposed for inclusion in the grid modernization portion of the TCRR, a new set of evaluation factors should be developed regarding investment functionality and alternatives. As noted above, such factors have not needed to be explicit in past TCRR determinations, as the functions of those investments were already established in the need/certification process.
>
> Here, functionality and alternatives are important to establish prior to allowing the project costs to be recovered through the TCRR. As a very limited example, it is important to determine whether the meters to be installed are simply needed to track energy usage, or do more, as that functionality or functionalities, will need to be known in order to determine the prudency of Xcel's investments in light of the benefits that materialize. Further, alternatives to the project cannot be vetted without knowing the functionalities intended for the new meters.

While a utility's plans for grid modernization investments are discussed in IDPs[15], there is not yet a clear connection between IDPs and any of the Grid Modernization Pathways analogous to the IRP-CN connection or the MISO transmission planning-CN connection. The IRP-CN and MISO transmission planning-CN connections have rules that were promulgated to create a clear, well-defined process that requires a utility to explicitly articulate and evaluate alternatives.

Creating a similar IDP-Grid Modernization connection can be made through the benefit-cost analysis framework articulated in the Guidance Document. The BCA framework of the Guidance Document establishes the functionality of the grid modernization investment, analyzes alternatives to the proposed investment, clearly identifies the costs and benefits of the proposed investment, and requires a comparison between scenarios that illustrates the impact that the proposed investment is expected to have. It can be used to create a standard of review specific to grid modernization investments. This standard of review should be applicable to all utility grid modernization investment proposals regardless of the path a utility takes to request approval. There should be a clear, well-

[15] See IDP Requirement 3.D.2: Long-Term Distribution System Modernization and Infrastructure Investment Plan.

defined process to evaluate whether the investment is needed. If the need is established, then there should be clear, well-defined evaluation methods that seek to maximize net benefits to utility ratepayers and society.

The Guidance Document is intended to provide the Commission with such a standard.

V. TOWARD A FRAMEWORK FOR GRID MODERNIZATION

The Commission has established a distribution planning process and principles that require utilities to transparently and proactively plan for the ongoing paradigm shift in technology and customer preferences through the IDP process.

Additionally, the Commission's July 23, 2020 Order recognized the importance of establishing ratepayer protections and preserving regulatory flexibility in the evaluation of grid modernization investments:[16]

> 8. Certification [of AMI and FAN] is made with the recognition, and acceptance from Xcel, that all future cost recovery will be based upon the Company accomplishing Commission-approved metrics and performance evaluations for the certified projects. Any future proposals for cost recovery of investments certified in this Order must be accompanied by a proposal for specific metrics and evaluation methods, and a detailed plan describing how the company will maximize the benefits of the AGIS investments for ratepayers.
>
> 10. When Xcel makes any future cost recovery proposal, in addition to requirements from previous orders, it must include:
>
> a. a discussion of mechanisms that will be employed to maximize cost reductions and minimize cost increases, and
>
> b. a demonstration that the utility has thoroughly considered the feasibility, costs, and benefits of alternatives, and that the proposed approach is preferable to alternatives. In discussing the alternatives, Xcel should compare different types of the same technology, for example, by comparing different AMI meters.

[16] July 23, 2020 Order, at 16-17.

> 11. By certifying these projects, the Commission clarifies that it is not pre-judging whether costs will be recovered through riders or base rates. Certification will permit Xcel to request rider recovery in the future, which the Commission may approve or deny based on the facts available at that time.

Further, the Commission's July 23, 2020 Order created a cost cap for Xcel's APT project, and established a "clear and convincing evidence" standard that Xcel would need to demonstrate if costs exceeded that cap:[17]

> 14. The Commission certifies the Advanced Planning Tool and limits cost recovery to a cost cap of $4 million unless Xcel can show by clear and convincing evidence that the costs were reasonable, prudent, and beyond their control. This certification does not imply any finding of prudency with respect to the recovery of costs in a petition for rider recovery under Minn. Stat. § 216B.16, subd. 7b(b), or certification or approval of any investments beyond those specifically associated with the APT.

The Commission's prudence and proactivity in relation to distribution system planning and evaluating grid modernization investments is commended, as it rightly puts the burden of proof on utilities to justify their grid modernization investments. The Guidance Document is intended to synthesize and consolidate the general thrust of the Commission's vision for grid modernization and utility system planning.

The Guidance Document is also intended to guide the creation of a framework for grid modernization in Minnesota, one that connects utility IDPs to specific utility grid modernization investments, similar to the IRP-CN and MISO transmission planning-CN connections, and at its core provides protections for utility ratepayers and certainty to stakeholders on the process by which grid modernization investments are undertaken in Minnesota.

It is the Department's intention to evaluate utility grid modernization proposals based on the prescriptions of the Guidance Document and will do so absent Commission action.

Nevertheless, the Department recommends that the Commission require utility grid modernization proposals to adhere to the filing requirements, methods of evaluation, and ratepayer protections detailed in the Guidance Document.

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[17] July 23, 2020 Order, at 17.

Review and Assessment of Grid Modernization Plans

Guidance for Regulators, Utilities, and Other Stakeholders

Prepared for Minnesota Department of Commerce

February 2022

AUTHORS

Synapse Energy Economics, Inc.
Ben Havumaki
Tim Woolf
Courtney Lane
Elijah Sinclair
Cheryl Roberto (Contributor)

Wired Group
Paul Alvarez

Synapse
Energy Economics, Inc.

485 Massachusetts Avenue, Suite 3
Cambridge, Massachusetts 02139

617.661.3248 | www.synapse-energy.com

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EXECUTIVE SUMMARY

This guidance document describes best practices for conducting economic evaluations of grid modernization investments and presents a set of recommended filing requirements for future utility evaluations of grid modernization plans.[1] These requirements will ensure the utility provides core elements of economic evaluation so the Minnesota Public Utilities Commission (Commission) has the necessary to establish whether investments are in the public interest. The guidance and filing requirements apply to the full range of grid modernization investments.

Grid modernization presents unique challenges to Minnesota regulators. New grid technologies promise to aid in the transition to a distributed, cleaner, and more customer-oriented grid. Further, investments in grid modernization may help to advance established grid goals such as reliability and safety. Yet unlike traditional distribution system project proposals, grid modernization proposals often include portfolios of largely elective components with benefits that may be difficult to value or verify. This can make it difficult to determine if the benefits outweigh the costs.

The Commission has established distribution system planning principles, and in multiple Orders has imposed integrated distribution planning (IDP) filing requirements for several of the state's largest utilities. The IDP filing requirements compel subject utilities to address grid modernization and prescribe both the scope and specific detail required in grid modernization plans.[2,3] Xcel Energy is subject to even more comprehensive requirements for its grid modernization proposals.[4]

Equally important, the Commission has recognized the potential regulatory gap that exists in the state concerning cost recovery for grid modernization proposals. The Commission has ordered that utilities address the benefits and costs of grid modernization plans in their respective IDPs, and it has specifically indicated that Xcel must provide comprehensive benefit-cost analysis as a condition of recovering grid modernization costs.[5] However, the regulatory landscape in Minnesota may create additional complication, as utilities are able to justify their grid modernization investments in the context of rider

[1] The terms "economic evaluation" and "evaluation" are used to refer to the analysis of cost-effectiveness of utility grid modernization investments, which may encompass multiple different approaches including benefit-cost analysis and least-cost/best-fit analysis.

[2] Minnesota Public Utilities Commission. Docket No. E-017/CI-18-253. Docket No. E-017/CI-18-254. Docket No. E-017/CI-18-255. Order Adopting Integrated-Distribution-Plan Filing Requirements. February 20, 2019.

[3] Minnesota Public Utilities Commission. Docket No. E-002/CI-18-251. Order Accepting Report and Amending Requirements. July 16, 2019.

[4] Minnesota Public Utilities Commission. Docket No. E-002/M-17-797. Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements. September 27, 2019.

[5] Minnesota Public Utilities Commission. Docket No. E-002/M-17-797. Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements. September 27, 2019.

proceedings. Indeed, Xcel even has a choice between two different riders for grid modernization cost recovery—the Transmission Cost Recovery (TCR) rider and the Electric Utility Infrastructure Cost (EUIC) rider. Using multiple regulatory processes and dockets to review grid modernization investments creates regulatory uncertainty and ambiguity that can lead to inefficient and less effective oversight by the Commission and stakeholders. (See APPENDIX A for more detail on these regulatory pathways.) Thus, the guidance in this document offers solutions that build on the Commission's progress and aim to close remaining gaps in regulatory practice.

Utilities and stakeholders have typically looked to regulators for guidance on assessing grid modernization proposals, and the Commission in Minnesota has been proactive in establishing regulatory standards for grid modernization evaluation and cost recovery. This guidance builds upon Minnesota's strong foundation to address strategies for answering core regulatory questions, including:

- Which objectives for grid modernization are valid?
- How should analytical challenges stemming from component interdependencies, stranded costs, uncertainty, and other matters be handled?
- How can regulators ensure that ratepayer interests and equity considerations are given due weight?

Summary of Grid Modernization Evaluation Guidance

This document provides detailed guidance on all major facets of economic evaluation of grid modernization investment plans, which is summarized below:

- Articulating the goals of grid modernization: Grid modernization is not a goal in itself, and grid modernization plans should identify concrete and measurable goals and clearly explain how each component individually advances related goals.
- Coordinating grid modernization and distribution planning: Ideally, the grid modernization evaluation and decision-making process should be an integral part of the Minnesota IDP process.
- Determining the evaluation methodology: Grid modernization plans should use the benefit-cost analysis approach as the primary method for determining whether grid modernization investments are in the public interest. Least-cost/best-fit analysis should not be the primary approach to evaluation, even if data are incomplete or investments are claimed to be necessary.
- Defining the scope of analysis: Grid modernization plans should clearly articulate the scope of the costs and benefits addressed in the plan by defining the cost-effectiveness test upon which the analysis relies. The plan should consistently apply the same cost-effectiveness test to all calculations.
- Defining the reference and investment scenarios: The reference scenario should include all the future resources and costs expected to be experienced under business-as-usual conditions. This scenario should also represent the optimal mix of resources associated

with the business-as-usual conditions. The investment scenario should include all the incremental future resources and costs expected to be experienced under the case where the investment is undertaken.

- Handling stranded costs: Appropriately defined reference and investment scenarios should help determine the proper treatment of stranded costs. If stranded costs are recovered from customers equally in both the reference and investment scenarios, these may be removed from the analysis because they cancel each other out. If any portion of stranded costs is not recovered from customers, then the reference scenario should include full recovery of legacy asset costs from customers, the investment scenario should include only the portion of stranded costs recovered from customers, and the difference between the two scenarios will indicate the benefits to customers of not paying the full amount of stranded costs.

- Accounting for unmonetized benefits: Evaluations should attempt to account for all benefits—even those not easily monetized. There are a variety of alternative approaches to quantify or otherwise account for unmonetized benefits, and grid modernization plans should leverage these approaches. In doing so, they should explicitly justify any alternative methodology used as part of the analysis.

- Accounting for interdependent components: Since many grid modernization components are interdependent or synergistically interact with each other, grid modernization plans should present costs and benefits for individual components alongside costs and benefits for all viable bundles of components.

- Establishing metrics: Grid modernization plans should specify metrics that map to as many of the claimed benefits as possible. Metrics in turn should allow for retrospective review of grid modernization investment performance. Cost recovery for utilities could be made conditional on utility achievement of performance targets. As a starting point the Commission should adopt the set of metrics provided in Appendix E of the Department of Commerce's December 2020 report.[6]

- Accounting for risk: Grid modernization planning should be predicated on risk analysis. Investment proposals should promote risk minimization.

- Applying a discount rate: Grid modernization plans should explicitly identify the discount rate used. The weighted average cost of capital (WACC) is not an appropriate discount rate for use in grid modernization evaluations because it reflects the utility investor perspective and has no direct connection to maximizing value for ratepayers or society.

- Considering customer equity: Evaluations should identify who benefits from grid modernization investments and should include quantitative and qualitative assessments of distributional impacts alongside a bill impact analysis.

[6] Minnesota Department of Commerce. Methods for Performance Evaluations, Metrics, and Consumer Protections for AMI and FAN. Department of Commerce Report to the Public Utilities Commission. December 1, 2020.

Summary of Initial Filing Requirements

Initial filing requirements are provided in Section 3. These build upon existing Commission requirements to enhance the quality of information available to the Commission and stakeholders for review of grid modernization investment plans. These filing requirements also serve as a reference checklist to assess future utility grid modernization evaluations.

1 INTRODUCTION

1.1 Grid Modernization Presents New Opportunities and Challenges

Grid modernization is an important part of Minnesota's effort to meet the challenges of climate change. In Minn. Stat. § 216B.2425, lawmakers connected grid modernization with energy conservation, and in Minn. Stat. § 216B.16 Subd. 7b, they authorized companies with multi-year rate plans (MRP) to utilize the Transmission Cost Recovery (TCR) rider process to recover grid modernization investments justified on a variety of grounds, including the promotion of environmental policy goals.[7] For utilities not operating under an MRP, Minn. Stat. § 216B.1636 similarly allows for rider recovery of grid modernization investments advancing conservation or efficiency through the Electric Utility Infrastructure Cost (EUIC) rider.[8] The combined effects of these riders is to promote grid modernization by offering expedient cost recovery.

At the executive level, Minnesota has similarly recognized the potential for grid modernization. As a signatory to the Subnational Global Climate Leadership Memorandum of Understanding[9] and as part of Governor Walz's Executive Order on Climate Change,[10] the state is committed to sharing information and experience:

> On redesign of the power supply and grid, technical solutions, and advances in promoting large-scale switch to renewable energy and the integration of renewable energy sources, actions needed to ensure security of supply, and strategies to promote energy efficiency.[11]

Notwithstanding the promise of grid modernization, these investments are often difficult for regulators to evaluate. There is a lack of standardization across utility plans, which are often evaluated in siloed regulatory proceedings. Overarching utility arguments in support of proposed investments may run the gamut, often including assertions about changing customer preferences and expectations. It is key to recognize that some of these justifications do not correspond to articulated state policy.

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[7] Minn. Stat. § 216B.2425 (the Grid Modernization Statute) and Minn. Stat. §216B.16, subd. 7b (the Transmission Cost Recovery (TCR) Rider Statute).

[8] Minn. Stat. § 216B.1636.

[9] The Subnational Global Leadership Memorandum of Understanding was signed by Governor Mark Dayton on October 16, 2015.

[10] Executive Order 19- 37. Establishing the Climate Change Cabinet and the Governor's Advisory Council on Climate Change to Promote Coordinated Climate Change Mitigation and Resilience Strategies in the State of Minnesota. December 2, 2019.

[11] Climate Change Subcabinet update report – 2020 annual report to the Governor on the Climate Change Executive Order. December 2020, Appendix C, p. 25.

The novelty and technical complexity of grid modernization plans can further compound regulatory challenges—an issue that may be exacerbated by informational asymmetries that favor utilities.

The range of cost recovery options may further challenge regulatory review of grid modernization proposals. With the benefits that rider treatment provides to utilities comes the risk that the rider review process will not allow for sufficient vetting of utility proposals. While the rate case process typically provides for thorough review of historical spending (and regulatory lag further encourages utility prudence), rider recovery could unduly tilt the balance of risk away from utilities and onto their customers.

To ensure that only grid modernization investment proposals in the public interest are authorized, Minnesota needs a clear, comprehensive, and standardized framework for evaluating all grid modernization plans. This guidance provided in this document aims to build on the groundwork already laid by the Minnesota Public Utilities Commission (Commission) in service of robust grid modernization evaluation practices.[12,13] The next section discusses this initial progress.

1.2 Overview of Grid Modernization Regulatory Developments in Minnesota

From the outset, Minnesota regulators have viewed grid modernization within the wider context of transmission and distribution system planning.[14] Initially, only Xcel was required to file a grid modernization plan as a component of its biennial transmission report.[15] With the Commission's most recent Orders on integrated distribution planning, the state's three largest investor-owned utilities—including Xcel—plus Dakota Electric Association, are now subject to similar baseline grid modernization filing requirements.[16] (See APPENDIX A for a detailed review of grid modernization regulatory developments in Minnesota.)

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[12] Minnesota Public Utilities Commission. Docket No. E-002/M-19-666. Order Accepting Integrated Distribution Plan, Modifying Reporting Requirements, and Certifying Certain Grid Modernization Projects. July 23, 2020.

[13] The terms "economic evaluation" and "evaluation" are used to refer to the analysis of cost-effectiveness of utility grid modernization investments, and they encompass multiple different approaches including benefit-cost analysis and least-cost/best-fit analysis. .

14 The importance of integrating grid modernization planning within the broader distribution system planning process is increasingly recognized in jurisdictions across the United States. For example, a stakeholder-driven taskforce initiative, sponsored by the National Association of Regulatory Utility Commissions (NARUC) and the National Association of State Energy Officials (NASEO), recently produced the Jade Cohort Roadmap, which describes an idealized comprehensive electricity planning process with coordination between grid modernization and other utility planning considerations. Through the prescribed process, the authors expect increased cost efficiency and transparency. See: https://pubs.naruc.org/pub/151E6947-155D-0A36-3190-C87F6548D4C2.

[15] Minn. Stat. §216B.2425, Subd. 2(e) and Subd. 8.

[16] Minnesota Public Utilities Commission. Docket No. E-017/CI-18-253. Docket No. E-017/CI-18-254. Docket No. E-017/CI-18-255. Order Adopting Integrated-Distribution-Plan Filing Requirements. February 20, 2019.

At the heart of these requirements is a set of principles which provide objectives for both grid modernization planning and more general distribution system planning, and which guide the preparation of IDPs. The principles are provided below.

1. Maintain and enhance the safety, security, reliability, and resilience of the electricity grid at fair and reasonable costs, consistent with the state's energy policies.
2. Enable greater customer engagement, empowerment, and options for energy services.
3. Move toward the creation of efficient, cost-effective, accessible grid platforms for new products and services, with opportunities for adoption of new distributed technologies.
4. Ensure optimized use of electricity grid assets and resources to minimize total system costs.
5. Provide the Commission with the information necessary to understand [the utility's] short-term and long-term distribution system plans, the costs and benefits of specific investments, and a comprehensive analysis of ratepayer cost and value.[17,18,19]

The first four principles describe key policy priorities that should inform how the Commission evaluates proposals for grid modernization investment. The fifth principle articulates the expectation that utilities should prepare complete evaluations of such investment plans to ensure that regulators are provided with the necessary information to make sound decisions about whether to grant cost recovery.

The Commission later increased the stringency of its standards for Xcel. In its 2019 Order granting recovery for Xcel's investments in Advanced Distribution Management Systems (ADMS), the Commission mandated that any future Advanced Grid Intelligence and Security (AGIS) cost recovery request be supported by a business case with a "comprehensive assessment of qualitative and quantitative benefits to customers."[20,21] This Order includes a kind of preliminary evaluation framework, with principles for evaluation and a detailed set of grid modernization evaluation filing requirements for Xcel in its future AGIS cost recovery requests.

[17] Minnesota Public Utilities Commission. Docket No. E-002/CI-18-251. Order Approving Integrated Distribution Planning Filing Requirements for Xcel Energy. August 30, 2018.

[18] Minnesota Public Utilities Commission. Docket No. E-017/CI-18-253. Docket No. E-017/CI-18-254. Docket No. E-017/CI-18-255. Order Adopting Integrated-Distribution-Plan Filing Requirements. February 20, 2019.

[19] Each of the subject utilities is required to include a "Long-Term Distribution System Modernization and Infrastructure Plan" with its IDP. The long-term plan is divided into two parts: a 5-year "Action Plan" and 10-year long-term distribution system plan. The "Action Plan" is to include a benefit-cost analysis (BCA) of each "grid modernization project" proposed, with the Commission dictating that the plan address objectives, alternatives, interactions, timing, assumptions, interoperability, and other key facets.

[20] The Advanced Grid Intelligence and Security is Xcel's grid modernization program.

[21] Minnesota Public Utilities Commission. Docket No. E-002/M-17-797. Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements. September 27, 2019.

In addition, each of the investor-owned utilities is required to submit an integrated resource plan (IRP). There are many areas of potential overlap between the IRP and distribution system planning processes. The IRP for each utility would typically address plans for achieving carbon reductions which are closely related to net load on the system, energy efficiency and demand response, and distributed energy resources—all of which may be critical factors in distribution system planning.

1.3 The Need for Additional Evaluation Standards

While the Commission has already advanced grid modernization evaluation practices through its Orders and guidance, there is a need for additional direction. To help protect the interests of Minnesota's electric utility customers and ensure that utility investments serve the state's policy priorities, the Commission should build on its past Orders with an expanded set of grid modernization evaluation standards and filing requirements that would uniformly apply to all of the state's electric utilities and for all of the available cost recovery mechanisms.[22]

This document provides a recommended set of evaluation standards and filing requirements that the Commission could adopt. This guidance would offer additional structure to improve the information available to the Commission and stakeholders for review of grid modernization investments. By adopting the evaluation principles and filing standards set forth in this document, the Commission would accomplish at least three related goals: ensuring consistency in the information that utilities provide in support of grid modernization investment proposals; supporting a robust stakeholder process; and providing for optimized regulatory decision-making.

The guidance provided in this document also builds on the December 2020 report of the Minnesota Department of Commerce (Department) titled, "Methods for Performance Evaluations, Metrics, and Consumer Protections for AMI and FAN."[23] That report emphasized the need for clear and early establishment of investment project scope, functionality, timeline, and cost—which may be accomplished through the grid modernization evaluation as prescribed in this document. The DOC's report also recommended two additional customer protections: a robust metrics reporting regime and cost caps. This guidance document includes those DOC recommendations.

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[22] Several states have adopted similar uniform standards for benefit-cost analysis. For example, the New York Public Service Commission ordered adoption of the "benefit-cost analysis framework" in 2016 and prescribed the use of the Societal Cost Test as the primary BCA framework; the California Public Utilities Commission issued an Order in 2018 as part of a wider rulemaking on distribution resource planning that directed the use of a least-cost test for grid modernization technologies designed to improve safety and reliability; the Hawaii Utilities Commission imposed grid modernization guidelines based on the recommendations of the regulated utilities. These guidelines outlined the use of a total resource cost test and a least-cost/best-fit test for analyzing grid modernization technologies. Appendix B provides a review of regulatory practices in key U.S. jurisdictions.

[23] Minnesota Department of Commerce. Methods for Performance Evaluations, Metrics, and Consumer Protections for AMI and FAN. Department of Commerce Report to the Public Utilities Commission. Filed in Minnesota Public Utilities Commission. Docket. No. E-002/M-19-666 and E-999/DI-20-627. December 1, 2020.

1.4 Appling the Evaluation Framework in Different Regulatory Contexts

The evaluation framework and associated filing requirements provided in this document are applicable in all regulatory contexts in Minnesota where grid modernization proposals are considered. Utility evaluations of grid modernization investments should conform to these standards whether they are submitted in conjunction with an IDP, a rate case, a certification request, a rider cost recovery proposal, in the course of a plan development process in which stakeholders participate, or in some other venue. Moreover, evaluations should be furnished at the earliest possible stage and should be supplemented as required on an ongoing basis to provide a fulsome record.

While utilities should always justify proposals for grid modernization investment with comprehensive evaluations conforming to the guidance provided here, there are additional complexities that may challenge review of these proposals. Two key considerations are addressed in brief below.

1.4.1 Grid modernization components proposed in separate proceedings

While it would be simpler if grid modernization proposals were to include all desired components, in practice, utilities frequently seek approval on a piecemeal basis for portions of a broader portfolio of investments. Further complicating things, the multiple cost recovery filings associated with this broader grid modernization initiative made be made in distinct dockets, and they may even seek to utilize different avenues for cost recovery. As noted above, in Minnesota, state law provides two different pathways for rider recovery of grid modernization costs, and utilities may also seek recovery through the rate case process.

To help reduce the risk of regulatory gaps or inconsistencies, some key principles are indicated. First, to the extent known, grid modernization proposals should specify all future intended investments—even if some of these investments are not included in the given proposal. To the extent that future intended investments have been excluded from the proposal, the filing should justify this exclusion. Second, grid modernization plans should not assume future approval of components that have been excluded from the current proposal. Finally, to ensure consistency over time, subsequent grid modernization investment proposals should generally maintain the core assumptions and methodologies of earlier proposals.

1.4.2 Certification in the TCR proceeding

Further complicating the regulatory treatment of grid modernization proposals, the TCR rider includes a unique feature that is not a part of recovery through the EUIC rider. Minnesota law requires that the Commission decide whether to certify, certify as modified, or deny certification to any of the utilities' proposed transmission and distribution projects; this includes grid modernization projects. Only projects that have been certified are eligible for recovery through the TCR rider. Certification of grid

modernization plans does not provide for their reasonableness or imply that cost recovery should be granted—a point that has been acknowledged by the Commission.[24,25]

While there may not be an obvious policy rationale for the absence of a certification stage in the EUIC process, to the extent that its inclusion in the TCR procedure provides any advantages to utilities with MRPs (by enabling these utilities to gauge the Commission's position on its investment plans and perhaps to seek pre-approval of spending) the existence of the certification stage should also serve to enhance customer protections by informing the implementation of cost caps. Cost caps are discussed in Section 2.6.

1.5 Overview of this Document

The main section of this document is divided into three sections. Two appendices follow. The next section describes a framework for evaluating grid modernization proposals. Section 3 provides a set of recommended filing requirements for utility evaluations of grid modernization plans. Section 4 lays out recommendations for ongoing reporting requirements. APPENDIX A gives an overview of relevant regulatory practices in Minnesota, while APPENDIX B describes grid modernization regulation in selected states nationwide.

2 GRID MODERNIZATION EVALUATION FRAMEWORK

2.1 Principles for Grid Modernization Evaluation

The establishment of overarching principles is a critical step to ensure that grid modernization investments are evaluated in a consistent, transparent, and efficient manner. Evaluation principles provide an outline for the evaluation framework and its more concrete directions. As mentioned above, the Commission provided a set of evaluation principles in its Order granting Xcel cost recovery for ADMS. The 11 principles are listed below.[26]

[24] Minnesota Public Utilities Commission. Docket No. E-002/M-15-962. Order Certifying Advanced Distribution Management System (ADMS) Project Under Minn. Stat. §216B.2425 And Requiring Distribution Study. June 28, 2016.

[25] This contrasts with other, traditional expenditures that are recovered in riders. For transmission investments, for example, a finding during the certification process that an investment is needed paves the way to cost recovery. Certification of a transmission project signifies prudence.

[26] Minnesota Public Utilities Commission. Docket No. E-002/M-17-797. Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements. September 27, 2019, p. 15. These principles are consistent with those provided in the National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources: NESP, *National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources* (NSPM for DERs), August 2020. See: https://www.nationalenergyscreeningproject.org.

1. Compare with traditional resources or technologies
2. Clearly account for state regulatory and policy goals
3. Account for all relevant costs and benefits, including those difficult to quantify
4. Provide symmetry across relevant costs and benefits
5. Apply a full life-cycle analysis
6. Provide a sufficient incremental and forward-looking view
7. Ensure transparency
8. Avoid combining or conflating different costs and benefits
9. Discuss customer equity issues, as needed
10. Assess bundles and portfolio where reasonable
11. Address locational and temporal values

These principles underly many of the recommendations offered in this guidance document and should be used to guide the development and review of grid modernization evaluations.

2.2 Articulating the Goals of Grid Modernization

Every grid modernization proposal should begin with a clear articulation of the goals that are to be achieved by the proposed investment. Utilities and stakeholders sometimes approach grid modernization as if it were a goal in and of itself. This is not an appropriate perspective, and it creates an undue bias in favor of investment before the evaluation even commences.

Instead, grid modernization investments should be viewed as a means to achieving certain goals. The actual goals of grid modernization include such outcomes as improved reliability, reduced costs, improved communication of information, increased customer satisfaction, improved resilience, increased installation of distributed energy resources, achievement of climate goals, and more. These goals are measurable and should serve as the basis for judging grid modernization investments. Critically, while there may be no alternative to the goal of "grid modernization" expressed as such, there are usually traditional alternative solutions to achieving the actual ultimate goals, whether they include improving reliability, reducing costs, improving customer satisfaction, or some other end.

The Commission has emphasized the importance of articulating the goals underlying grid modernization proposals by requiring that grid modernization planning be situated in the broader context of long-term distribution system planning (see APPENDIX A). In this context, grid modernization investments and technologies can be seen as resources to help meet the goals of long-term system planning. Grid modernization goals should also be consistent with goals set in other planning proceedings, including both the transmission planning and IRP processes.

Utility proposals for grid modernization should proceed beyond generalized goals such as "accommodate higher capacities of distributed energy resources" or "avoid delays in interconnection requests." Each goal should be accompanied by measurable objectives, timeframes, and metrics. The clear articulation of goals in this manner determines foundational assumptions for the evaluation of grid modernization investments prospectively, while also determining the criteria for evaluating the success of a particular investment once completed (i.e., through reporting metrics).

Establishing clear and completely articulated goals, coupled with metrics that can be objectively measured, leads to grid modernization spending that is more focused, restrained, and effective at achieving timely objectives. Examples of appropriate goals are provided in Table 1.

Table 1. Sample of clear and complete grid modernization goal articulation

Sample Goal	Sample Objectives and Targets	Sample Metric and Reporting
Accommodate higher capacities of distributed energy resources	DER capacity 50% of minimum recorded load on 25% of circuits by 2025	Annual report by circuit: • DER capacity • Minimum recorded load
	DER capacity 100% of minimum recorded load on 50% of circuits by 2030	
	DER capacity 100% of maximum recorded load on 50% of circuits by 2035	Annual report by circuit: • DER capacity • Maximum recorded load
Avoid interconnection Delays	Interconnection decisions rendered on systems under 10 kW within 5 business days on circuits with available distributed energy resource capacity.	Annual reports: • List of interconnection requests by size • Date of each request • Date on which decision was communicated for each request
	Interconnection decisions rendered on systems between 10 and 100 kW within 30 days on circuits with available distributed energy resource capacity	
	Interconnection decisions rendered on systems over 100 kW within 90 days	
Improve efficiency of electric delivery	Average annual voltage reductions of at least 1% on 20% of circuits by 2025	Annual report by circuit: • Baseline (pre-CVR) • Average annual delivery voltage
	Average annual voltage reductions of at least 2% on 25% of circuits by 2027	
	Average annual voltage reductions of at least 3% on 30% of circuits by 2029	

It is not enough for grid modernization plans to simply list goals in a general sense. Rather, plans must detail the goals associated with *each component* of the grid modernization proposal. Some components might be desirable because they can improve reliability, while others might offer no reliability value but can help meet the goal of increasing distributed energy resource installation. In order for regulators to be able to separately assess each component of a grid modernization proposal, as described below, it is essential that the goals of each component are clearly articulated up front. These goals can then be used to inform the economic evaluation of each component, particularly the benefits of each component.

2.3 Choosing an Evaluation Methodology

Two types of economic analysis have been used for many years to evaluate utility investments: benefit-cost analysis (BCA) and least-cost/best-fit analysis (LCBF). While both types of analysis are used in utility business cases for grid modernization, benefit-cost analysis is more appropriate for grid modernization evaluation. An overview of each approach is provided below, followed by specific explanation of why benefit-cost analysis is the preferred approach for evaluation of grid modernization investment plans.

2.3.1 Benefit-cost analysis

BCA is a systematic approach for assessing the cost-effectiveness of investments by comparing the benefits and costs of alternative options. The analysis entails identifying all the relevant benefits and costs of a project and determining whether the benefits exceed the costs over the lifetime of the expected program or project.

BCA is frequently used by utilities, both to make internal resource investment decisions and to justify resource investment decisions to regulators and other stakeholders. Utilities have used BCA many years to demonstrate the cost-effectiveness of energy efficiency and other distributed energy resource investments. It is central to utility planning practices used to optimize utility resources systemwide, such as integrated resource planning.

2.3.2 Least-cost/best-fit analysis

The LCBF approach is applied when the need for a particular project or investment is already established. Once the need is established, the next step is to identify the technology option(s) that are likely to be the best fit to meet that need. The final step is to identify the lowest cost way of implementing the technology chosen, often using a competitive procurement process.

The LCBF approach is distinct from a traditional BCA approach because it does not require a demonstration that monetized benefits exceed monetized costs. Instead, there is a presumption that the investment is needed, and the main goal of the economic analysis is to identify the best way to meet that need at the lowest cost. This approach eliminates the need to monetize all the benefits associated with the investment in question. However, this approach begs an obvious question: how does a regulator or stakeholder evaluate a utility's claim that a particular investment or capability is needed? Such presumptions are notoriously difficult to evaluate given the technical nature of investment or capability justifications presented by utilities.

2.3.3 Grid modernization evaluation should always include benefit-cost analysis

LCBF approach has been used for many years by utilities to help make decisions regarding traditional distribution investments, where the need for the distribution investments is uncontroversial (primarily driven by reliability and safety requirements). However, grid modernization investments are different. The goals of grid modernization investments may be more opaque or multifaceted, and these goals are

often connected to novel policy priorities.[27] Moreover, unlike traditional distribution and transmission investments, there may be perfectly viable alternatives to proposed grid modernization investment.

