Building Momentum for Implementation of Electric Utility Infrastructure Efficiency Projects

Action Plan for Minnesota Utilities and Regulators
06/28/2019
Contract 120865

Recommendations Prepared for:

Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy

And

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Acknowledgement: The information, data, or work presented herein was funded in part by the Office of Energy Efficiency and Renewable Energy (EERE), U.S. Department of Energy, under Award Number DE-EE0007769.

Special Thanks: The Department of Energy, Office of Energy Efficiency and Renewable Energy for awarding our project team this State Energy Program grant, and to the many stakeholders who contributed to this project's success.

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Definition of Terms and Acronyms

ACEEE	American Council for an Energy Efficient Economy
AESP	Association for Energy Service Professionals
AGI	Advanced Grid Infrastructure
AMI	Advanced Metering Infrastructure (or Smart Meters)
CHP	Combined Heat and Power
CIP	Conservation Improvement Program
COU	Consumer-Owned Utility
CPP	Clean Power Plan
CVR	Conservation Voltage Reduction
Commerce	Minnesota Department of Commerce (State)
DER	Division of Energy Resources
DOE	Department of Energy (Federal)
DSM	Demand Side Management
EE	Energy Efficiency
EERE	Energy Efficiency and Renewable Energy (DOE Department)
EERS	Energy Efficiency Resource Standard
EIA	Energy Information Administration
EM&V	Evaluation, Measurement, and Verification
ESP	Energy Savings Platform
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
EUI	Electric Utility Infrastructure
GMI	Grid Modernization Initiative (Department of Energy)
HVAC	Heating, Ventilation, and Air Conditioning
IDP	Integrated Distribution Plan
IOU	Investor-Owned Utility
IRP	Integrated Resource Plan
LBNL	Lawrence Berkeley National Laboratories
MW	Megawatt (power or capacity)
MWh	Megawatt-hour (energy or savings)
NARUC	National Association of Regulatory Utility Commissioners
NASEO	National Association of State Energy Officials
NEEA	Northwest Energy Efficiency Alliance
NSR	New Source Review
PCA	Pollution Control Agency
PNNL	Pacific Northwest National Laboratory
PUC	Public Utilities Commission
RAP	Regulatory Assistance Project
T&D	Transmission and Distribution
TRM	Technical Reference Manual
VO	Voltage Optimization (equivalent to CVR)
VVO	Volt-VAR Optimization

Executive Summary

Electric utilities in Minnesota have been implementing energy efficiency programs for decades. The Conservation Improvement Program (CIP), overseen by the Minnesota Department of Commerce (Commerce) and implemented by utilities, has successfully driven broad collaboration to achieve energy efficiency goals across the state. By statute, utilities are required to develop CIP plans to achieve energy savings equal to 1.5 percent of average annual retail sales,[1] unless adjusted by the Commissioner to no less than 1.0 percent.[2]

Historically, utility CIPs have focused on increasing the efficiency of demand-side applications, that is improvements made on the customer's side of the meter. However, Minnesota statute also specifically calls out Electric Utility Infrastructure (EUI) efficiency, meaning improvements made on the utility's side of the meter, as an additional tool to meet utility energy efficiency goals.[3] Despite statutory certainty that EUI projects are an allowable component of CIP, there is significant uncertainty among Minnesota stakeholders regarding how EUI efficiency can be leveraged within the current regulatory framework. This uncertainty results in a significant amount of potential conservation opportunity left on the table.

Through a U.S. Department of Energy (DOE) State Energy Program grant, a project team consisting of GDS Associates (GDS) and Center for Energy and Environment (CEE) undertook a stakeholder engagement process to address the regulatory uncertainty that exists regarding how EUI efficiency improvements fit into Minnesota's policy and regulatory framework.

Based on a synthesis of the outreach activities and stakeholder discussions, the findings from this project are distilled into policy and regulatory clarifications and stakeholder recommendations, and compiled into this Action Plan to unlock the potential of EUI efficiency and build momentum toward implementation.

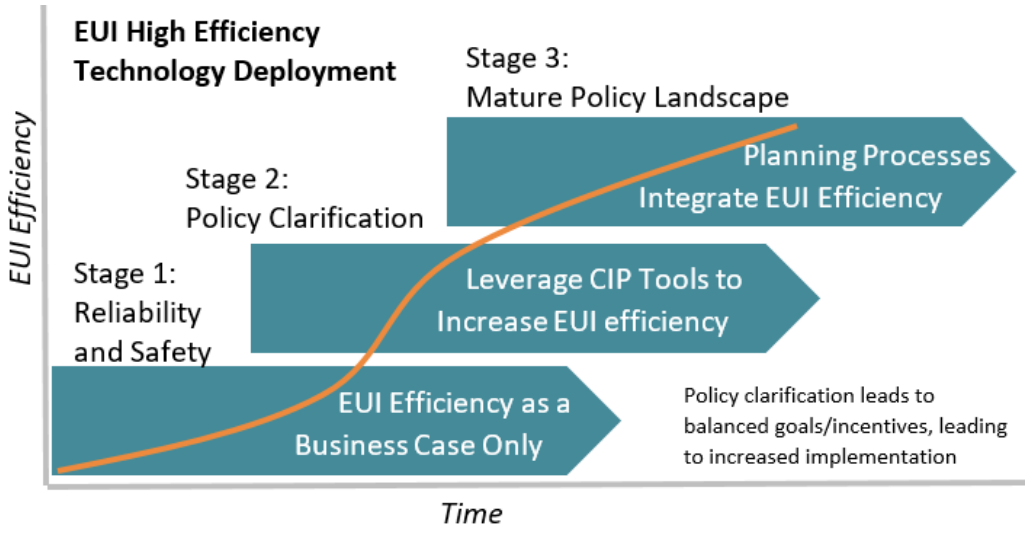
Figure 1 illustrates the long-term vision of EUI as a viable tool to help meet conservation goals. Currently, infrastructure design is largely driven by reliability and safety parameters. This Action Plan represents the climb from Stage 1 to Stage 2 by raising awareness of infrastructure efficiency opportunities and leveraging policy tools to drive the capture of those opportunities. If successful, the Action Plan will help to drive EUI efficiency implementation projects and lead to further clarifications of policy objectives. Ultimately, the goal is to seamlessly incorporate efficiency considerations into the infrastructure design process, with a full understanding of their value in terms of helping meet Minnesota's conservation goals, represented by Stage 3 in Figure 1.

[1] As defined in Minn. Stat. 216B.241 Subd. 1 (g), "gross annual retail sales" exclude sales to CIP-exempt customers.

[2] Minn. Stat. 216B.241 Subd. 1c (d) allows the Commissioner to adjust to a public utility's savings goal to a minimum of 1.0%.

[3] Minn. Stat. 216B.241, Subd.1c (d)

Figure 1 - Envisioned Stages to Driving EUI Efficiency Implementation



To accomplish this study's main goal of reducing EUI regulatory uncertainty, the project team embarked on an extensive stakeholder engagement process aimed at strengthening collaboration and understanding among stakeholders by:

1. *Informing stakeholders* about current policies and raise awareness about EUI as a conservation tool.
2. *Facilitating discussion* about how the current policies work and identify barriers to implementing EUI efficiency projects.
3. *Soliciting ideas* from stakeholders about barriers to implementation, opportunities for improvement, and solutions to identified barriers.
4. *Developing recommendations* for specific actions and policy clarifications to drive EUI efficiency implementation (culminating in the Action Plan).

As a result of the outreach, Minnesota stakeholders have a more nuanced understanding of the opportunities and barriers to implementing EUI efficiency projects in Minnesota. The process' outreach yielded the following outcomes:

- Four large, in-person stakeholder meetings with an average of about sixty participants each. Each meeting included a panel discussion among stakeholders and a total of twelve presentations from experts on relevant subjects. The meetings provided opportunities for stakeholders to engage with experts on technology and policies with local, state, national, and even international perspectives.
- Approximately 360 stakeholders engaged from utilities, advocacy groups, think tanks, consulting firms, government agencies, etc.
- Two stakeholder surveys with forty-eight valid completed responses.

- Creation of a dedicated EUI project website that serves as a repository for project materials produced during the stakeholder process.[4]

The full Action Plan consists of fifteen major recommendations and twenty-nine specific sub-recommendations. The following list is a summary of what the project team sees as the five most important overall recommendations:

1. **Build Partnerships:** Utilities should consciously build connections between infrastructure planning teams and CIP personnel to increase awareness of EUI efficiency options and to identify opportunities to leverage CIP resources in the infrastructure planning process.
2. **Review Policy Guidance:** Utilities and other stakeholders should review the policy guidance documents developed by Commerce to clarify the role of EUI efficiency within CIP.[5] In particular, utilities should become familiar with the "EUI Project Review and Approval Process" guidance issued by Commerce,[6] which provides a good starting point for understanding how EUI fits into CIP and how EUI projects will be evaluated.
3. **Apply Screening Tools:** As EUI project ideas are generated, utilities should apply Excel-based, high-level screening tools available on the Commerce website to estimate the savings potential and cost-effectiveness of potential projects.[7]
4. **Examine Potential:** Utilities should reference the EUI potential study conducted in 2018 that found EUI conservation is a worthwhile target of CIP resources in Minnesota. Estimates indicate EUI conservation has the potential to achieve approximately 9 percent of annual electric utility CIP goals statewide, on average, from 2020-2039.[8]
5. **Collaborate with Commerce:** Utilities should reach out to Commerce with ideas or questions about EUI within CIP. This is an evolving landscape with the potential for increased understanding and collaboration going forward.

Other states that may wish to drive infrastructure efficiency using existing conservation tools can apply lessons learned from this project in Minnesota. The first key to unlocking the value of EUI efficiency in Minnesota is the explicit inclusion of EUI projects in the state's conservation statute. In other states, that piece may not be as explicitly clear. Therefore, the likely first step other states can take is to clarify whether EUI projects can count toward conservation goals. Once that hurdle is cleared, the general

[4] EUI Projects Webpage. https://www.mncee.org/mnsupplystudy/home/

[5] Docket No. E, G999/CIP-17-856. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={30E3B861-0000-C119-AFBE-5532959C72DA}&documentTitle=20182-140321-01

[6] Docket No. E999/CIP-18-543. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7bB0849C66-0000-C310-A767-92B206A5993B%7d&documentTitle=201810-147198-01

[7] EUI Project Screening Tools. http://mn.gov/commerce-stat/xls/electric-infrastructure-efficiency-screening.xlsx

[8] Final EUI Potential Study Report. http://mn.gov/commerce-stat/pdfs/card-gds-eui-potential.pdf

findings of this study can apply to any jurisdiction and with state-specific modifications, they can help drive EUI efficiency across the country.

Table 1 presents a high-level summary of the findings of the stakeholder engagement process. The findings are organized into three categories: 1) Identified Barriers to EUI Efficiency Implementation, 2) Summaries of Important Stakeholder Discussions, 3) and Action Plan Outcomes and Recommendations. For the purposes of this summary table, the findings are loosely grouped into broad topic areas for easier reference. Each individual finding summarized in Table 1 is discussed in detail in respective sections of the report: Recommendations, Identified Barriers, and Appendix B: Additional Study Findings. Many of the recommendations included in the Action Plan reference external resources such as policy guidance, project screening tools, and expert presentations. These items appear in **bold** in the summary table.

Table 1 - Summary of EUI Stakeholder Engagement Findings

Topic Area	Identified Barriers to EUI Efficiency	Stakeholder Discussion Summary	Action Plan Outcomes and Recommendations
Technical Issues	Uncertainty in calculating eligible savings	Technical issues that prevent utilities from implementing EUI projects stem from the burden of defensibly calculating energy savings from projects. Several tools have been created to lessen this burden	**Outcome: Create EUI TRM measures and SmartMeasures™**
			Outcome: Create Excel-based high-level project screening tools to estimate projected savings
	Some EUI conservation may not be captured by CIP metrics (fuel input, VAR)	Existing CIP metrics may not adequately capture efficiency of EUI projects. Several discussions about possible ways to improve or replace the metrics for EUI – further discussions are required to reach consensus before making major recommendations	**Outcome: Submit comments to summarize findings for the Public Utilities Commission (PUC) performance metrics docket**
	Projects may trigger an otherwise unnecessary New Source Review (NSR)	Discussions indicate it is unlikely that efficiency considerations will affect go/no-go decisions or impact the NSR status of proposed projects	**Outcome: Policy Guidance - Establish clear and consistent EUI project review process**

Topic Area	Identified Barriers to EUI Efficiency	Stakeholder Discussion Summary	Action Plan Outcomes and Recommendations
Awareness	Lack of awareness of potential projects and their value	Some stakeholders have never considered EUI as a CIP resource. There may be obvious opportunities or even already-planned projects that can incorporate EUI efficiency	Recommended Action: Build connections between infrastructure design teams and CIP personnel
	Unclaimed current EUI CIP projects	Potential Study findings indicate EUI *can* be a valuable tool to meet conservation goals	**Outcome: Estimate statewide EUI potential for conservation**
EUI Place in Planning Process and Related Initiatives	General regulatory uncertainty	Several stakeholder discussions focused on the practical question of how to incorporate EUI considerations into existing planning process. Discussions ranged from where to start thinking about EUI to pinpointing the exact step in the infrastructure planning process to best insert EUI considerations	Recommended Action: Project team will develop comments to submit to PUC to incorporate EUI into the new Integrated Distribution Plan (IDP) process
	There are easier CIP options than EUI		Recommended Action: Connect to related grid modernization efforts to leverage findings and accomplish overlapping goals
	EUI projects do not have a customer engagement component		Recommended Action: Further discuss the possibility of requiring utilities to report on EUI *opportunities* in their Integrated Resource Plan (IRP) or IDP filings
	Efficiency is not a top priority (compared to reliability and rates)	Over the course of the project, we had an impressive array of experts from a variety of perspectives present on topics such as EUI technologies, other states' policies, existing infrastructure planning, and relevant Minnesota regulations and policies	**Outcome: Review slides and references from expert presentations to stakeholder meetings. Numerous great ideas, lessons learned, additional specific action items, and contact information**
	Staffing challenges		