Meanwhile, BCAs place the onus on the utility to demonstrate that an investment should be made, rather than starting from the assumption that it is necessary. By presenting and comparing the full range of costs and benefits to make the case for the utility investment in question, BCAs facilitate complete assessment of how a proposed investment will affect utility customers. Because BCAs are more comprehensive and rigorous than LCBF analyses, they should be the primary means of evaluating grid modernization plans—even in instances where investments are claimed to be necessary.

Note that nothing should be lost in requiring utilities to use BCA rather than falling back on LCBF. Utilities may still argue in BCA-based proposals that grid modernization investments are necessary. If monetized benefits alone do not justify the proposed investments, the utility may make the case with qualitative benefits. While BCA does not so singularly prioritize lowest cost solutions like LCBF does, it can accommodate multiple alternative scenarios—including those prioritizing cost-minimization. Regulators in turn may provide guidance to utilities on the relative priority of least-cost versus other outcomes such as benefit maximization.

2.4 Defining the Reference Scenario and the Investment Scenario

At minimum, a BCA boils down to a comparison of two scenarios: a reference scenario that indicates the business-as-usual approach and assumes that the investment in question is not undertaken, and an investment scenario that assumes that the investment is undertaken. The difference in the costs of these two scenarios will indicate the net costs, or net benefits, of the investment.[28] Properly defining these two scenarios is critical to ensuring a sound comparison.

The reference scenario should include all the future resources expected to be in the mix under business-as-usual conditions. This should include all future investments in generation, transmission, distribution, metering, and other assets, as well as all spending on fuel, operations and maintenance (O&M), and capital costs that have not yet been incurred and included in rates. This scenario should also represent the optimal mix of resources associated with the business-as-usual conditions; selecting a sub-optimal mix of resources can skew the results of the analysis in favor of the investment scenario.

The investment scenario should similarly include all future resources expected to be in the mix if the investment is undertaken. This should include all future investments in generation, transmission,

[27] Woolf, T., L. Schwartz, B. Havumaki, D. Bhandari, M. Whited. Benefit-Cost Analysis for Utility-Facing Grid Modernization Investments: Trends, Challenges, and Considerations. Prepared by Lawrence Berkeley National Laboratory and Synapse Energy Economics for the Grid Modernization Laboratory Consortium of the U.S. Department of Energy. 2021, pp. 13-14.

[28] A variety of other scenarios and sensitivities can be applied to investigate various questions, but in the end the economic evaluation typically comes down to a comparison of two scenarios.

distribution, metering, and other assets, as well as all spending on fuel, O&M, and capital costs that have not yet been incurred and included in rates.

The economic evaluation, then, consists of a comparison between the costs of the reference and investment scenarios. This concept of taking the difference between the two scenarios can help resolve some methodological issues that may arise around which costs and benefits to include in the grid modernization evaluation. One particularly challenging case concerns deciding whether and how to account for stranded costs created by grid modernization investments. It is critical in this event to consider which costs the utility will be permitted to recover from its customers in each scenario, and then take the difference. This challenge of accounting for stranded costs is addressed in further detail below.

2.4.1 Considerations of alternatives

While a BCA must at minimum include two alternative scenarios, as described above, this should not be construed to mean that the distribution system planning process in which the BCA is embedded should confine itself to comparing just business-as-usual with a single investment case. On the contrary, utilities must undertake comprehensive analysis of alternatives, the results of which may merit inclusion of additional scenarios in the formal economic evaluation. Utilities must provide comprehensive documentation of this analysis, including solicitations and cost and bid data, as supporting documentation with the economic evaluation.

The following, adjacent regulatory examples are instructive about the need for broad consideration of alternatives to grid modernization:

- In Certificate of Need proceedings whereby a utility or third party proposes to build a new generation source, there are robust requirements for evaluating alternatives to the proposed project.[29]
- For wind resource acquisitions, Xcel is required to conduct a rigorous bidding process before a project can be selected.[30]

In many cases, the proposed grid modernization solution may be just one of many alternatives to the status quo. As illustrated by the examples above, the need to consider alternatives at the planning stage pertains to both the choice of the solution (e.g., traditional investment in upgrading feeders vs. investment in grid modernization) and the selection of specific products (i.e., which manufacturer's grid modernization technology to choose).

[29] Minn. R. 7849.0120(B)(1)-(4); 7849.0250(B) and (C).

[30] For a description of the bidding process Xcel is required to use, see: Public Comments of the Minnesota Department of Commerce, Division of Energy Resources. Filed in Minnesota Public Utilities Commission. Docket No. E-002/M-20-620. November 2, 2020, pp. 7-9 and pp. 30-32.

2.4.2 Considerations for net benefits and other indicators

As noted above, taking the difference in costs between the reference and investment scenarios will produce an indicator of net benefits or net costs, depending on whether the investment case is costlier than the reference case. However, this difference in costs may not provide a complete picture. In many cases, unmonetized benefits associated with the investment scenario are a key variable in determining whether a proposed plan is cost-effective. The following section addresses this in greater detail.

In addition to the standard net benefits or net costs indicator, another complementary measure is the benefit-cost ratio, or BCR. This is calculated by taking the ratio of the incremental benefits to the incremental costs in the investment case relative to the reference case. Note that a result of positive net benefits implies a BCR greater than 1.0.

2.5 Accounting for Costs and Benefits

2.5.1 Define the scope of the evaluation

Utility grid modernization proposals should clearly articulate the scope of the economic evaluation to be applied. This is often referred to as the cost-effectiveness test or the BCA test.

For many years, Minnesota utilities have used the Societal Cost Test to evaluate energy efficiency investments. This test includes the costs and benefits associated with the utility system, the host customer (i.e., program participant), and society in general. The Minnesota utilities typically use the Societal Cost Test to evaluate resource plans in their IRPs.[31] The grid modernization proposals filed by Xcel to date also use the Societal Cost Test.[32]

The Department is currently holding stakeholder discussions to update the test used to evaluate energy efficiency programs, to account for the principles and recommendations in the 2017 *National Standard Practice Manual for Assessing the Cost Effectiveness of Energy Efficiency Resources* (NSPM for EE).[33] While the outcome of these discussions are uncertain, one goal of the stakeholder process is to determine the BCA test that specifically addresses applicable Minnesota energy policies, i.e., a "Minnesota test." This test might include all societal impacts, or it might include a subset of societal impacts.

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[31] Xcel Energy. Upper Midwest Integrated Resource Plan. 2020-2034. Filed in Minnesota Public Utilities Commission. Docket No. E-002/RP-19-368 and E-002/RP-15-21. May 30, 2019.

[32] Xcel Energy. Direct Testimony and Schedules. Ravikrishna Duggirala. Filed in Minnesota Public Utilities Commission. Docket No. E002/GR-19-564. November 1, 2019, p. 8.

[33] National Energy Screening Project. The National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources (NSPM for EE). 2017. Note that this version was updated and revised in 2020 to become The National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources (NSPM for DERs). See: https://www.nationalenergyscreeningproject.org/the-national-standard-practice-manual-for-energy-efficiency/.

Ideally, utilities should use the same cost-effectiveness test for all utility investments. Otherwise, they are likely to make uneconomic investments due to inconsistent comparisons, leading to higher costs for utility customers. As Minnesota updates its energy efficiency cost-effectiveness test and practices, those same practices should be applied to other utility investments, including grid modernization investments.

Regardless of which test is used to evaluate grid modernization proposals, the choice of test should be clearly articulated upfront. This helps resolve any questions that might arise regarding which costs and benefits to consider in the grid modernization evaluation.

2.5.2 Categorize costs and benefits according to sphere of impact

Examples of the types of costs and benefits associated with grid modernization plans are provided in the tables below. These tables categorize costs and benefits according to whether they apply to the utility system or to society in general. Breaking out grid modernization costs and benefits in this way provides public utility commissions with useful information regarding the implications of grid modernization for utility customers. Costs and benefits to the utility system indicate impacts on electric utility customers in terms of bills and services they receive, while costs and benefits to society indicate how well grid modernization projects are likely to meet additional state policy goals.

- The costs and benefits for the "utility system" are those impacts on the entire utility system used to provide electricity services to retail electricity customers.[34] The utility system includes all elements of electricity services—generation, transmission, and distribution—regardless of whether the utility is vertically integrated or distribution only.
- The costs and benefits for "society" are those impacts experienced by society in general, not just by customers of the electric utility.

Table 2. Examples of grid modernization costs

Cost	Utility System	Society	Measure
Utility capital costs	✓	-	revenue requirements
Utility O&M costs	✓	-	revenue requirements
Utility T&D costs	✓	-	revenue requirements
Utility data management costs	✓	-	revenue requirements

[34] National Energy Screening Project. NSPM for EE. 2017, Section 3.2.

Table 3. Examples of grid modernization benefits

Benefit	Utility System	Society	Measure
Reduced energy costs	✓	-	revenue requirements
Reduced generation capacity costs	✓	-	revenue requirements
Reduced T&D capacity costs	✓	-	revenue requirements
Reduced O&M costs	✓	-	revenue requirements
Reduced ancillary services costs	✓	-	revenue requirements
Increased distributed energy resource integration	✓	-	revenue requirements
Increased reliability	✓	✓	monetary values or metrics
Increased resilience	✓	✓	monetary values or metrics
Increased safety	✓	✓	metrics
Increased customer satisfaction	✓	-	metrics
Increased customer flexibility and choice	✓	-	metrics
Improved power quality	✓	-	metrics
Environmental benefits	-	✓	monetary values or metrics
Economic development benefits	-	✓	monetary values or metrics

Note that benefits should only be claimed for the utility system if they reduce utility revenue requirements and thus impact positively on the total ratepayer cost burden. As a specific example from the domain of grid modernization, utilities may be able to generate new revenue streams by using new technologies to gather customer or grid data. Such revenues should only be counted in a BCA as a utility-system benefit if they are used to reduce overall revenue requirements—as they arguably should be.

2.5.3 Include all relevant costs and benefits

Many grid modernization plans include increased distributed energy resource integration as a significant benefit of grid modernization.[35] However, this benefit is distinctly different from the other benefits listed. Increased distributed energy resource integration is an outcome that will have its own costs and benefits. If a utility claims increased distributed energy resource integration as one of the benefits of its grid modernization proposal, then the costs and benefits of the incremental distributed energy resource

[35] Woolf, et al. 2021.

additions should be addressed separately and then added into the economic analysis of the grid modernization proposal.[36,37]

It is important that the costs and benefits assumed in the grid modernization evaluation are consistent with those used in other analyses before the Commission. For example, carrying charges paid by customers and included in revenue requirement forecasts should also be included in BCAs. Similarly, contingency costs or indirect overhead capital cost allocations included in revenue requirement forecasts should be consistent with the cost estimates in BCAs.

2.5.4 Express costs and benefits in appropriate units

All costs accounted for in an evaluation should be expressed in both real and present value terms. To the extent possible, benefits should also be monetized, and provided in both real and present value terms. (See Section 2.8 for an explanation of discount rates and present value.)

Ideally the costs and benefits should be presented in terms of annual revenue requirements—again, reporting impacts in both real and present value terms. For example, upfront capital costs should be amortized over the book life of the asset to determine the annual revenue requirements necessary to recover those capital costs from customers. This is the most useful way to present the costs and benefits of grid modernization investments, as well as other utility investments. Revenue requirements are commonly used by commissions to express costs and benefits in terms that are meaningful to both customers and utilities, as they indicate the amount that customers will actually pay utilities for electricity services in each year. In general, commissions seek to minimize the present value of revenue requirements in order to minimize electricity costs to customers.[38,39]

Several grid modernization benefits are difficult or impossible to put in terms of revenue requirements. In such cases, these values should still be expressed in monetary terms because these can be added directly to the revenue requirements to determine total impacts in dollar terms. For some benefits, such as customer flexibility and choice, it does not make sense to put the benefit in terms of revenue requirements or monetary values, so quantitative metrics should be used to indicate the extent to which these benefits are achieved. Accounting for unmonetized benefits is one of the more challenging aspects of economic evaluation of grid modernization investments and is addressed further below.

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[36] For more information on BCAs for distributed energy resources, see: National Energy Screening Project, The National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources, 2020.

[37] One possible exception to this standard would be an instance in which policy specifically targets increased integration of distributed energy resources. In such a case, this benefit could be accounted for qualitatively.

[38] Commissions, of course, have other important objectives such as ensuring reliable electricity services and meeting other policy goals, but minimizing the present value of revenue requirements is a high priority.

[39] It is also important to consider the regulatory ratemaking process in place when assessing the benefits of grid modernization investments. There may be situations where some of the benefits, e.g., reduced O&M costs, do not flow to customers because reduced costs are incurred in years that are in between rate cases. In these years, these benefits will flow to the utility and its investors, not to customers.

2.5.5 Treatment of stranded costs

Some grid modernization investments might result in existing utility assets being retired before they are fully depreciated, leading to stranded costs. The most notable example is advanced metering infrastructure (AMI) proposals that could lead to replacement of legacy meters before the end of their book lives. Grid modernization evaluations should properly account for costs that might become stranded because stranded costs can have important implications for the results.

If grid modernization investments are expected to create stranded costs, they should be treated as follows:

1. Identify any costs that might become stranded as a result of new investments.
2. Estimate the total magnitude of those stranded costs. This should equal the full undepreciated portion of assets starting in the year that they are expected to be taken out of service.
3. Identify whether and how those stranded costs are likely to be recovered by the utility. Will the utility be able to recover them in full, recover the investment but not the return on the investment, recover neither the investment nor the return, or something else? Ideally, the Commission should articulate how stranded costs will be treated before the grid modernization evaluation is conducted. In the absence of a clear indication from the Commission about the recovery of stranded costs, the evaluation should include sensitivities to capture the range of potential outcomes for stranded cost treatment in the investment scenario.
4. For the investment scenario, which assumes that the new grid modernization investments are undertaken, include the amount of stranded costs that the utility will be allowed to recover from ratepayers. This estimate should present the annual revenue requirements associated with the allowed stranded costs. Stranded costs that will have to be written off by the utility should not be included in the economic analysis of the grid modernization investments because they will not affect revenue requirements.
5. For the reference scenario, which assumes that the grid modernization investments are not undertaken, there will be no stranded costs to include in the analysis. However, the remaining costs of the legacy equipment should be included in the scenario.[40]
6. Take the difference between the costs in the reference scenario and the costs in the investment scenario. This is an essential step in any economic analysis (see Section 2.4).
    a. If the utility is allowed full recovery of stranded costs by continuing to keep legacy costs in rates until the end of the assets' book lives, then there will be no

[40] This step is not typically done in economic analyses. That is, if a cost is expected to be recovered in both the reference and the investment scenarios, then they are not included in either because they will net out. This step is needed in the case of legacy assets that might become stranded in order to capture any effects of stranded cost recovery.

difference between the two scenarios; the legacy costs and stranded costs will net out of the results.

b. If the utility is not allowed full recovery of stranded costs, then the difference between full recovery of legacy costs in the reference case and the partial recovery of stranded costs in the investment case will represent a benefit to customers of the grid modernization investment.

2.5.6 Treatment of unmonetized benefits

Grid modernization investments tend to create impacts that are difficult to monetize and quantify, such as resilience or customer satisfaction. However, this is not a reason for excluding a benefit or cost. If an impact is deemed appropriate for inclusion in a cost-effectiveness test, it should be included regardless of whether it cannot be quantified and/or monetized.

If a utility grid modernization plan does not monetize some of the benefits being used to support grid modernization investments, it should justify why it is not possible to monetize those impacts. Further, the grid modernization plan should use one or more of the alternative approaches summarized below to address unmonetized impacts.[41]

1. *Quantitative detail*: It may be possible to quantify an impact even if it cannot be monetized. For example, if improved safety is presented as one of the benefits of grid modernization, and the utility is not able to put a monetary value on this benefit, then at a minimum the grid modernization plan should include quantitative information on the expected reduction in the number of safety-related incidents, injuries, and deaths.

2. *Quantitative techniques*: Where it is not possible to precisely quantify expected impacts, it can be useful to nonetheless provide a sense of the expected magnitude through one of several techniques. Examples of possible approaches include using a point or weighting system to assign value to unmonetized benefits, assigning proxy values for significant unmonetized benefits, and using multi-attribute decision-making techniques.

3. *Qualitative evidence*: Impacts that cannot be quantified or monetized should be discussed qualitatively. The discussion should be detailed enough to allow regulators and other stakeholders to generally assess the magnitude and implication of these impacts. For example, if a grid modernization plan claims that increased customer satisfaction is one of the benefits of grid modernization investments, then it should indicate how many customers, which types of customers, and in what way customers will be more satisfied.

4. *Alternative approach to defining benefits*: Define benefits in such a way that they can be monetized. For example, the impact of increased distributed energy resource adoption could be defined in terms of the associated benefits of reduced generation, transmission, and distribution costs, all of which can be monetized.

[41] Woolf, et al. 2021.

5. *Metrics*: Impacts that are not monetized should nonetheless be assessed using metrics. Metrics can be used to clearly define impacts, even those that cannot be monetized. They can then be used to (a) indicate the likely impact on the utility system, even if not in monetary terms, and (b) monitor over time the extent to which the benefits purported in the grid modernization plan are achieved.

It is imperative that any approach taken be well-documented and supported within a grid modernization plan. Further, the grid modernization plan should explain the implications of these unmonetized benefits in the decision to invest in the grid modernization components. For those components that are not cost-effective in the absence of the unmonetized benefits, the grid modernization plan should explain whether and how the unmonetized benefits are sufficient to make those components cost-effective.

2.5.7 Treatment of interdependent components and avoidance of double-counting

Grid modernization plans often include components that are interdependent and that may seek to enable new services and functions on the distribution grid. This creates a challenge to assessing the cost-effectiveness of proposed grid modernization investments due to the potential to double-count costs and benefits.

For example, some components of grid modernization will not produce benefits until additional investments are completed, and filings may be made at different points in time. In the case of AMI, full benefits may not be realized until customers have access to programs that enable them to take advantage of more granular energy pricing such as time-of-use rates or smart appliances. If the benefits associated with customers utilizing the meters was included in the BCA for AMI, and those benefits are also counted when assessing a smart appliance program, this might lead to double-counting. Likewise, including the cost of AMI in the smart appliance program might lead to double-counting. The utility should provide transparency around the timing of investments and potential overlapping of costs and benefits.[42]

The same issue holds true in seeking to assess the cost-effectiveness of a grid modernization plan with multiple interactive components. For example, ADMS enables several other grid modernization components such as AMI and Distribution Energy Resources Management Systems (DERMS). For this reason, the benefits and costs of ADMS cannot be easily separated from the other components in a BCA. Similarly, investment in a Field Area Network (FAN) alone would create costs without benefits, yet it enables AMI and Integrated Volt-VAr Optimization that will create benefits.

[42] As a general principle, benefits arising from the interaction of grid modernization components in the plan with future grid modernization components that have not been included in the utility proposal should not be counted. In other words, in cases where a utility envisions additional future grid modernization investments but has not included these in the grid modernization plan that is under review, these future investments should not factor into the calculation of benefits of this grid modernization investment scenario.

To prevent issues related to double-counting in this case, the utility should first conduct a BCA for each component separately. For this step, all monetary costs and benefits should be counted for each component in isolation. At this stage, the utility should indicate whether each component is essential (i.e., a "core" component) or elective within the overall grid modernization portfolio. Essential components are those that are foundational—providing functionality necessary to enable other components. Note that the characterization of a component as essential at this stage is with respect to the grid modernization portfolio that has been proposed and not an indication of whether it is the lone solution to a grid need.[43]

The second step is to account for interactive effects by combining components into bundles to determine how they provide benefits when operating in combination.[44] This is supported by the Commission in its Order in Docket No. E-002/M-17-797 where it directed Xcel Energy to provide a BCA for each investment component with overlapping costs or benefits in isolation and for each bundled components as part of its AGIS investments filing for cost recovery.[45,46]

The utility should only evaluate logical component bundles; while many combinations of different components may be feasible, only those components with sensible functional relationships should be combined in bundles.

Some utilities may resist the direction to evaluate grid modern components in isolation, claiming that program components are interdependent and cannot be evaluated in isolation. However, quantification of the costs and benefits of individual components is almost always possible. As an example, consider the conservation voltage reduction (CVR) capability described in the Technology Assessment provided to the Department by Xcel in Docket No. E002/GR-19-564. While a utility may wish to link CVR to smart meters, CVR can be implemented without a universal smart meter deployment. Line sensors can be deployed to provide feedback on CVR actions in the absence of smart meters. These examples illustrate how differentiation can be utilized to individually evaluate even those grid modernization components which appear to be interdependent.

While it is also true that more data points (universal smart meters) can enable more aggressive CVR actions, which can in turn deliver greater energy efficiency benefits, this is not dispositive. Key questions

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[43] For more detail on the distinction between essential and elective grid modernization components, see: U.S. Department of Energy. 2017. Modern Distribution Grid: Decision Guide Volume III. Prepared by the U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability, Office of Energy Policy and Systems Analysis, and the Pacific Northwest National Laboratory.

[44] Woolf, et al. 2021, pp. 27-28.

[45] Minnesota Public Utilities Commission. Docket No. E-002/M-17-797. Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements. September 27, 2019, p. 14.

[46] In Minnesota, one analogy from another regulatory domain that illustrates good practice is the utilities' Conservation Improvement Program (CIP) triennial filing. Each triennial CIP filing consists of a number of programs with varying degrees of energy efficiency benefit per dollar of cost. The benefit-cost ratio of the entire portfolio of CIP programs can be improved by eliminating programs which are barely cost-effective, or perhaps even cost-ineffective. At that point, subjective criteria are applied to determine which programs make sense to continue, and which programs should be ended (or not started).

must be addressed: How much more aggressive will the enabled CVR actions be given universal smart meters? Is the incremental CVR benefit worth the incremental smart meter cost? Do these incremental CVR benefits, when combined with other smart meter benefits, justify smart meter costs? A complete evaluation will provide the information needed to address these critical questions.[47]

2.6 Establishing Metrics

Metrics should be included as part of any grid modernization plan. Well-defined metrics allow regulators and stakeholders to track the progress of implementation plans and to monitor the extent to which the costs and benefits are experienced over time.[48]

2.6.1 Metrics should track benefits

Many of the frequently-cited benefits of grid modernization can be quantified and tracked using metrics. Examples include such benefits as customer satisfaction, hosting capacity, job creation, and power quality. Other metrics could include the number of AMI meters installed each year, the number of customers enrolled in time-varying rates and participating in other programs and services, the percent of customers accessing energy data, and more traditional performance indicators such as service quality and reliability standards for equipment, feeders, and systems. The utility should provide sufficient detail for how the metric will be measured and reported within its plan and the rationale for any target or benchmark.

Critically, metrics are still useful even when benefits cannot be monetized. For example, if the benefits of resilience are not monetized in a grid modernization plan, utilities can still track these outcomes to indicate the extent to which these benefits occurred due to its investment. Examples of potential resilience-related metrics might include electrical service (cumulative customer-hours of service), electrical service provided to critical customers (cumulative critical customer-hours of service), and restoration (time to recovery).[49]

In a similar vein, in its *2019 Integrated Distribution Plan*, Xcel describes several qualitative benefits related to its proposed *Advanced Grid Proposal* investments. Xcel states these investments will "support new developments in smart products and services; in the short term by supporting the display of more frequent energy usage data through the customer portal—and over the long term, allowing for the

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47 Even further, CVR actions can be automated, with software not only informing equipment settings at a circuit's head end, but also remotely controlling equipment throughout a circuit in near real time, from load tap changers to voltage regulators to capacitors.

48 Woolf, et al. 2021, p. 29.

49 Schwartz, L. Utility Investments in Resilience of Electricity Systems. Prepared by Lawrence Berkeley National, Organization of MISO States, National Rural Electric Cooperative Association, and National Association of State Utility Consumer Advocates. 2018.

implementation of more advanced price signals."[50] Thus, in addition to tracking quantitative benefits, and in order to ensure these qualitative benefits are realized, the company could track the number of new products entering the market after the investment was made and could track the number or percent of customers accessing the portal.

As a starting point, the Commission should adopt the set of metrics provided in Appendix E of the Department's December 2020 report.[51] This set reflects the input from various stakeholders and represents a comprehensive approach to accounting for grid modernization performance. This set of metrics may be subsequently refined through stakeholder input incidental to the cost recovery process.

2.6.2 Targets should accompany metrics

Targets can also be applied to establish regulatory goals regarding the metrics. For example, if there is a metric for the number of AMI meters installed in each year, the Commission might establish a target number of meters that the utility should install each year. Utility financial incentives can be applied on top of metrics and targets. In the example above, the Commission could provide the utility with rewards for significantly exceeding the target number of meters installed in each year, or penalties for falling well short of the target.[52]

2.6.3 Cost tracking and cost caps

As noted above, the Commission has indicated that cost recovery of AGIS investments will be contingent on achievement of metrics. These metrics should be explicitly tied to the benefits and goals that provide justification in the grid modernization proposal.[53] The Commission should establish tracking procedures, potentially to include specific metrics, to ensure detailed reporting of project spending. This will allow the Commission to monitor whether the actual project spending is consistent with the grid modernization proposal and identify early any problems with the grid modernization deployment.

The Commission should establish cost caps to set limits on cost recovery for grid modernization investment plans based on the cost projections provided by the utility at the time the proposal was initially certified by the Commission. If the investment did not receive certification, then the cost cap should be based upon the cost projections provided in the rate case or other regulatory proceeding in which the Company sought cost recovery. In addition, cost recovery should be conditioned on

50 Xcel Energy. 2019 Integrated Distribution Plan. Filed in Minnesota Public Utilities Commission. Docket No. E002/M-19- 666, p. 7.

51 Minnesota Department of Commerce. Methods for Performance Evaluations, Metrics, and Consumer Protections for AMI and FAN. Department of Commerce Report to the Public Utilities Commission. Filed in Minnesota Public Utilities Commission. Docket. No. E-002/M-19-666 and E-999/DI-20-627. December 1, 2020.

52 For more information on metrics, targets, and financial incentives, and the relationship between the three, see: Whited, M., T. Woolf, A. Napoleon. Utility Performance Incentive Mechanisms: A Handbook for Regulators. Synapse Energy Economics for the Western Interstate Energy Board. 2015.

53 Minnesota Public Utilities Commission. Docket No. E-002/M-19-666. Order Accepting Integrated Distribution Plan, Modifying Reporting Requirements, and Certifying Certain Grid Modernization Projects. July 23, 2020.

achievement of the benefits claimed for the grid modernization investments in the evaluation. To the extent that cost recovery is conditioned on performance, this performance should be evaluated on a regular basis, based on, among other things, annual filings made mandatory as a condition of investment approval. These annual filings should provide updates on costs incurred and benefits achieved, and also should include up-to-date results for any other metrics established in the course of approving the grid modernization investment.

Cost caps on grid modernization are an important tool to ensure that utilities are held accountable for their cost estimates at the first instance in which a utility proposes a grid modernization investment, regardless of the regulatory pathway a utility takes to request approval. A utility's cost recovery of a grid modernization investment should be limited to the cost cap, unless the utility can show by clear and convincing evidence that excess costs were reasonable, prudent, and beyond its control.[54]

In addition to providing an opportunity for a utility to petition for additional cost recovery beyond the cost cap limit, the annual filing process will also provide a venue for the utility to argue for modifications to standards on which recovery is conditioned—though the burden should remain with the utility to demonstrate that any such standards are unreasonable. (See Section 4 for more detail on recommended annual reporting requirements.)

2.7 Accounting for Risk

Like all industries, electric distribution operations can be characterized by various types and sizes of risk. Top operational risks faced by electric distribution utilities include reliability, safety, the ability to accommodate increasing electric demand (capacity), and the ability to take advantage of new resources (distributed energy resources). The successful operation of an electric distribution business in the 21st century is essentially an exercise in risk management, with the utility seeking to reduce risk at the least cost.

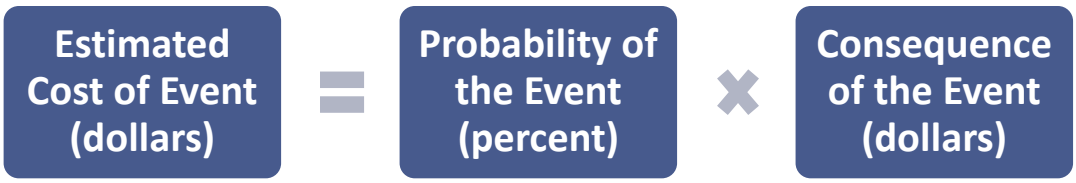
Grid modernization presents customers with risk. For grid modernization investments, customers may incur undue cost burdens if components are:

- Installed too early (due to technology or organizational maturity, or even geographically);
- Installed too late (where cost-effective opportunities are forgone by lack of action);
- Of the wrong type (i.e., too costly for/inappropriate to the risk being addressed);

[54] The Commission established the "clear and convincing" evidentiary standard in its July 23, 2020 Order in Docket No. E-002/M-19-666 in relation to a cost cap established for the Advanced Planning Tool. This standard should be applied to all utility cost recovery requests that are in excess of the cost cap established by the Commission in conjunction with its review of the utility proposal. See: Minnesota Public Utilities Commission. Docket No. E-002/M-19-666. Order Accepting Integrated Distribution Plan, Modifying Reporting Requirements, and Certifying Certain Grid Modernization Projects. July 23, 2020, p. 17.

- In the wrong places (i.e., when anticipated risks fail to show up).

In competitive industries, this cost risk does not materialize for customers. Businesses only spend the risk management amounts which can be afforded based on the prevailing market prices of their products or services. As monopolies, electric distribution businesses are not controlled by market prices.



Instead, regulation is the only way to identify the appropriate amounts to spend on risk reduction, and on the priorities to which these amounts are allocated. One of the principal ways to evaluate the cost-effectiveness of risk reduction is through use of an expected value formula, as shown below.

This approach to risk reduction may be used in the evaluation of potential solutions to grid needs and in the prioritization of proposed investments.[55,56,57] For example, a non-wires solution may only be 90 percent as reliable as a wired solution; but if the costs are only 20 percent of the wired solution, the non-wires solution may still merit consideration. As another example, interoperability (the availability of multiple, interchangeable technologies from different suppliers) can serve to reduce the execution or obsolescence risks of a potential solution or technology.

Finally, note that this risk reduction discussion only addresses the valuation of benefits, while a BCA addresses both benefits and costs. The choice of approach to allocate costs between different classes of customers, and between customers and non-customers, is significant. The challenge of placing a social value on a solar project is daunting enough. Striking the appropriate responsibility for any required grid

[55] An alternative and expanded formulation of this equation is one advanced by the Department of Homeland Security: *Risk = Threat X Vulnerability X Consequence*. See: Brashear, J., and Jones, J. Risk Analysis and Management for Critical Asset Protection (RAMCAP Plus). 2010.

[56] Examples of adverse events for which risk can be quantified in dollars, and therefore prioritized appropriately, include: the cost to a community of a 2-hour service interruption; the cost to a community of 2-day service interruption; the value to a community of a 2 percent improvement in outage frequency; the cost to a community of a 2-month delay in approval of a 4kW rooftop solar system; the cost of a workplace accident in which an employee suffers permanent injury.

[57] The Commission has emphasized consideration of risk in distribution planning. In its 2019 Order modifying Xcel's IDP filing requirements, the Commission indicated that "[t]he IDP should include details on the Company's distribution system risk analysis and comprehensive forecasting information for feeders and substations with a risk score or planned investment in the budget cycle." See: Minnesota Public Utilities Commission. Docket No. E-002/CI-18-251. Order Accepting Report, and Amending Requirements. July 16, 2019.

upgrade between utility customers and the solar project developer is potentially more difficult, but equally important to consider.

Once the risks have been prioritized, and needed capabilities identified through grid planning, the utility should begin the detailed work of determining the best way to deliver these capabilities. One relevant example comes from the U.S. Department of Energy's taxonomy framework for grid modernization, which offers a general approach for translating objectives (consistent with the above discussion on goals) all the way down into system requirements through a series of steps.[58]

2.8 Determining Discount Rates

The choice of a discount rate will significantly affect the economic analyses of utility investments, as it as the key parameter in converting results to present value. The discount rate impacts how much weight is given to long-term versus short-term benefits and costs. A higher discount rate gives more weight to short-term impacts, while a lower discount rate gives more weight to long-term impacts.

To our knowledge, there is currently no consensus on a discount rate to use across all energy investments and programs in Minnesota. This issue was debated most recently in the 2021–2023 Conservation Improvement Program (CIP) Triennial Plans. There it was determined that the utilities should use a discount rate of 3.02 percent in the Societal Cost Test for residential participants, a utility-specific CIP Utility Discount Rate in the Utility Cost Test, and a Participant Discount Rate for business customers. The Participant Discount Rate is calculated as the utility's after-tax weighted cost of capital (WACC) as approved in the utility's most recent rate case.[59] In recent grid modernization filings, utilities used the WACC as a discount rate in cost-effectiveness tests.[60]

The WACC should not be used for cost-effectiveness of grid modernization investments, or any investments in Minnesota. The WACC represents the time preference of utility investors. However, the purpose of a cost-effectiveness analysis is to identify utility resources that will best serve customers over the long term, while also achieving applicable policy goals of the jurisdiction.[61]

It is sometimes argued that using the WACC is necessary to ensure that the utility can recover its cost of capital for prudently incurred costs. However, this argument is not valid. The choice of discount rate

[58] U.S. Department of Energy, office of Electricity Delivery and Energy Reliability. Modern Distribution Grid, Volume 1: Customer and State Policy-Driven Functionality, v 1.1. March 27, 2017, pp. 39-40.

[59] Deputy Commissioner of the Minnesota Department of Commerce. Decision. In the Matter of CIP Gas and Electric Utilities 2021-2023 Cost-Effectiveness Review. Docket Nos. G999/CIP-18-782, E999/CIP-18-783. February 11, 2020.

[60] Direct Testimony and Schedules of Ravikrishna Duggirala. Filed in Minnesota Public Utilities Commission. Docket No. E002/GR-19-564. November 1, 2019, p. 10.

[61] National Energy Screening Project. The National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources (NSPM for EE). 2017. The National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources (NSPM for DERs). 2020.

does not influence the utility's cost of capital or its ability to recover its cost of capital. The costs included in BCAs should include all the costs that will be required to support the grid modernization investments, including all the costs of capital. And the utility should be allowed to recover those costs according to Minnesota ratemaking practices. The discount rate serves a completely different purpose: to place the appropriate amount of weight on long-term versus short-term costs and benefits.

The discount rate used in cost-effectiveness for grid modernization investments should reflect the policy goals driving those investments. For example, many of the important goals of grid modernization, such as improving reliability, improving resilience, ensuring customer equity, long-term maintenance of the utility grid, and increasing customer satisfaction, should affect the time preference of the cost-effectiveness analysis.

A low-risk or societal discount rate is most appropriate for assessing cost-effectiveness of grid modernization investments because it will better capture the value of these investments over the long term and align with the consideration of societal impacts within Minnesota's energy policies.

Ideally, the discount rate chosen for evaluating grid modernization investments should be the same discount rate used for all utility investments. This is necessary to avoid bias across resource types.

2.9 Considering Customer Equity

Grid modernization costs are typically incurred by all utility customers, while some benefits accrue to only a subset of customers. For example, many customers do not care about power quality while some industrial customers place a high value on it. Some low- and moderate-income customers might see very little value in the increased customer satisfaction or flexibility provided by grid modernization investments, while others might place a high value on those outcomes. This inconsistency between who pays the costs and who experiences the benefits makes it challenging to determine how much utility customers as a whole should pay for grid modernization benefits.

Distributional and equity considerations are difficult to account for in quantitative or monetary terms. Further, BCAs are not designed to address distributional or equity issues; they are designed to consider costs to all customers on average. LCBF analyses are even more limited on this point, as they are driven by the premise that the investments are necessary, and have less flexibility around assessment of costs and benefits.

Nonetheless, grid modernization evaluations should include some discussion of customer equity issues. This should begin with a bill impact analysis that shows the short- and long-term bill impacts of the grid modernization investments. Such a bill impact analysis should use the same reference and investment scenarios used in the rest of the evaluation and should report bill impacts by customer class.

Grid modernization plans should include further discussion of customer equity issues, especially in those cases where the customer bill impacts are substantial. This discussion may need to be qualitative due to the nature of customer equity, but a qualitative discussion is better than no discussion. For example, when a grid modernization plan claims certain benefits of a grid modernization investment, such as those listed in Table 3, it could specify which customer types are likely to experience and value each

benefit. These customer types could be disaggregated to include important sub-groups such as low-income, vulnerable customers, or other customers identified by the state's energy justice goals. Similarly, when a grid modernization plan claims substantial societal benefits to justify its investments, it could discuss the magnitude of those benefits relative to the magnitude of the utility system benefits.

These sorts of qualitative discussions, combined with a bill impact analysis, can help the Commission and other stakeholders get a sense of whether and to what extent the grid modernization investments are likely to have implications on customer equity.

3 INITIAL FILING REQUIREMENTS

The following filing requirements are intended for all Minnesota utilities that submit proposals for grid modernization investment plans. These requirements address the information that should be provided with these plans, including the necessary detail on economic evaluation methods and results to support the proposed investments.

These filing requirements are consistent with the standards that have already been adopted by the Commission, including the filing requirements contained in the Commission's September 27, 2019 Order in Docket No. E-002/M-17-797,[62] those contained in its July 23, 2020 Order in Docket No. E-002/M-19-666,[63] and those included in its Orders imposing IDP filing requirements.[64]

There are six numbered filing requirements. Following many of these requirements are lists of lettered sub-requirements. Plans should satisfy both the overarching numbered filing requirements, and all associated sub-requirements.

1 Plans Should Be Based on Long-Term Planning

a. Plans should be consistent with long-term distribution system planning, as required by the Commission in its Orders imposing IDP filing requirements[65] and any subsequent modifying Orders.

[62] Minnesota Public Utilities Commission. Docket No. E-002/M-17-797. Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements. September 27, 2019

[63] Minnesota Public Utilities Commission. Docket No. E-002/M-19-666. Order Accepting Integrated Distribution Plan, Modifying Reporting Requirements, and Certifying Certain Grid Modernization Projects. July 23, 2020

[64] Minnesota Public Utilities Commission. Docket No. E-002/CI-18-251. Order Approving Integrated Distribution Planning Filing Requirements for Xcel Energy. August 30, 2018. Docket No. E-017/CI-18-253. Docket No. E-017/CI-18-254. Docket No. E-017/CI-18-255. Order Adopting Integrated-Distribution-Plan Filing Requirements. February 20, 2019.

[65] Minnesota Public Utilities Commission. Docket No. E-002/CI-18-251. Order Approving Integrated Distribution Planning Filing Requirements for Xcel Energy. August 30, 2018. Docket No. E-017/CI-18-253. Docket No. E-017/CI-18-254. Docket No. E-017/CI-18-255. Order Adopting Integrated-Distribution-Plan Filing Requirements. February 20, 2019.

b. Plans should be consistent with all other distribution, transmission, and resource planning processes.

c. The goals of each plan should be clearly indicated, and proposals should explain how each of the indicated goals relates to the outcomes of the planning processes referenced in (a) and (b).

d. The identified goals for the plan should be expressed as concrete and measurable outcomes, to the extent possible.

e. Proposals should clearly explain how the goals of the plan relate to state policy, statutes, rules, and Commission Orders, including the objectives for grid modernization provided in the Grid Modernization statute[66] and the Commission's distribution planning goals.[67]

2 Proposals Should Identify the Roles and Relationships of the Components

a. For each component included in the plan, proposals should describe the component in detail, addressing:

   i. The functional role of this component;

   ii. The expected useful life of the component;

   iii. An explanation of how the component promotes the goals of the plan;

   iv. The relationship between this component, other components in the plan, and the rest of the grid—including grid modernization components not included in this plan but either already implemented or intended for future implementation; and

   v. All known and potential future use cases for the component.

b. Proposals should include details about any requests for proposal (RFP) issued, and any alternative component selection processes, including information about bids received, selection criteria, and rationale for ultimate selection.

c. For each component included in the plan, proposals should describe all alternative components that were considered, addressing the extent to which each alternative component achieves the identified goals that justify the grid modernization plan.

[66] Minn. Stat. §216B.2425, Subd. 2(e) and Subd. 8.

[67] Minnesota Public Utilities Commission. Docket No. E-002/CI-18-251. Order Approving Integrated Distribution Planning Filing Requirements for Xcel Energy. August 30, 2018, p. 6.

d. For every component that is included in the plan and is claimed to be necessary to comply with policy or statutory mandates, the proposal should include a clear explanation of why this component is required to comply with any such mandates.

e. For every component that is included in the plan and is claimed to be necessary to enable other grid modernization capabilities, functionalities, or technologies, the proposal should include a clear explanation of why this component is required to enable these other grid modernization capabilities, functionalities, or technologies.

f. For plans including multiple components, proposals should include a narrative that addresses the following:

    i. Which components are inseparable;

    ii. Any alternative deployment sequences for installation of components or alternative deployment timelines for installation of components;

    iii. The effects of substituting selected components for alternatives that were considered in the plan but not ultimately selected. The alternative components that are considered here should be the same as those discussed in response to requirement 2(c).

    iv. The effects of including grid modernization components that are expected to be proposed in future proceedings but have not been included in the current plan.

g. For plans including multiple components, proposals should include a description of all reasonable scenarios assessed that had alternative components or implementation plans—referred to here as alternative deployment scenarios.[68] This description should be based on the narrative information provided in response to requirement 2(f).

    i. Alternative deployment scenarios should include all necessary detail, including identification of all investments included in each alternative deployment scenario and a timeline for these investments.

    ii. Alternative deployment scenarios should differ from the plan on the basis of the components that are included, the installation sequence, or the timeline for installation.

[68] The term "alternative deployment scenarios" is used rather than "bundles" to refer to an investment plan other than the plan that has been proposed by the utility. The Commission has used the term "bundles" in, for example, its Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements in Docket No. E-002/M-17-797. Note that there may be a distinction drawn between bundles and portfolios in this context which is not maintained in these filing requirements. See: Minnesota Public Utilities Commission. Docket No. E-002/M-17-797. Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements. September 27, 2019.

3 Proposals Should Justify the Evaluation Scope

Proposals should indicate the scope of the evaluation by identifying which cost test has been used—whether the Utility Cost Test, the Societal Cost Test, or an alternative test. Proposals should also provide justification as to why the chosen cost test is appropriate. The same cost test should be used consistently throughout the plan.

4 Evaluation Methods Should Be Thoroughly Detailed in the Proposal

Every evaluation included in a grid modernization proposal should meet the following requirements:

a. Include a reference case that uses only traditional solutions and does not include any new grid modernization investments.

b. Identify and provide justification for all inputs and assumptions.

c. Identify the discount rate used and justify its use.

d. For both the plan and each reasonable alternative deployment scenario that was described for requirement 2(g):

   i. Indicate all monetized and unmonetized benefits for each component individually;

   ii. Indicate all monetized and unmonetized benefits for all components together;

   iii. Indicate all monetized and unmonetized benefits that arise distinctly through the interactions between components, reporting these incremental benefits separately for each relevant interaction between components;

   iv. For every benefit identified above in 4(d)i-4(d)iii, indicate how this benefit will be distributed across its beneficiaries, to the extent possible;

   v. For every unmonetized benefit identified above in 4(d)i-4(d)iii, explain why this benefit cannot be monetized, and justify all alternative methodologies used to gauge non-monetized impacts.

e. For both the plan and each reasonable alternative deployment scenario that was described for requirement 2(g):

   i. Indicate all costs for each component individually;

   ii. Indicate all costs for all components together;

   iii. For every cost identified above in 4(e)i-4(e)ii, provide a breakdown of this cost by the following categories: direct costs (product, service, customer, project, or activity); indirect costs; tangible costs; intangible costs; and real costs;

   iv. For each of the cost categories listed reported for 4(e)iii, provide the utility's definition of each of the cost categories;

v. For each of the cost categories reported for 4(e)iii, indicate whether internal or external labor costs are included in the category, and, if there is overlap between internal and external labor costs, or costs that are included in both categories, outline the overlapping costs and explain.

f. For each component that is included in the plan, indicate:

i. Where and when cost recovery will be sought. If recovery for any costs is sought outside of a rate case (i.e., through a rider), provide detailed justification of the eligibility for recovery of any such costs outside of a rate case;

ii. Whether this cost has been partially approved already or has been included in previous or ongoing docket riders, rate cases, or other cost recovery mechanisms;

iii. Whether it might lead to stranded costs and how such stranded costs were treated in the analysis.

g. For every grid modernization component not included in the plan but that is expected to be proposed in a future proceeding, detail where and when cost recovery will be sought.

5 Proposals Should Specify Metrics and Targets

All proposals should include recommended metrics and targets for future evaluation of grid modernization benefits, satisfying the following criteria:

a. Metrics should track the costs, benefits, and other goals identified in the grid modernization evaluation.

b. Metrics should reflect discrete outcomes.

c. Targets should correspond to the level of performance assumed in the grid modernization evaluation.

d. Metrics and targets should reflect the same time periods specified in the grid modernization evaluation.

6 Proposals Should Clearly Present All Results

a. The proposal should clearly present all the results of all evaluations used to justify the grid modernization plan.

b. The proposal should present the present value of costs, present value of benefits, present value of net benefits, and the benefit-cost ratio for each plan component individually, and jointly for all components included in the plan.

c. For each alternative deployment scenario considered, the proposal should present the present value of costs, present value of benefits, present value of net benefits,

and the benefit-cost ratio for each component individually, and jointly for all components.

d. The proposal should include a customer equity analysis, which includes a long-term bill analysis that reflects the impacts on customer bills of the grid modernization plan relative to the reference case:

   i. The bill analysis should include bills for each customer class and should show annual bill impacts as well as long-term averages.

   ii. The bill analysis should indicate the likely impacts on low-income, moderate-income, vulnerable, and disadvantaged customers, to the extent possible.

e. The proposal should include a clear articulation of why each grid modernization component was selected for the grid modernization plan, based on the results of the BCA and the customer equity analysis.

4 ONGOING REPORTING REQUIREMENTS

As recommended in the Department's December 2020 report, the Commission should require the utility to file an annual report on any approved grid modernization investments.[69,70] Consistent with the Department's recommendations in this report, at a minimum, the mandated annual grid modernization report should include the following information:

1. Any updates to the project scope, functionalities, and realized and anticipated benefits over the past year or expected over the coming year.

2. Progress on implementation and integration of grid modernization components relative to planned schedule over the past year. Projected progress on implementation and integration of grid modernization components for the coming year.

3. Update on capital and operations spending, including total spending to date, total spending for the last year, projected spending for the coming year, and projected total spending for the project lifetime.

4. Performance data for the last year for all metrics established in conjunction with Commission approval of grid modernization investments.

To the extent that there are any changes to the grid modernization investments scope, functionalities, timeline, costs, or benefits that were presented by the utility at the time that the grid modernization investments were approved, these changes should be explained in detail. As noted in the discussion on cost caps in Section 2.6, the Commission should establish limits on cost recovery for grid modernization

[69] Minnesota Department of Commerce. Methods for Performance Evaluations, Metrics, and Consumer Protections for AMI and FAN. Department of Commerce Report to the Public Utilities Commission. Filed in Minnesota Public Utilities Commission. Docket. No. E-002/M-19-666 and E-999/DI-20-627. December 1, 2020.

[70] In Xcel's case, this report is referred to as the "Advanced Grid Infrastructure Annual Report."

investment plans based on the cost projections provided by the utility at the time the proposal was reviewed by the Commission. The Commission may also condition recovery on achievement of benefits that were claimed for the grid modernization investments in the evaluation as another way to hold utilities accountable for the costs and benefits they claim.

To the extent that any changes in project scope, functionality, timing, cost, or benefits are requested in the annual report, it is incumbent on the utility to justify any such changes by a showing of clear and convincing evidence that any such changes are reasonable and prudent, and in the case of excess costs, a showing that they were incurred beyond the utility's control. In particular, the burden rests on the utility to justify any costs that are in excess of original cost projections. In reviewing the annual report, and making any determinations about ongoing cost recovery, the Commission should consider whether the utility has attempted and successfully provided process clarity, stakeholder input, and transparency in its plans, filings, and programs.

Lastly, in addition to the required annual grid modernization report, the utility should also be mandated to report performance data for all grid modernization metrics on a quarterly basis. The Commission should ensure that both the annual grid modernization report, and the quarterly metrics report, are harmonized with the utilities other reporting requirements.

APPENDIX A. OVERVIEW OF GRID MODERNIZATION REGULATORY PRACTICES IN MINNESOTA

A.1. Grid Modernization Planning and Filing Requirements

A.1.1. Statutory filing requirements

The first grid modernization plan filing requirement in Minnesota came in 2015 with new legislation requiring utilities that own transmission lines and are operating under MRPs to address grid modernization and planning in their newly mandated biennial transmission plans.[71] Only Xcel was subject to this requirement as none of the other transmission-owning utilities were then operating under MRPs.

Specifically, Minn. Stat. §216B.2425, Subd. 2(e) and Subd. 8 (the Grid Modernization Statute) required that, as a component of its mandatory biennial transmission plans, a qualifying utility:

- [I]dentify investments that it considers necessary to modernize the transmission and distribution system by enhancing reliability, improving security against cyber and physical threats, and by increasing energy conservation opportunities by facilitating communication between the utility and its customers through the use of two-way meters, control technologies, energy storage and microgrids, technologies to enable demand response, and other innovative technologies; and

- [C]onduct a distribution study to identify interconnection points on its distribution system for small-scale distributed generation resources and shall identify necessary distribution upgrades to support the continued development of distributed generation resources.[72]

In October 2015, Xcel submitted its first grid modernization proposal in conjunction with its *Biennial Transmission Projects Report*. The company requested regulatory approval of investments in ADMS and a solar-plus-battery-storage demonstration project.[73]

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[71] Also in 2015, the Minnesota Commission opened a proceeding to investigate grid modernization issues. See: Minnesota Public Utilities Commission. Docket No. E-999/CI-15-556.

[72] Minn. Stat. §216B.2425, Subd. 2(e) and Subd. 8.

[73] Xcel Energy. 2015 Biennial Transmission Projects Report – Distribution Grid Modernization. Filed in Minnesota Public Utilities Commission. Docket. No. E-999/M-15-439. October 30, 2015.

A.1.2. IDP Filing Requirements

In August 2018, the Commission adopted a set of IDP filing requirements for Xcel.[74,] At the core of the 2018 filing requirements is a set of principles meant to ensure that distribution grid investment planning is consistent with state goals. These principles are presented below.

Minnesota principles for distribution planning

1. Maintain and enhance the safety, security, reliability, and resilience of the electricity grid at fair and reasonable costs, consistent with the state's energy policies;
2. Enable greater customer engagement, empowerment, and options for energy services;
3. Move toward the creation of efficient, cost-effective, accessible grid platforms for new products and services, with opportunities for adoption of new distributed technologies;
4. Ensure optimized use of electricity grid assets and resources to minimize total system costs; and
5. Provide the Commission with the information necessary to understand Xcel's short-term and long-term distribution system plans, the costs and benefits of specific investments, and a comprehensive analysis of ratepayer cost and value.

In February 2019, the Commission set IDP filing requirements for Otter Tail Power Company, Minnesota Power, and Dakota Electric Association.[75] In this Order, the Commission established the same planning principles for these other utilities, and also promulgated additional filing requirements that were consistent with the Commission's 2018 IDP Order for Xcel.

Per the Commission's Orders, the four utilities are required to prepare a "Long-Term Distribution System Modernization and Infrastructure Plan," to be included with their respective IDPs. This plan is divided into two parts: a 5-year "Action Plan" and 10-year long-term distribution system plan. While the utilities are instructed to provide longer-term distribution system vision in their 10-year plans, the "Action Plan" prepared by each utility is to include more specific details about nearer-term grid modernization aims. Key required components of the "Action Plan" are presented below.

[74] Minnesota Public Utilities Commission. Docket No. E-002/CI-18-251. Order Approving Integrated Distribution Planning Filing Requirements for Xcel Energy. August 30, 2018.

[75] The specific filing requirements for the four investor-owned utilities cover five topic areas: (a) baseline distribution system and financial data; (b) hosting capacity and interconnection requirements; (c) distributed energy resource scenario analysis; (d) long-term distribution system modernization and infrastructure investment plan; and (e) non-wires (non-traditional) alternatives analysis. See: Minnesota Public Utilities Commission. Docket No. E-017/CI-18-253. Docket No. E-017/CI-18-254. Docket No. E-017/CI-18-255. Order Adopting Integrated-Distribution-Plan Filing Requirements. February 20, 2019.

Action plan filing requirements

- Scope of plan, underlying assumptions, plan timing, costs, and cost-recovery mechanisms, and the expected impact of costs on the net present value of utility revenue requirements;
- Plan objectives and analysis of alternatives—including alternative investment options, with associated functionality and cost characteristics, and alternative plan sequencing;
- Interactions between grid modernization components and between grid modernization plan and other initiatives (e.g., demand response); overview of tools to help understand complex interactions on the grid;
- System interoperability and communications strategy;
- Costs to obtain data and plans for utilizing data;
- BCA for each "grid modernization project" with detailed information on customer costs and benefits and plans to mitigate rate and bill impacts as relevant.

A.1.3. Additional filing requirements for Xcel

In July 2019, the Commission issued an Order accepting Xcel's initial IDP.[76] The Commission also made minor modifications and clarifications to its filing requirements for Xcel. Among other things, the Commission indicated that BCA should be conducted by Xcel with the "best information" that Xcel has available, should include discussion of non-quantifiable benefits, and should be substantiated through the company furnishing all supportive data, analysis, and assumptions.[77]

The Commission then further expanded its directions for cost-effectiveness analysis in a September 2019 Order in Docket No. E-002/M-17-797. In this document, the Commission indicated that future AGIS cost recovery requests would need to be supported by "a business case and comprehensive assessment of qualitative and quantitative benefits to customers."[78]

A.2. Certification and Cost Recovery

The Commission has made clear that certification of grid modernization investments does not amount to a finding of prudence or an assurance of cost recovery. Certification merely enables a utility to

[76] Minnesota Public Utilities Commission. Docket No. E-002/CI-18-251. Order Accepting Report and Amending Requirements. July 16, 2019.

[77] The Commission also directed Xcel to explicitly address how the IDP relates to each planning objective (principle), discuss how it has sought to improve on fulfillment of these objectives, and suggest modifications to the filing requirements to better enable it to meet planning objectives.

[78] Minnesota Public Utilities Commission. Docket No. E-002/M-17-797. Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements. September 27, 2019.

request recovery through the TCR mechanism.[79] Moreover, the absence of certification (or rejection of a certification application) does not foreclose on potential future cost recovery through a rate case, nor does it signal that the Commission is necessarily opposed to approval for the investment.

The Commission has not established formal criteria for certification of grid modernization investments, indicating instead that it would consider certification request on a "case-by-case" basis,[80] and hewing to the language of the grid modernization statute in recent decisions:

- In its 2016 Order certifying ADMS, the Commission found that "ADMS is a suite of software that will enable expanded distributed generation while creating a grid that is more transparent, reliable, and efficient. It is an investment necessary to ***'modernize the . . . distribution system' that will 'enhanc[e] reliability' and 'increas[e] energy conservation opportunities' using 'control technologies . . . and other innovative technologies***'" (*italics and bold added for portion excerpted from Grid Modernization statute*).[81]

- In its 2020 Order that certified AMI and FAN, the Commission concluded that these are, "…core components of the AGIS initiative and are necessary for ***modernizing the distribution system and enhancing reliability, improving security, and increasing energy conservation opportunities***. Specifically, they are technologies that ***"[facilitate] communication between the utility and its customers through the use of two-way meters,"*** a category explicitly included in Minn. Stat. § 216B.2425, subd. 2"[82] (*italics added for portions that reflect the language of the Grid Modernization statute*).

In addition to applying the plain language of the Grid Modernization statute, the Commission has also shown preference for core grid modernization components:

- In its 2020 certification Order, the Commission declined to certify investments in Fault Location, Isolation, and Service Restoration and Integrated Volt-VAr Optimization, finding that "…these two components of AGIS do not yet rise to the level of necessary and foundational for grid modernization and there has not been sufficient record development or analysis."[83]

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[79] Minnesota Public Utilities Commission. Docket No. E-002/M-15-962. Order Certifying Advanced Distribution Management System (ADMS) Project Under Minn. Stat. §216B.2425 And Requiring Distribution Study. June 28, 2016.

[80] Minnesota Public Utilities Commission. Docket No. E-002/M-19-666. Order Accepting Integrated Distribution Plan, Modifying Reporting Requirements, and Certifying Certain Grid Modernization Projects. July 23, 2020, p. 12.

[81] Minnesota Public Utilities Commission. Docket No. E-002/M-15-962. Order Certifying Advanced Distribution Management System (ADMS) Project Under Minn. Stat. §216B.2425 And Requiring Distribution Study. June 28, 2016.

[82] Minnesota Public Utilities Commission. Docket No. E-002/M-19-666. Order Accepting Integrated Distribution Plan, Modifying Reporting Requirements, and Certifying Certain Grid Modernization Projects. July 23, 2020.

[83] Ibid.

A.3. Electric Utility Infrastructure Cost Rider

In addition to the TCR rider that allows recovery of grid modernization investments by utilities with MRPs, rider recovery of grid modernization expenditures is also allowed through the separate EUIC rider process.[84,85] Similar to the TCR, the EUIC permits recovery of the costs (not already in base rates) of investments to "replace" or "modify" existing utility infrastructure to "conserve energy or use energy more efficiently." The EUIC statute also permits recovery of investments associated with converting waste heat into electricity. Similar to the provisions of the TCR statute, the EUIC also makes eligible for rider recovery investments in modernization toward "increasing energy conservation opportunities," in addition to investments in modernization to improve reliability and security.[86]

A.4. Subsequent Reporting and Metrics

In its 2020 Order certifying AMI and FAN, the Commission expressed that cost recovery for Xcel's certified grid modernization projects in the future would be contingent on achievement of "Commission-approved metrics and performance evaluations." Per the Commission, future cost recovery proposals must include specific metrics and evaluation methods for utility performance, and "a detailed plan describing how the company will maximize the benefits of the investments for ratepayers."[87]

Previously, the Commission had not made cost recovery dependent on performance: Xcel was granted recovery of 2018 ADMS spending (excluding hardware costs) without reference to outcomes.[88]

[84] Minn. Stat. § 216B.1636.

[85] Minnesota Public Utilities Commission. Docket No. E-002/M-17-821. Order Approving Recovery of Grid Modernization Costs. May 8, 2018.

[86] Minn. Stat. § 216B.2425.

[87] Minnesota Public Utilities Commission. Docket No. E-002/M-17-797. Order Authorizing Rider Recovery, Setting Return on Equity, and Setting Filing Requirements. September 27, 2019.

[88] Ibid.

APPENDIX B. GRID MODERNIZATION REGULATORY PRACTICES ACROSS THE UNITED STATES

States have taken various approaches to meeting their grid modernization goals. One trend observed is the increasing push toward regulatory standardization. Rather than contend with competing claims about how to conduct BCA or what constitutes "cost-effective" grid modernization, many states have established explicit standards dictating how utilities should evaluate their grid modernization plans.

A cornerstone of this effort is selection of a cost test (or several) for use by utilities in conducting this economic evaluation. The choice of a cost test is meant to reflect a state's overarching policy goals. For example, if a state is motivated to reduce GHG emissions, its cost test would account for benefits associated with reductions in GHGs. Many states also consider benefits associated with expansion of distributed energy resources, which in turn has implications for GHG reduction and other benefits.

The section that follows provides a survey of grid modernization regulatory practices in selected states. It should be noted that grid modernization and its regulation are dynamic and evolving fields; while the information included in this section is accurate as of the date of publication, the practices are liable to change over time.

B.1. California

In California, grid modernization proposals are subject to different evaluation criteria that are dependent on the purpose of the investment.[89] However, the utilities are required to demonstrate that all grid modernization investments meet distribution planning objectives by exhibiting cost reasonableness.

CPUC has designed a template with certain classifications that utilities must submit in annual grid modernization filings. In this form, the utilities each calculate benefits including the "sum of avoided cost of utility operations, including environmental, customer service, and T&D; reliability, physical security, and cybersecurity benefits; and demand response savings realized in a fiscal year."[90] Their results are not necessarily comparable to one another, as they use different methods to calculate both the costs and benefits. Table 4 presents the estimated costs and benefits of grid modernization reported by each utility.

[89] Woolf, et al. 2021, pp. 15-16

[90] California Public Utilities Commission. California Smart Grid Annual Report 2019. Prepared by the California Public Utilities Commission for the Legislature and Governor. 2020, p. 8

Table 4. Investor-owned utility estimated costs and benefits for July 1, 2018 through June 30, 2019

IOU	Smart Grid Costs ($Millions)	Smart Grid Benefits ($Millions)	Avoided Outage Minutes
PG&E	$253.73	$200.27	87.2 million
SDG&E	$133.5	$99.9	3 million
SCE	$115.38	$659.3	239 million

Note: As of the date of this report, these data were the most recent available from the California Public Utilities Commission. Source: Frost, Jonathan et al. California Smart Grid Annual Report 2019. Prepared by the California Public Utilities Commission for the Legislature and Governor. 2020. p. 9

In addition to the benefits mentioned above, the benefits of grid modernization investments are measured in the context of 19 consensus metrics.[91] Each of these metrics relates back to a policy goal, with nine of the metrics relating to AMI, one to electric vehicles, one to storage, and eight to grid operations.[92] Grid modernization investment costs are recovered in each utility's general rate case.[93]

B.2. New York

In 2016, the New York Public Service Commission issued an Order establishing the "Benefit-Cost Analysis Framework."[94] In this Order, the New York Public Service Commission adopted the Societal Cost Test as the primary cost-effectiveness test for BCA, although other costs tests may be used to support analysis. Each jurisdictional utility was advised to develop a BCA handbook that would outline its BCA processes and detail information on "various sensitivities and synergies" between technologies.[95] One New York utility notes in its BCA handbook that the Societal Cost Test is calculated by comparing "the costs incurred to design and deliver projects, including customer costs, with avoided electricity and other supply-side resource costs (e.g., generation, transmission, and natural gas);…also includes the cost of externalities (e.g., carbon emissions, and net non-energy benefits)."[96]

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[91] California Public Utilities Commission. Rulemaking 08-12-009. Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission's own Motion to Actively Guide Policy in California's Development of a Smart Grid Platform. Decision 12-04-025. Decision Adopting Metrics to Measure the Smart Grid Deployments of Pacific Gas and Electric Company, Southern California Edison Company and San Diego Gas & Electric Company. April 19, 2012.

[92] California Public Utilities Commission. Rulemaking 14-08-013. Regarding Policies, Procedures and Rules for Development of Distribution Resources Plans Pursuant to Public Utilities Code Section 769, Decision on Track 3 Policy Issues, Sub-Track 2 (Grid Modernization), Decision 18-03-023. March 22, 2018.

[93] California Public Utilities Commission. California Smart Grid Annual Report 2019. Prepared by the California Public Utilities Commission for the Legislature and Governor. 2020, p. 7

[94] New York Public Service Commission. Case 14-M-0101 Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, Order Establishing the Benefit Cost Analysis Framework. January 21, 2016.

[95] Id., p. 29.

[96] Niagara Mohawk Power Corporation D/B/A National Grid. Version 3.0 Benefit-Cost Analysis (BCA) Handbook. Filed in New York Public Service Commission. Cases 16-M-0411 and 14-M-0101. June 30, 2020, p. 17.

The decision to use the Societal Cost Test was motivated by New York's clean energy goals, which include the recognition that pollutants and climate change affect the community as a whole.[97] Societal benefits, such as the social cost of carbon (SCC), are included to account for this. The SCC is calculated using methods developed by the U.S. Environmental Protection Agency (EPA) and is discounted at a rate of 3 percent per year.[98] In addition to including societal benefits, net non-energy benefits such as land, water, and health impacts are included as often as they can be monetized.[99] Notably, utilities were directed to use their respective WACC in their BCA calculations. The only exception to this applied to the cost of carbon, monetized using the SCC value.

B.3. Rhode Island

Rhode Island has developed its own cost-effectiveness test, known as the "Rhode Island Benefit Cost Framework." The test is used to measure how a given proposal will help the state advance its specified policy goals. These goals include strengthening the economy; appropriately valuing distributed energy resources; and providing safe, clean, and affordable energy, among other goals.[100] To reflect the state's broad goals, the test outlines costs and benefits in the power sector (e.g., transmission capacity costs), those directly impacting customers (e.g., non-energy benefits), and those that accrue to society (e.g., GHG externalities).[101] The test takes into account both quantitative and qualitative impacts.

Notably, in Rhode Island, BCA is not the exclusive measure used to determine whether a project should be approved. According to the Division of Public Utilities, "there may be outside factors that need to be considered by the PUC regardless of whether a specific proposal is determined to be cost-effective or not."[102] Moreover, a project can also pass the Rhode Island Benefit Cost Framework even if all its components are not net beneficial. This is allowed in situations where two components have some "important connection or synergy."

These two exceptions to the rule may be applied to grid modernization technologies. The Rhode Island Benefit Cost Framework specifically notes that some grid modernization technologies, such as advanced

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[97] Id., p. 12.

[98] In 2021, the New York Department of Environmental Conservation recommended the use of a discount rate with central value of 2 percent for state entities estimating the value of future damages associated with carbon emissions – i.e., the Social Cost of Carbon. New York Department of Environmental Conservation. October 2021. Establishing a Value of Carbon: Guidelines for Use by State Agencies. See: https://www.dec.ny.gov/docs/administration_pdf/vocguidrev.pdf

[99] New York Public Service Commission. Case 14-M-0101 Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, Order Establishing the Benefit Cost Analysis Framework. January 21, 2016, Appendix C, p. 16.

[100] Raab Associates Ltd., Paul Centolella & Associates, and Tarbors Caramanis Rudkevich. Docket No. 4600: Stakeholder Working Group Process: Report to the Rhode Island Public Utilities Commission. Filed in Rhode Island Public Utilities Commission. Docket No. 4600. April 5, 2017.

[101] Ibid.