Topic Area	Identified Barriers to EUI Efficiency	Stakeholder Discussion Summary	Action Plan Outcomes and Recommendations
CIP Policies Applied to EUI	1 percent Demand-side requirement *before* EUI savings count Definition of "normal maintenance" as the baseline is not always clear Uncertain how to begin process to recommend projects and/or how they will be reviewed by Commerce	Several specific existing CIP policies do not apply well to EUI projects. Concern over their interpretation prevents utilities from considering otherwise-viable EUI options Four specific policy issues were identified as needing only clarification to resolve. Three of them produced policy guidance during the course of the project	**Outcome: Policy Guidance - Clarify 1 percent DSM threshold requirement and establish 5-year carry forward provision for EUI** **Outcome: Policy Guidance - Describe determination of "Normal Maintenance" and describe Commerce's EUI project review process** Recommended Action: Issue Policy Guidance to clarify the 50MW automatic exemption clause in statute
Costs and Recovery	EUI spending does not count toward CIP spending requirements	The current Shared Savings DSM Financial Incentive mechanism calculation specifically excludes EUI, which disadvantages EUI as a CIP tool. It may be appropriate to add EUI – or maybe it should be viable without the incentive (no lost revenue for most EUI projects). Or, perhaps there are certain EUI projects that should count (e.g. CVR) while others do not.	Recommended Action: Continue discussion of appropriateness of adjusting the Shared Savings Financial Incentive mechanism to include some specific, limited types of EUI projects
	Business case for EUI efficiency may not be strong enough Higher cost, longer lifetimes, and rapid changes all mean an uncertain payback		**Outcome: Create Excel-based high-level project screening tools to estimate cost effectiveness**
	Capital cost recovery for certain projects may be uncertain or complicated	The current dedicated EUI cost recovery rider is too onerous to use	Recommended Action: Streamline the EUI cost recovery rider

Introduction

Objective

The objective of this project is to address the uncertainty that exists among stakeholders regarding how electric utility infrastructure (EUI) efficiency improvements fit into Minnesota's policy and regulatory framework. In particular, the goal is to clarify how EUI projects can be incorporated into utilities' conservation improvement program (CIP) efforts.

The ultimate outcome of the project is to develop actionable recommendations for utilities and policymakers to build momentum for EUI efficiency project implementation. The recommendations are based on the collaborative stakeholder engagement process where existing policies were examined, barriers to implementation were identified, and potential policy improvements were discussed.

The collection of recommendations comprises the content of this Action Plan. Over time, the impact of the Action Plan is expected to be an increased number of EUI efficiency projects completed as part of CIP.

Background

This section outlines important background information leading to the undertaking of this project, including an overview of the CIP regulatory framework, how relevant policies were understood prior to beginning the stakeholder engagement process, and a series of previous EUI-related projects commissioned by the Minnesota Department of Commerce (Commerce).

Conservation Improvement Program

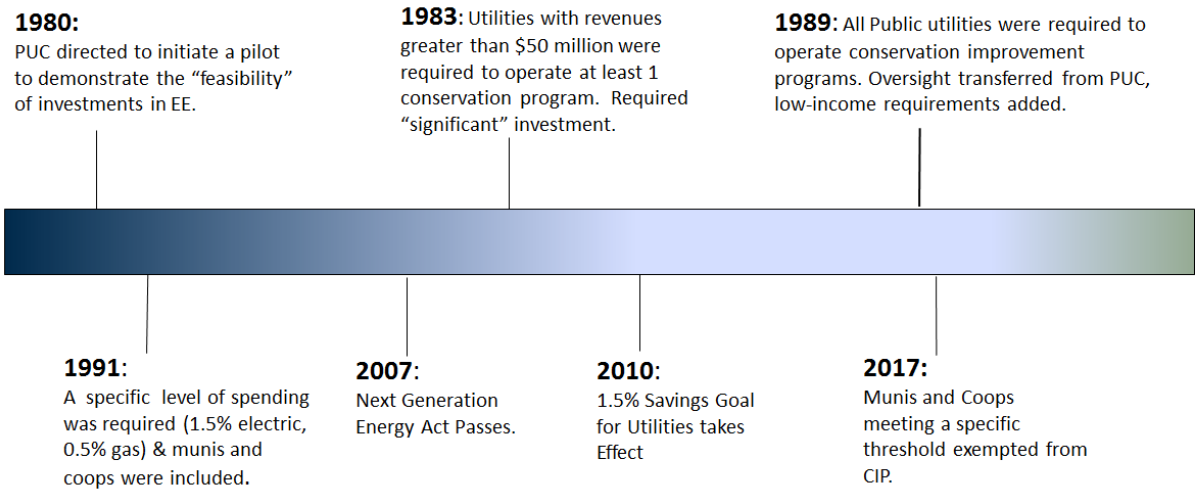
CIP helps Minnesota households and businesses use electricity and natural gas more efficiently – conserving energy, reducing carbon dioxide emissions, and lessening the need for new utility infrastructure. CIP is funded by ratepayers and administered by electric and natural gas utilities.

Minnesota policymakers have long recognized the promotion of energy efficiency as a cornerstone of the state's energy policy. As summarized in Figure 2, CIP began in Minnesota in the 1980s with the intention of motivating utility spending on energy efficiency. The passage of the 2007 Next Generation Energy Act established Minnesota's Energy Efficiency Resource Standard (EERS). As a result, beginning in 2010, utilities were required to develop CIP plans to achieve energy savings equal to 1.5 percent of average annual retail sales each year,[9] unless adjusted by the Commissioner to no less than 1.0

[9] As defined in Minn. Stat. 216B.241 subd. 1 (g), "gross annual retail sales" exclude sales to CIP-exempt customers.

percent.[10] Minnesota's EERS remains one of the most productive energy efficiency policies in the nation (according to the ACEEE scorecard[11]), ensuring that utilities, residents and businesses are optimizing their energy usage.

Figure 2 – CIP History



Minnesota Statute 216B.241[12] outlines the statutory requirements for utility CIP programs that are designed to meet Minnesota's 1.5 percent energy savings goal. Currently, 140 of Minnesota's 213 electric and natural gas utilities are covered under Minnesota Statute 216B.241. Commerce oversees CIP to ensure that ratepayer dollars are used effectively in achieving the 1.5 percent energy savings goal and that energy savings are reported as accurately as possible.

Minnesota utilities operate a wide array of residential, commercial, and industrial CIP programs targeted to both retrofits as well as new construction projects. Typical utility programs for residential customers include:

- Energy audits, where a trained energy consultant examines a home and offers specific advice on energy improvements;
- Rebates on high-efficiency heating, cooling, and water-heating appliances; efficient lighting; and low-flow showerheads and faucet aerators; and
- Air-conditioner cycling programs, which allow the utility to manage its peak energy demand in return for discounted electric bills for participating customers.

[10] Minn. Stat. 216B.241 subd. 1c (d) allows the Commissioner to adjust to a public utility's savings goal to a minimum of 1.0 percent.

[11] ACEEE State Efficiency Scorecard. https://aceee.org/state-policy/scorecard

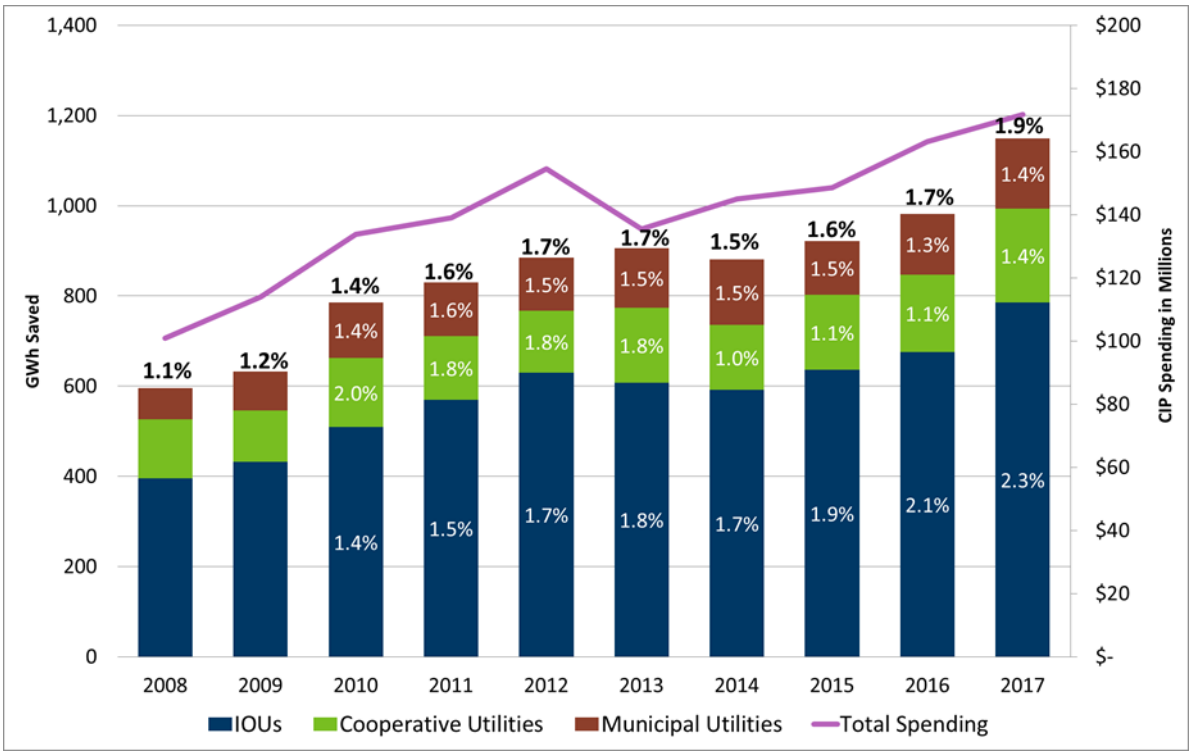
[12] Minnesota Statute 216B.241 Energy Conservation Improvement. https://www.revisor.mn.gov/statutes/cite/216B.241

Typical utility programs for commercial or industrial customers include:

- Rebates for high-efficiency boilers, chillers, and rooftop units; high efficiency motors and drives; high-efficiency lighting and lighting control systems;
- Building recommissioning studies; and
- Manufacturing process improvements that reduce energy intensity and improve productivity.

Figure 3 illustrates that Minnesota electric utilities, as a whole, have met or exceeded the 1.5 percent annual energy savings goal each year since 2011. While Minnesota has historically done quite well with energy efficiency achievements, Commerce has heard concerns from stakeholders about being able to meet the CIP savings goal in the future. To address these concerns and plan for CIP's future, Commerce hopes to address regulatory barriers to EUI efficiency implementation, so EUI projects can act as another tool in the toolbox in supporting Minnesota's energy savings goals.

Figure 3 - Energy efficiency spending and savings achievements of Minnesota electric utilities (in gigawatt-hours and as a percentage of total sales), 2008-2017



Relevant Existing Policies

Prior to beginning the EUI stakeholder engagement process, there was not an existing body of policy guidance (in Minnesota or nationally) dedicated to understanding EUI conservation opportunities. In

Minnesota's case, the relevant policy comprises only a handful of sentences found directly in statute,[13] an Order from the Public Utilities Commission (PUC) stating that EUI efficiency should be *excluded* from calculating a utility's Shared Savings DSM Financial Incentive,[14] and in a Rider available for investor-owned utilities to claim cost recovery for EUI efficiency projects that are not included in their rate case.[15] At the outset of this project, the EUI Rider had not been used to recover costs, but one case was opened in 2018 that could serve as an example of how the EUI Rider may be a valuable tool for IOUs.[16]

The statute that gave rise to the entire CIP policy framework (Minnesota Statute 216B.241[17]) establishes a goal of conserving 1.5 percent of retail electric sales annually. That is, for every 100kWh sold to retail customers, electric utilities must show they are reducing consumption by 1.5kWh through their conservation efforts. The statute specifically calls out improvements to EUI as an option for achieving part of that goal,[18] but the degree to which EUI can contribute to the goal is limited. Of the energy-savings goal for electric utilities, at least two-thirds (1 percent of retail sales) must come from demand-side conservation efforts. The remaining one-third (0.5 percent of retail sales) can be achieved through infrastructure efficiency, load management, or waste heat recovery projects. Additional demand-side conservation can also be used to fulfill the entire 1.5 percent goal, which has been the strategy for most utilities historically.

A small, but relevant piece of the statute is the provision that EUI savings in excess of the 1.5 percent goal can be carried forward for five years if needed to buffer against a future shortage of savings instead of the three years allowed for demand-side projects. However, the final sentence of the last paragraph in the statute relevant to infrastructure poses one of the greater hurdles to implementation due to difficulty of interpretation. In order to qualify for conservation credit, it says, "Electric utility infrastructure projects must result in increased energy efficiency greater than that which would have occurred through normal maintenance activity."

At the outset of this project, there were questions about nearly all aspects of the EUI policy as outlined in the statute. Why has the EUI Rider not been used more often? How much of the total energy savings goal is considered to be met if utilities achieve 0.5 percent of retail sales with EUI conservation, but fail

[13] subdivision 1c. paragraph d of Minnesota Statue 216B.241

[14] Docket No. E,G-999/CI-08-133. Order Adopting Modifications to Shared Savings Demand-Side-Management Financial Incentive Plan. Section B – Miscellaneous Provisions, paragraph L, "Costs, energy savings, and energy production from Electric Utility Infrastructure Projects (EUIC), solar installation, and biomethane purchases shall not be included in energy savings for DSM financial incentive purposes."