[102] Rhode Island Public Utility Commission. Docket No. 4600. Public Utilities Commission's Guidance on Goals, Principles and Values for Matters Involving The Narragansett Electric Company d/b/a National Grid. October 27, 2017.- p. 7.

metering, enable other resources; it states that these technologies could be analyzed in the greater context of a project.[103]

B.4. Hawaii

Hawaii utilizes a segmented approach to grid modernization that applies different cost tests based on the purpose of grid modernization investments. Hawaii allows utilities to utilize the LCBF approach when justifying expenditures based on policy compliance or standards/safety compliance. For example, the Commission found that "the installation of secondary var controllers to manage voltages within safety standards would not require cost effectiveness and will be considered as part of ongoing 'investment planning and evaluation.'"[104] Costs associated with interconnecting customers also do not need to demonstrate cost-effectiveness. However, other grid modernization expenditures that did not meet prescribed exclusion criteria are analyzed according to a Total Resource Cost test. The Total Resource Cost test is generally consistent with the Electric Power Research Institute's (EPRI) Integrated Benefit Cost Framework except that it does not include societal impacts.[105] For example, this test would include benefits associated with reduced customer outage costs but not with increased customer choice.

Utilities may seek recovery of eligible grid modernization costs through the Exception Project Recovery Mechanism (EPRM) rider.[106] While the regulated utilities in Hawaii operate under MRPs with revenues increasing according to index, the EPRM provides a vehicle for incremental recovery of grid modernization expenditures above allowed revenues. For grid modernization specifically, recoverable costs under the EPRM include projects such as "smart meters, inverters, energy storage, and distribution automation to enable demand response."[107]

Table 5. Investment and cost-benefit methodologies of HECO's Grid Modernization Plan

Expenditure Purpose Category	Methodology
Standards and Safety Compliance Grid expenditures required to ensure reliable operations or comply with service quality and safety standards, including both ongoing asset management (replacement of aging and failing infrastructure) and relevant grid modernization technologies	Lowest Reasonable Cost (similar to Least-Cost/Best-Fit test used in other jurisdictions)

[103] Raab Associates Ltd., p. 8.

[104] Hawaiian Electric Companies. Modernizing Hawai'i's Grid for Our Customers. August 29, 2017, p. 44.

[105] EPRI Integrated Grid Online Community, Phase II: The Benefit-Cost Framework. See: http://integratedgrid.com/phase-ii-the-benefitcost-framework/.

[106] Hawaii Public Utilities Commission. Docket No. 2018-0088. Decision and Order No. 36326. May 23, 2019, Appendix C, p. 7.

[107] Id., Appendix A, p. 6.

Policy Compliance Expenditures that are needed to comply with state policy goals like the renewable portfolio standard, or direction to interconnect and enable customer adoption of distributed energy resources	Total Resource Cost test
Net Benefits Expenditures that are not required for standards and safety compliance or policy compliance but would provide positive net benefits for customers	Total Resource Cost test
Self-Supporting Expenditures incurred for a specific customer (e.g., interconnection), with costs directly assigned to those specific customers.	Only for projects that do not shift a cost burden to non-participants—this category does not require benefit-cost justification.

Source: Hawaiian Electric Companies. Modernizing Hawai'i's Grid For Our Customers. August 29, 2017.

B.5. Massachusetts

Massachusetts is outlier in its regulatory approach to BCA for grid modernization. Rather than prescribing a cost test, the Massachusetts Department of Public Utilities (DPU) allows electric utilities to recover the costs of eligible pre-authorized grid modernization investments within a budget cap through a grid modernization factor (GMF). These factors are filed annually and undergo a prudence review at the end of the grid modernization term.[108] In order to obtain pre-authorization, utilities must demonstrate that a given grid modernization investment is designed to make incremental and "measurable progress achievement" toward the Department's grid modernization objectives and demonstrate how the "projected benefits justify the costs."[109]

In 2018, the DPU issued an Order approving three-year Grid Modernization Plans (GMP) filed by the three Massachusetts electric utilities: Eversource, National Grid, and Unitil. As part of its Order, the DPU pre-authorized $220 million in company-specific grid-facing investments, subject to a company-specific budget cap for a three-year term (2018–2020).[110] The DPU created a formal evaluation process for the preauthorized GMP investments, including requirements for annual reports, annual evaluations, and performance metrics to help ensure that the benefits are maximized and achieved with greater certainty.[111] Only a few categories of technology are considered for investment: monitoring/control,

[108] Massachusetts Department of Public Utilities. D.P.U. 15-120. D.P.U. 15-121. D.P.U. 15-122. Grid Modernization Order. May 10, 2018.

[109] Massachusetts Department of Public Utilities. D.P.U. 15-120. D.P.U. 15-121. D.P.U. 15-122. Grid Modernization Order. May 10, 2018, p. 116.

[110] Foley & Hoag. DPU Approves Significant Investments and Upgrades to State's Grid Modernization Technologies. See: https://www.energycleantechcounsel.com/2018/05/21/ma-dpu-approves-significant-investments-and-upgrades-to-states-grid-modernization-technologies/.

[111] NSTAR Electric Company d/b/a Eversource Energy. 2019 Grid Modernization Annual Report. Filed in Massachusetts Department of Public Utilities. D.P.U. 15-122. April 1, 2020.

distribution automation, volt/VAR optimization, ADMS, advanced communications infrastructure.[112] Notably, AMI is not included in this list. In its 2018 Order, the DPU explained that it "found that the primary benefits of advanced metering functionality are derived from reduced peak usage as customers respond to pricing signals."[113] Until participation in dynamic pricing products increases, the DPU has not authorized investments in AMI. However, it notes that it will continue to explore the use cases in future proceedings. Ultimately, the DPU has a vision of "a cleaner, more efficient and reliable electric grid, which would empower customers to manage and reduce their energy costs."[114] It plans to meet those goals by "reducing outages and optimizing distribution system performance, optimizing system demand, and integrating distributed energy resources."[115]

B.6. Summary

Table 6 summarizes various aspects of states' grid modernization processes and criteria. Notably, each state discussed has a relatively unique set of practices in line with its overarching goals. This includes different mechanisms to gauge the effectiveness of grid modernization investments and different methods for financing them. The range in methodologies displays a general lack of uniformity regarding best practices but highlights the need to build a grid modernization program that best fits a state's individual goals.

[112] Id., pp. 3-4

[113] Id., p. 2.

[114] Id., p. 1.

[115] Id., p. 4.

Table 6. Overview of state grid modernization practices

Measure/State	California	Hawaii	Massachusetts	New York	Rhode Island
Cost Test	Utilities must demonstrate the cost reasonableness of investment	LCBF and TRC test	Department pre-authorizes	Societal Cost Test	RI Cost Test
Discount Rate	Not specified	Recorded depreciation accruals to be determined by project	WACC	WACC, and 3% for SCC	WACC
Cost Recovery	General Rate Case	EPRM mechanism within general rate case	Pre-authorized for 3 years in general rate case	General Rate Case	Multi-Year General Rate Case
Modernization and distributed energy resource overlap	Some investments analyzed in the context of distributed energy resource	Mentioned together; will be explored in future proceedings	Distributed energy resources are considered one of the reasons for investment	Some overlap, but benefits are not necessarily grouped	Investments can be analyzed in the context of the larger proposal

Note: A final decision on the appropriate discount rate has not yet been made in Rhode Island. Discount rates for Massachusetts, Rhode Island, and Hawaii are sourced from, respectively: Nantucket Electric Company, d/b/a National Grid. Petition of Massachusetts Electric Company and Nantucket Electric Company, d/b/a National Grid for Approval by the Department of Public Utilities of its Grid Modernization Plan. D.P.U.15-120. Massachusetts Department of Public Utilities. May 10, 2018. p. 227; The Narragansett Electric Co. d/b/a National Grid. The Narragansett Electric Co. d/b/a National Grid's Proposed Power Sector Transformation (PST) Vision and Implementation Plan. Rhode Island Public Utilities Commission. Docket No. 4780; Hawaiian Electric Companies. Application of Hawaiian Electric Companies Limited Verification Hawaii Public Utilities Commission. Docket 2019-0327. Sep. 30 2019.

CERTIFICATE OF SERVICE

I, Linda Chavez, hereby certify that I have this day served copies of the following document on the attached list of persons by electronic filing, e-mail, or by depositing a true and correct copy thereof properly enveloped with postage paid in the United States Mail at St. Paul, Minnesota.

MINNESOTA DEPARTMENT OF COMMERCE – LETTER

Docket Nos. **E002/M-21-814**

- **Docket No. E002/M-19-666 (Xcel 2019 IDP)**
- **Docket No. E999/DI-20-627 (Department Stakeholder Process re: Department Report)**
- **Docket No. E002/M-20-680 (Xcel Procedural Path Compliance Filing)**
- **Docket No. E002/M-21-694 (Xcel 2021 IDP)**
- **Docket No. E017/M-21-612 (Otter Tail Power 2021 IDP)**
- **Docket No. E015/M-21-390 (Minnesota Power 2021 IDP)**
- **Docket No. E111/M-21-728 (Dakota Electric Association 2021 IDP)**

Dated this **9th** day of **February 2022**

/s/Linda Chavez

_____

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Allen	michael.allen@allenergysolar.com	All Energy Solar	721 W 26th st Suite 211 Minneapolis, Minnesota 55405	Electronic Service	No	OFF_SL_21-814_M-21-814
David	Amster Olzweski	david@mysunshare.com	SunShare, LLC	1151 Bannock St Denver, CO 80204-8020	Electronic Service	No	OFF_SL_21-814_M-21-814
Ellen	Anderson	ellena@umn.edu	325 Learning and Environmental Sciences	1954 Buford Ave Saint Paul, MN 55108	Electronic Service	No	OFF_SL_21-814_M-21-814
Alison C	Archer	aarcher@misoenergy.org	MISO	2985 Ames Crossing Rd Eagan, MN 55121	Electronic Service	No	OFF_SL_21-814_M-21-814
Mara	Ascheman	mara.k.ascheman@xcelenergy.com	Xcel Energy	414 Nicollet Mall Fl 5 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814
Donna	Attanasio	dattanasio@law.gwu.edu	George Washington University	2000 H Street NW Washington, DC 20052	Electronic Service	No	OFF_SL_21-814_M-21-814
John	Bailey	bailey@ilsr.org	Institute For Local Self-Reliance	1313 5th St SE Ste 303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_21-814_M-21-814
Mark	Bakk	mbakk@lcp.coop	Lake Country Power	26039 Bear Ridge Drive Cohasset, MN 55721	Electronic Service	No	OFF_SL_21-814_M-21-814
Gail	Baranko	gail.baranko@xcelenergy.com	Xcel Energy	414 Nicollet Mall7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814
Jessica L	Bayles	Jessica.Bayles@stoel.com	Stoel Rives LLP	1150 18th St NW Ste 325 Washington, DC 20036	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
James J.	Bertrand	james.bertrand@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Derek	Bertsch	derek.bertsch@mrenergy.com	Missouri River Energy Services	3724 West Avera Drive PO Box 88920 Sioux Falls, SD 57109-8920	Electronic Service	No	OFF_SL_21-814_M-21-814
William	Black	bblack@mmua.org	MMUA	Suite 200 3131 Fernbrook Lane North Plymouth, MN 55447	Electronic Service	No	OFF_SL_21-814_M-21-814
Kenneth	Bradley	kbradley1965@gmail.com		2837 Emerson Ave S Apt CW112 Minneapolis, MN 55408	Electronic Service	No	OFF_SL_21-814_M-21-814
Elizabeth	Brama	ebrama@taftlaw.com	Taft Stettinius & Hollister LLP	2200 IDS Center 80 South 8th Street Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Jon	Brekke	jbrekke@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_21-814_M-21-814
Sydney R.	Briggs	sbriggs@swce.coop	Steele-Waseca Cooperative Electric	2411 W. Bridge St PO Box 485 Owatonna, MN 55060-0485	Electronic Service	No	OFF_SL_21-814_M-21-814
Mark B.	Bring	mbring@otpco.com	Otter Tail Power Company	215 South Cascade Street PO Box 496 Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_21-814_M-21-814
Christina	Brusven	cbrusven@fredlaw.com	Fredrikson Byron	200 S 6th St Ste 4000 Minneapolis, MN 554021425	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jason	Burwen	jburwen@cleanpower.org	Energy Storage Association	1155 15th St NW, Ste 500 Washington, DC 20005	Electronic Service	No	OFF_SL_21-814_M-21-814
LORI	CLOBES	lclobes@mienergy.coop	MiEnergy Cooperative	31110 COOPERATIVE WAY PO BOX 626 RUSHFORD, MN 55971	Electronic Service	No	OFF_SL_21-814_M-21-814
James	Canaday	james.canaday@ag.state.mn.us	Office of the Attorney General-RUD	Suite 1400 445 Minnesota St. St. Paul, MN 55101	Electronic Service	No	OFF_SL_21-814_M-21-814
Douglas M.	Carnival	dmc@mcgrannshea.com	McGrann Shea Carnival Straughn & Lamb	N/A	Electronic Service	No	OFF_SL_21-814_M-21-814
Ray	Choquette	rchoquette@agp.com	Ag Processing Inc.	12700 West Dodge Road PO Box 2047 Omaha, NE 68103-2047	Electronic Service	No	OFF_SL_21-814_M-21-814
John	Coffman	john@johncoffman.net	AARP	871 Tuxedo Blvd. St, Louis, MO 63119-2044	Electronic Service	No	OFF_SL_21-814_M-21-814
Kenneth A.	Colburn	kcolburn@symbioticstrategies.com	Symbiotic Strategies, LLC	26 Winton Road Meredith, NH 32535413	Electronic Service	No	OFF_SL_21-814_M-21-814
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-814_M-21-814
Riley	Conlin	riley.conlin@stoel.com	Stoel Rives LLP	33 S. 6th Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Brooke	Cooper	bcooper@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022191	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
George	Crocker	gwillc@nawo.org	North American Water Office	PO Box 174 Lake Elmo, MN 55042	Electronic Service	No	OFF_SL_21-814_M-21-814
David	Dahlberg	davedahlberg@nweco.com	Northwestern Wisconsin Electric Company	P.O. Box 9 104 South Pine Street Grantsburg, WI 548400009	Electronic Service	No	OFF_SL_21-814_M-21-814
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, 401-8 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814
Curt	Dieren	curt.dieren@dgr.com	L&O Power Cooperative	1302 S Union St Rock Rapids, IA 51246	Electronic Service	No	OFF_SL_21-814_M-21-814
Carlon	Doyle Fontaine	carlon.doyle.fontaine@senate.mn	MN Senate	75 Rev Dr Martin Luther King Jr Blvd Room G-17 St Paul, MN 55155	Electronic Service	No	OFF_SL_21-814_M-21-814
Brian	Draxten	bhdraxten@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380498	Electronic Service	No	OFF_SL_21-814_M-21-814
Brian	Edstrom	briane@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota St Ste W1360 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_21-814_M-21-814
Kristen	Eide Tollefson	healingsystems69@gmail.com	R-CURE	28477 N Lake Ave Frontenac, MN 55026-1044	Electronic Service	No	OFF_SL_21-814_M-21-814
Rebecca	Eilers	rebecca.d.eilers@xcelenergy.com	Xcel Energy	414 Nicollet Mall - 401 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Bob	Eleff	bob.eleff@house.mn	Regulated Industries Cmte	100 Rev Dr Martin Luther King Jr Blvd Room 600 St. Paul, MN 55155	Electronic Service	No	OFF_SL_21-814_M-21-814
Betsy	Engelking	betsy@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_21-814_M-21-814
Oncu	Er	oncu.er@avantenergy.com	Avant Energy, Agent for MMPA	220 S. Sixth St. Ste. 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
James C.	Erickson	jericksonkbc@gmail.com	Kelly Bay Consulting	17 Quechee St Superior, WI 54880-4421	Electronic Service	No	OFF_SL_21-814_M-21-814
John	Farrell	jfarrell@ilsr.org	Institute for Local Self-Reliance	2720 E. 22nd St Institute for Local Self-Reliance Minneapolis, MN 55406	Electronic Service	No	OFF_SL_21-814_M-21-814
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_21-814_M-21-814
Lucas	Franco	lfranco@liunagroc.com	LIUNA	81 Little Canada Rd E Little Canada, MN 55117	Electronic Service	No	OFF_SL_21-814_M-21-814
Nathan	Franzen	nathan@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_21-814_M-21-814
Hal	Galvin	halgalvin@comcast.net	Provectus Energy Development llc	1936 Kenwood Parkway Minneapolis, MN 55405	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Edward	Garvey	edward.garvey@AESLconsulting.com	AESL Consulting	32 Lawton St Saint Paul, MN 55102-2617	Electronic Service	No	OFF_SL_21-814_M-21-814
Edward	Garvey	garveyed@aol.com	Residence	32 Lawton St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-814_M-21-814
Bruce	Gerhardson	bgerhardson@otpco.com	Otter Tail Power Company	PO Box 496 215 S Cascade St Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_21-814_M-21-814
Allen	Gleckner	gleckner@fresh-energy.org	Fresh Energy	408 St. Peter Street Ste 350 Saint Paul, Minnesota 55102	Electronic Service	No	OFF_SL_21-814_M-21-814
Jenny	Glumack	jenny@mrea.org	Minnesota Rural Electric Association	11640 73rd Ave N Maple Grove, MN 55369	Electronic Service	No	OFF_SL_21-814_M-21-814
Timothy	Gulden	timothy.gulden@yahoo.com	Winona Renewable Energy, LLC	1449 Ridgewood Dr Winona, MN 55987	Electronic Service	No	OFF_SL_21-814_M-21-814
Tony	Hainault	anthony.hainault@co.hennepin.mn.us	Hennepin County DES	701 4th Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_21-814_M-21-814
Shubha	Harris	Shubha.M.Harris@xcelenergy.com	Xcel Energy	414 Nicollet Mall, 401 - FL 8 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814
Kim	Havey	kim.havey@minneapolismn.gov	City of Minneapolis	350 South 5th Street, Suite 315M Minneapolis, MN 55415	Electronic Service	No	OFF_SL_21-814_M-21-814
Todd	Headlee	theadlee@dvigridsolutions.com	Dominion Voltage, Inc.	701 E. Cary Street Richmond, VA 23219	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Amber	Hedlund	amber.r.hedlund@xcelenergy.com	Northern States Power Company dba Xcel Energy-Elec	414 Nicollet Mall, 401-7 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814
Adam	Heinen	aheinen@dakotaelectric.com	Dakota Electric Association	4300 220th St W Farmington, MN 55024	Electronic Service	No	OFF_SL_21-814_M-21-814
Jared	Hendricks	jared.hendricks@owatonnautilities.com	Owatonna Municipal Public Utilities	PO Box 800 208 S Walnut Ave Owatonna, MN 55060-2940	Electronic Service	No	OFF_SL_21-814_M-21-814
Annete	Henkel	mui@mnutilityinvestors.org	Minnesota Utility Investors	413 Wacouta Street #230 St.Paul, MN 55101	Electronic Service	No	OFF_SL_21-814_M-21-814
Shane	Henriksen	shane.henriksen@enbridge.com	Enbridge Energy Company, Inc.	1409 Hammond Ave FL 2 Superior, WI 54880	Paper Service	No	OFF_SL_21-814_M-21-814
Lynn	Hinkle	lynnh@ips-solar.com	IPS Solar	2670 Patton Rd Roseville, MN 55113	Electronic Service	No	OFF_SL_21-814_M-21-814
Michael	Hoppe	lu23@ibew23.org	Local Union 23, I.B.E.W.	445 Etna Street Ste. 61 St. Paul, MN 55106	Electronic Service	No	OFF_SL_21-814_M-21-814
Jan	Hubbard	jan.hubbard@comcast.net		7730 Mississippi Lane Brooklyn Park, MN 55444	Electronic Service	No	OFF_SL_21-814_M-21-814
Geoffrey	Inge	ginge@regintllc.com	Regulatory Intelligence LLC	PO Box 270636 Superior, CO 80027-9998	Electronic Service	No	OFF_SL_21-814_M-21-814
Ralph	Jacobson	ralphj@ips-solar.com		2126 Roblyn Avenue Saint Paul, Minnesota 55104	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Casey	Jacobson	cjacobson@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58501	Electronic Service	No	OFF_SL_21-814_M-21-814
John S.	Jaffray	jjaffray@jjrpower.com	JJR Power	350 Highway 7 Suite 236 Excelsior, MN 55331	Electronic Service	No	OFF_SL_21-814_M-21-814
Alan	Jenkins	aj@jenkinsatlaw.com	Jenkins at Law	2950 Yellowtail Ave. Marathon, FL 33050	Electronic Service	No	OFF_SL_21-814_M-21-814
Richard	Johnson	Rick.Johnson@lawmoss.com	Moss & Barnett	150 S. 5th Street Suite 1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Sarah	Johnson Phillips	sarah.phillips@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Nate	Jones	njones@hcpd.com	Heartland Consumers Power	PO Box 248 Madison, SD 57042	Electronic Service	No	OFF_SL_21-814_M-21-814
Michael	Kampmeyer	mkampmeyer@a-e-group.com	AEG Group, LLC	260 Salem Church Road Sunfish Lake, Minnesota 55118	Electronic Service	No	OFF_SL_21-814_M-21-814
Ted	Kjos	tkjos@mienergy.coop	MiEnergy Cooperative	31110 Cooperative Way PO Box 626 Rushford, MN 55971	Electronic Service	No	OFF_SL_21-814_M-21-814
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600 Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Thomas	Koehler	TGK@IBEW160.org	Local Union #160, IBEW	2909 Anthony Ln St Anthony Village, MN 55418-3238	Electronic Service	No	OFF_SL_21-814_M-21-814
Chris	Kopel	chrisk@CMPASgroup.org	Central Minnesota Municipal Power Agency	459 S Grove St Blue Earth, MN 56013-2629	Electronic Service	No	OFF_SL_21-814_M-21-814
Brian	Krambeer	bkrambeer@mienergy.coop	MiEnergy Cooperative	PO Box 626 31110 Cooperative Way Rushford, MN 55971	Electronic Service	No	OFF_SL_21-814_M-21-814
Michael	Krause	michaelkrause61@yahoo.com	Kandiyo Consulting, LLC	433 S 7th Street Suite 2025 Minneapolis, Minnesota 55415	Electronic Service	No	OFF_SL_21-814_M-21-814
Michael	Krikava	mkrikava@taftlaw.com	Taft Stettinius & Hollister LLP	2200 IDS Center 80 S 8th St Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Matthew	Lacey	Mlacey@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_21-814_M-21-814
Carmel	Laney	carmel.laney@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
James D.	Larson	james.larson@avantenergy.com	Avant Energy Services	220 S 6th St Ste 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Peder	Larson	plarson@larkinhoffman.com	Larkin Hoffman Daly & Lindgren, Ltd.	8300 Norman Center Drive Suite 1000 Bloomington, MN 55437	Electronic Service	No	OFF_SL_21-814_M-21-814
Dean	Leischow	dean@sunrisenrg.com	Sunrise Energy Ventures	315 Manitoba Ave Ste 200 Wayzata, MN 55391	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Annie	Levenson Falk	annielf@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota Street, Suite W1360 St. Paul, MN 55101	Electronic Service	No	OFF_SL_21-814_M-21-814
Ryan	Long	ryan.j.long@xcelenergy.com	Xcel Energy	414 Nicollet Mall 401 8th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814
Susan	Ludwig	sludwig@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_21-814_M-21-814
Kavita	Maini	kmaini@wi.rr.com	KM Energy Consulting, LLC	961 N Lost Woods Rd Oconomowoc, WI 53066	Electronic Service	No	OFF_SL_21-814_M-21-814
Pam	Marshall	pam@energycents.org	Energy CENTS Coalition	823 7th St E St. Paul, MN 55106	Electronic Service	No	OFF_SL_21-814_M-21-814
Mary	Martinka	mary.a.martinka@xcelenergy.com	Xcel Energy Inc	414 Nicollet Mall 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814
Samuel	Mason	smason@beltramielectric.com	Beltrami Electric Cooperative, Inc.	4111 Technology Dr. NW PO Box 488 Bemidji, MN 56619-0488	Electronic Service	No	OFF_SL_21-814_M-21-814
Gregg	Mast	gmast@cleanenergyeconomymn.org	Clean Energy Economy Minnesota	4808 10th Avenue S Minneapolis, MN 55417	Electronic Service	No	OFF_SL_21-814_M-21-814
Dave	McNary	David.McNary@hennepin.us	Hennepin County DES	701 Fourth Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_21-814_M-21-814
Thomas	Melone	Thomas.Melone@AllcoUS.com	Minnesota Go Solar LLC	222 South 9th Street Suite 1600 Minneapolis, Minnesota 55120	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Brian	Meloy	brian.meloy@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Joseph	Meyer	joseph.meyer@ag.state.mn.us	Office of the Attorney General-RUD	Bremer Tower, Suite 1400 445 Minnesota Street St Paul, MN 55101-2131	Electronic Service	No	OFF_SL_21-814_M-21-814
Stacy	Miller	stacy.miller@minneapolismn.gov	City of Minneapolis	350 S. 5th Street Room M 301 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_21-814_M-21-814
David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	No	OFF_SL_21-814_M-21-814
Dalene	Monsebroten	dalene.monsebroten@nmpagency.com	Northern Municipal Power Agency	123 2nd St W Thief River Falls, MN 56701	Electronic Service	No	OFF_SL_21-814_M-21-814
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Carl	Nelson	cnelson@mncee.org	Center for Energy and Environment	212 3rd Ave N Ste 560 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814
Ben	Nelson	benn@cmpasgroup.org	CMMPA	459 South Grove Street Blue Earth, MN 56013	Electronic Service	No	OFF_SL_21-814_M-21-814
Dale	Niezwaag	dniezwaag@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58503	Electronic Service	No	OFF_SL_21-814_M-21-814
David	Niles	david.niles@avantenergy.com	Minnesota Municipal Power Agency	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Sephra	Ninow	sephra.ninow@energycenter.org	Center for Sustainable Energy	426 17th Street, Suite 700 Oakland, CA 94612	Electronic Service	No	OFF_SL_21-814_M-21-814
Rolf	Nordstrom	rnordstrom@gpisd.net	Great Plains Institute	2801 21ST AVE S STE 220 Minneapolis, MN 55407-1229	Electronic Service	No	OFF_SL_21-814_M-21-814
Samantha	Norris	samanthanorris@alliantenergy.com	Interstate Power and Light Company	200 1st Street SE PO Box 351 Cedar Rapids, IA 524060351	Electronic Service	No	OFF_SL_21-814_M-21-814
David	O'Brien	david.obrien@navigant.com	Navigant Consulting	77 South Bedford St Ste 400 Burlington, MA 01803	Electronic Service	No	OFF_SL_21-814_M-21-814
Jeff	O'Neill	jeff.oneill@ci.monticello.mn.us	City of Monticello	505 Walnut Street Suite 1 Monticelllo, Minnesota 55362	Electronic Service	No	OFF_SL_21-814_M-21-814
Russell	Olson	rolson@hcpd.com	Heartland Consumers Power District	PO Box 248 Madison, SD 570420248	Electronic Service	No	OFF_SL_21-814_M-21-814
Carol A.	Overland	overland@legalectric.org	Legalectric - Overland Law Office	1110 West Avenue Red Wing, MN 55066	Electronic Service	No	OFF_SL_21-814_M-21-814
Dan	Patry	dpatry@sunedison.com	SunEdison	600 Clipper Drive Belmont, CA 94002	Electronic Service	No	OFF_SL_21-814_M-21-814
Jeffrey C	Paulson	jeff.jcplaw@comcast.net	Paulson Law Office, Ltd.	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jennifer	Peterson	jjpeterson@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_21-814_M-21-814
Hannah	Polikov	hpolikov@aee.net	Advanced Energy Economy Institute	1000 Vermont Ave, Third Floor Washington, DC 20005	Electronic Service	No	OFF_SL_21-814_M-21-814
David G.	Prazak	dprazak@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_21-814_M-21-814
Mark	Rathbun	mrathbun@grenergy.com	Great River Energy	12300 Elm Creek Blvd Maple Grove, MN 55369	Electronic Service	No	OFF_SL_21-814_M-21-814
Michael	Reinertson	michael.reinertson@avantenergy.com	Avant Energy	220 S. Sixth St. Ste 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
John C.	Reinhardt	N/A	Laura A. Reinhardt	3552 26th Ave S Minneapolis, MN 55406	Paper Service	No	OFF_SL_21-814_M-21-814
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_21-814_M-21-814
Kevin	Reuther	kreuther@mncenter.org	MN Center for Environmental Advocacy	26 E Exchange St, Ste 206 St. Paul, MN 551011667	Electronic Service	No	OFF_SL_21-814_M-21-814
Isabel	Ricker	ricker@fresh-energy.org	Fresh Energy	408 Saint Peter Street Suite 220 Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-814_M-21-814
Amanda	Rome	amanda.rome@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 5 Minneapoli, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Robert K.	Sahr	bsahr@eastriver.coop	East River Electric Power Cooperative	P.O. Box 227 Madison, SD 57042	Electronic Service	No	OFF_SL_21-814_M-21-814
Joseph L	Sathe	jsathe@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Richard	Savelkoul	rsavelkoul@martinsquires.com	Martin & Squires, P.A.	332 Minnesota Street Ste W2750 St. Paul, MN 55101	Electronic Service	No	OFF_SL_21-814_M-21-814
Thomas	Scharff	thomas.scharff@versoco.com	Verso Corp	600 High Street Wisconsin Rapids, WI 54495	Electronic Service	No	OFF_SL_21-814_M-21-814
Christopher	Schoenherr	cp.schoenherr@smmpa.org	SMMPA	500 First Ave SW Rochester, MN 55902-3303	Electronic Service	No	OFF_SL_21-814_M-21-814
Kay	Schraeder	kschraeder@minnkota.com	Minnkota Power	5301 32nd Ave S Grand Forks, ND 58201	Electronic Service	No	OFF_SL_21-814_M-21-814
Dean	Sedgwick	Sedgwick@Itascapower.com	Itasca Power Company	PO Box 455 Spring Lake, MN 56680	Electronic Service	No	OFF_SL_21-814_M-21-814
Maria	Seidler	maria.seidler@dom.com	Dominion Energy Technology	120 Tredegar Street Richmond, Virginia 23219	Electronic Service	No	OFF_SL_21-814_M-21-814
Will	Seuffert	Will.Seuffert@state.mn.us	Public Utilities Commission	121 7th Pl E Ste 350 Saint Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-814_M-21-814
Patricia F	Sharkey	psharkey@environmentallawcounsel.com	Midwest Cogeneration Association.	180 N LaSalle St Ste 3700 Chicago, IL 60601	Electronic Service	No	OFF_SL_21-814_M-21-814

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Bria	Shea	bria.e.shea@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-814_M-21-814
Doug	Shoemaker	dougs@charter.net	Minnesota Renewable Energy	2928 5th Ave S Minneapolis, MN 55408	Electronic Service	No	OFF_SL_21-814_M-21-814
Anne	Smart	anne.smart@chargepoint.com	ChargePoint, Inc.	254 E Hacienda Ave Campbell, CA 95008	Electronic Service	No	OFF_SL_21-814_M-21-814
Ken	Smith	ken.smith@ever-greenenergy.com	Ever Green Energy	305 Saint Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-814_M-21-814
Joshua	Smith	joshua.smith@sierraclub.org		85 Second St FL 2 San Francisco, California 94105	Electronic Service	No	OFF_SL_21-814_M-21-814
Ken	Smith	ken.smith@districtenergy.com	District Energy St. Paul Inc.	76 W Kellogg Blvd St. Paul, MN 55102	Electronic Service	No	OFF_SL_21-814_M-21-814
Trevor	Smith	trevor.smith@avantenergy.com	Avant Energy, Inc.	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Beth H.	Soholt	bsoholt@windonthewires.org	Wind on the Wires	570 Asbury Street Suite 201 St. Paul, MN 55104	Electronic Service	No	OFF_SL_21-814_M-21-814
Sky	Stanfield	stanfield@smwlaw.com	Shute, Mihaly & Weinberger	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_21-814_M-21-814
Tom	Stanton	tstanton@nrri.org	NRRI	1080 Carmack Road Columbus, OH 43210	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Byron E.	Starns	byron.starns@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
James M	Strommen	jstrommen@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Eric	Swanson	eswanson@winthrop.com	Winthrop & Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_21-814_M-21-814
Lynnette	Sweet	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	Yes	OFF_SL_21-814_M-21-814
Peter	Teigland	pteigland@mnseia.org	Minnesota Solar Energy Industries Association	2288 University Ave W Saint Paul, MN 55114	Electronic Service	No	OFF_SL_21-814_M-21-814
Stuart	Tommerdahl	stommerdahl@otpco.com	Otter Tail Power Company	215 S Cascade St PO Box 496 Fergus Falls, MN 56537	Electronic Service	No	OFF_SL_21-814_M-21-814
Pat	Treseler	pat.jcplaw@comcast.net	Paulson Law Office LTD	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_21-814_M-21-814
Lise	Trudeau	lise.trudeau@state.mn.us	Department of Commerce	85 7th Place East Suite 500 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_21-814_M-21-814
Karen	Turnboom	karen.turnboom@versoco.com	Verso Corporation	100 Central Avenue Duluth, MN 55807	Electronic Service	No	OFF_SL_21-814_M-21-814
Thomas	Tynes	jjazynka@energyfreedomcoalition.com	Energy Freedom Coalition of America	101 Constitution Ave NW Ste 525 East Washington, DC 20001	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Lisa	Veith	lisa.veith@ci.stpaul.mn.us	City of St. Paul	400 City Hall and Courthouse 15 West Kellogg Blvd. St. Paul, MN 55102	Electronic Service	No	OFF_SL_21-814_M-21-814
Curt	Volkmann	curt@newenergy-advisors.com	Fresh Energy	408 St Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-814_M-21-814
Roger	Warehime	roger.warehime@owatonnautilities.com	Owatonna Municipal Public Utilities	208 S Walnut Ave PO BOX 800 Owatonna, MN 55060	Electronic Service	No	OFF_SL_21-814_M-21-814
Jenna	Warmuth	jwarmuth@mnpower.com	Minnesota Power	30 W Superior St Duluth, MN 55802-2093	Electronic Service	No	OFF_SL_21-814_M-21-814
Samantha	Williams	swilliams@nrdc.org	Natural Resources Defense Council	20 N. Wacker Drive Ste 1600 Chicago, IL 60606	Electronic Service	No	OFF_SL_21-814_M-21-814
Joseph	Windler	jwindler@winthrop.com	Winthrop & Weinstine	225 South Sixth Street, Suite 3500 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814
Robyn	Woeste	robynwoeste@alliantenergy.com	Interstate Power and Light Company	200 First St SE Cedar Rapids, IA 52401	Electronic Service	No	OFF_SL_21-814_M-21-814
Yochi	Zakai	yzakai@smwlaw.com	SHUTE, MIHALY & WEINBERGER LLP	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_21-814_M-21-814
Thomas J.	Zaremba	TZaremba@wheelerlaw.com	WHEELER, VAN SICKLE & ANDERSON	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Christopher	Zibart	czibart@atcllc.com	American Transmission Company LLC	W234 N2000 Ridgeview Pkwy Court Waukesha, WI 53188-1022	Electronic Service	No	OFF_SL_21-814_M-21-814
Patrick	Zomer	Pat.Zomer@lawmoss.com	Moss & Barnett PA	150 S 5th St #1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-814_M-21-814