[15] Minnesota Statute 216B.1636 Recovery of Electric Utility Infrastructure Costs. https://www.revisor.mn.gov/statutes/cite/216B.1636

[16] Docket 18-640. Petition for approval requesting to implement service features related to Advanced Grid Infrastructure (AGI) technology. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=eDocketsResult&userType=public#

[17] Minnesota Statute 216B.241 Energy Conservation Improvement. https://www.revisor.mn.gov/statutes/cite/216b.241

[18] subdivision 1c. paragraph d of Minnesota Statue 216B.241

to meet 1.0 percent through demand-side savings? What constitutes "normal maintenance activity"? Lack of clear answers to these questions indicated the need for a project to improve the clarity of the existing policies and reduce barriers to implementing EUI efficiency projects within CIP.

Literature Review

Prior to the full EUI stakeholder engagement process, the project team conducted a literature review to collect relevant information to inform the ensuing discussions. The review examined existing policies, infrastructure technologies, relevant work done outside of Minnesota, and held some preliminary discussions with individual stakeholders about EUI efficiency. Many of the literature review topics were developed over the course of stakeholder engagement into findings presented in the Identified Barriers and Action Plan sections of this report. This section summarizes the literature review findings.

EUI Technologies

To understand how policies affect infrastructure efficiency, the project team conducted a brief review of relevant EUI technologies. Utility infrastructure can be divided into three broad sectors: Generation, transmission, and distribution. Transmission and distribution (T&D) are separate sectors in terms of important policies, but are commonly combined from a systems perspective because they rely on similar technologies (primarily conductors and transformers). Therefore, technologies are grouped by generation and T&D for purposes of this project. It should be noted that natural gas utilities are only affected by infrastructure efficiency efforts as far they affect natural gas generation facilities (there are no T&D gas efficiency considerations).

Transmission and Distribution

The U.S. Department of Energy estimates that electricity losses in the T&D sectors average about 7 percent of total energy transmitted.[19] These losses are caused by resistance in conductors (load losses) and energy lost whenever transformers are energized, whether they are delivering power or not (no-load losses). Highly efficient T&D systems can achieve lower losses in the range of 3-4 percent of total consumption. A separate potential study was recently completed (published early 2019[20]) to evaluate actual realizable efficiency gains in Minnesota, but a quick estimate of the upper bound of T&D savings potential in the state is in the neighborhood of 1.8 million MWh annually (assuming a reduction from 7 percent losses to 4 percent losses on 60 million MWh transmitted).

T&D efficiency improvements include upgrading components with low-loss transmission lines, high efficiency transformers, or converting to higher voltage lines. They also include controls strategies like load balancing, Conservation Voltage Reduction (CVR), and Volt-VAR Optimization. Technologies like

[19] DOE report quoted in LBNL Webinar, "Opportunities and EM&V for Improving Electricity Distribution Efficiency" https://emp.lbl.gov/sites/default/files/emv_webinar_td_october_2016_final.pdf

[20] Final EUI Potential Study Report. http://mn.gov/commerce-stat/pdfs/card-gds-eui-potential.pdf

Smart Grid, storage, and advanced metering infrastructure do not achieve energy efficiency directly, but may enable or enhance other efficiency strategies.

Generation

Electric generation facilities in the United States produced 4.1 billion net MWh of electricity in 2016[21]. Of that, approximately 60 million MWh were generated to serve loads in Minnesota[22]. By fuel source nationwide, approximately 30.4 percent of electricity produced comes from coal generators, 33.8 percent comes from natural gas, 19.7 percent comes from nuclear, 6.5 percent comes from hydroelectric, and 8.4 percent from other renewables with the remaining small fraction coming from a variety of other sources.

Figure 4 – Nationwide 2016 Net Generation by Fuel Type

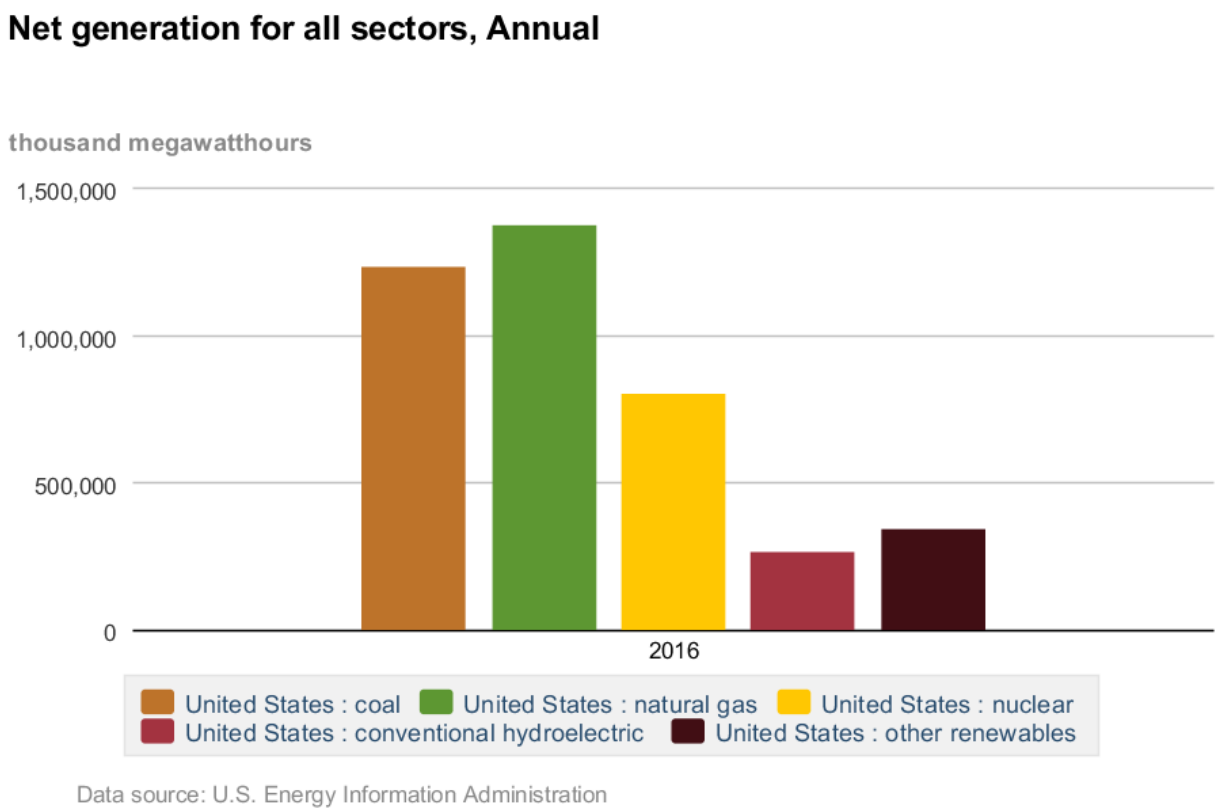


Figure 4 shows energy produced in the United States by fuel source in terms of net generation for 2016. Net generation values do not include auxiliary consumption at the generation facility required to operate machinery, thus represent only useful energy delivered to the grid. For fossil fuel facilities,

[21] US Energy Information Administration. Report from online Electricity Data Browser. Net Generation for All Sectors (Thousand Megawatt Hours). 2016 https://www.eia.gov/electricity/data/browser/

[22] US Energy Information Administration. Report from online Electricity Data Browser. Net Generation for All Fuels (utility scale) (Thousand Megawatt Hours). 2016 https://www.eia.gov/electricity/data/browser/

generation energy efficiency improvements will result in reduced input fuel (in Btu) required to deliver the same net energy output (in kWh), which is measured by a plant's net heat rate (Btu/kWh). Generation efficiency efforts will primarily focus on fossil fuel facilities, at least in the near term, for several reasons. First, they generate a larger share of energy than any other sector. Second, their efficiency (and improvements) can be measured and compared using net heat rate as a metric. Third, increasing their efficiency has a greater impact on carbon emissions than in non-fossil sectors. Finally, and most importantly, fossil fuel plants have the most room for energy efficiency improvements due to both the technology involved and the average age of the facilities.

The national average heat rates for coal and natural gas plants in 2015 were 10,495Btu/kWh and 7,878Btu/kWh, respectively.[23] Heat rates in coal plants have actually been getting worse over time, largely due to aging facilities and reliability needs of the grid that require faster plant cycling.[24] However, top-performing coal plants today can achieve heat rates under 9,000Btu/kWh[25] and gas plants under 7,000btu/kWh.

Unlike measures found in other sectors, generation efficiency measures are typically unique, custom projects for which a prescriptive or deemed savings calculation methodology does not make sense. The report "Utility Infrastructure Improvements for Energy Efficiency"[26] outlines some examples of possible projects including: boiler upgrades, turbine upgrades, measurement and control optimization, waste heat recovery, fuel enhancement, materials handling improvements, and fan and pump variable speed drives. Because the range of possible projects is large, the Minnesota Technical Reference Manual includes a protocol, rather than prescriptive measures, to calculate energy efficiency credit for completing projects that improve the heat rate of generation facilities.

As a note on generation technologies, fuel switching opportunities are especially difficult to assess in terms of energy efficiency impacts. A coal plant replaced entirely by a natural gas plant will generate electricity more efficiently. However, choosing to replace an entire generation facility depends on many factors and measuring the impact that efficiency considerations have on a final decision to replace a generation facility is difficult. There is room to explore awarding efficiency credit to tip the scales in a fuel-switching decision process toward efficiency, but more discussion is needed regarding Minnesota's fuel-switching policy.

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[23] Average Operating Heat Rate for Selected Energy Sources. EIA, 2017. https://www.eia.gov/electricity/annual/html/epa_08_01.html

[24] 2010 EPRI report, Evaluation of Fuel Quality Impacts on Heat Rate (EPRI document 1019703)

[25] John W. Turk Jr. Power Plant. Operated by Southwestern Electric Power Co. in Arkansas. Operating capacity of 609-MW. Heat rate: 8,858 btu/kWh http://www.power-eng.com/articles/slideshow/2014/08/top-5-u-s-coal-plant-heat-rates/pg001.html

[26] Brown, M. 2010. Utility Infrastructure Improvements for Energy Efficiency: Understanding the Supply-Side Opportunity. Prepared for Minnesota Office of Energy Security, Minnesota Department of Commerce. Prepared by Franklin Energy.

Minnesota EUI Efforts

Commerce has long recognized that EUI has been a rarely-used, but potentially valuable tool in the toolbox for CIP energy efficiency savings. Prior to embarking on this stakeholder engagement process, Commerce laid the groundwork for a more comprehensive evaluation of EUI barriers and opportunities, including commissioning the following studies.

Preliminary Report on Infrastructure Opportunities

In 2010, Commerce commissioned Franklin Energy to compile a report entitled *Utility Improvements for Infrastructure: Understanding the Supply-Side Opportunity.*[27] The effort was meant to better understand what opportunity might exist in the EUI sector. The report reviewed many possible specific technologies to achieve greater EUI efficiency, for example: boiler upgrades, turbine upgrades, measurement and control optimization, waste heat recovery, fuel enhancement, materials handling improvements, and fan and pump variable speed drives. Findings indicated that there is likely significant opportunity and additional efforts to unlock the potential of EUI conservation are likely worthwhile.

Technical Reference Manual EUI Measures

In 2016, Commerce commissioned GDS Associates to create EUI measures to add to the Minnesota Technical Reference Manual.[28] Utilities can use these prescribed methodologies to calculate efficiency savings, which provides utilities certainty in the savings achieved and reduces barriers to implementation. 28 existing TRM measures were adapted for use at utility-owned facilities. Four entirely new TRM measures were created to calculate savings for:

- Generation Equipment Retrofit (Net Heat Rate Improvements)
- Conservation Voltage Reduction
- High Efficiency Transformers
- Efficient Conductors for Transmission and Distribution Lines

EUI Potential Study

Concurrent with the EUI stakeholder engagement process, a companion EUI potential study (led by GDS Associates) was carried out to identify and quantify the statewide energy savings potential of EUI assets owned by utilities serving Minnesota customers. The results are intended to inform utility program design and policy decisions aimed at capturing the identified opportunities. The findings of the potential study fed directly into many discussions over the course of the stakeholder engagement effort.[29] In fact,

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[27] Brown, M. 2010. Utility Infrastructure Improvements for Energy Efficiency: Understanding the Supply-Side Opportunity. Prepared for Minnesota Office of Energy Security, Minnesota Department of Commerce. Prepared by Franklin Energy. November

[28] State of Minnesota Technical Reference Manual for Energy Conservation Improvement Programs. Version 3.0, January, 2019. http://mn.gov/commerce-stat/pdfs/mn-trm-v3.0.pdf

[29] Final EUI Potential Study Report. http://mn.gov/commerce-stat/pdfs/card-gds-eui-potential.pdf

since the projects had an overlapping timeline and drew from a similar pool of stakeholder contributors, they shared some parts of common methodology and produced intertwining findings. Results from the potential study are summarized in Appendix B: Additional Study Findings and have been incorporated into the broader Action Plan recommendations.

Other Related Minnesota Initiatives

There are several additional initiatives related to EUI efficiency that have overlapping goals, which are summarized in this section.

Grid Modernization

In March 2016, the Minnesota PUC published a staff report on Grid Modernization.[30] The report includes specific technology recommendations that overlap with EUI efficiency measures as well as a discussion of regulatory recommendations. Grid Modernization is defined by the Staff Report as the following:

> A modernized grid assures continued safe, reliable, and resilient utility network operations, and enables Minnesota to meet its energy policy goals, including the integration of variable renewable electricity sources and distributed energy resources. An integrated, modern grid provides for *greater system efficiency and greater utilization of grid assets*, enables the development of new products and services, provides customers with necessary information and tools to enable their energy choices, and supports a standards-based and interoperable utility network.

The italicized portion of the definition highlights the overlap between Grid Modernization and EUI efficiency. The efforts are being conducted separately, but technical and policy recommendations from EUI efforts will very likely complement Grid Modernization recommendations and should be considered in parallel. Policy recommendations should be framed such that they include the expected effects in terms of achieving both projects' goals.

In particular, in one of the guiding questions for Grid Modernization, the Minnesota PUC considered actions that would support improved alignment of planning for investment in the distribution system. New legislation in 2015 established the Integrated Distribution Plan (IDP) process, which instructed specific utilities to identify investments necessary to modernize the grid, including ways that increase energy conservation opportunities[31] (currently, only Xcel Energy is affected). This provision is an opportunity to inject EUI efficiency considerations into the planning process at the same time that Grid Modernization planning is being developed.

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[30] Minnesota Public Utilities Commission Staff Report on Grid Modernization, March 2016. Docket 15-556. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E04F7495-01E6-49EA-965E-21E8F0DD2D2A}&documentTitle=20163-119406-01

[31] House File 3 of the 2015 Special Session, approved on June 13, 2015, modifying Minn. Stat. §216B.2425

There are several ways the Grid Modernization process may overlap with EUI efficiency efforts. Over the course of the stakeholder engagement process, discussions touched on how to fit EUI efficiency into grid modernization efforts. Specifically, stakeholders heard from Minnesota PUC Commissioner Nancy Lange about the state's grid modernization efforts, DOE representative Joe Paladino about a nationwide grid modernization vision, and from utility design engineers about how they could incorporate efficiency into the planning process.

Integrated Resource Plans

Most utilities in Minnesota (those serving 10,000 or more retail customers) are required to periodically file an Integrated Resource Plan (IRP).[32] The purpose of an IRP is to ensure that each utility has a plan to meet their customers' needs in a reliable and low-cost manner over a long-term planning horizon. IRPs identify generation and conservation resources used to match energy supply and demand on the grid. IRPs already include estimates of EUI losses (and therefore efficiency) and include expected updates to infrastructure over the planning horizon. IRPs provide a likely vehicle for introducing policy levers to drive EUI efficiency. For example, by clarifying the value of EUI efficiency (in terms of cost-effective CIP compliance or simply recommending considering high efficiency options), utilities may incorporate EUI efficiency into their long-term plans directly as a cost-effective resource. A stronger incentive could also be developed modeled on the current requirement that IRPs demonstrate a good-faith effort to meet Minnesota's Renewable Energy Standard.

E21 Initiative

The E21 Initiative[33] is a collaborative group of Minnesota energy leaders focused on updating the utility business model to adapt to the 21st century energy system. Many of their policy recommendations form a long-term vision of energy in Minnesota that includes a focus on efficiency. One recommendation is to consider developing a Performance Based Ratemaking model, which would include the performance of infrastructure assets and would be a top-down solution to achieve EUI efficiency. Using the existing CIP framework as a bottom-up approach may work more in the short-term and it may be possible to combine the efforts into a complete action plan.

National EUI Efficiency Efforts

There have also been a few national studies of specific infrastructure efficiency technologies and targeted efforts to promote them, summarized here.

The most comprehensive study of infrastructure efficiency opportunities we found was conducted on behalf of the Northwest Energy Efficiency Alliance (NEEA) by Navigant Consulting to evaluate the degree

[32] Minnesota Statute §216B.2422 Resource planning; Renewable Energy

[33] e21 Initiative, Phase 1 Report, December 2014.
http://www.betterenergy.org/sites/default/files/e21_Initiative_Phase_I_Report_2014.pdf

to which utilities in the Pacific Northwest have deployed distribution efficiency technologies.[34] There has been a consistent push for distribution efficiency programs in the Northwest over the last 10 years and the report outlines numerous lessons that will likely apply to Minnesota. Major takeaways include: utilities are willing to implement efficiency measures, but it is typically not their top priority, financial incentives have been useful in promoting adoption, and Conservation Voltage Reduction (CVR) is the measure most likely to produce significant energy savings.

In addition to the NEEA report, several studies have estimated the potential of CVR specifically. CVR alone could potentially deliver as much savings by itself as all other T&D measures combined according to some experts[35]. One representative study produced by Pacific Northwest National Laboratory in 2010 projected that CVR could potentially conserve up to 3 percent (and realistically 2.5 percent targeting high-value projects) of total energy consumption nationwide.[36] These findings are consistent with other studies from Maryland,[37] Washington,[38] and California.[39]

During a webinar hosted by Lawrence Berkeley National Laboratories focused on distribution efficiency, experts said measurement and verification of CVR is, "Probably the most advanced of any category of any T&D efficiency actions." Their assessment includes reviewing an EPRI study[40] and a Regional Technical Forum protocol.[41] These resources also formed the basis for the Minnesota TRM measure. Being able to present decision makers with reliable evaluations of the impact of efficiency projects is crucial to their success, which strengthens the case for CVR.

There are also efficiency measures that are very difficult to measure impacts. For example, Smart Grid deployment is very likely to enable controls measures, including CVR, that improve grid efficiency, but infrastructure efficiency is not its only impact. Smart Grid can also improve reliability and security as well as integrate distributed generation and storage technologies and allow the creation of new retail rate

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[34] 2014. Prepared by Navigant Consulting. Northwest Energy Efficiency Alliance. "Long-Term Monitoring and Tracking Distribution Efficiency." https://neea.org/img/uploads/long-term-monitoring-and-tracking-distribution-efficiency.pdf

[35] Quote from recorded LBNL Webinar, "Opportunities and EM&V for Improving Electricity Distribution Efficiency." October 27, 2016.

[36] PNNL, "Evaluation of Conservation Voltage Reduction (CVR) on a National Level," US Department of Energy Pacific Northwest National Laboratory, 2010 http://www.pnl.gov/main/publications/external/technical_reports/PNNL-19596.pdf

[37] 2015. Faruqui A. Impact Evaluation of Pepco Maryland's Phase 1 Conservation Voltage Reduction (CVR) Program

[38] Conservation Voltage Reduction – On the Other Side of the Meter: An Evaluation Case Study. Presented at: International Energy Program Evaluation Conference, Long Beach, CA. 2015

[39] EPRI. Document 3002004930. Analysis of Sacramento Municipal Utility District Conservation Voltage Reduction (CVR) Tests: June 2013 – June 2014.

[40] EPRI 1023518, Green Circuits: Distribution Efficiency Case Studies, Electric Power Research Institute, Palo Alto, CA, 2011. http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001023518

[41] Simplified Voltage Optimization (VO) Measurement and Verification Protocol https://www.bpa.gov/EE/Sectors/Industrial/Documents/Final_Draft_VO_MV_Protocol_4-27-10.pdf

structures and demand side management programs. Despite the wide range of benefits, Smart Grid is complicated such that the costs and exact value of benefits are difficult to specify and many of the benefits are conditional on customer participation in programs. If it is not done correctly, Smart Grid rollout may not be worth the cost even if it does unlock infrastructure efficiency opportunities.[i] There have been efforts on a national level to develop guidance to modernize the grid,[ii] with case studies underway to test its impacts and many specific plans for states to modernize their grids.[iii] As states and utilities begin to focus more on grid modernization and Smart Grid technologies, they will play a big role in the infrastructure efficiency conversation and it will be important to communicate among advocates of both efforts.

Another policy issue related to infrastructure efficiency is the Clean Power Plan (CPP) issued by the U.S. Environmental Protection Agency (EPA). A study to identify CPP compliance strategies identified several activities labeled grid optimization that both improve performance and efficiency of T&D systems. These activities may alleviate conflict between reliability priorities and the desire to promote efficiency. Specific activities the report identifies include: CVR, Power Factor Management, Demand Response and energy storage.[42] Because the CPP is currently stayed, compliance issues will not be a priority soon, but if they become important again there is likely to be overlap with infrastructure efficiency efforts.

[42] Implementing EPA's Clean Power Plan: A Menu of Options, Chapter 5, Optimize Grid Operations

Stakeholder Engagement Process

To accomplish this project's main goal of addressing EUI regulatory uncertainty, the project team devised a strategy to engage stakeholders, develop the Action Plan, and disseminate the study's findings. The most important component of the process was a series of open stakeholder meetings to facilitate conversations and reach consensus about EUI issues. To help steer the project (and the concurrent potential study), an Advisory Committee was convened of key experts. The project team also conducted two remote surveys of stakeholders to gather additional, more detailed perspectives.

Between stakeholder meetings, the project team developed materials to advance the goals of the project. The team developed draft policy guidance for stakeholder discussion (which were also posted to a formal regulatory docket for stakeholder comment), set specific goals for the project to achieve, organized meeting agendas, and reached out to experts on relevant issues to invite them to present at stakeholder meetings. This iterative process of engaging stakeholders, developing ideas, and reengaging stakeholders to hone those ideas culminated in the eventual recommendations included in the Action Plan.

All project activities were designed to advance four sub-goals aimed at strengthening collaboration and understanding among stakeholders:

1. *Inform stakeholders* about current policies and raise awareness about EUI as a conservation tool
2. *Facilitate discussion* about how the current policies work and identify barriers to implementing EUI efficiency projects
3. *Solicit ideas* from stakeholders about barriers to implementation, opportunities for improvement, and solutions to identified barriers
4. *Develop recommendations* for specific actions and policy clarifications to drive EUI efficiency implementation (culminating in the Action Plan)

Stakeholder Meetings

At the core of the project were four half-day meetings held to facilitate discussions among stakeholders, iteratively build understanding of relevant issues, and reach consensus on Action Plan recommendations. Figure 5 illustrates the process of iterative stakeholder engagement culminating in the Action Plan.

Figure 5 - Illustration of the Stakeholder Meetings Process

The open meetings provided a broad base of involvement from diverse stakeholders to ensure that the Action Plan considered all perspectives and helped anticipate the effects of possible recommendations. Stakeholders invited to meetings (and actual attendees) included: individual utilities, utility associations, advocacy groups, technology manufacturers, Minnesota Public Utilities Commission staff, large utility customers, students, and industry consultants. Speakers invited to present at meetings included: technology experts (researchers and manufacturers), policy/regulatory experts (local, regional, national, and international), and utility infrastructure design engineers (including both investor-owned and consumer-owned utility staff).

Building from the literature review and early conversations, the team set the first meeting agenda to focus on identifying barriers to EUI implementation and discussing relevant EUI technologies. Three subsequent meetings continued these discussions and added relevant expert presentations to develop and discuss possible recommendations to include in the Action Plan. Summaries of the conversations held at the meetings can be found in Appendix B: Additional Study Findings. Full meeting notes, presentation slides, and materials can be found on the project webpage.[43]

Advisory Committee Meetings

At the beginning of the EUI projects, an Advisory Committee convened to help steer activities toward accomplishing the desired goals. Advisory Committee members were expected to contribute more effort to the projects than the wider group of stakeholders. This involved activity between meetings to consider proposals and discuss the projects within their organizations. For the potential study, the

[43] EUI Efficiency Projects webpage. https://www.mncee.org/mnsupplystudy/project-resources/

Advisory Committee played an active role in improving the methodology and helping collect required data.

For the stakeholder engagement process, the Advisory Committee's role was to provide input to the project team to validate our understanding of issues. The Committee provided a preliminary vetting of ideas proposed by the project team to verify they were reasonable before presenting them to the large stakeholder meetings for discussion. The Committee also helped identify potential experts to present at the wider stakeholder group meetings and reviewed proposed agendas for those meetings. Overall, the Advisory Committed helped to ensure stakeholder discussions made the best possible use of time and focused on the most important issues.

The Advisory Committee members included utility representatives, industry consultants, and efficiency advocates with significant experience interpreting and applying energy efficiency policy. The full list of members is shown in Table 2.

Table 2 - List of Advisory Committee Members

Name	Title	Organization
Nick Minderman	DSM & Renewable Policy Strategy Consultant	Xcel Energy
Clifford Haefke	Director	Energy Resources Center/DOE CHP TAP
Grey Staples	Managing Director	The Mendota Group
Jeff Haase	Strategic Energy & Efficiency Program Representative	Great River Energy
Jim Horan	Director of Government Affairs and Counsel	Minnesota Rural Utilities Association
Kevin Lawless	Principal	The Forward Curve LLC
Lisa Severson	Conservation Coordinator	Minnkota Power Cooperative
Nick Mark	Manager, Conservation & Renewable Energy Policy	CenterPoint Energy
Richard Sedano	Principal, Director of US Programs	Regulatory Assistance Project
Rob Scott-Hovland	State Legislative Representative	Missouri River Energy Services
Robert Jagusch	Director of Engineering and Policy Analysis	Minnesota Municipal Utilities Association
Tina Koecher	Manager - Customer Solutions	Minnesota Power
Will Nissen	Director, Energy Performance	Fresh Energy
Greg Anderson	Energy Efficiency Engineer	Otter Tail Power Company

Stakeholder Surveys

Wilder Research worked with CEE to conduct in-depth qualitative interviews with 25 key stakeholders in summer 2017. A follow-up web survey was conducted in November 2018, with responses from 23 stakeholders representing a variety of organization types.

The surveys were designed to gauge interest in EUI issues among stakeholders in terms of both awareness and importance to their organization's conservation plans. The team was also interested in tracking changes in stakeholder attitudes about EUI issues over the time between the two surveys. The findings of the first survey were used to inform stakeholder meeting discussion topics including identifying barriers to EUI implementation. Findings from both surveys are incorporated into the Action Plan's recommendations.

Dissemination of Results

In the later stages of the project, the stakeholder engagement process shifted from collecting input to disseminating findings. This entails presenting results and recommendations in several different formats to a variety of audiences. The dissemination strategy includes: in-person presentations, direct outreach to related projects, reconnecting with stakeholders who attended meetings, recording a summary webinar, and publishing the final Action Plan.

In-person presentations allowed the project team to reach stakeholders that did not directly participate in the project to this point. Several in-person presentations have been given already or are planned for the near future.

- GDS Associates and Commerce presented preliminary findings from this study during the NASEO conference in February 2019. The focus of the 20-minute presentation was to raise awareness of EUI efficiency opportunities for state policymakers beyond Minnesota and summarize the important findings of the study in terms of how they might apply to other states.
- GDS Associates prepared a poster presentation for the Iowa Energy Summit in November 2018. The poster included preliminary results from three EUI projects (TRM measure development, Potential Study, and this stakeholder engagement project). The poster drew some interest and will be updated with the final results for future presentations.
- GDS Associates, CEE, and Commerce presented findings from this study as well as the companion demand-side potential study to the Midwest AESP chapter.
- The project team submitted abstracts to present findings at additional national conferences.