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Allen	michael.allen@allenergysolar.com	All Energy Solar	721 W 26th st Suite 211 Minneapolis, Minnesota 55405	Electronic Service	No	OFF_SL_20-627_DI-20-627
David	Amster Olzweski	david@mysunshare.com	SunShare, LLC	1151 Bannock St Denver, CO 80204-8020	Electronic Service	No	OFF_SL_20-627_DI-20-627
Ellen	Anderson	ellena@umn.edu	325 Learning and Environmental Sciences	1954 Buford Ave Saint Paul, MN 55108	Electronic Service	No	OFF_SL_20-627_DI-20-627
Alison C	Archer	aarcher@misoenergy.org	MISO	2985 Ames Crossing Rd Eagan, MN 55121	Electronic Service	No	OFF_SL_20-627_DI-20-627
Mara	Ascheman	mara.k.ascheman@xcelenergy.com	Xcel Energy	414 Nicollet Mall Fl 5 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Donna	Attanasio	dattanasio@law.gwu.edu	George Washington University	2000 H Street NW Washington, DC 20052	Electronic Service	No	OFF_SL_20-627_DI-20-627
John	Bailey	bailey@ilsr.org	Institute For Local Self-Reliance	1313 5th St SE Ste 303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_20-627_DI-20-627
Mark	Bakk	mbakk@lcp.coop	Lake Country Power	26039 Bear Ridge Drive Cohasset, MN 55721	Electronic Service	No	OFF_SL_20-627_DI-20-627
Gail	Baranko	gail.baranko@xcelenergy.com	Xcel Energy	414 Nicollet Mall7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jessica L	Bayles	Jessica.Bayles@stoel.com	Stoel Rives LLP	1150 18th St NW Ste 325 Washington, DC 20036	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
James J.	Bertrand	james.bertrand@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
Derek	Bertsch	derek.bertsch@mrenergy.com	Missouri River Energy Services	3724 West Avera Drive PO Box 88920 Sioux Falls, SD 57109-8920	Electronic Service	No	OFF_SL_20-627_DI-20-627
William	Black	bblack@mmua.org	MMUA	Suite 200 3131 Fernbrook Lane North Plymouth, MN 55447	Electronic Service	No	OFF_SL_20-627_DI-20-627
Kenneth	Bradley	kbradley1965@gmail.com		2837 Emerson Ave S Apt CW112 Minneapolis, MN 55408	Electronic Service	No	OFF_SL_20-627_DI-20-627
Elizabeth	Brama	ebrama@taftlaw.com	Taft Stettinius & Hollister LLP	2200 IDS Center 80 South 8th Street Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jon	Brekke	jbrekke@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_20-627_DI-20-627
Sydney R.	Briggs	sbriggs@swce.coop	Steele-Waseca Cooperative Electric	2411 W. Bridge St PO Box 485 Owatonna, MN 55060-0485	Electronic Service	No	OFF_SL_20-627_DI-20-627
Mark B.	Bring	mbring@otpco.com	Otter Tail Power Company	215 South Cascade Street PO Box 496 Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_20-627_DI-20-627
Christina	Brusven	cbrusven@fredlaw.com	Fredrikson Byron	200 S 6th St Ste 4000 Minneapolis, MN 554021425	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jessica	Burdette	jessica.burdette@state.mn.us	Department of Commerce	85 7th Place East Suite 500 St. Paul, MN 55101	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jason	Burwen	jburwen@cleanpower.org	Energy Storage Association	1155 15th St NW, Ste 500 Washington, DC 20005	Electronic Service	No	OFF_SL_20-627_DI-20-627
LORI	CLOBES	lclobes@mienergy.coop	MiEnergy Cooperative	31110 COOPERATIVE WAY PO BOX 626 RUSHFORD, MN 55971	Electronic Service	No	OFF_SL_20-627_DI-20-627
James	Canaday	james.canaday@ag.state.mn.us	Office of the Attorney General-RUD	Suite 1400 445 Minnesota St. St. Paul, MN 55101	Electronic Service	No	OFF_SL_20-627_DI-20-627
Douglas M.	Carnival	dmc@mcgrannshea.com	McGrann Shea Carnival Straughn & Lamb	N/A	Electronic Service	No	OFF_SL_20-627_DI-20-627
Ray	Choquette	rchoquette@agp.com	Ag Processing Inc.	12700 West Dodge Road PO Box 2047 Omaha, NE 68103-2047	Electronic Service	No	OFF_SL_20-627_DI-20-627
John	Coffman	john@johncoffman.net	AARP	871 Tuxedo Blvd. St, Louis, MO 63119-2044	Electronic Service	No	OFF_SL_20-627_DI-20-627
Kenneth A.	Colburn	kcolburn@symbioticstrategies.com	Symbiotic Strategies, LLC	26 Winton Road Meredith, NH 32535413	Electronic Service	No	OFF_SL_20-627_DI-20-627
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_20-627_DI-20-627
Riley	Conlin	riley.conlin@stoel.com	Stoel Rives LLP	33 S. 6th Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Brooke	Cooper	bcooper@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022191	Electronic Service	No	OFF_SL_20-627_DI-20-627
George	Crocker	gwillc@nawo.org	North American Water Office	PO Box 174 Lake Elmo, MN 55042	Electronic Service	No	OFF_SL_20-627_DI-20-627
David	Dahlberg	davedahlberg@nweco.com	Northwestern Wisconsin Electric Company	P.O. Box 9 104 South Pine Street Grantsburg, WI 548400009	Electronic Service	No	OFF_SL_20-627_DI-20-627
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, 401-8 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Curt	Dieren	curt.dieren@dgr.com	L&O Power Cooperative	1302 S Union St Rock Rapids, IA 51246	Electronic Service	No	OFF_SL_20-627_DI-20-627
Carlon	Doyle Fontaine	carlon.doyle.fontaine@senate.mn	MN Senate	75 Rev Dr Martin Luther King Jr Blvd Room G-17 St Paul, MN 55155	Electronic Service	No	OFF_SL_20-627_DI-20-627
Brian	Draxten	bhdraxten@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380498	Electronic Service	No	OFF_SL_20-627_DI-20-627
Brian	Edstrom	briane@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota St Ste W1360 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_20-627_DI-20-627
Kristen	Eide Tollefson	healingsystems69@gmail.com	R-CURE	28477 N Lake Ave Frontenac, MN 55026-1044	Electronic Service	No	OFF_SL_20-627_DI-20-627

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Rebecca	Eilers	rebecca.d.eilers@xcelenergy.com	Xcel Energy	414 Nicollet Mall - 401 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Bob	Eleff	bob.eleff@house.mn	Regulated Industries Cmte	100 Rev Dr Martin Luther King Jr Blvd Room 600 St. Paul, MN 55155	Electronic Service	No	OFF_SL_20-627_DI-20-627
Betsy	Engelking	betsy@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_20-627_DI-20-627
Oncu	Er	oncu.er@avantenergy.com	Avant Energy, Agent for MMPA	220 S. Sixth St. Ste. 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
James C.	Erickson	jericksonkbc@gmail.com	Kelly Bay Consulting	17 Quechee St Superior, WI 54880-4421	Electronic Service	No	OFF_SL_20-627_DI-20-627
John	Farrell	jfarrell@ilsr.org	Institute for Local Self-Reliance	2720 E. 22nd St Institute for Local Self-Reliance Minneapolis, MN 55406	Electronic Service	No	OFF_SL_20-627_DI-20-627
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_20-627_DI-20-627
Nathan	Franzen	nathan@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_20-627_DI-20-627
Hal	Galvin	halgalvin@comcast.net	Provectus Energy Development llc	1936 Kenwood Parkway Minneapolis, MN 55405	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Edward	Garvey	edward.garvey@AESLconsulting.com	AESL Consulting	32 Lawton St Saint Paul, MN 55102-2617	Electronic Service	No	OFF_SL_20-627_DI-20-627
Edward	Garvey	garveyed@aol.com	Residence	32 Lawton St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_20-627_DI-20-627
Bruce	Gerhardson	bgerhardson@otpco.com	Otter Tail Power Company	PO Box 496 215 S Cascade St Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_20-627_DI-20-627
Allen	Gleckner	gleckner@fresh-energy.org	Fresh Energy	408 St. Peter Street Ste 350 Saint Paul, Minnesota 55102	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jenny	Glumack	jenny@mrea.org	Minnesota Rural Electric Association	11640 73rd Ave N Maple Grove, MN 55369	Electronic Service	No	OFF_SL_20-627_DI-20-627
Timothy	Gulden	timothy.gulden@yahoo.com	Winona Renewable Energy, LLC	1449 Ridgewood Dr Winona, MN 55987	Electronic Service	No	OFF_SL_20-627_DI-20-627
Tony	Hainault	anthony.hainault@co.hennepin.mn.us	Hennepin County DES	701 4th Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_20-627_DI-20-627
Kim	Havey	kim.havey@minneapolismn.gov	City of Minneapolis	350 South 5th Street, Suite 315M Minneapolis, MN 55415	Electronic Service	No	OFF_SL_20-627_DI-20-627
Todd	Headlee	theadlee@dvigridsolutions.com	Dominion Voltage, Inc.	701 E. Cary Street Richmond, VA 23219	Electronic Service	No	OFF_SL_20-627_DI-20-627
Amber	Hedlund	amber.r.hedlund@xcelenergy.com	Northern States Power Company dba Xcel Energy-Elec	414 Nicollet Mall, 401-7 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Adam	Heinen	aheinen@dakotaelectric.com	Dakota Electric Association	4300 220th St W Farmington, MN 55024	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jared	Hendricks	jared.hendricks@owatonnautilities.com	Owatonna Municipal Public Utilities	PO Box 800 208 S Walnut Ave Owatonna, MN 55060-2940	Electronic Service	No	OFF_SL_20-627_DI-20-627
Annete	Henkel	mui@mnutilityinvestors.org	Minnesota Utility Investors	413 Wacouta Street #230 St.Paul, MN 55101	Electronic Service	No	OFF_SL_20-627_DI-20-627
Shane	Henriksen	shane.henriksen@enbridge.com	Enbridge Energy Company, Inc.	1409 Hammond Ave FL 2 Superior, WI 54880	Paper Service	No	OFF_SL_20-627_DI-20-627
Lynn	Hinkle	lynnh@ips-solar.com	IPS Solar	2670 Patton Rd Roseville, MN 55113	Electronic Service	No	OFF_SL_20-627_DI-20-627
Michael	Hoppe	lu23@ibew23.org	Local Union 23, I.B.E.W.	445 Etna Street Ste. 61 St. Paul, MN 55106	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jan	Hubbard	jan.hubbard@comcast.net		7730 Mississippi Lane Brooklyn Park, MN 55444	Electronic Service	No	OFF_SL_20-627_DI-20-627
Geoffrey	Inge	ginge@regintllc.com	Regulatory Intelligence LLC	PO Box 270636 Superior, CO 80027-9998	Electronic Service	No	OFF_SL_20-627_DI-20-627
Casey	Jacobson	cjacobson@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58501	Electronic Service	No	OFF_SL_20-627_DI-20-627
Ralph	Jacobson	ralphj@ips-solar.com		2126 Roblyn Avenue Saint Paul, Minnesota 55104	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
John S.	Jaffray	jjaffray@jjrpower.com	JJR Power	350 Highway 7 Suite 236 Excelsior, MN 55331	Electronic Service	No	OFF_SL_20-627_DI-20-627
Alan	Jenkins	aj@jenkinsatlaw.com	Jenkins at Law	2950 Yellowtail Ave. Marathon, FL 33050	Electronic Service	No	OFF_SL_20-627_DI-20-627
Richard	Johnson	Rick.Johnson@lawmoss.com	Moss & Barnett	150 S. 5th Street Suite 1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
Sarah	Johnson Phillips	sarah.phillips@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
Nate	Jones	njones@hcpd.com	Heartland Consumers Power	PO Box 248 Madison, SD 57042	Electronic Service	No	OFF_SL_20-627_DI-20-627
Michael	Kampmeyer	mkampmeyer@a-e-group.com	AEG Group, LLC	260 Salem Church Road Sunfish Lake, Minnesota 55118	Electronic Service	No	OFF_SL_20-627_DI-20-627
Ted	Kjos	tkjos@mienergy.coop	MiEnergy Cooperative	31110 Cooperative Way PO Box 626 Rushford, MN 55971	Electronic Service	No	OFF_SL_20-627_DI-20-627
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600 Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_20-627_DI-20-627
Thomas	Koehler	TGK@IBEW160.org	Local Union #160, IBEW	2909 Anthony Ln St Anthony Village, MN 55418-3238	Electronic Service	No	OFF_SL_20-627_DI-20-627
Chris	Kopel	chrisk@CMPASgroup.org	Central Minnesota Municipal Power Agency	459 S Grove St Blue Earth, MN 56013-2629	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Brian	Krambeer	bkrambeer@mienergy.coop	MiEnergy Cooperative	PO Box 626 31110 Cooperative Way Rushford, MN 55971	Electronic Service	No	OFF_SL_20-627_DI-20-627
Michael	Krause	michaelkrause61@yahoo.com	Kandiyo Consulting, LLC	433 S 7th Street Suite 2025 Minneapolis, Minnesota 55415	Electronic Service	No	OFF_SL_20-627_DI-20-627
Michael	Krikava	mkrikava@taftlaw.com	Taft Stettinius & Hollister LLP	2200 IDS Center 80 S 8th St Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
Matthew	Lacey	Mlacey@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_20-627_DI-20-627
Carmel	Laney	carmel.laney@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
James D.	Larson	james.larson@avantenergy.com	Avant Energy Services	220 S 6th St Ste 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
Peder	Larson	plarson@larkinhoffman.com	Larkin Hoffman Daly & Lindgren, Ltd.	8300 Norman Center Drive Suite 1000 Bloomington, MN 55437	Electronic Service	No	OFF_SL_20-627_DI-20-627
Dean	Leischow	dean@sunrisenrg.com	Sunrise Energy Ventures	315 Manitoba Ave Ste 200 Wayzata, MN 55391	Electronic Service	No	OFF_SL_20-627_DI-20-627
Annie	Levenson Falk	annielf@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota Street, Suite W1360 St. Paul, MN 55101	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Ryan	Long	ryan.j.long@xcelenergy.com	Xcel Energy	414 Nicollet Mall 401 8th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Susan	Ludwig	sludwig@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_20-627_DI-20-627
Kavita	Maini	kmaini@wi.rr.com	KM Energy Consulting, LLC	961 N Lost Woods Rd Oconomowoc, WI 53066	Electronic Service	No	OFF_SL_20-627_DI-20-627
Pam	Marshall	pam@energycents.org	Energy CENTS Coalition	823 7th St E St. Paul, MN 55106	Electronic Service	No	OFF_SL_20-627_DI-20-627
Mary	Martinka	mary.a.martinka@xcelenergy.com	Xcel Energy Inc	414 Nicollet Mall 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Samuel	Mason	smason@beltramielectric.com	Beltrami Electric Cooperative, Inc.	4111 Technology Dr. NW PO Box 488 Bemidji, MN 56619-0488	Electronic Service	No	OFF_SL_20-627_DI-20-627
Gregg	Mast	gmast@cleanenergyeconomymn.org	Clean Energy Economy Minnesota	4808 10th Avenue S Minneapolis, MN 55417	Electronic Service	No	OFF_SL_20-627_DI-20-627
Dave	McNary	David.McNary@hennepin.us	Hennepin County DES	701 Fourth Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_20-627_DI-20-627
Thomas	Melone	Thomas.Melone@AllcoUS.com	Minnesota Go Solar LLC	222 South 9th Street Suite 1600 Minneapolis, Minnesota 55120	Electronic Service	No	OFF_SL_20-627_DI-20-627
Brian	Meloy	brian.meloy@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627

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Joseph	Meyer	joseph.meyer@ag.state.mn.us	Office of the Attorney General-RUD	Bremer Tower, Suite 1400 445 Minnesota Street St Paul, MN 55101-2131	Electronic Service	No	OFF_SL_20-627_DI-20-627
Stacy	Miller	stacy.miller@minneapolismn.gov	City of Minneapolis	350 S. 5th Street Room M 301 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_20-627_DI-20-627
David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	No	OFF_SL_20-627_DI-20-627
Dalene	Monsebroten	dalene.monsebroten@nmpagency.com	Northern Municipal Power Agency	123 2nd St W Thief River Falls, MN 56701	Electronic Service	No	OFF_SL_20-627_DI-20-627
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
Ben	Nelson	benn@cmpasgroup.org	CMMPA	459 South Grove Street Blue Earth, MN 56013	Electronic Service	No	OFF_SL_20-627_DI-20-627
Carl	Nelson	cnelson@mncee.org	Center for Energy and Environment	212 3rd Ave N Ste 560 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Dale	Niezwaag	dniezwaag@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58503	Electronic Service	No	OFF_SL_20-627_DI-20-627
David	Niles	david.niles@avantenergy.com	Minnesota Municipal Power Agency	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
Sephra	Ninow	sephra.ninow@energycenter.org	Center for Sustainable Energy	426 17th Street, Suite 700 Oakland, CA 94612	Electronic Service	No	OFF_SL_20-627_DI-20-627

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Rolf	Nordstrom	rnordstrom@gpisd.net	Great Plains Institute	2801 21ST AVE S STE 220 Minneapolis, MN 55407-1229	Electronic Service	No	OFF_SL_20-627_DI-20-627
Samantha	Norris	samanthanorris@alliantenergy.com	Interstate Power and Light Company	200 1st Street SE PO Box 351 Cedar Rapids, IA 524060351	Electronic Service	No	OFF_SL_20-627_DI-20-627
David	O'Brien	david.obrien@navigant.com	Navigant Consulting	77 South Bedford St Ste 400 Burlington, MA 01803	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jeff	O'Neill	jeff.oneill@ci.monticello.mn.us	City of Monticello	505 Walnut Street Suite 1 Monticelllo, Minnesota 55362	Electronic Service	No	OFF_SL_20-627_DI-20-627
Russell	Olson	rolson@hcpd.com	Heartland Consumers Power District	PO Box 248 Madison, SD 570420248	Electronic Service	No	OFF_SL_20-627_DI-20-627
Carol A.	Overland	overland@legalectric.org	Legalectric - Overland Law Office	1110 West Avenue Red Wing, MN 55066	Electronic Service	No	OFF_SL_20-627_DI-20-627
Audrey	Partridge	apartridge@mncee.org	Center for Energy and Environment	212 3rd Ave. N. Suite 560 Minneapolis, Minnesota 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Dan	Patry	dpatry@sunedison.com	SunEdison	600 Clipper Drive Belmont, CA 94002	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jeffrey C	Paulson	jeff.jcplaw@comcast.net	Paulson Law Office, Ltd.	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Mary Beth	Peranteau	mperanteau@wheelerlaw.com	Wheeler Van Sickle & Anderson SC	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jennifer	Peterson	jjpeterson@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_20-627_DI-20-627
Hannah	Polikov	hpolikov@aee.net	Advanced Energy Economy Institute	1000 Vermont Ave, Third Floor Washington, DC 20005	Electronic Service	No	OFF_SL_20-627_DI-20-627
David G.	Prazak	dprazak@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_20-627_DI-20-627
Mark	Rathbun	mrathbun@grenergy.com	Great River Energy	12300 Elm Creek Blvd Maple Grove, MN 55369	Electronic Service	No	OFF_SL_20-627_DI-20-627
Michael	Reinertson	michael.reinertson@avantenergy.com	Avant Energy	220 S. Sixth St. Ste 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
John C.	Reinhardt	N/A	Laura A. Reinhardt	3552 26th Ave S Minneapolis, MN 55406	Paper Service	No	OFF_SL_20-627_DI-20-627
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_20-627_DI-20-627
Kevin	Reuther	kreuther@mncenter.org	MN Center for Environmental Advocacy	26 E Exchange St, Ste 206 St. Paul, MN 551011667	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Isabel	Ricker	ricker@fresh-energy.org	Fresh Energy	408 Saint Peter Street Suite 220 Saint Paul, MN 55102	Electronic Service	No	OFF_SL_20-627_DI-20-627
Amanda	Rome	amanda.rome@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 5 Minneapoli, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Robert K.	Sahr	bsahr@eastriver.coop	East River Electric Power Cooperative	P.O. Box 227 Madison, SD 57042	Electronic Service	No	OFF_SL_20-627_DI-20-627
Richard	Savelkoul	rsavelkoul@martinsquires.com	Martin & Squires, P.A.	332 Minnesota Street Ste W2750 St. Paul, MN 55101	Electronic Service	No	OFF_SL_20-627_DI-20-627
Thomas	Scharff	thomas.scharff@versoco.com	Verso Corp	600 High Street Wisconsin Rapids, WI 54495	Electronic Service	No	OFF_SL_20-627_DI-20-627
Christopher	Schoenherr	cp.schoenherr@smmpa.org	SMMPA	500 First Ave SW Rochester, MN 55902-3303	Electronic Service	No	OFF_SL_20-627_DI-20-627
Kay	Schraeder	kschraeder@minnkota.com	Minnkota Power	5301 32nd Ave S Grand Forks, ND 58201	Electronic Service	No	OFF_SL_20-627_DI-20-627
Dean	Sedgwick	Sedgwick@Itascapower.com	Itasca Power Company	PO Box 455 Spring Lake, MN 56680	Electronic Service	No	OFF_SL_20-627_DI-20-627
Maria	Seidler	maria.seidler@dom.com	Dominion Energy Technology	120 Tredegar Street Richmond, Virginia 23219	Electronic Service	No	OFF_SL_20-627_DI-20-627
Will	Seuffert	Will.Seuffert@state.mn.us	Public Utilities Commission	121 7th Pl E Ste 350 Saint Paul, MN 55101	Electronic Service	Yes	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Janet	Shaddix Elling	jshaddix@janetshaddix.com	Shaddix And Associates	7400 Lyndale Ave S Ste 190 Richfield, MN 55423	Electronic Service	Yes	OFF_SL_20-627_DI-20-627
Patricia F	Sharkey	psharkey@environmentallawcounsel.com	Midwest Cogeneration Association.	180 N LaSalle St Ste 3700 Chicago, IL 60601	Electronic Service	No	OFF_SL_20-627_DI-20-627
Bria	Shea	bria.e.shea@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Doug	Shoemaker	dougs@charter.net	Minnesota Renewable Energy	2928 5th Ave S Minneapolis, MN 55408	Electronic Service	No	OFF_SL_20-627_DI-20-627
Anne	Smart	anne.smart@chargepoint.com	ChargePoint, Inc.	254 E Hacienda Ave Campbell, CA 95008	Electronic Service	No	OFF_SL_20-627_DI-20-627
Ken	Smith	ken.smith@ever-greenenergy.com	Ever Green Energy	305 Saint Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_20-627_DI-20-627
Joshua	Smith	joshua.smith@sierraclub.org		85 Second St FL 2 San Francisco, California 94105	Electronic Service	No	OFF_SL_20-627_DI-20-627
Ken	Smith	ken.smith@districtenergy.com	District Energy St. Paul Inc.	76 W Kellogg Blvd St. Paul, MN 55102	Electronic Service	No	OFF_SL_20-627_DI-20-627
Trevor	Smith	trevor.smith@avantenergy.com	Avant Energy, Inc.	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627

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Beth H.	Soholt	bsoholt@windonthewires.org	Wind on the Wires	570 Asbury Street Suite 201 St. Paul, MN 55104	Electronic Service	No	OFF_SL_20-627_DI-20-627
Sky	Stanfield	stanfield@smwlaw.com	Shute, Mihaly & Weinberger	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_20-627_DI-20-627
Tom	Stanton	tstanton@nrri.org	NRRI	1080 Carmack Road Columbus, OH 43210	Electronic Service	No	OFF_SL_20-627_DI-20-627
Byron E.	Starns	byron.starns@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
James M	Strommen	jstrommen@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627
Eric	Swanson	eswanson@winthrop.com	Winthrop & Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_20-627_DI-20-627
Lynnette	Sweet	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	No	OFF_SL_20-627_DI-20-627
Peter	Teigland	pteigland@mnseia.org	Minnesota Solar Energy Industries Association	2288 University Ave W Saint Paul, MN 55114	Electronic Service	No	OFF_SL_20-627_DI-20-627
Stuart	Tommerdahl	stommerdahl@otpco.com	Otter Tail Power Company	215 S Cascade St PO Box 496 Fergus Falls, MN 56537	Electronic Service	No	OFF_SL_20-627_DI-20-627
Pat	Treseler	pat.jcplaw@comcast.net	Paulson Law Office LTD	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Lise	Trudeau	lise.trudeau@state.mn.us	Department of Commerce	85 7th Place East Suite 500 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_20-627_DI-20-627
Karen	Turnboom	karen.turnboom@versoco.com	Verso Corporation	100 Central Avenue Duluth, MN 55807	Electronic Service	No	OFF_SL_20-627_DI-20-627
Thomas	Tynes	jjazynka@energyfreedomcoalition.com	Energy Freedom Coalition of America	101 Constitution Ave NW Ste 525 East Washington, DC 20001	Electronic Service	No	OFF_SL_20-627_DI-20-627
Lisa	Veith	lisa.veith@ci.stpaul.mn.us	City of St. Paul	400 City Hall and Courthouse 15 West Kellogg Blvd. St. Paul, MN 55102	Electronic Service	No	OFF_SL_20-627_DI-20-627
Curt	Volkmann	curt@newenergy-advisors.com	Fresh Energy	408 St Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_20-627_DI-20-627
Roger	Warehime	roger.warehime@owatonnautilities.com	Owatonna Municipal Public Utilities	208 S Walnut Ave PO BOX 800 Owatonna, MN 55060	Electronic Service	No	OFF_SL_20-627_DI-20-627
Jenna	Warmuth	jwarmuth@mnpower.com	Minnesota Power	30 W Superior St Duluth, MN 55802-2093	Electronic Service	No	OFF_SL_20-627_DI-20-627
Samantha	Williams	swilliams@nrdc.org	Natural Resources Defense Council	20 N. Wacker Drive Ste 1600 Chicago, IL 60606	Electronic Service	No	OFF_SL_20-627_DI-20-627
Joseph	Windler	jwindler@winthrop.com	Winthrop & Weinstine	225 South Sixth Street, Suite 3500 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Robyn	Woeste	robynwoeste@alliantenergy.com	Interstate Power and Light Company	200 First St SE Cedar Rapids, IA 52401	Electronic Service	No	OFF_SL_20-627_DI-20-627
Yochi	Zakai	yzakai@smwlaw.com	SHUTE, MIHALY & WEINBERGER LLP	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_20-627_DI-20-627
Thomas J.	Zaremba	TZaremba@wheelerlaw.com	WHEELER, VAN SICKLE & ANDERSON	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_20-627_DI-20-627
Christopher	Zibart	czibart@atcllc.com	American Transmission Company LLC	W234 N2000 Ridgeview Pkwy Court Waukesha, WI 53188-1022	Electronic Service	No	OFF_SL_20-627_DI-20-627
Patrick	Zomer	Pat.Zomer@lawmoss.com	Moss & Barnett PA	150 S 5th St #1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-627_DI-20-627