The project team will specifically reach out to organizations managing initiatives related to EUI efficiency to suggest review of the study findings. In particular, the team will collect relevant findings to summarize for managers of the projects identified in the Connections to Related Initiatives section. The project team hosted a live webinar on March 26th, 2019 to summarize the project findings and major Action Plan recommendations. The webinar was recorded and published on the project web page and Commerce site for any stakeholders who wish to access it.

As a concluding step in this study, the project team solicited stakeholder feedback on the Draft Action Plan from March 26th through May 3rd, 2019. Feedback was incorporated into this final version of the Action Plan. The Action Plan will be hosted on the Commerce website and project website. When it is published, all stakeholders who participated in the project will be notified by email that the final Action Plan is available. The project team plans to also develop a factsheet to highlight the most important practical recommendations specifically for utility infrastructure design teams.

Action Plan

This section summarizes specific utility recommendations developed over the course of the stakeholder engagement process and the companion EUI Potential Study. Along with the recommendations themselves, there is additional discussion of possible ways to connect EUI efficiency to related efforts as a vehicle to continue conversations started through this project. Many of the recommendations reference resources available to help stakeholders understand the value of EUI efficiency; a compiled list of links can be found in Appendix A: Collected References and Resources.

Recommendations

This section summarizes the recommendations developed to drive implementation of EUI efficiency projects in Minnesota. The recommendations were developed over the course of stakeholder discussions by identifying barriers to implementation and then developing the best solutions to overcome them.

Table 3 summarizes the Action Plan recommendations in approximate order of importance in terms of impact on driving EUI efficiency implementation. The capital letters in parentheses in the right column of Table 3 can be used to cross reference Table 9 in the Identified Barriers section of Appendix B: Additional Study Findings, where all barriers are discussed in more detail.

Table 3 - Summary of Action Plan Recommendations and the Barriers They Address

Recommendation	Barrier(s) addressed
1) Connect infrastructure design teams with CIP personnel	Lack of Awareness (B), Priorities (H), Unclaimed Existing Projects (P)
2) Combine EUI efficiency with overlapping Grid Modernization efforts	Lack of Awareness (B), Priorities (H), Alternative Options (N)
3) Review EUI policy guidance documents issued by Commerce	Savings Uncertainty (A), Lack of Awareness (B), Regulatory Uncertainty (E), DSM 1 percent Requirement (G), "Normal Maintenance" Definition (L)
4) Apply excel-based high-level screening tools on Commerce website	Savings Uncertainty (A), Lack of Awareness (B), Cost Recovery (C), Weak Business Case (D), Uncertain Payback (J), Alternative Options (N)
5) Review EUI Potential Study results	Lack of Awareness (B)
6) Reach out to Commerce with ideas or questions	Regulatory Uncertainty (E), Staffing Challenges (I)
7) Establish a repository for EUI project information	Lack of Awareness (B), Regulatory Uncertainty (E), "Normal Maintenance" Definition (L)

Recommendation	Barrier(s) addressed
8) Conduct internal, utility-specific assessments of EUI potential	Savings Uncertainty (A), Lack of Awareness (B), Uncertain Payback (J)
9) Refer to the TRM for standardized EUI measures	Savings Uncertainty (A)
10) Review EUI Potential Study's recommendations	Lack of Awareness (B), Regulatory Uncertainty (E), Weak Business Case (D), Uncertain Payback (J), New Source Review Concern (K), Unclaimed Existing Projects (P)
11) *Discuss* including *some* EUI projects in the Shared Savings DSM Financial Incentive mechanism	Lack of Awareness (B), Weak Business Case (D), Lack of Incentives (F)
12) Streamline the cost recovery rider	Cost Recovery Uncertainty (C
13) Summarize findings to pass along to related, ongoing efforts	Lack of Awareness (B)
14) Clarify the large natural gas generation automatic CIP exemption clause	Savings Uncertainty (A), Regulatory Uncertainty (E
15) Continue discussions of long-term vision for EUI within CIP	Insufficient EUI Metrics (Q)

1. Utilities should consciously build connections between infrastructure design teams and CIP personnel - Currently, most utilities separate CIP activities from infrastructure design work and the respective responsible personnel have little reason to interact. Some of the "lowest-hanging fruit" of potential EUI conservation is very likely already possible to achieve and only requires increased awareness of EUI efficiency options among design engineers. Connecting CIP personnel to design teams to help raise awareness may quickly identify opportunities to leverage CIP resources in the infrastructure planning process. Further, stronger connections across teams will lay the groundwork for the development of more complicated EUI project design and evaluation of conservation impacts. Some specific recommendations to help build these connections include:

a) Designating an individual as the EUI efficiency point-person to review opportunities and coordinate connections among relevant staff.
b) Making utility design engineers aware that EUI efficiency options may be justifiable even if they are more costly than business-as-usual because they may help achieve conservation goals.
c) Adding conservation credit to the cost-benefit evaluation of infrastructure design processes.

Barriers addressed by this recommendation: Lack of awareness of potential projects and their value; Efficiency is not a top priority; Unclaimed current projects (Entries B, H, and P on Table 9 in Appendix B: Additional Study Findings).

2. Utilities should connect EUI efficiency to related grid modernization efforts to leverage findings and accomplish overlapping goals - As utilities consider strategies to modernize the grid, they should also

consider the possible impacts of increased infrastructure efficiency in terms of helping to achieve conservation goals. Cost/benefit analyses do not currently include EUI conservation as a line-item benefit, but it should be included and may increase the value of grid modernization proposals. The benefits do not just apply to explicit grid modernization. Any project that affects infrastructure (Advanced Metering Infrastructure deployment, microgrids, capacity expansion, renewable integration, hosting capacity, routine transformer replacement protocols, etc.) should all consider EUI efficiency impacts.

Barriers addressed by this recommendation: Lack of awareness of potential projects and their value; Efficiency is not a top priority; There are easier CIP options than EUI (Entries B, H, and N on Table 9 in Appendix B: Additional Study Findings).

3. Utilities should review policy guidance documents developed by Commerce to clarify the role of EUI efficiency within CIP - Over the course of this project, two policy guidance documents were issued by Commerce covering four subjects:

a) "Claiming Energy Savings through Electric Utility Infrastructure Improvements and the Energy Savings Carry Forward Provision" includes a clarification on the 1 percent demand-side threshold and defines a 5-year carry-forward provision for EUI conservation.[44]
b) "Determining Normal Maintenance Activities and CIP Review Process for Electric Utility Infrastructure Projects" describes how to determine the meaning of "normal maintenance" for a given project and outlines the process used by Commerce to review EUI conservation projects – this may be the best starting point for utilities to begin considering EUI within CIP.[45]

Barriers addressed by this recommendation: Lack of certainty in calculating eligible savings; Lack of awareness of potential projects and their value; General regulatory uncertainty; 1 percent Demand-side requirement before EUI savings count; Definition of "normal maintenance" unclear (Entries A, B, E, G, and L on Table 9 in Appendix B: Additional Study Findings).

4. As EUI project ideas are generated, utilities should apply the Excel-based, high-level screening tools available on the Commerce website to estimate the savings potential and cost-effectiveness of potential projects[46] - These tools were created as part of this project and the concurrent potential

[44] Docket No. E, G999/CIP-17-856. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={30E3B861-0000-C119-AFBE-5532959C72DA}&documentTitle=20182-140321-01

[45] Docket No. E999/CIP-18-543. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7bB0849C66-0000-C310-A767-92B206A5993B%7d&documentTitle=201810-147198-01

[46] High-level EUI project screening tools. http://mn.gov/commerce-stat/xls/electric-infrastructure-efficiency-screening.xlsx

study. They are designed to lower the effort required by utilities to estimate the value of EUI projects by streamlining the TRM measures and cost-effectiveness tests. Outputs from the screening tools can be used for rough planning purposes and may indicate which projects are worth further development. Users should be aware that although the tools will calculate savings from EUI projects accurately, they should be used only for high-level screening until all inputs are reviewed and approved by Commerce.

> Barriers addressed by this recommendation: Lack of certainty in calculating eligible savings; Lack of awareness of potential projects and their value; Capital cost recovery for certain projects may be uncertain or complicated; Business case for conservation is not strong enough; Uncertain payback; There are easier CIP options than EUI (Entries A, B, C, D, J, and N on Table 9 in Appendix B: Additional Study Findings).

5. Utilities should review the results of an EUI potential study conducted in Minnesota, which found that EUI conservation is a worthwhile target of CIP resources - Estimates indicate EUI conservation has the potential to achieve approximately 9 percent of electric utility CIP goals statewide, on average, from 2020-2039.[47] All utilities in the state are likely to find economically-viable EUI efficiency opportunities worth considering for implementation.

> Barriers addressed by this recommendation: Lack of awareness of potential projects and their value; (Entry B, on Table 9 in Appendix B: Additional Study Findings).

6. Utilities should reach out to Commerce with ideas or questions about EUI within CIP - EUI policies and technologies comprise an evolving landscape with the potential for confusion among stakeholders. However, there is also potential for increased understanding and collaboration going forward. All parties are likely to learn from each other when questions arise. Utilities are encouraged to build on this process by asking questions when uncertain and suggesting recommendations for improvements to policies as applicable.

> General regulatory uncertainty; Staffing challenges (Entries E and I on Table 9 in Appendix B: Additional Study Findings).

7. Stakeholders should establish a common repository for EUI efficiency information - All materials generated by this project will be available on the project webpage even after it concludes (or available by contacting the author), but these are only the starting point for driving EUI efficiency and they will no longer be updated. There are likely to be new developments in the EUI landscape that warrant maintaining updated information. Interested stakeholders should establish common space (possibly hosted by Commerce) where they can communicate among each other to:

a) Periodically review EUI technologies, specifically considering efficiency impacts
b) Monitor successful EUI projects completed by other stakeholders

[47] Final EUI Potential Study Report. http://mn.gov/commerce-stat/pdfs/card-gds-eui-potential.pdf

c) Reference meeting notes, presentations, and contact information from experts who shared their insights at the stakeholder meetings

Barriers addressed by this recommendation: Lack of awareness of potential projects and their value; General regulatory uncertainty; Definition of "normal maintenance" unclear (Entries B, E, and L on Table 9 in Appendix B: Additional Study Findings).

8. Utilities should conduct internal assessments of EUI efficiency potential within their service territories - The statewide EUI potential study examined a representative sample of utilities across the state to identify possible opportunities. However, individual utilities may find more or less conservation potential than average. Tracking system performance over time may indicate areas where improvement is possible. Many utilities may already have this information but may not have considered using it to identify conservation potential. Specifically, utilities should:

a) Periodically conduct T&D system loss analyses and track results over time. If a full analysis is not possible, at least track wholesale purchases and subtract retail sales to estimate system losses.
b) Periodically compare generation plant heat rates to similar facilities.
c) Estimate the potential value of improved system efficiencies in terms of conservation – possibly by applying the excel-based screening tools called out in recommendation 4.

Barriers addressed by this recommendation: Lack of certainty in calculating eligible savings; Lack of awareness of potential projects and their value; Uncertain payback; (Entries A, B, and J on Table 9 in Appendix B: Additional Study Findings).

9. Stakeholders should be aware that standardized measures are available in the Minnesota TRM to calculate CIP savings from certain EUI efficiency projects[48] - One of the important barriers to implementation identified by stakeholders is the uncertainty of calculating conservation credit for an EUI project. Some measures have prescribed methodologies in the TRM and have associated SmartMeasures™ on the Energy Services Platform (ESP). This may provide certainty that will simplify the evaluation of conservation options.

Barriers addressed by this recommendation: Lack of certainty in calculating eligible savings; (Entry A on Table 9 in Appendix B: Additional Study Findings).

10. Stakeholders should reference the specific findings and recommendations from the EUI Potential Study - Many of the Potential Study findings were used to inform the development of the Action Plan recommendations to this point, but the Potential Study produced technically specific recommendations as well. For full context, reference the Potential Study report. [49] To summarize:

[48] State of Minnesota Technical Reference Manual for Energy Conservation Improvement Programs. Version 3.0, January, 2019. http://mn.gov/commerce-stat/pdfs/mn-trm-v3.0.pdf

[49] Final EUI Potential Study Report. http://mn.gov/commerce-stat/pdfs/card-gds-eui-potential.pdf

a) Adjustments to generation operating protocols may be a cost-effective way to achieve modest savings.
b) Coal plants that are not planned for decommissioning offer significant opportunity for improved heat rates and energy conservation.
c) AMI deployment or accelerating existing AMI deployment plans will likely enable significant EUI efficiency opportunity.
d) As a reminder to utilities, traditional demand-side conservation projects (HVAC, lighting, motors, etc.) at sites owned by utilities are eligible for conservation credit as EUI projects.
e) Updating maintenance protocols to incorporate higher efficiency considerations can be a cost-effective option to achieve conservation goals on a continuous basis.
f) Protocols for replacing EUI equipment on failure or end-of-life can be updated to specify high-efficiency options, which generates conservation credit each time routine equipment replacement activities are completed.
g) The issue of potentially triggering a New Source Review was addressed by meeting with the Minnesota Pollution Control Agency (PCA). This is not likely an issue. If a proposed upgrade project will not trigger an NSR, the marginal additional consideration of conservation is very unlikely to change that fact.
h) A concern was raised that efficiency improvements may extend the lifetime or run hours of fossil generation plants. This effect will likely be outweighed by increased efficiency, but Commerce should add a step to the review process to request an estimated impact of EUI efficiency projects at generation facilities in terms of lifetime and annual runtime. This step should be added to the review process policy guidance document.

Barriers addressed by this recommendation: Lack of awareness of potential projects and their value; Business case for conservation is not strong enough; General regulatory uncertainty; Uncertain payback; Projects may trigger a New Source Review; Unclaimed current projects (Entries B, D, E, J, K, and P on Table 9 in Appendix B: Additional Study Findings).