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Allen	michael.allen@allenergysolar.com	All Energy Solar	721 W 26th st Suite 211 Minneapolis, Minnesota 55405	Electronic Service	No	OFF_SL_19-666_Official
David	Amster Olzweski	david@mysunshare.com	SunShare, LLC	1151 Bannock St Denver, CO 80204-8020	Electronic Service	No	OFF_SL_19-666_Official
Ellen	Anderson	ellena@umn.edu	325 Learning and Environmental Sciences	1954 Buford Ave Saint Paul, MN 55108	Electronic Service	No	OFF_SL_19-666_Official
Alison C	Archer	aarcher@misoenergy.org	MISO	2985 Ames Crossing Rd Eagan, MN 55121	Electronic Service	No	OFF_SL_19-666_Official
Mara	Ascheman	mara.k.ascheman@xcelenergy.com	Xcel Energy	414 Nicollet Mall Fl 5 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-666_Official
Donna	Attanasio	dattanasio@law.gwu.edu	George Washington University	2000 H Street NW Washington, DC 20052	Electronic Service	No	OFF_SL_19-666_Official
John	Bailey	bailey@ilsr.org	Institute For Local Self-Reliance	1313 5th St SE Ste 303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_19-666_Official
Mark	Bakk	mbakk@lcp.coop	Lake Country Power	26039 Bear Ridge Drive Cohasset, MN 55721	Electronic Service	No	OFF_SL_19-666_Official
Gail	Baranko	gail.baranko@xcelenergy.com	Xcel Energy	414 Nicollet Mall7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-666_Official
Jessica L	Bayles	Jessica.Bayles@stoel.com	Stoel Rives LLP	1150 18th St NW Ste 325 Washington, DC 20036	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
James J.	Bertrand	james.bertrand@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
Derek	Bertsch	derek.bertsch@mrenergy.com	Missouri River Energy Services	3724 West Avera Drive PO Box 88920 Sioux Falls, SD 57109-8920	Electronic Service	No	OFF_SL_19-666_Official
William	Black	bblack@mmua.org	MMUA	Suite 200 3131 Fernbrook Lane North Plymouth, MN 55447	Electronic Service	No	OFF_SL_19-666_Official
Kenneth	Bradley	kbradley1965@gmail.com		2837 Emerson Ave S Apt CW112 Minneapolis, MN 55408	Electronic Service	No	OFF_SL_19-666_Official
Elizabeth	Brama	ebrama@taftlaw.com	Taft Stettinius & Hollister LLP	2200 IDS Center 80 South 8th Street Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
Jon	Brekke	jbrekke@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_19-666_Official
Sydney R.	Briggs	sbriggs@swce.coop	Steele-Waseca Cooperative Electric	2411 W. Bridge St PO Box 485 Owatonna, MN 55060-0485	Electronic Service	No	OFF_SL_19-666_Official
Mark B.	Bring	mbring@otpco.com	Otter Tail Power Company	215 South Cascade Street PO Box 496 Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_19-666_Official
Christina	Brusven	cbrusven@fredlaw.com	Fredrikson Byron	200 S 6th St Ste 4000 Minneapolis, MN 554021425	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jessica	Burdette	jessica.burdette@state.mn.us	Department of Commerce	85 7th Place East Suite 500 St. Paul, MN 55101	Electronic Service	No	OFF_SL_19-666_Official
Jason	Burwen	jburwen@cleanpower.org	Energy Storage Association	1155 15th St NW, Ste 500 Washington, DC 20005	Electronic Service	No	OFF_SL_19-666_Official
LORI	CLOBES	lclobes@mienergy.coop	MiEnergy Cooperative	31110 COOPERATIVE WAY PO BOX 626 RUSHFORD, MN 55971	Electronic Service	No	OFF_SL_19-666_Official
James	Canaday	james.canaday@ag.state.mn.us	Office of the Attorney General-RUD	Suite 1400 445 Minnesota St. St. Paul, MN 55101	Electronic Service	No	OFF_SL_19-666_Official
Douglas M.	Carnival	dmc@mcgrannshea.com	McGrann Shea Carnival Straughn & Lamb	N/A	Electronic Service	No	OFF_SL_19-666_Official
Ray	Choquette	rchoquette@agp.com	Ag Processing Inc.	12700 West Dodge Road PO Box 2047 Omaha, NE 68103-2047	Electronic Service	No	OFF_SL_19-666_Official
John	Coffman	john@johncoffman.net	AARP	871 Tuxedo Blvd. St, Louis, MO 63119-2044	Electronic Service	No	OFF_SL_19-666_Official
Kenneth A.	Colburn	kcolburn@symbioticstrategies.com	Symbiotic Strategies, LLC	26 Winton Road Meredith, NH 32535413	Electronic Service	No	OFF_SL_19-666_Official
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_19-666_Official
Riley	Conlin	riley.conlin@stoel.com	Stoel Rives LLP	33 S. 6th Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Brooke	Cooper	bcooper@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022191	Electronic Service	No	OFF_SL_19-666_Official
George	Crocker	gwillc@nawo.org	North American Water Office	PO Box 174 Lake Elmo, MN 55042	Electronic Service	No	OFF_SL_19-666_Official
David	Dahlberg	davedahlberg@nweco.com	Northwestern Wisconsin Electric Company	P.O. Box 9 104 South Pine Street Grantsburg, WI 548400009	Electronic Service	No	OFF_SL_19-666_Official
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, 401-8 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-666_Official
Curt	Dieren	curt.dieren@dgr.com	L&O Power Cooperative	1302 S Union St Rock Rapids, IA 51246	Electronic Service	No	OFF_SL_19-666_Official
Carlon	Doyle Fontaine	carlon.doyle.fontaine@senate.mn	MN Senate	75 Rev Dr Martin Luther King Jr Blvd Room G-17 St Paul, MN 55155	Electronic Service	No	OFF_SL_19-666_Official
Brian	Draxten	bhdraxten@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380498	Electronic Service	No	OFF_SL_19-666_Official
Kristen	Eide Tollefson	healingsystems69@gmail.com	R-CURE	28477 N Lake Ave Frontenac, MN 55026-1044	Electronic Service	No	OFF_SL_19-666_Official
Rebecca	Eilers	rebecca.d.eilers@xcelenergy.com	Xcel Energy	414 Nicollet Mall - 401 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Bob	Eleff	bob.eleff@house.mn	Regulated Industries Cmte	100 Rev Dr Martin Luther King Jr Blvd Room 600 St. Paul, MN 55155	Electronic Service	No	OFF_SL_19-666_Official
Betsy	Engelking	betsy@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_19-666_Official
Oncu	Er	oncu.er@avantenergy.com	Avant Energy, Agent for MMPA	220 S. Sixth St. Ste. 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
James C.	Erickson	jericksonkbc@gmail.com	Kelly Bay Consulting	17 Quechee St Superior, WI 54880-4421	Electronic Service	No	OFF_SL_19-666_Official
John	Farrell	jfarrell@ilsr.org	Institute for Local Self-Reliance	2720 E. 22nd St Institute for Local Self-Reliance Minneapolis, MN 55406	Electronic Service	No	OFF_SL_19-666_Official
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_19-666_Official
Nathan	Franzen	nathan@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_19-666_Official
Hal	Galvin	halgalvin@comcast.net	Provectus Energy Development llc	1936 Kenwood Parkway Minneapolis, MN 55405	Electronic Service	No	OFF_SL_19-666_Official
Edward	Garvey	edward.garvey@AESLconsulting.com	AESL Consulting	32 Lawton St Saint Paul, MN 55102-2617	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Edward	Garvey	garveyed@aol.com	Residence	32 Lawton St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_19-666_Official
Bruce	Gerhardson	bgerhardson@otpco.com	Otter Tail Power Company	PO Box 496 215 S Cascade St Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_19-666_Official
Allen	Gleckner	gleckner@fresh-energy.org	Fresh Energy	408 St. Peter Street Ste 350 Saint Paul, Minnesota 55102	Electronic Service	No	OFF_SL_19-666_Official
Jenny	Glumack	jenny@mrea.org	Minnesota Rural Electric Association	11640 73rd Ave N Maple Grove, MN 55369	Electronic Service	No	OFF_SL_19-666_Official
Janet	Gonzalez	Janet.gonzalez@state.mn.us	Public Utilities Commission	Suite 350 121 7th Place East St. Paul, MN 55101	Electronic Service	No	OFF_SL_19-666_Official
Timothy	Gulden	timothy.gulden@yahoo.com	Winona Renewable Energy, LLC	1449 Ridgewood Dr Winona, MN 55987	Electronic Service	No	OFF_SL_19-666_Official
Tony	Hainault	anthony.hainault@co.hennepin.mn.us	Hennepin County DES	701 4th Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_19-666_Official
Kim	Havey	kim.havey@minneapolismn.gov	City of Minneapolis	350 South 5th Street, Suite 315M Minneapolis, MN 55415	Electronic Service	No	OFF_SL_19-666_Official
Todd	Headlee	theadlee@dvigridsolutions.com	Dominion Voltage, Inc.	701 E. Cary Street Richmond, VA 23219	Electronic Service	No	OFF_SL_19-666_Official
Amber	Hedlund	amber.r.hedlund@xcelenergy.com	Northern States Power Company dba Xcel Energy-Elec	414 Nicollet Mall, 401-7 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Adam	Heinen	aheinen@dakotaelectric.com	Dakota Electric Association	4300 220th St W Farmington, MN 55024	Electronic Service	No	OFF_SL_19-666_Official
Jared	Hendricks	jared.hendricks@owatonnautilities.com	Owatonna Municipal Public Utilities	PO Box 800 208 S Walnut Ave Owatonna, MN 55060-2940	Electronic Service	No	OFF_SL_19-666_Official
Annete	Henkel	mui@mnutilityinvestors.org	Minnesota Utility Investors	413 Wacouta Street #230 St.Paul, MN 55101	Electronic Service	No	OFF_SL_19-666_Official
Shane	Henriksen	shane.henriksen@enbridge.com	Enbridge Energy Company, Inc.	1409 Hammond Ave FL 2 Superior, WI 54880	Paper Service	No	OFF_SL_19-666_Official
Lynn	Hinkle	lynnh@ips-solar.com	IPS Solar	2670 Patton Rd Roseville, MN 55113	Electronic Service	No	OFF_SL_19-666_Official
Michael	Hoppe	lu23@ibew23.org	Local Union 23, I.B.E.W.	445 Etna Street Ste. 61 St. Paul, MN 55106	Electronic Service	No	OFF_SL_19-666_Official
Jan	Hubbard	jan.hubbard@comcast.net		7730 Mississippi Lane Brooklyn Park, MN 55444	Electronic Service	No	OFF_SL_19-666_Official
Geoffrey	Inge	ginge@regintllc.com	Regulatory Intelligence LLC	PO Box 270636 Superior, CO 80027-9998	Electronic Service	No	OFF_SL_19-666_Official
Ralph	Jacobson	ralphj@ips-solar.com		2126 Roblyn Avenue Saint Paul, Minnesota 55104	Electronic Service	No	OFF_SL_19-666_Official
Casey	Jacobson	cjacobson@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58501	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
John S.	Jaffray	jjaffray@jjrpower.com	JJR Power	350 Highway 7 Suite 236 Excelsior, MN 55331	Electronic Service	No	OFF_SL_19-666_Official
Alan	Jenkins	aj@jenkinsatlaw.com	Jenkins at Law	2950 Yellowtail Ave. Marathon, FL 33050	Electronic Service	No	OFF_SL_19-666_Official
Richard	Johnson	Rick.Johnson@lawmoss.com	Moss & Barnett	150 S. 5th Street Suite 1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
Sarah	Johnson Phillips	sarah.phillips@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
Nate	Jones	njones@hcpd.com	Heartland Consumers Power	PO Box 248 Madison, SD 57042	Electronic Service	No	OFF_SL_19-666_Official
Michael	Kampmeyer	mkampmeyer@a-e-group.com	AEG Group, LLC	260 Salem Church Road Sunfish Lake, Minnesota 55118	Electronic Service	No	OFF_SL_19-666_Official
Ted	Kjos	tkjos@mienergy.coop	MiEnergy Cooperative	31110 Cooperative Way PO Box 626 Rushford, MN 55971	Electronic Service	No	OFF_SL_19-666_Official
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600 Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_19-666_Official
Thomas	Koehler	TGK@IBEW160.org	Local Union #160, IBEW	2909 Anthony Ln St Anthony Village, MN 55418-3238	Electronic Service	No	OFF_SL_19-666_Official
Chris	Kopel	chrisk@CMPASgroup.org	Central Minnesota Municipal Power Agency	459 S Grove St Blue Earth, MN 56013-2629	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Brian	Krambeer	bkrambeer@mienergy.coop	MiEnergy Cooperative	PO Box 626 31110 Cooperative Way Rushford, MN 55971	Electronic Service	No	OFF_SL_19-666_Official
Michael	Krause	michaelkrause61@yahoo.com	Kandiyo Consulting, LLC	433 S 7th Street Suite 2025 Minneapolis, Minnesota 55415	Electronic Service	No	OFF_SL_19-666_Official
Matthew	Lacey	Mlacey@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_19-666_Official
Carmel	Laney	carmel.laney@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
James D.	Larson	james.larson@avantenergy.com	Avant Energy Services	220 S 6th St Ste 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
Peder	Larson	plarson@larkinhoffman.com	Larkin Hoffman Daly & Lindgren, Ltd.	8300 Norman Center Drive Suite 1000 Bloomington, MN 55437	Electronic Service	No	OFF_SL_19-666_Official
Dean	Leischow	dean@sunrisenrg.com	Sunrise Energy Ventures	315 Manitoba Ave Ste 200 Wayzata, MN 55391	Electronic Service	No	OFF_SL_19-666_Official
Annie	Levenson Falk	annielf@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota Street, Suite W1360 St. Paul, MN 55101	Electronic Service	No	OFF_SL_19-666_Official
Ryan	Long	ryan.j.long@xcelenergy.com	Xcel Energy	414 Nicollet Mall 401 8th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Susan	Ludwig	sludwig@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_19-666_Official
Kavita	Maini	kmaini@wi.rr.com	KM Energy Consulting, LLC	961 N Lost Woods Rd Oconomowoc, WI 53066	Electronic Service	No	OFF_SL_19-666_Official
Pam	Marshall	pam@energycents.org	Energy CENTS Coalition	823 7th St E St. Paul, MN 55106	Electronic Service	No	OFF_SL_19-666_Official
Mary	Martinka	mary.a.martinka@xcelenergy.com	Xcel Energy Inc	414 Nicollet Mall 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-666_Official
Samuel	Mason	smason@beltramielectric.com	Beltrami Electric Cooperative, Inc.	4111 Technology Dr. NW PO Box 488 Bemidji, MN 56619-0488	Electronic Service	No	OFF_SL_19-666_Official
Gregg	Mast	gmast@cleanenergyeconomymn.org	Clean Energy Economy Minnesota	4808 10th Avenue S Minneapolis, MN 55417	Electronic Service	No	OFF_SL_19-666_Official
Dave	McNary	David.McNary@hennepin.us	Hennepin County DES	701 Fourth Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_19-666_Official
Thomas	Melone	Thomas.Melone@AllcoUS.com	Minnesota Go Solar LLC	222 South 9th Street Suite 1600 Minneapolis, Minnesota 55120	Electronic Service	No	OFF_SL_19-666_Official
Brian	Meloy	brian.meloy@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
Joseph	Meyer	joseph.meyer@ag.state.mn.us	Office of the Attorney General-RUD	Bremer Tower, Suite 1400 445 Minnesota Street St Paul, MN 55101-2131	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Stacy	Miller	stacy.miller@minneapolismn.gov	City of Minneapolis	350 S. 5th Street Room M 301 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_19-666_Official
David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	No	OFF_SL_19-666_Official
Dalene	Monsebroten	dalene.monsebroten@nmpagency.com	Northern Municipal Power Agency	123 2nd St W Thief River Falls, MN 56701	Electronic Service	No	OFF_SL_19-666_Official
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
Ben	Nelson	benn@cmpasgroup.org	CMMPA	459 South Grove Street Blue Earth, MN 56013	Electronic Service	No	OFF_SL_19-666_Official
Carl	Nelson	cnelson@mncee.org	Center for Energy and Environment	212 3rd Ave N Ste 560 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-666_Official
Dale	Niezwaag	dniezwaag@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58503	Electronic Service	No	OFF_SL_19-666_Official
David	Niles	david.niles@avantenergy.com	Minnesota Municipal Power Agency	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_19-666_Official
Sephra	Ninow	sephra.ninow@energycenter.org	Center for Sustainable Energy	426 17th Street, Suite 700 Oakland, CA 94612	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Rolf	Nordstrom	rnordstrom@gpisd.net	Great Plains Institute	2801 21ST AVE S STE 220 Minneapolis, MN 55407-1229	Electronic Service	No	OFF_SL_19-666_Official
Samantha	Norris	samanthanorris@alliantenergy.com	Interstate Power and Light Company	200 1st Street SE PO Box 351 Cedar Rapids, IA 524060351	Electronic Service	No	OFF_SL_19-666_Official
David	O'Brien	david.obrien@navigant.com	Navigant Consulting	77 South Bedford St Ste 400 Burlington, MA 01803	Electronic Service	No	OFF_SL_19-666_Official
Jeff	O'Neill	jeff.oneill@ci.monticello.mn.us	City of Monticello	505 Walnut Street Suite 1 Monticelllo, Minnesota 55362	Electronic Service	No	OFF_SL_19-666_Official
Russell	Olson	rolson@hcpd.com	Heartland Consumers Power District	PO Box 248 Madison, SD 570420248	Electronic Service	No	OFF_SL_19-666_Official
Carol A.	Overland	overland@legalectric.org	Legalectric - Overland Law Office	1110 West Avenue Red Wing, MN 55066	Electronic Service	No	OFF_SL_19-666_Official
Dan	Patry	dpatry@sunedison.com	SunEdison	600 Clipper Drive Belmont, CA 94002	Electronic Service	No	OFF_SL_19-666_Official
Jeffrey C	Paulson	jeff.jcplaw@comcast.net	Paulson Law Office, Ltd.	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_19-666_Official
Mary Beth	Peranteau	mperanteau@wheelerlaw.com	Wheeler Van Sickle & Anderson SC	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jennifer	Peterson	jjpeterson@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_19-666_Official
Hannah	Polikov	hpolikov@aee.net	Advanced Energy Economy Institute	1000 Vermont Ave, Third Floor Washington, DC 20005	Electronic Service	No	OFF_SL_19-666_Official
David G.	Prazak	dprazak@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_19-666_Official
Mark	Rathbun	mrathbun@grenergy.com	Great River Energy	12300 Elm Creek Blvd Maple Grove, MN 55369	Electronic Service	No	OFF_SL_19-666_Official
Michael	Reinertson	michael.reinertson@avantenergy.com	Avant Energy	220 S. Sixth St. Ste 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_19-666_Official
John C.	Reinhardt	N/A	Laura A. Reinhardt	3552 26th Ave S Minneapolis, MN 55406	Paper Service	No	OFF_SL_19-666_Official
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_19-666_Official
Kevin	Reuther	kreuther@mncenter.org	MN Center for Environmental Advocacy	26 E Exchange St, Ste 206 St. Paul, MN 551011667	Electronic Service	No	OFF_SL_19-666_Official
Isabel	Ricker	ricker@fresh-energy.org	Fresh Energy	408 Saint Peter Street Suite 220 Saint Paul, MN 55102	Electronic Service	No	OFF_SL_19-666_Official
Amanda	Rome	amanda.rome@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 5 Minneapoli, MN 55401	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Robert K.	Sahr	bsahr@eastriver.coop	East River Electric Power Cooperative	P.O. Box 227 Madison, SD 57042	Electronic Service	No	OFF_SL_19-666_Official
Joseph L	Sathe	jsathe@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
Richard	Savelkoul	rsavelkoul@martinsquires.com	Martin & Squires, P.A.	332 Minnesota Street Ste W2750 St. Paul, MN 55101	Electronic Service	No	OFF_SL_19-666_Official
Thomas	Scharff	thomas.scharff@versoco.com	Verso Corp	600 High Street Wisconsin Rapids, WI 54495	Electronic Service	No	OFF_SL_19-666_Official
Christopher	Schoenherr	cp.schoenherr@smmpa.org	SMMPA	500 First Ave SW Rochester, MN 55902-3303	Electronic Service	No	OFF_SL_19-666_Official
Kay	Schraeder	kschraeder@minnkota.com	Minnkota Power	5301 32nd Ave S Grand Forks, ND 58201	Electronic Service	No	OFF_SL_19-666_Official
Dean	Sedgwick	Sedgwick@Itascapower.com	Itasca Power Company	PO Box 455 Spring Lake, MN 56680	Electronic Service	No	OFF_SL_19-666_Official
Maria	Seidler	maria.seidler@dom.com	Dominion Energy Technology	120 Tredegar Street Richmond, Virginia 23219	Electronic Service	No	OFF_SL_19-666_Official
Will	Seuffert	Will.Seuffert@state.mn.us	Public Utilities Commission	121 7th Pl E Ste 350 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Janet	Shaddix Elling	jshaddix@janetshaddix.com	Shaddix And Associates	7400 Lyndale Ave S Ste 190 Richfield, MN 55423	Electronic Service	Yes	OFF_SL_19-666_Official
Patricia F	Sharkey	psharkey@environmentallawcounsel.com	Midwest Cogeneration Association.	180 N LaSalle St Ste 3700 Chicago, IL 60601	Electronic Service	No	OFF_SL_19-666_Official
Bria	Shea	bria.e.shea@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, MN 55401	Electronic Service	No	OFF_SL_19-666_Official
Doug	Shoemaker	dougs@charter.net	Minnesota Renewable Energy	2928 5th Ave S Minneapolis, MN 55408	Electronic Service	No	OFF_SL_19-666_Official
Anne	Smart	anne.smart@chargepoint.com	ChargePoint, Inc.	254 E Hacienda Ave Campbell, CA 95008	Electronic Service	No	OFF_SL_19-666_Official
Trevor	Smith	trevor.smith@avantenergy.com	Avant Energy, Inc.	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_19-666_Official
Joshua	Smith	joshua.smith@sierraclub.org		85 Second St FL 2 San Francisco, California 94105	Electronic Service	No	OFF_SL_19-666_Official
Ken	Smith	ken.smith@ever-greenenergy.com	Ever Green Energy	305 Saint Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_19-666_Official
Ken	Smith	ken.smith@districtenergy.com	District Energy St. Paul Inc.	76 W Kellogg Blvd St. Paul, MN 55102	Electronic Service	No	OFF_SL_19-666_Official

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Beth H.	Soholt	bsoholt@windonthewires.org	Wind on the Wires	570 Asbury Street Suite 201 St. Paul, MN 55104	Electronic Service	No	OFF_SL_19-666_Official
Sky	Stanfield	stanfield@smwlaw.com	Shute, Mihaly & Weinberger	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_19-666_Official
Tom	Stanton	tstanton@nrri.org	NRRI	1080 Carmack Road Columbus, OH 43210	Electronic Service	No	OFF_SL_19-666_Official
Byron E.	Starns	byron.starns@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
James M	Strommen	jstrommen@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official
Eric	Swanson	eswanson@winthrop.com	Winthrop & Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_19-666_Official
Lynnette	Sweet	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	No	OFF_SL_19-666_Official
Peter	Teigland	pteigland@mnseia.org	Minnesota Solar Energy Industries Association	2288 University Ave W Saint Paul, MN 55114	Electronic Service	No	OFF_SL_19-666_Official
Stuart	Tommerdahl	stommerdahl@otpco.com	Otter Tail Power Company	215 S Cascade St PO Box 496 Fergus Falls, MN 56537	Electronic Service	No	OFF_SL_19-666_Official
Pat	Treseler	pat.jcplaw@comcast.net	Paulson Law Office LTD	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Lise	Trudeau	lise.trudeau@state.mn.us	Department of Commerce	85 7th Place East Suite 500 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_19-666_Official
Karen	Turnboom	karen.turnboom@versoco.com	Verso Corporation	100 Central Avenue Duluth, MN 55807	Electronic Service	No	OFF_SL_19-666_Official
Thomas	Tynes	jjazynka@energyfreedomcoalition.com	Energy Freedom Coalition of America	101 Constitution Ave NW Ste 525 East Washington, DC 20001	Electronic Service	No	OFF_SL_19-666_Official
Lisa	Veith	lisa.veith@ci.stpaul.mn.us	City of St. Paul	400 City Hall and Courthouse 15 West Kellogg Blvd. St. Paul, MN 55102	Electronic Service	No	OFF_SL_19-666_Official
Curt	Volkmann	curt@newenergy-advisors.com	Fresh Energy	408 St Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_19-666_Official
Roger	Warehime	roger.warehime@owatonnautilities.com	Owatonna Municipal Public Utilities	208 S Walnut Ave PO BOX 800 Owatonna, MN 55060	Electronic Service	No	OFF_SL_19-666_Official
Jenna	Warmuth	jwarmuth@mnpower.com	Minnesota Power	30 W Superior St Duluth, MN 55802-2093	Electronic Service	No	OFF_SL_19-666_Official
Samantha	Williams	swilliams@nrdc.org	Natural Resources Defense Council	20 N. Wacker Drive Ste 1600 Chicago, IL 60606	Electronic Service	No	OFF_SL_19-666_Official
Joseph	Windler	jwindler@winthrop.com	Winthrop & Weinstine	225 South Sixth Street, Suite 3500 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Robyn	Woeste	robynwoeste@alliantenergy.com	Interstate Power and Light Company	200 First St SE Cedar Rapids, IA 52401	Electronic Service	No	OFF_SL_19-666_Official
Yochi	Zakai	yzakai@smwlaw.com	SHUTE, MIHALY & WEINBERGER LLP	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_19-666_Official
Thomas J.	Zaremba	TZaremba@wheelerlaw.com	WHEELER, VAN SICKLE & ANDERSON	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_19-666_Official
Christopher	Zibart	czibart@atcllc.com	American Transmission Company LLC	W234 N2000 Ridgeview Pkwy Court Waukesha, WI 53188-1022	Electronic Service	No	OFF_SL_19-666_Official
Patrick	Zomer	Pat.Zomer@lawmoss.com	Moss & Barnett PA	150 S 5th St #1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_19-666_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Allen	michael.allen@allenergysolar.com	All Energy Solar	721 W 26th st Suite 211 Minneapolis, Minnesota 55405	Electronic Service	No	OFF_SL_20-680_Official
David	Amster Olzweski	david@mysunshare.com	SunShare, LLC	1151 Bannock St Denver, CO 80204-8020	Electronic Service	No	OFF_SL_20-680_Official
Ellen	Anderson	ellena@umn.edu	325 Learning and Environmental Sciences	1954 Buford Ave Saint Paul, MN 55108	Electronic Service	No	OFF_SL_20-680_Official
Alison C	Archer	aarcher@misoenergy.org	MISO	2985 Ames Crossing Rd Eagan, MN 55121	Electronic Service	No	OFF_SL_20-680_Official
Mara	Ascheman	mara.k.ascheman@xcelenergy.com	Xcel Energy	414 Nicollet Mall Fl 5 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-680_Official
Donna	Attanasio	dattanasio@law.gwu.edu	George Washington University	2000 H Street NW Washington, DC 20052	Electronic Service	No	OFF_SL_20-680_Official
John	Bailey	bailey@ilsr.org	Institute For Local Self-Reliance	1313 5th St SE Ste 303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_20-680_Official
Mark	Bakk	mbakk@lcp.coop	Lake Country Power	26039 Bear Ridge Drive Cohasset, MN 55721	Electronic Service	No	OFF_SL_20-680_Official
Gail	Baranko	gail.baranko@xcelenergy.com	Xcel Energy	414 Nicollet Mall7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-680_Official
Jessica L	Bayles	Jessica.Bayles@stoel.com	Stoel Rives LLP	1150 18th St NW Ste 325 Washington, DC 20036	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
James J.	Bertrand	james.bertrand@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Derek	Bertsch	derek.bertsch@mrenergy.com	Missouri River Energy Services	3724 West Avera Drive PO Box 88920 Sioux Falls, SD 57109-8920	Electronic Service	No	OFF_SL_20-680_Official
William	Black	bblack@mmua.org	MMUA	Suite 200 3131 Fernbrook Lane North Plymouth, MN 55447	Electronic Service	No	OFF_SL_20-680_Official
Kenneth	Bradley	kbradley1965@gmail.com		2837 Emerson Ave S Apt CW112 Minneapolis, MN 55408	Electronic Service	No	OFF_SL_20-680_Official
Elizabeth	Brama	ebrama@taftlaw.com	Taft Stettinius & Hollister LLP	2200 IDS Center 80 South 8th Street Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Jon	Brekke	jbrekke@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_20-680_Official
Sydney R.	Briggs	sbriggs@swce.coop	Steele-Waseca Cooperative Electric	2411 W. Bridge St PO Box 485 Owatonna, MN 55060-0485	Electronic Service	No	OFF_SL_20-680_Official
Mark B.	Bring	mbring@otpco.com	Otter Tail Power Company	215 South Cascade Street PO Box 496 Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_20-680_Official
Christina	Brusven	cbrusven@fredlaw.com	Fredrikson Byron	200 S 6th St Ste 4000 Minneapolis, MN 554021425	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jason	Burwen	jburwen@cleanpower.org	Energy Storage Association	1155 15th St NW, Ste 500 Washington, DC 20005	Electronic Service	No	OFF_SL_20-680_Official
LORI	CLOBES	lclobes@mienergy.coop	MiEnergy Cooperative	31110 COOPERATIVE WAY PO BOX 626 RUSHFORD, MN 55971	Electronic Service	No	OFF_SL_20-680_Official
Douglas M.	Carnival	dmc@mcgrannshea.com	McGrann Shea Carnival Straughn & Lamb	N/A	Electronic Service	No	OFF_SL_20-680_Official
Ray	Choquette	rchoquette@agp.com	Ag Processing Inc.	12700 West Dodge Road PO Box 2047 Omaha, NE 68103-2047	Electronic Service	No	OFF_SL_20-680_Official
John	Coffman	john@johncoffman.net	AARP	871 Tuxedo Blvd. St, Louis, MO 63119-2044	Electronic Service	No	OFF_SL_20-680_Official
Kenneth A.	Colburn	kcolburn@symbioticstrategies.com	Symbiotic Strategies, LLC	26 Winton Road Meredith, NH 32535413	Electronic Service	No	OFF_SL_20-680_Official
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_20-680_Official
Riley	Conlin	riley.conlin@stoel.com	Stoel Rives LLP	33 S. 6th Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Brooke	Cooper	bcooper@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022191	Electronic Service	No	OFF_SL_20-680_Official
George	Crocker	gwillc@nawo.org	North American Water Office	PO Box 174 Lake Elmo, MN 55042	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
David	Dahlberg	davedahlberg@nweco.com	Northwestern Wisconsin Electric Company	P.O. Box 9 104 South Pine Street Grantsburg, WI 548400009	Electronic Service	No	OFF_SL_20-680_Official
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, 401-8 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-680_Official
Curt	Dieren	curt.dieren@dgr.com	L&O Power Cooperative	1302 S Union St Rock Rapids, IA 51246	Electronic Service	No	OFF_SL_20-680_Official
Carlon	Doyle Fontaine	carlon.doyle.fontaine@senate.mn	MN Senate	75 Rev Dr Martin Luther King Jr Blvd Room G-17 St Paul, MN 55155	Electronic Service	No	OFF_SL_20-680_Official
Brian	Draxten	bhdraxten@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380498	Electronic Service	No	OFF_SL_20-680_Official
Brian	Edstrom	briane@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota St Ste W1360 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_20-680_Official
Kristen	Eide Tollefson	healingsystems69@gmail.com	R-CURE	28477 N Lake Ave Frontenac, MN 55026-1044	Electronic Service	No	OFF_SL_20-680_Official
Rebecca	Eilers	rebecca.d.eilers@xcelenergy.com	Xcel Energy	414 Nicollet Mall - 401 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-680_Official
Bob	Eleff	bob.eleff@house.mn	Regulated Industries Cmte	100 Rev Dr Martin Luther King Jr Blvd Room 600 St. Paul, MN 55155	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Betsy	Engelking	betsy@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_20-680_Official
Oncu	Er	oncu.er@avantenergy.com	Avant Energy, Agent for MMPA	220 S. Sixth St. Ste. 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
James C.	Erickson	jericksonkbc@gmail.com	Kelly Bay Consulting	17 Quechee St Superior, WI 54880-4421	Electronic Service	No	OFF_SL_20-680_Official
John	Farrell	jfarrell@ilsr.org	Institute for Local Self-Reliance	2720 E. 22nd St Institute for Local Self-Reliance Minneapolis, MN 55406	Electronic Service	No	OFF_SL_20-680_Official
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_20-680_Official
Lucas	Franco	lfranco@liunagroc.com	LIUNA	81 Little Canada Rd E Little Canada, MN 55117	Electronic Service	No	OFF_SL_20-680_Official
Nathan	Franzen	nathan@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_20-680_Official
Hal	Galvin	halgalvin@comcast.net	Provectus Energy Development llc	1936 Kenwood Parkway Minneapolis, MN 55405	Electronic Service	No	OFF_SL_20-680_Official
Edward	Garvey	garveyed@aol.com	Residence	32 Lawton St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Edward	Garvey	edward.garvey@AESLconsulting.com	AESL Consulting	32 Lawton St Saint Paul, MN 55102-2617	Electronic Service	No	OFF_SL_20-680_Official
Bruce	Gerhardson	bgerhardson@otpco.com	Otter Tail Power Company	PO Box 496 215 S Cascade St Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_20-680_Official
Allen	Gleckner	gleckner@fresh-energy.org	Fresh Energy	408 St. Peter Street Ste 350 Saint Paul, Minnesota 55102	Electronic Service	No	OFF_SL_20-680_Official
Jenny	Glumack	jenny@mrea.org	Minnesota Rural Electric Association	11640 73rd Ave N Maple Grove, MN 55369	Electronic Service	No	OFF_SL_20-680_Official
Timothy	Gulden	timothy.gulden@yahoo.com	Winona Renewable Energy, LLC	1449 Ridgewood Dr Winona, MN 55987	Electronic Service	No	OFF_SL_20-680_Official
Tony	Hainault	anthony.hainault@co.hennepin.mn.us	Hennepin County DES	701 4th Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_20-680_Official
Kim	Havey	kim.havey@minneapolismn.gov	City of Minneapolis	350 South 5th Street, Suite 315M Minneapolis, MN 55415	Electronic Service	No	OFF_SL_20-680_Official
Todd	Headlee	theadlee@dvigridsolutions.com	Dominion Voltage, Inc.	701 E. Cary Street Richmond, VA 23219	Electronic Service	No	OFF_SL_20-680_Official
Amber	Hedlund	amber.r.hedlund@xcelenergy.com	Northern States Power Company dba Xcel Energy-Elec	414 Nicollet Mall, 401-7 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-680_Official
Adam	Heinen	aheinen@dakotaelectric.com	Dakota Electric Association	4300 220th St W Farmington, MN 55024	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jared	Hendricks	jared.hendricks@owatonnautilities.com	Owatonna Municipal Public Utilities	PO Box 800 208 S Walnut Ave Owatonna, MN 55060-2940	Electronic Service	No	OFF_SL_20-680_Official
Annete	Henkel	mui@mnutilityinvestors.org	Minnesota Utility Investors	413 Wacouta Street #230 St.Paul, MN 55101	Electronic Service	No	OFF_SL_20-680_Official
Shane	Henriksen	shane.henriksen@enbridge.com	Enbridge Energy Company, Inc.	1409 Hammond Ave FL 2 Superior, WI 54880	Paper Service	No	OFF_SL_20-680_Official
Lynn	Hinkle	lynnh@ips-solar.com	IPS Solar	2670 Patton Rd Roseville, MN 55113	Electronic Service	No	OFF_SL_20-680_Official
Michael	Hoppe	lu23@ibew23.org	Local Union 23, I.B.E.W.	445 Etna Street Ste. 61 St. Paul, MN 55106	Electronic Service	No	OFF_SL_20-680_Official
Jan	Hubbard	jan.hubbard@comcast.net		7730 Mississippi Lane Brooklyn Park, MN 55444	Electronic Service	No	OFF_SL_20-680_Official
Geoffrey	Inge	ginge@regintllc.com	Regulatory Intelligence LLC	PO Box 270636 Superior, CO 80027-9998	Electronic Service	No	OFF_SL_20-680_Official
Ralph	Jacobson	ralphj@ips-solar.com		2126 Roblyn Avenue Saint Paul, Minnesota 55104	Electronic Service	No	OFF_SL_20-680_Official
Casey	Jacobson	cjacobson@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58501	Electronic Service	No	OFF_SL_20-680_Official
John S.	Jaffray	jjaffray@jjrpower.com	JJR Power	350 Highway 7 Suite 236 Excelsior, MN 55331	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Alan	Jenkins	aj@jenkinsatlaw.com	Jenkins at Law	2950 Yellowtail Ave. Marathon, FL 33050	Electronic Service	No	OFF_SL_20-680_Official
Richard	Johnson	Rick.Johnson@lawmoss.com	Moss & Barnett	150 S. 5th Street Suite 1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Sarah	Johnson Phillips	sarah.phillips@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Nate	Jones	njones@hcpd.com	Heartland Consumers Power	PO Box 248 Madison, SD 57042	Electronic Service	No	OFF_SL_20-680_Official
Michael	Kampmeyer	mkampmeyer@a-e-group.com	AEG Group, LLC	260 Salem Church Road Sunfish Lake, Minnesota 55118	Electronic Service	No	OFF_SL_20-680_Official
Ted	Kjos	tkjos@mienergy.coop	MiEnergy Cooperative	31110 Cooperative Way PO Box 626 Rushford, MN 55971	Electronic Service	No	OFF_SL_20-680_Official
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600 Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_20-680_Official
Thomas	Koehler	TGK@IBEW160.org	Local Union #160, IBEW	2909 Anthony Ln St Anthony Village, MN 55418-3238	Electronic Service	No	OFF_SL_20-680_Official
Chris	Kopel	chrisk@CMPASgroup.org	Central Minnesota Municipal Power Agency	459 S Grove St Blue Earth, MN 56013-2629	Electronic Service	No	OFF_SL_20-680_Official
Brian	Krambeer	bkrambeer@mienergy.coop	MiEnergy Cooperative	PO Box 626 31110 Cooperative Way Rushford, MN 55971	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Krause	michaelkrause61@yahoo.com	Kandiyo Consulting, LLC	433 S 7th Street Suite 2025 Minneapolis, Minnesota 55415	Electronic Service	No	OFF_SL_20-680_Official
Michael	Krikava	mkrikava@taftlaw.com	Taft Stettinius & Hollister LLP	2200 IDS Center 80 S 8th St Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Matthew	Lacey	Mlacey@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_20-680_Official
Carmel	Laney	carmel.laney@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Peder	Larson	plarson@larkinhoffman.com	Larkin Hoffman Daly & Lindgren, Ltd.	8300 Norman Center Drive Suite 1000 Bloomington, MN 55437	Electronic Service	No	OFF_SL_20-680_Official
James D.	Larson	james.larson@avantenergy.com	Avant Energy Services	220 S 6th St Ste 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Dean	Leischow	dean@sunrisenrg.com	Sunrise Energy Ventures	315 Manitoba Ave Ste 200 Wayzata, MN 55391	Electronic Service	No	OFF_SL_20-680_Official
Annie	Levenson Falk	annielf@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota Street, Suite W1360 St. Paul, MN 55101	Electronic Service	No	OFF_SL_20-680_Official
Ryan	Long	ryan.j.long@xcelenergy.com	Xcel Energy	414 Nicollet Mall 401 8th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Susan	Ludwig	sludwig@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_20-680_Official
Kavita	Maini	kmaini@wi.rr.com	KM Energy Consulting, LLC	961 N Lost Woods Rd Oconomowoc, WI 53066	Electronic Service	No	OFF_SL_20-680_Official
Pam	Marshall	pam@energycents.org	Energy CENTS Coalition	823 7th St E St. Paul, MN 55106	Electronic Service	No	OFF_SL_20-680_Official
Mary	Martinka	mary.a.martinka@xcelenergy.com	Xcel Energy Inc	414 Nicollet Mall 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-680_Official
Samuel	Mason	smason@beltramielectric.com	Beltrami Electric Cooperative, Inc.	4111 Technology Dr. NW PO Box 488 Bemidji, MN 56619-0488	Electronic Service	No	OFF_SL_20-680_Official
Gregg	Mast	gmast@cleanenergyeconomymn.org	Clean Energy Economy Minnesota	4808 10th Avenue S Minneapolis, MN 55417	Electronic Service	No	OFF_SL_20-680_Official
Dave	McNary	David.McNary@hennepin.us	Hennepin County DES	701 Fourth Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_20-680_Official
Thomas	Melone	Thomas.Melone@AllcoUS.com	Minnesota Go Solar LLC	222 South 9th Street Suite 1600 Minneapolis, Minnesota 55120	Electronic Service	No	OFF_SL_20-680_Official
Brian	Meloy	brian.meloy@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Joseph	Meyer	joseph.meyer@ag.state.mn.us	Office of the Attorney General-RUD	Bremer Tower, Suite 1400 445 Minnesota Street St Paul, MN 55101-2131	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Stacy	Miller	stacy.miller@minneapolismn.gov	City of Minneapolis	350 S. 5th Street Room M 301 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_20-680_Official
David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	No	OFF_SL_20-680_Official
Dalene	Monsebroten	dalene.monsebroten@nmpagency.com	Northern Municipal Power Agency	123 2nd St W Thief River Falls, MN 56701	Electronic Service	No	OFF_SL_20-680_Official
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Ben	Nelson	benn@cmpasgroup.org	CMMPA	459 South Grove Street Blue Earth, MN 56013	Electronic Service	No	OFF_SL_20-680_Official
Carl	Nelson	cnelson@mncee.org	Center for Energy and Environment	212 3rd Ave N Ste 560 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-680_Official
Dale	Niezwaag	dniezwaag@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58503	Electronic Service	No	OFF_SL_20-680_Official
David	Niles	david.niles@avantenergy.com	Minnesota Municipal Power Agency	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_20-680_Official
Sephra	Ninow	sephra.ninow@energycenter.org	Center for Sustainable Energy	426 17th Street, Suite 700 Oakland, CA 94612	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Rolf	Nordstrom	rnordstrom@gpisd.net	Great Plains Institute	2801 21ST AVE S STE 220 Minneapolis, MN 55407-1229	Electronic Service	No	OFF_SL_20-680_Official
Samantha	Norris	samanthanorris@alliantenergy.com	Interstate Power and Light Company	200 1st Street SE PO Box 351 Cedar Rapids, IA 524060351	Electronic Service	No	OFF_SL_20-680_Official
David	O'Brien	david.obrien@navigant.com	Navigant Consulting	77 South Bedford St Ste 400 Burlington, MA 01803	Electronic Service	No	OFF_SL_20-680_Official
Jeff	O'Neill	jeff.oneill@ci.monticello.mn.us	City of Monticello	505 Walnut Street Suite 1 Monticelllo, Minnesota 55362	Electronic Service	No	OFF_SL_20-680_Official
Russell	Olson	rolson@hcpd.com	Heartland Consumers Power District	PO Box 248 Madison, SD 570420248	Electronic Service	No	OFF_SL_20-680_Official
Carol A.	Overland	overland@legalectric.org	Legalectric - Overland Law Office	1110 West Avenue Red Wing, MN 55066	Electronic Service	No	OFF_SL_20-680_Official
Dan	Patry	dpatry@sunedison.com	SunEdison	600 Clipper Drive Belmont, CA 94002	Electronic Service	No	OFF_SL_20-680_Official
Jeffrey C	Paulson	jeff.jcplaw@comcast.net	Paulson Law Office, Ltd.	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_20-680_Official
Mary Beth	Peranteau	mperanteau@wheelerlaw.com	Wheeler Van Sickle & Anderson SC	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jennifer	Peterson	jjpeterson@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_20-680_Official
Hannah	Polikov	hpolikov@aee.net	Advanced Energy Economy Institute	1000 Vermont Ave, Third Floor Washington, DC 20005	Electronic Service	No	OFF_SL_20-680_Official
David G.	Prazak	dprazak@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_20-680_Official
Mark	Rathbun	mrathbun@grenergy.com	Great River Energy	12300 Elm Creek Blvd Maple Grove, MN 55369	Electronic Service	No	OFF_SL_20-680_Official
Michael	Reinertson	michael.reinertson@avantenergy.com	Avant Energy	220 S. Sixth St. Ste 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_20-680_Official
John C.	Reinhardt	N/A	Laura A. Reinhardt	3552 26th Ave S Minneapolis, MN 55406	Paper Service	No	OFF_SL_20-680_Official
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_20-680_Official
Kevin	Reuther	kreuther@mncenter.org	MN Center for Environmental Advocacy	26 E Exchange St, Ste 206 St. Paul, MN 551011667	Electronic Service	No	OFF_SL_20-680_Official
Isabel	Ricker	ricker@fresh-energy.org	Fresh Energy	408 Saint Peter Street Suite 220 Saint Paul, MN 55102	Electronic Service	No	OFF_SL_20-680_Official
Amanda	Rome	amanda.rome@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 5 Minneapoli, MN 55401	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Robert K.	Sahr	bsahr@eastriver.coop	East River Electric Power Cooperative	P.O. Box 227 Madison, SD 57042	Electronic Service	No	OFF_SL_20-680_Official
Richard	Savelkoul	rsavelkoul@martinsquires.com	Martin & Squires, P.A.	332 Minnesota Street Ste W2750 St. Paul, MN 55101	Electronic Service	No	OFF_SL_20-680_Official
Thomas	Scharff	thomas.scharff@versoco.com	Verso Corp	600 High Street Wisconsin Rapids, WI 54495	Electronic Service	No	OFF_SL_20-680_Official
Christopher	Schoenherr	cp.schoenherr@smmpa.org	SMMPA	500 First Ave SW Rochester, MN 55902-3303	Electronic Service	No	OFF_SL_20-680_Official
Kay	Schraeder	kschraeder@minnkota.com	Minnkota Power	5301 32nd Ave S Grand Forks, ND 58201	Electronic Service	No	OFF_SL_20-680_Official
Dean	Sedgwick	Sedgwick@Itascapower.com	Itasca Power Company	PO Box 455 Spring Lake, MN 56680	Electronic Service	No	OFF_SL_20-680_Official
Maria	Seidler	maria.seidler@dom.com	Dominion Energy Technology	120 Tredegar Street Richmond, Virginia 23219	Electronic Service	No	OFF_SL_20-680_Official
Will	Seuffert	Will.Seuffert@state.mn.us	Public Utilities Commission	121 7th Pl E Ste 350 Saint Paul, MN 55101	Electronic Service	Yes	OFF_SL_20-680_Official
Janet	Shaddix Elling	jshaddix@janetshaddix.com	Shaddix And Associates	7400 Lyndale Ave S Ste 190 Richfield, MN 55423	Electronic Service	Yes	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Patricia F	Sharkey	psharkey@environmentallawcounsel.com	Midwest Cogeneration Association.	180 N LaSalle St Ste 3700 Chicago, IL 60601	Electronic Service	No	OFF_SL_20-680_Official
Bria	Shea	bria.e.shea@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, MN 55401	Electronic Service	No	OFF_SL_20-680_Official
Doug	Shoemaker	dougs@charter.net	Minnesota Renewable Energy	2928 5th Ave S Minneapolis, MN 55408	Electronic Service	No	OFF_SL_20-680_Official
Anne	Smart	anne.smart@chargepoint.com	ChargePoint, Inc.	254 E Hacienda Ave Campbell, CA 95008	Electronic Service	No	OFF_SL_20-680_Official
Joshua	Smith	joshua.smith@sierraclub.org		85 Second St FL 2 San Francisco, California 94105	Electronic Service	No	OFF_SL_20-680_Official
Ken	Smith	ken.smith@districtenergy.com	District Energy St. Paul Inc.	76 W Kellogg Blvd St. Paul, MN 55102	Electronic Service	No	OFF_SL_20-680_Official
Ken	Smith	ken.smith@ever-greenenergy.com	Ever Green Energy	305 Saint Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_20-680_Official
Trevor	Smith	trevor.smith@avantenergy.com	Avant Energy, Inc.	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_20-680_Official
Beth H.	Soholt	bsoholt@windonthewires.org	Wind on the Wires	570 Asbury Street Suite 201 St. Paul, MN 55104	Electronic Service	No	OFF_SL_20-680_Official
Sky	Stanfield	stanfield@smwlaw.com	Shute, Mihaly & Weinberger	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Tom	Stanton	tstanton@nrri.org	NRRI	1080 Carmack Road Columbus, OH 43210	Electronic Service	No	OFF_SL_20-680_Official
Byron E.	Starns	byron.starns@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
James M	Strommen	jstrommen@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Eric	Swanson	eswanson@winthrop.com	Winthrop & Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_20-680_Official
Lynnette	Sweet	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	Yes	OFF_SL_20-680_Official
Peter	Teigland	pteigland@mnseia.org	Minnesota Solar Energy Industries Association	2288 University Ave W Saint Paul, MN 55114	Electronic Service	No	OFF_SL_20-680_Official
Stuart	Tommerdahl	stommerdahl@otpco.com	Otter Tail Power Company	215 S Cascade St PO Box 496 Fergus Falls, MN 56537	Electronic Service	No	OFF_SL_20-680_Official
Pat	Treseler	pat.jcplaw@comcast.net	Paulson Law Office LTD	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_20-680_Official
Lise	Trudeau	lise.trudeau@state.mn.us	Department of Commerce	85 7th Place East Suite 500 Saint Paul, MN 55101	Electronic Service	No	OFF_SL_20-680_Official
Karen	Turnboom	karen.turnboom@versoco.com	Verso Corporation	100 Central Avenue Duluth, MN 55807	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Thomas	Tynes	jjazynka@energyfreedomcoalition.com	Energy Freedom Coalition of America	101 Constitution Ave NW Ste 525 East Washington, DC 20001	Electronic Service	No	OFF_SL_20-680_Official
Lisa	Veith	lisa.veith@ci.stpaul.mn.us	City of St. Paul	400 City Hall and Courthouse 15 West Kellogg Blvd. St. Paul, MN 55102	Electronic Service	No	OFF_SL_20-680_Official
Curt	Volkmann	curt@newenergy-advisors.com	Fresh Energy	408 St Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_20-680_Official
Roger	Warehime	roger.warehime@owatonnautilities.com	Owatonna Municipal Public Utilities	208 S Walnut Ave PO BOX 800 Owatonna, MN 55060	Electronic Service	No	OFF_SL_20-680_Official
Jenna	Warmuth	jwarmuth@mnpower.com	Minnesota Power	30 W Superior St Duluth, MN 55802-2093	Electronic Service	No	OFF_SL_20-680_Official
Samantha	Williams	swilliams@nrdc.org	Natural Resources Defense Council	20 N. Wacker Drive Ste 1600 Chicago, IL 60606	Electronic Service	No	OFF_SL_20-680_Official
Joseph	Windler	jwindler@winthrop.com	Winthrop & Weinstine	225 South Sixth Street, Suite 3500 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official
Robyn	Woeste	robynwoeste@alliantenergy.com	Interstate Power and Light Company	200 First St SE Cedar Rapids, IA 52401	Electronic Service	No	OFF_SL_20-680_Official
Yochi	Zakai	yzakai@smwlaw.com	SHUTE, MIHALY & WEINBERGER LLP	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Thomas J.	Zaremba	TZaremba@wheelerlaw.com	WHEELER, VAN SICKLE & ANDERSON	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_20-680_Official
Christopher	Zibart	czibart@atcllc.com	American Transmission Company LLC	W234 N2000 Ridgeview Pkwy Court Waukesha, WI 53188-1022	Electronic Service	No	OFF_SL_20-680_Official
Patrick	Zomer	Pat.Zomer@lawmoss.com	Moss & Barnett PA	150 S 5th St #1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_20-680_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Allen	michael.allen@allenergysolar.com	All Energy Solar	721 W 26th st Suite 211 Minneapolis, Minnesota 55405	Electronic Service	No	OFF_SL_21-694_M-21-694
David	Amster Olzweski	david@mysunshare.com	SunShare, LLC	1151 Bannock St Denver, CO 80204-8020	Electronic Service	No	OFF_SL_21-694_M-21-694
Ellen	Anderson	ellena@umn.edu	325 Learning and Environmental Sciences	1954 Buford Ave Saint Paul, MN 55108	Electronic Service	No	OFF_SL_21-694_M-21-694
Alison C	Archer	aarcher@misoenergy.org	MISO	2985 Ames Crossing Rd Eagan, MN 55121	Electronic Service	No	OFF_SL_21-694_M-21-694
Mara	Ascheman	mara.k.ascheman@xcelenergy.com	Xcel Energy	414 Nicollet Mall Fl 5 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694
Donna	Attanasio	dattanasio@law.gwu.edu	George Washington University	2000 H Street NW Washington, DC 20052	Electronic Service	No	OFF_SL_21-694_M-21-694
John	Bailey	bailey@ilsr.org	Institute For Local Self-Reliance	1313 5th St SE Ste 303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_21-694_M-21-694
Mark	Bakk	mbakk@lcp.coop	Lake Country Power	26039 Bear Ridge Drive Cohasset, MN 55721	Electronic Service	No	OFF_SL_21-694_M-21-694
Gail	Baranko	gail.baranko@xcelenergy.com	Xcel Energy	414 Nicollet Mall7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694
Jessica L	Bayles	Jessica.Bayles@stoel.com	Stoel Rives LLP	1150 18th St NW Ste 325 Washington, DC 20036	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
James J.	Bertrand	james.bertrand@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Derek	Bertsch	derek.bertsch@mrenergy.com	Missouri River Energy Services	3724 West Avera Drive PO Box 88920 Sioux Falls, SD 57109-8920	Electronic Service	No	OFF_SL_21-694_M-21-694
William	Black	bblack@mmua.org	MMUA	Suite 200 3131 Fernbrook Lane North Plymouth, MN 55447	Electronic Service	No	OFF_SL_21-694_M-21-694
Zoe	Bourgerie	zoe.bourgerie@minneapolismn.gov	Minneapolis City of Lakes	350 S 5th St Rm 307 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_21-694_M-21-694
Kenneth	Bradley	kbradley1965@gmail.com		2837 Emerson Ave S Apt CW112 Minneapolis, MN 55408	Electronic Service	No	OFF_SL_21-694_M-21-694
Elizabeth	Brama	ebrama@taftlaw.com	Taft Stettinius & Hollister LLP	2200 IDS Center 80 South 8th Street Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Jon	Brekke	jbrekke@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_21-694_M-21-694
Sydney R.	Briggs	sbriggs@swce.coop	Steele-Waseca Cooperative Electric	2411 W. Bridge St PO Box 485 Owatonna, MN 55060-0485	Electronic Service	No	OFF_SL_21-694_M-21-694
Mark B.	Bring	mbring@otpco.com	Otter Tail Power Company	215 South Cascade Street PO Box 496 Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Janet	Brown	jab5100@gmail.com	Sabathani Community Center (Sabathani/SCC)	310 E 38th St Ste 200 Minneapolis, MN 55409	Electronic Service	No	OFF_SL_21-694_M-21-694
Christina	Brusven	cbrusven@fredlaw.com	Fredrikson Byron	200 S 6th St Ste 4000 Minneapolis, MN 554021425	Electronic Service	No	OFF_SL_21-694_M-21-694
Jason	Burwen	jburwen@cleanpower.org	Energy Storage Association	1155 15th St NW, Ste 500 Washington, DC 20005	Electronic Service	No	OFF_SL_21-694_M-21-694
LORI	CLOBES	lclobes@mienergy.coop	MiEnergy Cooperative	31110 COOPERATIVE WAY PO BOX 626 RUSHFORD, MN 55971	Electronic Service	No	OFF_SL_21-694_M-21-694
James	Canaday	james.canaday@ag.state.mn.us	Office of the Attorney General-RUD	Suite 1400 445 Minnesota St. St. Paul, MN 55101	Electronic Service	No	OFF_SL_21-694_M-21-694
Douglas M.	Carnival	dmc@mcgrannshea.com	McGrann Shea Carnival Straughn & Lamb	N/A	Electronic Service	No	OFF_SL_21-694_M-21-694
Ray	Choquette	rchoquette@agp.com	Ag Processing Inc.	12700 West Dodge Road PO Box 2047 Omaha, NE 68103-2047	Electronic Service	No	OFF_SL_21-694_M-21-694
John	Coffman	john@johncoffman.net	AARP	871 Tuxedo Blvd. St, Louis, MO 63119-2044	Electronic Service	No	OFF_SL_21-694_M-21-694
Kenneth A.	Colburn	kcolburn@symbioticstrategies.com	Symbiotic Strategies, LLC	26 Winton Road Meredith, NH 32535413	Electronic Service	No	OFF_SL_21-694_M-21-694
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Riley	Conlin	riley.conlin@stoel.com	Stoel Rives LLP	33 S. 6th Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Brooke	Cooper	bcooper@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022191	Electronic Service	No	OFF_SL_21-694_M-21-694
George	Crocker	gwillc@nawo.org	North American Water Office	PO Box 174 Lake Elmo, MN 55042	Electronic Service	No	OFF_SL_21-694_M-21-694
David	Dahlberg	davedahlberg@nweco.com	Northwestern Wisconsin Electric Company	P.O. Box 9 104 South Pine Street Grantsburg, WI 548400009	Electronic Service	No	OFF_SL_21-694_M-21-694
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, 401-8 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694
Curt	Dieren	curt.dieren@dgr.com	L&O Power Cooperative	1302 S Union St Rock Rapids, IA 51246	Electronic Service	No	OFF_SL_21-694_M-21-694
Carlon	Doyle Fontaine	carlon.doyle.fontaine@senate.mn	MN Senate	75 Rev Dr Martin Luther King Jr Blvd Room G-17 St Paul, MN 55155	Electronic Service	No	OFF_SL_21-694_M-21-694
Brian	Draxten	bhdraxten@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380498	Electronic Service	No	OFF_SL_21-694_M-21-694
Kristen	Eide Tollefson	healingsystems69@gmail.com	R-CURE	28477 N Lake Ave Frontenac, MN 55026-1044	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Rebecca	Eilers	rebecca.d.eilers@xcelenergy.com	Xcel Energy	414 Nicollet Mall - 401 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694
Bob	Eleff	bob.eleff@house.mn	Regulated Industries Cmte	100 Rev Dr Martin Luther King Jr Blvd Room 600 St. Paul, MN 55155	Electronic Service	No	OFF_SL_21-694_M-21-694
Betsy	Engelking	betsy@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_21-694_M-21-694
Oncu	Er	oncu.er@avantenergy.com	Avant Energy, Agent for MMPA	220 S. Sixth St. Ste. 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
James C.	Erickson	jericksonkbc@gmail.com	Kelly Bay Consulting	17 Quechee St Superior, WI 54880-4421	Electronic Service	No	OFF_SL_21-694_M-21-694
John	Farrell	jfarrell@ilsr.org	Institute for Local Self-Reliance	2720 E. 22nd St Institute for Local Self-Reliance Minneapolis, MN 55406	Electronic Service	No	OFF_SL_21-694_M-21-694
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_21-694_M-21-694
Nathan	Franzen	nathan@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_21-694_M-21-694
Hal	Galvin	halgalvin@comcast.net	Provectus Energy Development llc	1936 Kenwood Parkway Minneapolis, MN 55405	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Edward	Garvey	garveyed@aol.com	Residence	32 Lawton St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-694_M-21-694
Edward	Garvey	edward.garvey@AESLconsulting.com	AESL Consulting	32 Lawton St Saint Paul, MN 55102-2617	Electronic Service	No	OFF_SL_21-694_M-21-694
Bruce	Gerhardson	bgerhardson@otpco.com	Otter Tail Power Company	PO Box 496 215 S Cascade St Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_21-694_M-21-694
Allen	Gleckner	gleckner@fresh-energy.org	Fresh Energy	408 St. Peter Street Ste 350 Saint Paul, Minnesota 55102	Electronic Service	No	OFF_SL_21-694_M-21-694
Jenny	Glumack	jenny@mrea.org	Minnesota Rural Electric Association	11640 73rd Ave N Maple Grove, MN 55369	Electronic Service	No	OFF_SL_21-694_M-21-694
Timothy	Gulden	timothy.gulden@yahoo.com	Winona Renewable Energy, LLC	1449 Ridgewood Dr Winona, MN 55987	Electronic Service	No	OFF_SL_21-694_M-21-694
Tony	Hainault	anthony.hainault@co.hennepin.mn.us	Hennepin County DES	701 4th Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_21-694_M-21-694
Kim	Havey	kim.havey@minneapolismn.gov	City of Minneapolis	350 South 5th Street, Suite 315M Minneapolis, MN 55415	Electronic Service	No	OFF_SL_21-694_M-21-694
Todd	Headlee	theadlee@dvigridsolutions.com	Dominion Voltage, Inc.	701 E. Cary Street Richmond, VA 23219	Electronic Service	No	OFF_SL_21-694_M-21-694
Amber	Hedlund	amber.r.hedlund@xcelenergy.com	Northern States Power Company dba Xcel Energy-Elec	414 Nicollet Mall, 401-7 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Adam	Heinen	aheinen@dakotaelectric.com	Dakota Electric Association	4300 220th St W Farmington, MN 55024	Electronic Service	No	OFF_SL_21-694_M-21-694
Jared	Hendricks	jared.hendricks@owatonnautilities.com	Owatonna Municipal Public Utilities	PO Box 800 208 S Walnut Ave Owatonna, MN 55060-2940	Electronic Service	No	OFF_SL_21-694_M-21-694
Annete	Henkel	mui@mnutilityinvestors.org	Minnesota Utility Investors	413 Wacouta Street #230 St.Paul, MN 55101	Electronic Service	No	OFF_SL_21-694_M-21-694
Shane	Henriksen	shane.henriksen@enbridge.com	Enbridge Energy Company, Inc.	1409 Hammond Ave FL 2 Superior, WI 54880	Paper Service	No	OFF_SL_21-694_M-21-694
Sandra	Henry	Sandra.Henry@elevatenp.org	Elevate	322 S Green St Ste 300 Chicago, IL 60607	Electronic Service	No	OFF_SL_21-694_M-21-694
Lynn	Hinkle	lynnh@ips-solar.com	IPS Solar	2670 Patton Rd Roseville, MN 55113	Electronic Service	No	OFF_SL_21-694_M-21-694
Michael	Hoppe	lu23@ibew23.org	Local Union 23, I.B.E.W.	445 Etna Street Ste. 61 St. Paul, MN 55106	Electronic Service	No	OFF_SL_21-694_M-21-694
Jan	Hubbard	jan.hubbard@comcast.net		7730 Mississippi Lane Brooklyn Park, MN 55444	Electronic Service	No	OFF_SL_21-694_M-21-694
Geoffrey	Inge	ginge@regintllc.com	Regulatory Intelligence LLC	PO Box 270636 Superior, CO 80027-9998	Electronic Service	No	OFF_SL_21-694_M-21-694
Casey	Jacobson	cjacobson@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58501	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Ralph	Jacobson	ralphj@ips-solar.com		2126 Roblyn Avenue Saint Paul, Minnesota 55104	Electronic Service	No	OFF_SL_21-694_M-21-694
John S.	Jaffray	jjaffray@jjrpower.com	JJR Power	350 Highway 7 Suite 236 Excelsior, MN 55331	Electronic Service	No	OFF_SL_21-694_M-21-694
Andrea	Jenkins	Andrea.Jenkins@minneapolismn.gov	Minneapolis City of Lakes	350 S 5th St Room 307 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_21-694_M-21-694
Alan	Jenkins	aj@jenkinsatlaw.com	Jenkins at Law	2950 Yellowtail Ave. Marathon, FL 33050	Electronic Service	No	OFF_SL_21-694_M-21-694
Richard	Johnson	Rick.Johnson@lawmoss.com	Moss & Barnett	150 S. 5th Street Suite 1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Sarah	Johnson Phillips	sarah.phillips@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Nate	Jones	njones@hcpd.com	Heartland Consumers Power	PO Box 248 Madison, SD 57042	Electronic Service	No	OFF_SL_21-694_M-21-694
Michael	Kampmeyer	mkampmeyer@a-e-group.com	AEG Group, LLC	260 Salem Church Road Sunfish Lake, Minnesota 55118	Electronic Service	No	OFF_SL_21-694_M-21-694
Ted	Kjos	tkjos@mienergy.coop	MiEnergy Cooperative	31110 Cooperative Way PO Box 626 Rushford, MN 55971	Electronic Service	No	OFF_SL_21-694_M-21-694
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600 Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Thomas	Koehler	TGK@IBEW160.org	Local Union #160, IBEW	2909 Anthony Ln St Anthony Village, MN 55418-3238	Electronic Service	No	OFF_SL_21-694_M-21-694
Chris	Kopel	chrisk@CMPASgroup.org	Central Minnesota Municipal Power Agency	459 S Grove St Blue Earth, MN 56013-2629	Electronic Service	No	OFF_SL_21-694_M-21-694
Brian	Krambeer	bkrambeer@mienergy.coop	MiEnergy Cooperative	PO Box 626 31110 Cooperative Way Rushford, MN 55971	Electronic Service	No	OFF_SL_21-694_M-21-694
Michael	Krause	michaelkrause61@yahoo.com	Kandiyo Consulting, LLC	433 S 7th Street Suite 2025 Minneapolis, Minnesota 55415	Electronic Service	No	OFF_SL_21-694_M-21-694
Mary	LaGarde	mlagarde@maicnet.org	Minneapolis American Indian Center	1530 E Franklin Ave Minneapolis, MN 55404	Electronic Service	No	OFF_SL_21-694_M-21-694
Matthew	Lacey	Mlacey@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_21-694_M-21-694
Carmel	Laney	carmel.laney@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
James D.	Larson	james.larson@avantenergy.com	Avant Energy Services	220 S 6th St Ste 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Peder	Larson	plarson@larkinhoffman.com	Larkin Hoffman Daly & Lindgren, Ltd.	8300 Norman Center Drive Suite 1000 Bloomington, MN 55437	Electronic Service	No	OFF_SL_21-694_M-21-694
Dean	Leischow	dean@sunrisenrg.com	Sunrise Energy Ventures	315 Manitoba Ave Ste 200 Wayzata, MN 55391	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Annie	Levenson Falk	annielf@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota Street, Suite W1360 St. Paul, MN 55101	Electronic Service	No	OFF_SL_21-694_M-21-694
Ryan	Long	ryan.j.long@xcelenergy.com	Xcel Energy	414 Nicollet Mall 401 8th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694
Susan	Ludwig	sludwig@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_21-694_M-21-694
Kavita	Maini	kmaini@wi.rr.com	KM Energy Consulting, LLC	961 N Lost Woods Rd Oconomowoc, WI 53066	Electronic Service	No	OFF_SL_21-694_M-21-694
Pam	Marshall	pam@energycents.org	Energy CENTS Coalition	823 7th St E St. Paul, MN 55106	Electronic Service	No	OFF_SL_21-694_M-21-694
Mary	Martinka	mary.a.martinka@xcelenergy.com	Xcel Energy Inc	414 Nicollet Mall 7th Floor Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694
Samuel	Mason	smason@beltramielectric.com	Beltrami Electric Cooperative, Inc.	4111 Technology Dr. NW PO Box 488 Bemidji, MN 56619-0488	Electronic Service	No	OFF_SL_21-694_M-21-694
Gregg	Mast	gmast@cleanenergyeconomymn.org	Clean Energy Economy Minnesota	4808 10th Avenue S Minneapolis, MN 55417	Electronic Service	No	OFF_SL_21-694_M-21-694
Dave	McNary	David.McNary@hennepin.us	Hennepin County DES	701 Fourth Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_21-694_M-21-694
Thomas	Melone	Thomas.Melone@AllcoUS.com	Minnesota Go Solar LLC	222 South 9th Street Suite 1600 Minneapolis, Minnesota 55120	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Brian	Meloy	brian.meloy@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Stacy	Miller	stacy.miller@minneapolismn.gov	City of Minneapolis	350 S. 5th Street Room M 301 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_21-694_M-21-694
David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	No	OFF_SL_21-694_M-21-694
Dalene	Monsebroten	dalene.monsebroten@nmpagency.com	Northern Municipal Power Agency	123 2nd St W Thief River Falls, MN 56701	Electronic Service	No	OFF_SL_21-694_M-21-694
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Carl	Nelson	cnelson@mncee.org	Center for Energy and Environment	212 3rd Ave N Ste 560 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694
Ben	Nelson	benn@cmpasgroup.org	CMMPA	459 South Grove Street Blue Earth, MN 56013	Electronic Service	No	OFF_SL_21-694_M-21-694
Dale	Niezwaag	dniezwaag@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58503	Electronic Service	No	OFF_SL_21-694_M-21-694
David	Niles	david.niles@avantenergy.com	Minnesota Municipal Power Agency	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Sephra	Ninow	sephra.ninow@energycenter.org	Center for Sustainable Energy	426 17th Street, Suite 700 Oakland, CA 94612	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Rolf	Nordstrom	rnordstrom@gpisd.net	Great Plains Institute	2801 21ST AVE S STE 220 Minneapolis, MN 55407-1229	Electronic Service	No	OFF_SL_21-694_M-21-694
Samantha	Norris	samanthanorris@alliantenergy.com	Interstate Power and Light Company	200 1st Street SE PO Box 351 Cedar Rapids, IA 524060351	Electronic Service	No	OFF_SL_21-694_M-21-694
David	O'Brien	david.obrien@navigant.com	Navigant Consulting	77 South Bedford St Ste 400 Burlington, MA 01803	Electronic Service	No	OFF_SL_21-694_M-21-694
Jeff	O'Neill	jeff.oneill@ci.monticello.mn.us	City of Monticello	505 Walnut Street Suite 1 Monticelllo, Minnesota 55362	Electronic Service	No	OFF_SL_21-694_M-21-694
Russell	Olson	rolson@hcpd.com	Heartland Consumers Power District	PO Box 248 Madison, SD 570420248	Electronic Service	No	OFF_SL_21-694_M-21-694
Carol A.	Overland	overland@legalectric.org	Legalectric - Overland Law Office	1110 West Avenue Red Wing, MN 55066	Electronic Service	No	OFF_SL_21-694_M-21-694
Dan	Patry	dpatry@sunedison.com	SunEdison	600 Clipper Drive Belmont, CA 94002	Electronic Service	No	OFF_SL_21-694_M-21-694
Jeffrey C	Paulson	jeff.jcplaw@comcast.net	Paulson Law Office, Ltd.	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_21-694_M-21-694
Mary Beth	Peranteau	mperanteau@wheelerlaw.com	Wheeler Van Sickle & Anderson SC	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Jennifer	Peterson	jjpeterson@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_21-694_M-21-694
Hannah	Polikov	hpolikov@aee.net	Advanced Energy Economy Institute	1000 Vermont Ave, Third Floor Washington, DC 20005	Electronic Service	No	OFF_SL_21-694_M-21-694
David G.	Prazak	dprazak@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_21-694_M-21-694
Kenneth	Rance	krance@sabathani.org	Sabathani Community Center	310 East 38th St Rm #120 Minneapolis, MN 55409	Electronic Service	No	OFF_SL_21-694_M-21-694
Mark	Rathbun	mrathbun@grenergy.com	Great River Energy	12300 Elm Creek Blvd Maple Grove, MN 55369	Electronic Service	No	OFF_SL_21-694_M-21-694
Michael	Reinertson	michael.reinertson@avantenergy.com	Avant Energy	220 S. Sixth St. Ste 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
John C.	Reinhardt	N/A	Laura A. Reinhardt	3552 26th Ave S Minneapolis, MN 55406	Paper Service	No	OFF_SL_21-694_M-21-694
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_21-694_M-21-694
Kevin	Reuther	kreuther@mncenter.org	MN Center for Environmental Advocacy	26 E Exchange St, Ste 206 St. Paul, MN 551011667	Electronic Service	No	OFF_SL_21-694_M-21-694
Isabel	Ricker	ricker@fresh-energy.org	Fresh Energy	408 Saint Peter Street Suite 220 Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Amanda	Rome	amanda.rome@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 5 Minneapoli, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694
Robert K.	Sahr	bsahr@eastriver.coop	East River Electric Power Cooperative	P.O. Box 227 Madison, SD 57042	Electronic Service	No	OFF_SL_21-694_M-21-694
Joseph L	Sathe	jsathe@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Richard	Savelkoul	rsavelkoul@martinsquires.com	Martin & Squires, P.A.	332 Minnesota Street Ste W2750 St. Paul, MN 55101	Electronic Service	No	OFF_SL_21-694_M-21-694
Thomas	Scharff	thomas.scharff@versoco.com	Verso Corp	600 High Street Wisconsin Rapids, WI 54495	Electronic Service	No	OFF_SL_21-694_M-21-694
Christopher	Schoenherr	cp.schoenherr@smmpa.org	SMMPA	500 First Ave SW Rochester, MN 55902-3303	Electronic Service	No	OFF_SL_21-694_M-21-694
Kay	Schraeder	kschraeder@minnkota.com	Minnkota Power	5301 32nd Ave S Grand Forks, ND 58201	Electronic Service	No	OFF_SL_21-694_M-21-694
Dean	Sedgwick	Sedgwick@Itascapower.com	Itasca Power Company	PO Box 455 Spring Lake, MN 56680	Electronic Service	No	OFF_SL_21-694_M-21-694
Maria	Seidler	maria.seidler@dom.com	Dominion Energy Technology	120 Tredegar Street Richmond, Virginia 23219	Electronic Service	No	OFF_SL_21-694_M-21-694
Will	Seuffert	Will.Seuffert@state.mn.us	Public Utilities Commission	121 7th Pl E Ste 350 Saint Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Patricia F	Sharkey	psharkey@environmentallawcounsel.com	Midwest Cogeneration Association.	180 N LaSalle St Ste 3700 Chicago, IL 60601	Electronic Service	No	OFF_SL_21-694_M-21-694
Bria	Shea	bria.e.shea@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-694_M-21-694
Doug	Shoemaker	dougs@charter.net	Minnesota Renewable Energy	2928 5th Ave S Minneapolis, MN 55408	Electronic Service	No	OFF_SL_21-694_M-21-694
Anne	Smart	anne.smart@chargepoint.com	ChargePoint, Inc.	254 E Hacienda Ave Campbell, CA 95008	Electronic Service	No	OFF_SL_21-694_M-21-694
Joshua	Smith	joshua.smith@sierraclub.org		85 Second St FL 2 San Francisco, California 94105	Electronic Service	No	OFF_SL_21-694_M-21-694
Ken	Smith	ken.smith@districtenergy.com	District Energy St. Paul Inc.	76 W Kellogg Blvd St. Paul, MN 55102	Electronic Service	No	OFF_SL_21-694_M-21-694
Ken	Smith	ken.smith@ever-greenenergy.com	Ever Green Energy	305 Saint Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-694_M-21-694
Trevor	Smith	trevor.smith@avantenergy.com	Avant Energy, Inc.	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Beth H.	Soholt	bsoholt@windonthewires.org	Wind on the Wires	570 Asbury Street Suite 201 St. Paul, MN 55104	Electronic Service	No	OFF_SL_21-694_M-21-694
Sky	Stanfield	stanfield@smwlaw.com	Shute, Mihaly & Weinberger	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Tom	Stanton	tstanton@nrri.org	NRRI	1080 Carmack Road Columbus, OH 43210	Electronic Service	No	OFF_SL_21-694_M-21-694
Byron E.	Starns	byron.starns@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
James M	Strommen	jstrommen@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Eric	Swanson	eswanson@winthrop.com	Winthrop & Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_21-694_M-21-694
Lynnette	Sweet	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	Yes	OFF_SL_21-694_M-21-694
Peter	Teigland	pteigland@mnseia.org	Minnesota Solar Energy Industries Association	2288 University Ave W Saint Paul, MN 55114	Electronic Service	No	OFF_SL_21-694_M-21-694
Stuart	Tommerdahl	stommerdahl@otpco.com	Otter Tail Power Company	215 S Cascade St PO Box 496 Fergus Falls, MN 56537	Electronic Service	No	OFF_SL_21-694_M-21-694
Pat	Treseler	pat.jcplaw@comcast.net	Paulson Law Office LTD	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_21-694_M-21-694
Karen	Turnboom	karen.turnboom@versoco.com	Verso Corporation	100 Central Avenue Duluth, MN 55807	Electronic Service	No	OFF_SL_21-694_M-21-694
Thomas	Tynes	jjazynka@energyfreedomcoalition.com	Energy Freedom Coalition of America	101 Constitution Ave NW Ste 525 East Washington, DC 20001	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Lisa	Veith	lisa.veith@ci.stpaul.mn.us	City of St. Paul	400 City Hall and Courthouse 15 West Kellogg Blvd. St. Paul, MN 55102	Electronic Service	No	OFF_SL_21-694_M-21-694
Curt	Volkmann	curt@newenergy-advisors.com	Fresh Energy	408 St Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-694_M-21-694
Roger	Warehime	roger.warehime@owatonnautilities.com	Owatonna Municipal Public Utilities	208 S Walnut Ave PO BOX 800 Owatonna, MN 55060	Electronic Service	No	OFF_SL_21-694_M-21-694
Jenna	Warmuth	jwarmuth@mnpower.com	Minnesota Power	30 W Superior St Duluth, MN 55802-2093	Electronic Service	No	OFF_SL_21-694_M-21-694
Samantha	Williams	swilliams@nrdc.org	Natural Resources Defense Council	20 N. Wacker Drive Ste 1600 Chicago, IL 60606	Electronic Service	No	OFF_SL_21-694_M-21-694
Joseph	Windler	jwindler@winthrop.com	Winthrop & Weinstine	225 South Sixth Street, Suite 3500 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694
Robyn	Woeste	robynwoeste@alliantenergy.com	Interstate Power and Light Company	200 First St SE Cedar Rapids, IA 52401	Electronic Service	No	OFF_SL_21-694_M-21-694
Yochi	Zakai	yzakai@smwlaw.com	SHUTE, MIHALY & WEINBERGER LLP	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_21-694_M-21-694
Thomas J.	Zaremba	TZaremba@wheelerlaw.com	WHEELER, VAN SICKLE & ANDERSON	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Christopher	Zibart	czibart@atcllc.com	American Transmission Company LLC	W234 N2000 Ridgeview Pkwy Court Waukesha, WI 53188-1022	Electronic Service	No	OFF_SL_21-694_M-21-694
Patrick	Zomer	Pat.Zomer@lawmoss.com	Moss & Barnett PA	150 S 5th St #1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-694_M-21-694