11. Stakeholders should continue discussion of appropriateness of adjusting the Shared Savings DSM Financial Incentive Mechanism to include some types of EUI projects - This is NOT a recommendation to include EUI projects in the Shared Savings DSM Financial Incentive mechanism. This is a recommendation to continue the *discussion* of the possibility of including some types of EUI efficiency in the mechanism with the understanding that it may not be justified. The rationale for the performance mechanism is to reward utilities for investing in conservation projects even though they result in reduced retail sales. Most EUI projects would not be justified for inclusion under this rationale, but some may be. For example, CVR conservation accrues mostly on the demand-side of the meter, meaning that CVR projects could possibly be justifiably counted toward the performance incentive mechanism algorithm.

a) Further, as a corollary to the Performance Incentive justification, utilities should consider the added value of EUI conservation projects due to the fact that they do *not* result in reduced retail sales revenue in the way most demand-side projects do. This may improve the relative value of EUI conservation from the utility's perspective.

Barriers addressed by this recommendation: Lack of awareness of potential projects and their value; Business case for conservation is not strong enough; Lack of direct incentive mechanism (Entries B, D, and F on Table 9 in Appendix B: Additional Study Findings).

12. Policymakers should examine ways to streamline the existing EUI cost recovery rider - There is a dedicated cost recovery rider for EUI projects outlined in statute, but it is cumbersome and utilities who have considered using it get the impression that the rider is more of a punishment for failure to include EUI projects in the base rate case rather than an incentive to consider implementation of projects between rate cases. Policymakers and regulators could work to issue guidance to streamline the rider. For example, perhaps examining whether projects that meet some threshold of preliminary technical review standards could earn waiver of some of the current rider requirements for approval.

Barriers addressed by this recommendation: Capital cost recovery for certain projects may be uncertain or complicated (Entry C on Table 9 in Appendix B: Additional Study Findings).

13. Policymakers should summarize findings from EUI efficiency efforts to inform other ongoing related efforts - The findings from this project could be used to help improve outcomes of related efforts and prevent duplication of work. The project team intends to submit a summary of this project's findings as public comments to the following initiatives:

a) Integrated Distribution Planning process – Docket 18-251.
b) Performance Metrics stakeholder process – Docket 17-401.
c) Ongoing grid modernization efforts led by the Minnesota PUC.
d) National Association of Regulatory Utility Commissioners (NARUC) workforce on comprehensive electricity system planning (Minnesota is participating in the workforce).
e) The Department of Energy's Modern Distribution Grid Project. This project is completed, but feedback from this Action Plan may inform future updates to the Modern Distribution Grid Report.

Barriers addressed by this recommendation: None directly. This recommendation is meant to inform future discussions of related initiatives.

14. Policymakers should issue policy guidance to clarify the interpretation of the automatic exemption clause for large natural gas generation facilities as it applies to EUI conservation - There is some consensus building that indicates large generation facilities (>50MW) that are automatically exempted from CIP as natural gas customers are *not* exempted from CIP participation as electric utility infrastructure assets. However, this issue is not resolved completely. Regulators should continue discussion of this topic and issue policy guidance to clarify the CIP eligibility status of large natural gas generation plants.

Barriers addressed by this recommendation: Lack of certainty in calculating eligible savings; General regulatory uncertainty; (Entries A, and E on Table 9 in Appendix B: Additional Study Findings).

15. Stakeholders should continue having discussions about long-term vision for EUI within CIP - The Action Plan and all recommendations to this point are meant to clarify and leverage existing policies under the current CIP framework to drive EUI efficiency implementation. However, it is possible to conceive of fundamental changes to the CIP framework itself to better fit the goal of driving EUI projects. Stakeholders should consider such adjustments, with the understanding that they may require a long time to implement. More importantly, they require a long-term vision for how CIP can best promote EUI goals without causing unintended side-effects. Some groundwork was laid during this project to anticipate possible long-term adjustments to CIP, primarily through the work done by Kevin Lawless and presented at the third stakeholder meeting. Discussions of potential long-term changes should include:

a) Definition of new metrics for reporting EUI efficiency improvements.
   The current conservation metric for electric savings is annual kWh conserved. This may not be ideal for EUI efficiency projects, which may result in conserved reactive power draw (currently ignored) or generation input fuel (currently converted to equivalent kWh). EUI projects may also be easier to measure in terms of system impacts, such as distribution loss reductions. It may also eventually become more desirable to measure efficiency in terms of carbon emission reductions rather than energy savings directly (which could apply to demand-side projects as well).
b) Prescription of clear methods for measuring EUI project characteristics.
   If new metrics are defined, the existing methods of determining conservation savings will no longer apply. New methods will need to be devised. For example, a holistic evaluation of conservation impacts of a smart grid project may be calculated in terms of its impact on reducing distribution system losses instead of measuring impacts of individual technologies. As new methods to evaluate EUI projects emerge, they can be prescribed by new TRM measures.
c) Developing consensus as to whether it would be appropriate or beneficial to explicitly require utilities to achieve EUI efficiency improvements to meet conservation goals.
d) The possibility of requiring utilities to report on EUI efficiency *opportunities* in their IRP or IDP filings.

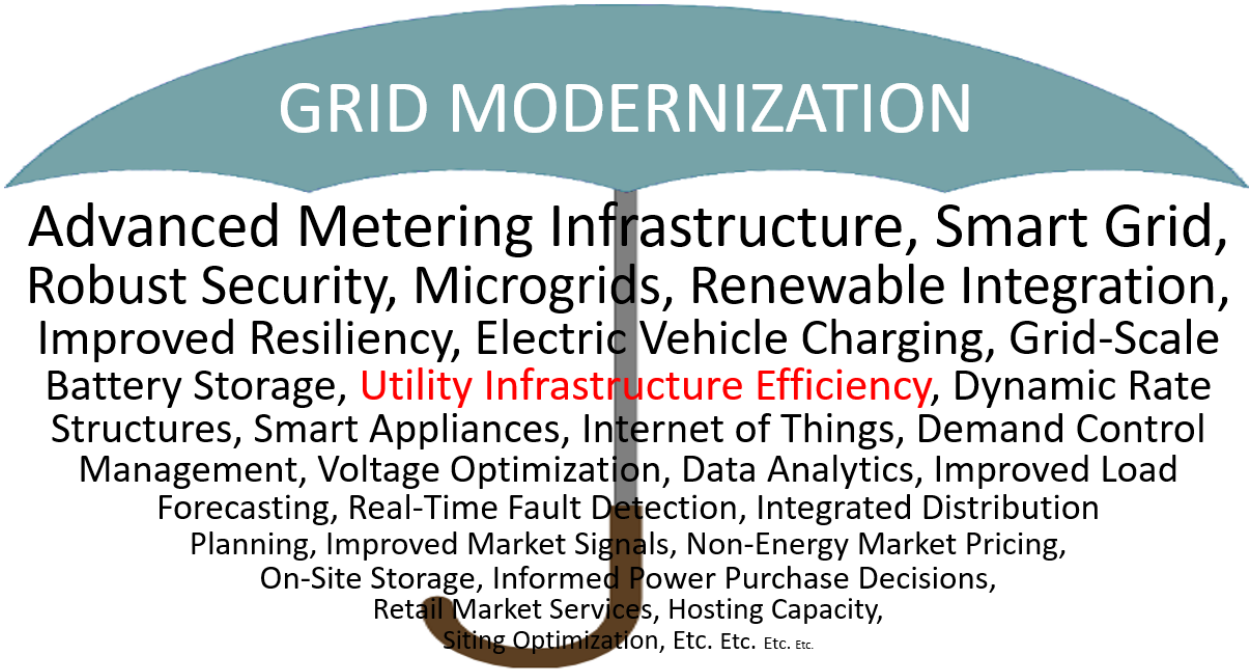
Barriers addressed by this recommendation: Some EUI conservation may not be captured by CIP metrics (fuel input, VAR) (Entry Q on Table 9 in Appendix B: Additional Study Findings).

Connections to Related Initiatives

The findings of this study could easily become lost among the myriad grid initiatives underway across the utility industry today. One of the most important Action Plan recommendations is to connect this study with related Grid Modernization efforts. Connecting this project to related initiatives will allow stakeholders to harness their common momentum to advance overlapping goals. These connections will also help to put the findings of this study in a larger context and ensure they are applied optimally within the evolving grid technology and policy landscape.

Grid Modernization is an umbrella term that applies to any number of technologies and strategies for upgrading grid performance. Smart Grid, microgrids, renewable integration, Advanced Metering Infrastructure, battery storage, electric vehicles, etc. are all current, active initiatives that involve infrastructure planning components. All could affect, and be affected by, infrastructure efficiency. The recommendation to connect to related projects is meant to prompt any stakeholder working on any of these initiatives to review the Action Plan and consider opportunities to leverage resources (including CIP compliance tools) to achieve common goals. Five specific initiatives are listed here that are very likely to benefit from considering EUI efficiency directly. This list is by no means comprehensive and is meant as an example to illustrate that improvements to infrastructure efficiency are just one component of ongoing modernization of the grid.

Figure 6 – Illustration of the role of EUI Under the Umbrella of Grid Modernization



Integrated Distribution Plans (IDPs). The Minnesota PUC recently established a formal process to review regulated utilities' plans for modernizing their distribution grid infrastructure.[50] Preliminary filings indicate that utilities consider system efficiency as a planning objective, as expected.[51] However, they do not appear to consider the possibility of leveraging CIP resources to improve EUI efficiency. Findings from this study could be useful for the IDP process by illustrating the potential value of

[50] Integrated Distribution Plans. EDockets – 18-251. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showeDocketsSearch&showEdocket=true&userType=public

[51] Integrated Distribution Plan submitted by Xcel Energy to Docket 18-251. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E098D466-0000-C319-8EF6-08D47888D999}&documentTitle=201811-147534-01

considering EUI efficiency as a CIP compliance tool. There may be an opportunity to reference findings from this study to explicitly include EUI conservation considerations in the IDP process.

National Association of Regulatory Utility Commissioners (NARUC) Task Force on Comprehensive Electricity System Planning. NARUC established the Task Force in early 2019 to foster development of state-led pathways to a more resilient, efficient, and affordable grid.[52] Minnesota is participating in the Task Force. Findings from this study may be able to inform the Task Force initiative and help to develop tools to unlock the potential of leveraging state efficiency programs to drive EUI improvements across the country.

PUC Docket on Utility Performance Metrics (17-401). The Minnesota PUC and stakeholders are currently conducting a review of utility performance metrics, which could include the existing Shared Savings Financial Incentive mechanism established by PUC Order.[53] The findings of this study could be useful to inform the development of updates to the Shared Savings mechanism in terms of setting incentives to drive EUI efficiency implementation. Currently, EUI projects are excluded from the Shared Savings mechanism, but there may be justification for examining possible exceptions to the existing rule. Relevant study findings were summarized and submitted during the public comment period for the stakeholder discussions under Docket 17-401.[54]

Grid Modernization Efforts Led by the MN PUC. In 2016, the Minnesota PUC issued a staff report on Grid Modernization.[55] The report outlines grid planning issues the state will face in the future and describes an approach the state will use to develop grid policies (the IDP process mentioned above grew out of this effort). As the grid modernization effort evolves, the findings of this project are likely to be useful for identifying opportunities to improve the alignment of grid policies and outcomes.

The Department of Energy's Grid Modernization Initiative (GMI). The GMI is an umbrella project with several participating programs.[56] Findings from this project can be exported to the GMI collaboration to inform other participating projects about the potential for leveraging conservation resources to accomplish overlapping goals.

To illustrate the interconnectedness of EUI efficiency with grid modernization efforts, Figure 7 shows the components of a modern grid, as envisioned by the Department of Energy's Modern Distribution Grid Report, Volume III.[57] Leveraging CIP tools to improve EUI efficiency could impact almost all of the

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[52] NARUC Task Force on Comprehensive Electricity Planning. Project Homepage. https://www.naruc.org/taskforce/

[53] Docket No. E,G-999/CI-08-133. Order Adopting Modifications to Shared Savings Demand-Side-Management Financial Incentive Plan.

[54] GDS comments submitted to Docket 17-401. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={80CC6F6A-0000-CD15-935F-E1B7F9ECC06C}&documentTitle=20194-152516-01

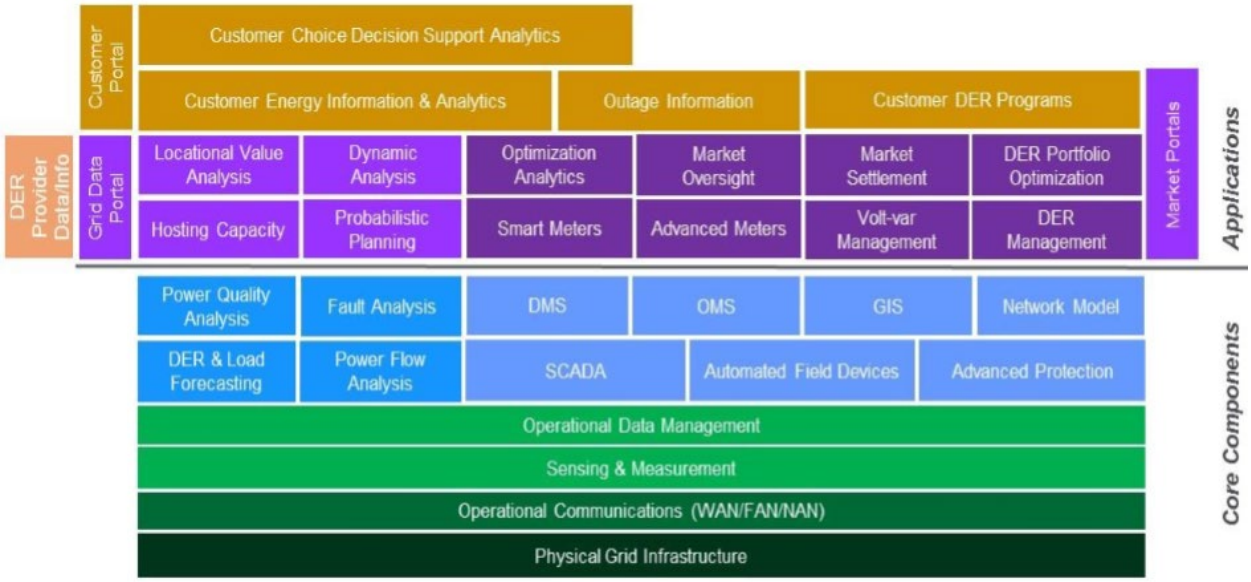
[55] Minnesota Public Utilities Commission. Staff Report on Grid Modernization, March, 2016. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E04F7495-01E6-49EA-965E-21E8F0DD2D2A}&documentTitle=20163-119406-01

[56] About the Grid Modernization Effort. Department of Energy. https://www.energy.gov/grid-modernization-initiative-0/about-grid-modernization-initiative

[57] US Department of Energy. Modern Distribution Grid, Decision Guide, Volume III. June, 2017. https://gridarchitecture.pnnl.gov/media/Modern-Distribution-Grid-Volume-III.pdf

identified components of the modern grid. Beyond creating additional tools to achieve conservation goals, improved efficiency can be an integral component of the future of electric utility infrastructure.

Figure 7 – Components of a Modern Grid



Appendix A: Collected Resources and References

This section collects the most important links to EUI tools and resources developed over the course of the project.

Potential Study Report. The statewide EUI Potential Study identifies and quantifies conservation opportunities in infrastructure assets owned and operated by utilities serving Minnesota consumers. The results presented here can be used to inform utility programs and policy decisions aimed at capturing the identified conservation opportunities.

Technical Reference Manual. The TRM contains prescriptive algorithms for calculating energy savings from efficiency measures, including EUI measures.

EUI Project Screening Tools. Excel-based spreadsheet high-level screening tools can be used to evaluate possible EUI conservation projects in terms of estimating energy savings and cost-effectiveness.

Policy Guidance - EUI Project Review Process and Determining Normal Maintenance. Policy guidance developed over the course of this project that describes a step-by-step process to submit, review and confirm conservation impacts of EUI efficiency projects. For utilities considering EUI efficiency as a conservation tool, this guidance provides a next step. The guidance also outlines a protocol to clarify project eligibility and appropriate baselines for conservation calculations by determining the meaning of "normal maintenance" for proposed EUI efficiency projects.

Policy Guidance – 1 Percent Threshold Clarification and Carry Forward Provision. Policy guidance developed over the course of this project that clarifies certain requirements for meeting utility conservation goals with EUI project savings. Specifically, if a utility submits a CIP plan to the Department that is subsequently approved, and the plan includes at least 1 percent DSM savings with the remainder of a utilities' goal to be met through EUI projects, the actual resulting savings from those EUI projects could then later be counted toward the utility's energy savings results for that particular program year regardless of whether the 1 percent threshold is actually achieved as part of its CIP results. Further guidance establishes a 5-year carry-forward provision.

Project Webpage. The project webpage hosts a record of stakeholder meetings including meeting notes, summaries of discussions, and presentation materials. These records can be useful for stakeholders to help understand the evolution of the Action Plan recommendations. The presentation materials include information from a wide variety of experts on issues relevant to EUI efficiency. The materials provide a trove valuable information for stakeholders interested in pursuing EUI efficiency projects.

Appendix B: Additional Study Findings

This section provides a summary of the project findings that ultimately led to the development of the Action Plan Recommendations. Findings include outcomes from the concurrent EUI potential study, discussions at stakeholder meetings, Advisory Committee proceedings, and stakeholder survey responses. This Appendix also includes a detailed discussion of the identified barriers to implementation of EUI efficiency projects.

EUI Potential Study

Commerce commissioned an EUI Potential Study that was conducted concurrently with this project. The two projects shared a similar timeline, involved overlapping stakeholders, and used methodologies that intertwined nicely. Many of the Action Plan recommendations were directly informed by the EUI Potential Study's outcomes.

The EUI Potential Study's results indicate that aiming to capture EUI conservation under CIP is a worthwhile endeavor. Utilities should consider pursuing EUI conservation projects as an important component of their CIP plans and policymakers should continue examining policy provisions to lower barriers to implementation and drive utilization of EUI resources to meet CIP goals. Thus, the potential study findings validate the objective of the Action Plan (reducing barriers to EUI conservation) as worthwhile.

The results of the EUI Potential Study show that EUI projects have the potential to offset approximately 0.13 percent of annual electric sales (excluding CIP-exempt sales) toward conservation goals over 20-year period between 2020 and 2039.[58] This corresponds to approximately 9 percent of utilities' predicted CIP goals on average over the study timeframe. The identified potential is split between the generation sector (3.3 percent of goals) and the T&D sector (5.7 percent). Technical conservation potential is estimated to be approximately 19.6 percent of electric conservation goals over the period of the study, suggesting that changes to policies could unlock additional potential for utilities to use EUI projects to meet their CIP goals. Tables 4, 5, 6, 7, and Figure 8 present a summary of the overall estimated statewide potential found by the study organized into useful categories. Following the summary of technical results are high-level conclusions from the study.

[58] Final EUI Potential Study Report. http://mn.gov/commerce-stat/pdfs/card-gds-eui-potential.pdf

EUI Potential Study – Summary of Overall Modelling Results

Table 4 - Total Statewide Conservation Potential in MWh (equivalent MWh for generation) 2020-2039

	Generation	T&D	Total
Technical Conservation Potential	1,399,850	3,248,923	4,648,773
Economic Conservation Potential	786,782	2,515,143	3,301,925
Achievable Conservation Potential	786,782	1,342,519	2,129,301

Table 5 - Total Statewide Conservation Potential as a Percentage of Predicted Electric Sales 2020-2039

	Generation	T&D	Total
Technical Conservation Potential	0.09%	0.21%	0.29%
Economic Conservation Potential	0.05%	0.16%	0.21%
Achievable Conservation Potential	0.05%	0.09%	0.13%

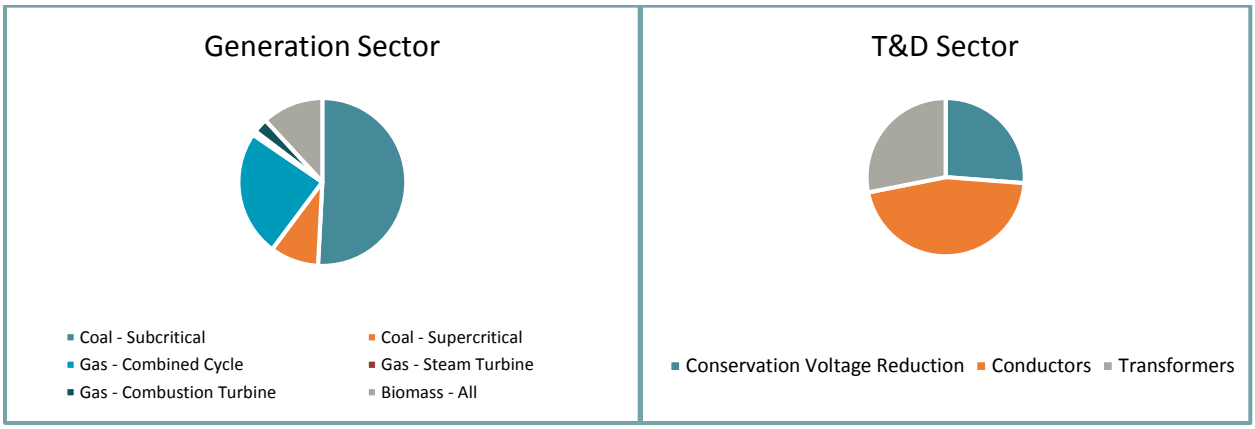
Table 6 - Total Statewide Conservation Potential as a Percentage of CIP Electric Goals 2020-2039

	Generation	T&D	Total
Technical Conservation Potential	5.9%	13.7%	19.6%
Economic Conservation Potential	3.3%	10.7%	13.9%
Achievable Conservation Potential	3.3%	5.7%	9.0%

Table 7 - Percent of Total Conservation Potential by Sector and IOU/COU 2020-2039

	IOU Generation	IOU T&D	COU Generation	COU T&D
Technical Conservation Potential	20.8%	33.7%	9.3%	36.2%
Economic Conservation Potential	15.4%	37.1%	8.4%	39.1%
Achievable Conservation Potential	23.9%	30.8%	13.0%	32.2%

Figure 8 – Approximate Achievable Potential for Conservation by Technology



EUI Potential Study – High-Level Conclusions

- EUI conservation opportunity is large enough that utilities should consider projects and programs to capture it
- Potential is not so large that EUI activities are likely to displace significant DSM initiatives on average, over time – though some individual projects may contribute to a large share of a utility's savings goal in a given year
- Coal plants not scheduled for retirement offer the most opportunity for heat rate improvements and should be targeted for evaluation, if possible
- Low-loss conductors provide more opportunity that originally anticipated
- Almost all T&D opportunity is in replace-on-fail or end of life situations, with the remainder in new expansion (direct replacement of functioning equipment did not typically result in cost-effective opportunities)
- The study produced several specific recommendations for utilities to capture EUI potential, which have been incorporated into the Action Plan

Policy Guidance Issued

In an attempt to address stakeholder input about key barriers to EUI implementation, two formal policy guidance documents were fully developed and issued by Commerce over the course of the stakeholder engagement process.

Policy Guidance #1 – Claiming Energy Savings through Electric Utility Infrastructure Improvements and the Carry Forward Provision

The first document addresses concerns about the statutory 1 percent demand-side savings threshold requirement.[59] Prior to this project, utilities were concerned that even if they achieved EUI conservation, the EUI savings might not count toward their goals if they were below the statutory minimum 1 percent savings threshold on the demand-side. This made EUI projects much riskier and posed a barrier to implementation. The issued policy guidance clarifies that as long as the utility's approved CIP plan shows a strategy to achieve 1 percent savings from demand-side efforts, EUI conservation will be eligible even if the demand-side goals are not met when they are reporting their performance toward the goals. This was a clear consensus solution to the problem with little controversy.

The first policy guidance document also establishes a 5-year carry-forward provision for EUI projects instead of the 3 years used for demand-side projects. This increases the value of EUI projects slightly because it increases the stability of conservation programs by adding years of protection against failure to meet goals. This provision is justified because EUI projects are typically much larger and require

[59] Docket No. E, G999/CIP-17-856.
https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={30E3B861-0000-C119-AFBE-5532959C72DA}&documentTitle=20182-140321-01

longer planning timelines than demand-side efforts, so reasonably qualify for longer carry-forward eligibility. The guidance was also uncontroversial and was able to add value to EUI conservation without any cost.

Policy Guidance #2 – Determining Normal Maintenance Activities and Review Process for EUI Projects

This guidance describes how to determine "normal maintenance" activities, how to determine an EUI project's energy use baseline, and a step-by-step process to help standardize how EUI projects are reviewed and approved for CIP energy savings credit.[60] This clearly reduces obstacles to implementing EUI projects by providing a roadmap to utilities to follow when considering them. The review process leaves some room for case-by-case considerations, but still provides a clear indication of what utilities should expect and prepare for to claim EUI efficiency credit toward their conservation goals.

Finally, the second guidance document also outlined a method to determine the meaning of "normal maintenance" for a given EUI project. Normal maintenance is important to establish a baseline to compare an EUI efficiency project against to calculate savings and also to verify eligibility to claim savings at all. However, the meaning of normal maintenance is extremely hard to define in a way that applies to multiple use cases. The method laid out in the document sets guiderails to help utilities understand how to define normal maintenance for a given project. The final determination will depend on each EUI project's specific characteristics and may require careful documentation to justify, but the guidance document provides a starting point to significantly limit the effort required.

Stakeholder Meetings

A core activity of the project to reduce policy uncertainty was to hold a series of four large stakeholder meetings to discuss issues and build consensus on a pragmatic path forward. This section provides summaries of each meeting including expert presenters, discussion topics, and major takeaways. All meeting materials including agendas, handouts, presentation slide decks, and meeting notes can be found on the project webpage.[61] Approximately 60 stakeholders attended each of the four meetings (as shown in Figure 9). Most stakeholders attended on behalf of utilities with the rest representing advocacy groups, technology manufacturers, consultants, and the University of Minnesota.

[60] Docket No. E999/CIP-18-543. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId=%7bB0849C66-0000-C310-A767-92B206A5993B%7d&documentTitle=201810-147198-01

[61] EUI Projects webpage. https://www.mncee.org/mnsupplystudy/project-resources/

Figure 9 – Stakeholder Meeting Attendees

Expert Presenters

Over the course of the project, stakeholders benefited from the expertise of an impressive group of presenters. All four meetings featured presentations from experts in relevant subjects. Many of the best conversations during the project came while discussing opportunities with experts about: emerging infrastructure technologies, national and local regulatory policies, infrastructure initiatives in other states, related efforts in Minnesota (grid modernization, in particular), and even an international perspective on EUI experiences in Denmark. The variety of perspectives provided stakeholders with a robust array of ideas to consider while reaching consensus on EUI issues in Minnesota. Table 8 lists the experts who presented to the stakeholder meetings and the topics they discussed.