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-390_M-21-390
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_21-390_M-21-390
Melinda	Granley	mgranley@duluthmn.gov		411 West First St Duluth, MN 55802	Electronic Service	No	OFF_SL_21-390_M-21-390
Alexander	Jackson	ajackson@DuluthMN.gov	Minnesota Power	1532 W Michigan St Duluth, MN 55806	Electronic Service	No	OFF_SL_21-390_M-21-390
David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	Yes	OFF_SL_21-390_M-21-390
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_21-390_M-21-390
Anne	Rittgers	arittgers@mnpower.com	Minnesota Power	30 W Superior St Duluth, MN 55802	Electronic Service	No	OFF_SL_21-390_M-21-390
Will	Seuffert	Will.Seuffert@state.mn.us	Public Utilities Commission	121 7th Pl E Ste 350 Saint Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-390_M-21-390

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Michael	Allen	michael.allen@allenergysolar.com	All Energy Solar	721 W 26th st Suite 211 Minneapolis, Minnesota 55405	Electronic Service	No	OFF_SL_21-612_M-21-612
David	Amster Olzweski	david@mysunshare.com	SunShare, LLC	1151 Bannock St Denver, CO 80204-8020	Electronic Service	No	OFF_SL_21-612_M-21-612
Ellen	Anderson	ellena@umn.edu	325 Learning and Environmental Sciences	1954 Buford Ave Saint Paul, MN 55108	Electronic Service	No	OFF_SL_21-612_M-21-612
Alison C	Archer	aarcher@misoenergy.org	MISO	2985 Ames Crossing Rd Eagan, MN 55121	Electronic Service	No	OFF_SL_21-612_M-21-612
Donna	Attanasio	dattanasio@law.gwu.edu	George Washington University	2000 H Street NW Washington, DC 20052	Electronic Service	No	OFF_SL_21-612_M-21-612
John	Bailey	bailey@ilsr.org	Institute For Local Self-Reliance	1313 5th St SE Ste 303 Minneapolis, MN 55414	Electronic Service	No	OFF_SL_21-612_M-21-612
Mark	Bakk	mbakk@lcp.coop	Lake Country Power	26039 Bear Ridge Drive Cohasset, MN 55721	Electronic Service	No	OFF_SL_21-612_M-21-612
James J.	Bertrand	james.bertrand@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
Derek	Bertsch	derek.bertsch@mrenergy.com	Missouri River Energy Services	3724 West Avera Drive PO Box 88920 Sioux Falls, SD 57109-8920	Electronic Service	No	OFF_SL_21-612_M-21-612
William	Black	bblack@mmua.org	MMUA	Suite 200 3131 Fernbrook Lane North Plymouth, MN 55447	Electronic Service	No	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Kenneth	Bradley	kbradley1965@gmail.com		2837 Emerson Ave S Apt CW112 Minneapolis, MN 55408	Electronic Service	No	OFF_SL_21-612_M-21-612
Jon	Brekke	jbrekke@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_21-612_M-21-612
Sydney R.	Briggs	sbriggs@swce.coop	Steele-Waseca Cooperative Electric	2411 W. Bridge St PO Box 485 Owatonna, MN 55060-0485	Electronic Service	No	OFF_SL_21-612_M-21-612
Mark B.	Bring	mbring@otpco.com	Otter Tail Power Company	215 South Cascade Street PO Box 496 Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_21-612_M-21-612
Christina	Brusven	cbrusven@fredlaw.com	Fredrikson Byron	200 S 6th St Ste 4000 Minneapolis, MN 554021425	Electronic Service	No	OFF_SL_21-612_M-21-612
Jason	Burwen	jburwen@cleanpower.org	Energy Storage Association	1155 15th St NW, Ste 500 Washington, DC 20005	Electronic Service	No	OFF_SL_21-612_M-21-612
LORI	CLOBES	lclobes@mienergy.coop	MiEnergy Cooperative	31110 COOPERATIVE WAY PO BOX 626 RUSHFORD, MN 55971	Electronic Service	No	OFF_SL_21-612_M-21-612
Douglas M.	Carnival	dmc@mcgrannshea.com	McGrann Shea Carnival Straughn & Lamb	N/A	Electronic Service	No	OFF_SL_21-612_M-21-612
Ray	Choquette	rchoquette@agp.com	Ag Processing Inc.	12700 West Dodge Road PO Box 2047 Omaha, NE 68103-2047	Electronic Service	No	OFF_SL_21-612_M-21-612
Kenneth A.	Colburn	kcolburn@symbioticstrategies.com	Symbiotic Strategies, LLC	26 Winton Road Meredith, NH 32535413	Electronic Service	No	OFF_SL_21-612_M-21-612

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Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-612_M-21-612
Brooke	Cooper	bcooper@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022191	Electronic Service	No	OFF_SL_21-612_M-21-612
George	Crocker	gwillc@nawo.org	North American Water Office	PO Box 174 Lake Elmo, MN 55042	Electronic Service	No	OFF_SL_21-612_M-21-612
David	Dahlberg	davedahlberg@nweco.com	Northwestern Wisconsin Electric Company	P.O. Box 9 104 South Pine Street Grantsburg, WI 548400009	Electronic Service	No	OFF_SL_21-612_M-21-612
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, 401-8 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-612_M-21-612
Curt	Dieren	curt.dieren@dgr.com	L&O Power Cooperative	1302 S Union St Rock Rapids, IA 51246	Electronic Service	No	OFF_SL_21-612_M-21-612
Carlon	Doyle Fontaine	carlon.doyle.fontaine@senate.mn	MN Senate	75 Rev Dr Martin Luther King Jr Blvd Room G-17 St Paul, MN 55155	Electronic Service	No	OFF_SL_21-612_M-21-612
Brian	Draxten	bhdraxten@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380498	Electronic Service	No	OFF_SL_21-612_M-21-612
Kristen	Eide Tollefson	healingsystems69@gmail.com	R-CURE	28477 N Lake Ave Frontenac, MN 55026-1044	Electronic Service	No	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Bob	Eleff	bob.eleff@house.mn	Regulated Industries Cmte	100 Rev Dr Martin Luther King Jr Blvd Room 600 St. Paul, MN 55155	Electronic Service	No	OFF_SL_21-612_M-21-612
Betsy	Engelking	betsy@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_21-612_M-21-612
Oncu	Er	oncu.er@avantenergy.com	Avant Energy, Agent for MMPA	220 S. Sixth St. Ste. 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
James C.	Erickson	jericksonkbc@gmail.com	Kelly Bay Consulting	17 Quechee St Superior, WI 54880-4421	Electronic Service	No	OFF_SL_21-612_M-21-612
John	Farrell	jfarrell@ilsr.org	Institute for Local Self-Reliance	2720 E. 22nd St Institute for Local Self-Reliance Minneapolis, MN 55406	Electronic Service	No	OFF_SL_21-612_M-21-612
Christian	Fenstermacher	christian.fenstermacher@owatonnautilities.com	Owatonna Municipal Public Utilities	PO Box 800 208 S Walnut Ave Owatonna, MN 55060	Electronic Service	No	OFF_SL_21-612_M-21-612
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_21-612_M-21-612
Nathan	Franzen	nathan@nationalgridrenewables.com	Geronimo Energy, LLC	8400 Normandale Lake Blvd Ste 1200 Bloomington, MN 55437	Electronic Service	No	OFF_SL_21-612_M-21-612
Jessica	Fyhrie	jfyhrie@otpco.com	Otter Tail Power Company	PO Box 496 Fergus Falls, MN 56538-0496	Electronic Service	Yes	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Hal	Galvin	halgalvin@comcast.net	Provectus Energy Development llc	1936 Kenwood Parkway Minneapolis, MN 55405	Electronic Service	No	OFF_SL_21-612_M-21-612
Edward	Garvey	garveyed@aol.com	Residence	32 Lawton St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-612_M-21-612
Bruce	Gerhardson	bgerhardson@otpco.com	Otter Tail Power Company	PO Box 496 215 S Cascade St Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_21-612_M-21-612
Allen	Gleckner	gleckner@fresh-energy.org	Fresh Energy	408 St. Peter Street Ste 350 Saint Paul, Minnesota 55102	Electronic Service	No	OFF_SL_21-612_M-21-612
Jenny	Glumack	jenny@mrea.org	Minnesota Rural Electric Association	11640 73rd Ave N Maple Grove, MN 55369	Electronic Service	No	OFF_SL_21-612_M-21-612
Timothy	Gulden	timothy.gulden@yahoo.com	Winona Renewable Energy, LLC	1449 Ridgewood Dr Winona, MN 55987	Electronic Service	No	OFF_SL_21-612_M-21-612
Tony	Hainault	anthony.hainault@co.hennepin.mn.us	Hennepin County DES	701 4th Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_21-612_M-21-612
Todd	Headlee	theadlee@dvigridsolutions.com	Dominion Voltage, Inc.	701 E. Cary Street Richmond, VA 23219	Electronic Service	No	OFF_SL_21-612_M-21-612
Adam	Heinen	aheinen@dakotaelectric.com	Dakota Electric Association	4300 220th St W Farmington, MN 55024	Electronic Service	No	OFF_SL_21-612_M-21-612
Jared	Hendricks	jared.hendricks@owatonnautilities.com	Owatonna Municipal Public Utilities	PO Box 800 208 S Walnut Ave Owatonna, MN 55060-2940	Electronic Service	No	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Annete	Henkel	mui@mnutilityinvestors.org	Minnesota Utility Investors	413 Wacouta Street #230 St.Paul, MN 55101	Electronic Service	No	OFF_SL_21-612_M-21-612
Shane	Henriksen	shane.henriksen@enbridge.com	Enbridge Energy Company, Inc.	1409 Hammond Ave FL 2 Superior, WI 54880	Paper Service	No	OFF_SL_21-612_M-21-612
Michael	Hoppe	lu23@ibew23.org	Local Union 23, I.B.E.W.	445 Etna Street Ste. 61 St. Paul, MN 55106	Electronic Service	No	OFF_SL_21-612_M-21-612
Jan	Hubbard	jan.hubbard@comcast.net		7730 Mississippi Lane Brooklyn Park, MN 55444	Electronic Service	No	OFF_SL_21-612_M-21-612
Casey	Jacobson	cjacobson@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58501	Electronic Service	No	OFF_SL_21-612_M-21-612
John S.	Jaffray	jjaffray@jjrpower.com	JJR Power	350 Highway 7 Suite 236 Excelsior, MN 55331	Electronic Service	No	OFF_SL_21-612_M-21-612
Alan	Jenkins	aj@jenkinsatlaw.com	Jenkins at Law	2950 Yellowtail Ave. Marathon, FL 33050	Electronic Service	No	OFF_SL_21-612_M-21-612
Richard	Johnson	Rick.Johnson@lawmoss.com	Moss & Barnett	150 S. 5th Street Suite 1200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
Nate	Jones	njones@hcpd.com	Heartland Consumers Power	PO Box 248 Madison, SD 57042	Electronic Service	No	OFF_SL_21-612_M-21-612
Michael	Kampmeyer	mkampmeyer@a-e-group.com	AEG Group, LLC	260 Salem Church Road Sunfish Lake, Minnesota 55118	Electronic Service	No	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Max	Kieley	max.kieley@ag.state.mn.us	Office of the Attorney General-RUD	1400 Town Square Tower 445 Minnesota Street St. Paul, MN 55101	Electronic Service	No	OFF_SL_21-612_M-21-612
Ted	Kjos	tkjos@mienergy.coop	MiEnergy Cooperative	31110 Cooperative Way PO Box 626 Rushford, MN 55971	Electronic Service	No	OFF_SL_21-612_M-21-612
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600 Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_21-612_M-21-612
Thomas	Koehler	TGK@IBEW160.org	Local Union #160, IBEW	2909 Anthony Ln St Anthony Village, MN 55418-3238	Electronic Service	No	OFF_SL_21-612_M-21-612
Chris	Kopel	chrisk@CMPASgroup.org	Central Minnesota Municipal Power Agency	459 S Grove St Blue Earth, MN 56013-2629	Electronic Service	No	OFF_SL_21-612_M-21-612
Brian	Krambeer	bkrambeer@mienergy.coop	MiEnergy Cooperative	PO Box 626 31110 Cooperative Way Rushford, MN 55971	Electronic Service	No	OFF_SL_21-612_M-21-612
Michael	Krause	michaelkrause61@yahoo.com	Kandiyo Consulting, LLC	433 S 7th Street Suite 2025 Minneapolis, Minnesota 55415	Electronic Service	No	OFF_SL_21-612_M-21-612
Michael	Krikava	mkrikava@taftlaw.com	Taft Stettinius & Hollister LLP	2200 IDS Center 80 S 8th St Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
Matthew	Lacey	Mlacey@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 553694718	Electronic Service	No	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
James D.	Larson	james.larson@avantenergy.com	Avant Energy Services	220 S 6th St Ste 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
Dean	Leischow	dean@sunrisenrg.com	Sunrise Energy Ventures	315 Manitoba Ave Ste 200 Wayzata, MN 55391	Electronic Service	No	OFF_SL_21-612_M-21-612
Annie	Levenson Falk	annielf@cubminnesota.org	Citizens Utility Board of Minnesota	332 Minnesota Street, Suite W1360 St. Paul, MN 55101	Electronic Service	No	OFF_SL_21-612_M-21-612
Susan	Ludwig	sludwig@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_21-612_M-21-612
Kavita	Maini	kmaini@wi.rr.com	KM Energy Consulting, LLC	961 N Lost Woods Rd Oconomowoc, WI 53066	Electronic Service	No	OFF_SL_21-612_M-21-612
Pam	Marshall	pam@energycents.org	Energy CENTS Coalition	823 7th St E St. Paul, MN 55106	Electronic Service	No	OFF_SL_21-612_M-21-612
Samuel	Mason	smason@beltramielectric.com	Beltrami Electric Cooperative, Inc.	4111 Technology Dr. NW PO Box 488 Bemidji, MN 56619-0488	Electronic Service	No	OFF_SL_21-612_M-21-612
Gregg	Mast	gmast@cleanenergyeconomymn.org	Clean Energy Economy Minnesota	4808 10th Avenue S Minneapolis, MN 55417	Electronic Service	No	OFF_SL_21-612_M-21-612
Dave	McNary	David.McNary@hennepin.us	Hennepin County DES	701 Fourth Ave S Ste 700 Minneapolis, MN 55415-1842	Electronic Service	No	OFF_SL_21-612_M-21-612
Thomas	Melone	Thomas.Melone@AllcoUS.com	Minnesota Go Solar LLC	222 South 9th Street Suite 1600 Minneapolis, Minnesota 55120	Electronic Service	No	OFF_SL_21-612_M-21-612

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David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	No	OFF_SL_21-612_M-21-612
Dalene	Monsebroten	dalene.monsebroten@nmpagency.com	Northern Municipal Power Agency	123 2nd St W Thief River Falls, MN 56701	Electronic Service	No	OFF_SL_21-612_M-21-612
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
Carl	Nelson	cnelson@mncee.org	Center for Energy and Environment	212 3rd Ave N Ste 560 Minneapolis, MN 55401	Electronic Service	No	OFF_SL_21-612_M-21-612
Ben	Nelson	benn@cmpasgroup.org	CMMPA	459 South Grove Street Blue Earth, MN 56013	Electronic Service	No	OFF_SL_21-612_M-21-612
Dale	Niezwaag	dniezwaag@bepc.com	Basin Electric Power Cooperative	1717 East Interstate Avenue Bismarck, ND 58503	Electronic Service	No	OFF_SL_21-612_M-21-612
David	Niles	david.niles@avantenergy.com	Minnesota Municipal Power Agency	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
Sephra	Ninow	sephra.ninow@energycenter.org	Center for Sustainable Energy	426 17th Street, Suite 700 Oakland, CA 94612	Electronic Service	No	OFF_SL_21-612_M-21-612
Rolf	Nordstrom	rnordstrom@gpisd.net	Great Plains Institute	2801 21ST AVE S STE 220 Minneapolis, MN 55407-1229	Electronic Service	No	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Samantha	Norris	samanthanorris@alliantenergy.com	Interstate Power and Light Company	200 1st Street SE PO Box 351 Cedar Rapids, IA 524060351	Electronic Service	No	OFF_SL_21-612_M-21-612
David	O'Brien	david.obrien@navigant.com	Navigant Consulting	77 South Bedford St Ste 400 Burlington, MA 01803	Electronic Service	No	OFF_SL_21-612_M-21-612
Jeff	O'Neill	jeff.oneill@ci.monticello.mn.us	City of Monticello	505 Walnut Street Suite 1 Monticelllo, Minnesota 55362	Electronic Service	No	OFF_SL_21-612_M-21-612
Russell	Olson	rolson@hcpd.com	Heartland Consumers Power District	PO Box 248 Madison, SD 570420248	Electronic Service	No	OFF_SL_21-612_M-21-612
Dan	Patry	dpatry@sunedison.com	SunEdison	600 Clipper Drive Belmont, CA 94002	Electronic Service	No	OFF_SL_21-612_M-21-612
Jeffrey C	Paulson	jeff.jcplaw@comcast.net	Paulson Law Office, Ltd.	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_21-612_M-21-612
Mary Beth	Peranteau	mperanteau@wheelerlaw.com	Wheeler Van Sickle & Anderson SC	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_21-612_M-21-612
Jennifer	Peterson	jjpeterson@mnpower.com	Minnesota Power	30 West Superior Street Duluth, MN 55802	Electronic Service	No	OFF_SL_21-612_M-21-612
Hannah	Polikov	hpolikov@aee.net	Advanced Energy Economy Institute	1000 Vermont Ave, Third Floor Washington, DC 20005	Electronic Service	No	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
David G.	Prazak	dprazak@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_21-612_M-21-612
Mark	Rathbun	mrathbun@grenergy.com	Great River Energy	12300 Elm Creek Blvd Maple Grove, MN 55369	Electronic Service	No	OFF_SL_21-612_M-21-612
Michael	Reinertson	michael.reinertson@avantenergy.com	Avant Energy	220 S. Sixth St. Ste 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
John C.	Reinhardt	N/A	Laura A. Reinhardt	3552 26th Ave S Minneapolis, MN 55406	Paper Service	No	OFF_SL_21-612_M-21-612
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_21-612_M-21-612
Kevin	Reuther	kreuther@mncenter.org	MN Center for Environmental Advocacy	26 E Exchange St, Ste 206 St. Paul, MN 551011667	Electronic Service	No	OFF_SL_21-612_M-21-612
Michael	Riewer	MRiewer@otpco.com	Otter Tail Power Company	PO Box 4496 Fergus Falls, MN 56538-0496	Electronic Service	Yes	OFF_SL_21-612_M-21-612
Robert K.	Sahr	bsahr@eastriver.coop	East River Electric Power Cooperative	P.O. Box 227 Madison, SD 57042	Electronic Service	No	OFF_SL_21-612_M-21-612
Richard	Savelkoul	rsavelkoul@martinsquires.com	Martin & Squires, P.A.	332 Minnesota Street Ste W2750 St. Paul, MN 55101	Electronic Service	No	OFF_SL_21-612_M-21-612
Thomas	Scharff	thomas.scharff@versoco.com	Verso Corp	600 High Street Wisconsin Rapids, WI 54495	Electronic Service	No	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Christopher	Schoenherr	cp.schoenherr@smmpa.org	SMMPA	500 First Ave SW Rochester, MN 55902-3303	Electronic Service	No	OFF_SL_21-612_M-21-612
Kay	Schraeder	kschraeder@minnkota.com	Minnkota Power	5301 32nd Ave S Grand Forks, ND 58201	Electronic Service	No	OFF_SL_21-612_M-21-612
Dean	Sedgwick	Sedgwick@Itascapower.com	Itasca Power Company	PO Box 455 Spring Lake, MN 56680	Electronic Service	No	OFF_SL_21-612_M-21-612
Maria	Seidler	maria.seidler@dom.com	Dominion Energy Technology	120 Tredegar Street Richmond, Virginia 23219	Electronic Service	No	OFF_SL_21-612_M-21-612
Will	Seuffert	Will.Seuffert@state.mn.us	Public Utilities Commission	121 7th Pl E Ste 350 Saint Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-612_M-21-612
Patricia F	Sharkey	psharkey@environmentallawcounsel.com	Midwest Cogeneration Association.	180 N LaSalle St Ste 3700 Chicago, IL 60601	Electronic Service	No	OFF_SL_21-612_M-21-612
Doug	Shoemaker	dougs@charter.net	Minnesota Renewable Energy	2928 5th Ave S Minneapolis, MN 55408	Electronic Service	No	OFF_SL_21-612_M-21-612
Anne	Smart	anne.smart@chargepoint.com	ChargePoint, Inc.	254 E Hacienda Ave Campbell, CA 95008	Electronic Service	No	OFF_SL_21-612_M-21-612
Trevor	Smith	trevor.smith@avantenergy.com	Avant Energy, Inc.	220 South Sixth Street Suite 1300 Minneapolis, Minnesota 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
Ken	Smith	ken.smith@districtenergy.com	District Energy St. Paul Inc.	76 W Kellogg Blvd St. Paul, MN 55102	Electronic Service	No	OFF_SL_21-612_M-21-612

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Joshua	Smith	joshua.smith@sierraclub.org		85 Second St FL 2 San Francisco, California 94105	Electronic Service	No	OFF_SL_21-612_M-21-612
Ken	Smith	ken.smith@ever-greenenergy.com	Ever Green Energy	305 Saint Peter St Saint Paul, MN 55102	Electronic Service	No	OFF_SL_21-612_M-21-612
Beth H.	Soholt	bsoholt@windonthewires.org	Wind on the Wires	570 Asbury Street Suite 201 St. Paul, MN 55104	Electronic Service	No	OFF_SL_21-612_M-21-612
Sky	Stanfield	stanfield@smwlaw.com	Shute, Mihaly & Weinberger	396 Hayes Street San Francisco, CA 94102	Electronic Service	No	OFF_SL_21-612_M-21-612
Tom	Stanton	tstanton@nrri.org	NRRI	1080 Carmack Road Columbus, OH 43210	Electronic Service	No	OFF_SL_21-612_M-21-612
Byron E.	Starns	byron.starns@stinson.com	STINSON LLP	50 S 6th St Ste 2600 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
Cary	Stephenson	cStephenson@otpco.com	Otter Tail Power Company	215 South Cascade Street Fergus Falls, MN 56537	Electronic Service	Yes	OFF_SL_21-612_M-21-612
James M	Strommen	jstrommen@kennedy-graven.com	Kennedy & Graven, Chartered	150 S 5th St Ste 700 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_21-612_M-21-612
Eric	Swanson	eswanson@winthrop.com	Winthrop & Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_21-612_M-21-612
Peter	Teigland	pteigland@mnseia.org	Minnesota Solar Energy Industries Association	2288 University Ave W Saint Paul, MN 55114	Electronic Service	No	OFF_SL_21-612_M-21-612

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Stuart	Tommerdahl	stommerdahl@otpco.com	Otter Tail Power Company	215 S Cascade St PO Box 496 Fergus Falls, MN 56537	Electronic Service	Yes	OFF_SL_21-612_M-21-612
Pat	Treseler	pat.jcplaw@comcast.net	Paulson Law Office LTD	4445 W 77th Street Suite 224 Edina, MN 55435	Electronic Service	No	OFF_SL_21-612_M-21-612
Karen	Turnboom	karen.turnboom@versoco.com	Verso Corporation	100 Central Avenue Duluth, MN 55807	Electronic Service	No	OFF_SL_21-612_M-21-612
Lisa	Veith	lisa.veith@ci.stpaul.mn.us	City of St. Paul	400 City Hall and Courthouse 15 West Kellogg Blvd. St. Paul, MN 55102	Electronic Service	No	OFF_SL_21-612_M-21-612
Roger	Warehime	roger.warehime@owatonnautilities.com	Owatonna Municipal Public Utilities	208 S Walnut Ave PO BOX 800 Owatonna, MN 55060	Electronic Service	No	OFF_SL_21-612_M-21-612
Jenna	Warmuth	jwarmuth@mnpower.com	Minnesota Power	30 W Superior St Duluth, MN 55802-2093	Electronic Service	No	OFF_SL_21-612_M-21-612
Robyn	Woeste	robynwoeste@alliantenergy.com	Interstate Power and Light Company	200 First St SE Cedar Rapids, IA 52401	Electronic Service	No	OFF_SL_21-612_M-21-612
Thomas J.	Zaremba	TZaremba@wheelerlaw.com	WHEELER, VAN SICKLE & ANDERSON	44 E. Mifflin Street, 10th Floor Madison, WI 53703	Electronic Service	No	OFF_SL_21-612_M-21-612
Christopher	Zibart	czibart@atcllc.com	American Transmission Company LLC	W234 N2000 Ridgeview Pkwy Court Waukesha, WI 53188-1022	Electronic Service	No	OFF_SL_21-612_M-21-612

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Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1400 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-728_M-21-728
Sharon	Ferguson	sharon.ferguson@state.mn.us	Department of Commerce	85 7th Place E Ste 280 Saint Paul, MN 551012198	Electronic Service	No	OFF_SL_21-728_M-21-728
Adam	Heinen	aheinen@dakotaelectric.com	Dakota Electric Association	4300 220th St W Farmington, MN 55024	Electronic Service	Yes	OFF_SL_21-728_M-21-728
Generic Notice	Residential Utilities Division	residential.utilities@ag.state.mn.us	Office of the Attorney General-RUD	1400 BRM Tower 445 Minnesota St St. Paul, MN 551012131	Electronic Service	Yes	OFF_SL_21-728_M-21-728
Will	Seuffert	Will.Seuffert@state.mn.us	Public Utilities Commission	121 7th Pl E Ste 350 Saint Paul, MN 55101	Electronic Service	Yes	OFF_SL_21-728_M-21-728
Craig	Turner	cturner@dakotaelectric.com	Dakota Electric Association	4300 - 220th Street West Farmington, MN 550249583	Electronic Service	No	OFF_SL_21-728_M-21-728