Table 8 - List of Expert Presenters at Stakeholder Meetings

Speaker	Organization	Title	Topic
Ron Schoff	Electric Power Research Institute (EPRI)	Senior Program Manager	Emerging grid technologies
Lisa Severson	Minnkota Power Cooperative	Energy Conservation Coordinator	Successful EUI efficiency projects in Minnesota
Rich Sedano	Regulatory Assistance Project (RAP)	President and CEO	Similar regulatory initiatives across the country
Mary Santori	Xcel Energy	Manager, Distribution System Planning & Strategy	Current distribution system planning process
Jeff Haase	Great River Energy	Leader, Member Technology & Innovation	Impacts of policy changes from cooperative utility perspective
Kevin Lawless	The Forward Curve	Principal	Metrics measuring EUI efficiency improvements
Joe Paladino	U.S. Department of Energy	Senior Advisor	Grid Modernization
Niels Malskær	Danish Embassy	Commercial Advisor	Importance of data-driven grid modernization

Speaker	Organization	Title	Topic
Anthony Fryer	MN Department of Commerce	CIP Coordinator	CIP and policy guidance
Greg Anderson	Otter Tail Power	Energy Efficiency Engineer	Rural utility perspectives on EUI
Tricia DeBleeckerer	MN Public Utilities Commission	Commission Staff	Minnesota's grid modernization initiatives
Nancy Lange	MN Public Utilities Commission	Commissioner	Minnesota's grid modernization and distribution planning initiatives
David Townley	CTC Global	Director of Public Affairs	Efficient transmission and distribution conductors
Jose Medina	OATI	VP of Smart Grid Development	Conservation Voltage Reduction applications and case studies

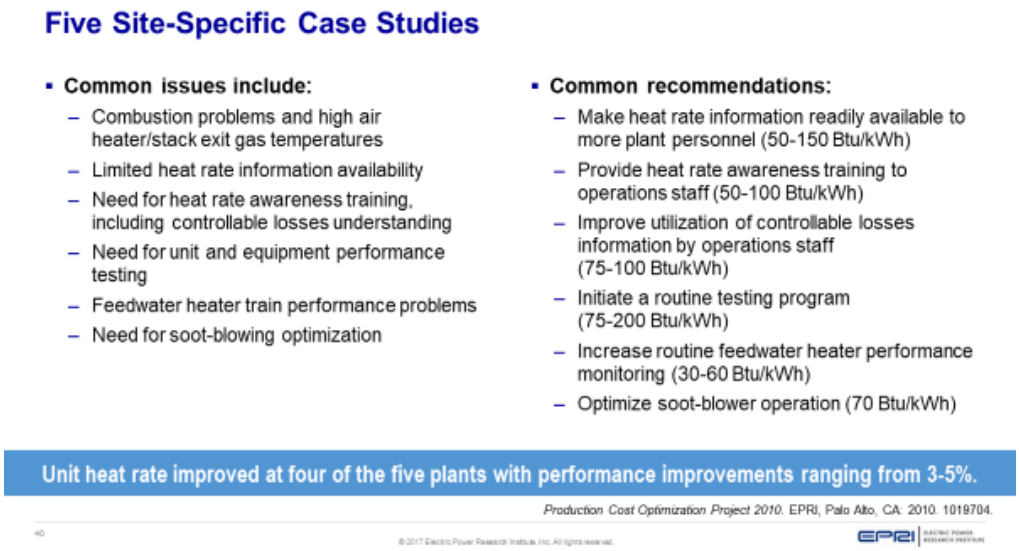
Meeting 1 – EUI Basics, Technologies and Barriers

The first stakeholder meeting was held at the Wilder Center in St. Paul, MN on July 28th, 2017. The meeting began by introducing the concept of EUI efficiency as a conservation tool and outlining the goals for the two EUI projects, then turned to our expert presentations and concluded with a group exercise to discuss stakeholders' familiarity with EUI efficiency opportunities and possible barriers to implementing projects. The takeaways from the first meeting presentations formed the foundations for the remainder of the project.

National expert Ron Schoff from the Electric Power Research Institute (EPRI) gave a detailed presentation on emerging technologies that enable EUI efficiency improvements. Stakeholders then heard from Lisa Severson of Minnkota Power Cooperative about successful EUI projects that have been completed in Minnesota. The expert presentations are a good starting point for understanding the practical potential for EUI efficiency projects. Figure 10 shows a slide from Mr. Schoff's presentation as an example of the depth of content. Readers of this report interested in exploring EUI technologies and projects are strongly encouraged to review the full meeting presentation materials on the project website.

Following the expert presentations, stakeholders broke into groups to discuss possible opportunities for implementing EUI efficiency projects. Stakeholders were also asked to identify potential barriers to implementation. These barriers became the preliminary roadmap to completing this project. Clarifying policies and driving EUI efficiency implementation means understanding and overcoming the identified barriers.

Figure 10 – Example Slide from EPRI Presentation Summarizing Generation Efficiency Research



Meeting 2 – Infrastructure Planning and National Policy Perspectives

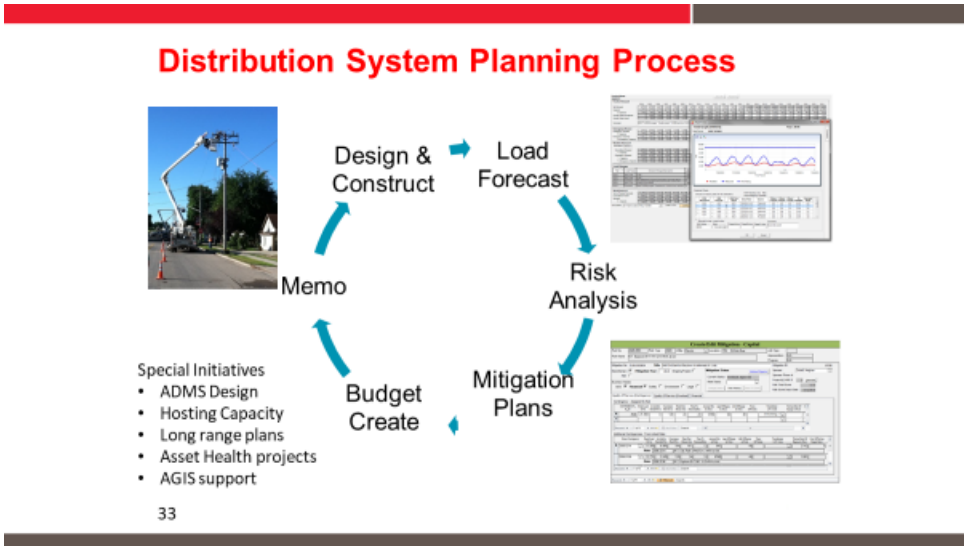
Held at the McNamara Alumni Center in Minneapolis on October 20th, 2017, the second stakeholder meeting focused on exploring infrastructure planning processes and the ways policy affect those processes. The goal was to identify potential policy improvements that would more effectively connect existing utility infrastructure planning and energy efficiency activities in Minnesota.

National policy expert Rich Sedano, President of the Regulatory Assistance Project (RAP), spoke about utility infrastructure policies across the country and discussed their effectiveness at promoting efficiency. He gave examples of policies from New York, Ohio, California, and Rhode Island to demonstrate a variety of possible models to consider as models for Minnesota. Mary Santori, Manager of Distribution System Planning & Strategy at Xcel Energy, provided stakeholders with an overview of Xcel's current utility infrastructure planning process. For the purposes of this project, Mary highlighted the points of the planning process where efficiency considerations could be added, if the relevant policies are properly designed (as visualized in Figure 11). The meeting also featured a presentation from the project team on the evolving understanding of barriers to EUI efficiency implementation as identified in stakeholder meeting 1 and refined since then.

The meeting concluded with a very productive panel discussion among the experts already mentioned who were joined by Jeff Haase of Great River Energy and Kevin Lawless of the Forward Curve. The panel helped to collect and organize the ideas presented at the meeting in the context of reaching consensus on a path forward for Minnesota. All stakeholders were able to participate in the discussion, which makes the consensus more robust. The specific outcome of the discussions was a continued

improvement in the understanding of identified barriers and *preliminary* solutions to them (emphasis on 'preliminary' at this stage to remind stakeholders that they were not committing to anything and to keep the conversation open-ended). Many of the solutions discussed at the second meeting evolved into the final recommendations included in the Action Plan.

Figure 11 – Stakeholder Meeting 2 Slide Showing Distribution System Planning Process



Meeting 3 – Potential Solutions and Long-Term Vision

Held at the St. Paul History Center in St. Paul, MN on February 12th, 2018, the third stakeholder meeting focused on possible metrics for measuring EUI efficiency improvements and connecting the drive for EUI efficiency to related initiatives. Stakeholders also discussed ongoing evolution of barriers and solutions, including proposed guidance documents designed to clarify EUI policies.

Joe Paladino, Senior Advisor at the U.S. Department of Energy, presented an overview of national grid modernization efforts and connected them to EUI opportunities in Minnesota. The insights from the presentation give perspective on how EUI efficiency can fit into other, related initiatives under the umbrella of grid modernization.

Kevin Lawless, Principal at The Forward Curve, presented ideas for how system efficiency metrics could be defined, measured, and used to define specific goals for EUI efficiency improvements. These ideas lay the groundwork for a potential long-term vision of EUI efficiency in Minnesota. It is unlikely entirely new goals or metrics will be adopted quickly, but over time they may become viable tools to drive EUI efficiency.

Niels Malskær, Commercial Advisor at the Royal Danish Embassy, highlighted data and tools that Denmark has used to optimize its local grid. Denmark's grid is extremely resilient while also being

efficient and incorporating a large share of decentralized, renewable energy. The key takeaway for Minnesota from his presentation is a lesson learned in Denmark – do not make policies or decisions about grid improvements without data to support them. That is, while EUI efficiency is a worthy goal, creating policies to target it without understanding technical and economic constraints could backfire.

Greg Anderson, Energy Efficiency Engineer at Otter Tail Power, discussed unique challenges faced by a rural utility compared to the larger, urban Xcel Energy. His perspective helped to put the conversations about possible policy changes into the context of statewide effects they might have.

Anthony Fryer of Commerce presented a policy guidance document to clarify two identified issues with EUI policies. This represents a concrete outcome of the project. First, EUI savings will count even if the 1 percent threshold savings are not achieved on the demand-side (as long 1 percent demand-side savings were included in the utility's plan). Second, EUI project savings are subject to a 5-year carry-forward provision rather than the 3 years allowed for demand-side savings. The guidance addresses two of the identified barriers to EUI efficiency implementation with common sense, consensus solutions.

The meeting concluded with a panel discussion among the presenters above and Tricia DeBleeckerer of the Minnesota Public Utilities Commission. The panelists agreed that there is a large gap between the grid today and the grid of the future. There are a lot of initiatives trying to drive toward the grid of the future, including a PUC effort on grid modernization and a focus on distribution planning by regulators. Leveraging EUI efficiency tools can bolster related initiatives, but should be thought of as a component of a larger framework rather than a standalone effort.

Meeting 4 – Action Plan and Related Initiatives

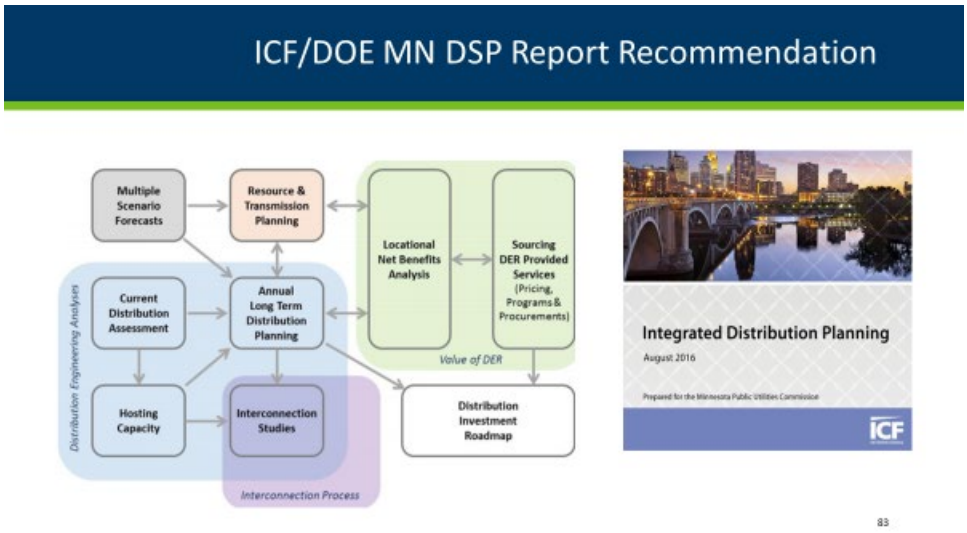
Held at the Wilder Center in St. Paul on July 30th, 2018, the fourth stakeholder meeting focused on consolidating findings from the project and defining next steps to drive EUI efficiency implementation. This included final comments from stakeholders on the development of the Action Plan and connecting to related grid initiatives.

The meeting started by presenting draft results from the EUI potential study. Next, proposed language for policy guidance was presented, which prescribes the determination of "normal maintenance" and outlines the review process for EUI conservation projects. These represent concrete steps toward overcoming identified barriers to EUI implementation.

Then, two technical experts presented in detail on the practical implementation of some of the potentially efficient EUI technologies. Dave Townley from CTC Global presented on completed projects demonstrating the efficiency improvements and economic viability of transmission conductor replacements. Jose Medina from OATI presented on improving control strategies to derive significant efficiency gains from Conservation Voltage Reduction projects with real world examples.

Finally, Commissioner Nancy Lange of the Minnesota Public Utilities Commission presented on Minnesota grid modernization efforts being undertaken by the PUC. Specifically, she highlighted the newly-developed Integrated Distribution System Planning (IDP) process. This process is an ideal vehicle to carry forward findings from this study. The effort to drive EUI efficiency by clarifying policies fits neatly into the practical framework for increased scrutiny of distribution planning the PUC is beginning to implement. Figure 12 is an excerpted slide from Commissioner Lange's presentation that visualizes the IDP process. The findings from this project suggest that a new box should be added to the diagram to encourage utilities to consider the value of conservation through EUI efficiency as a part of the distribution planning process (this is formalized as an Action Plan recommendation).

Figure 12 – Slide from PUC Presentation Visualizing the IDP Process



Stakeholder Surveys

The project team asked Wilder Research to conduct in-depth qualitative interviews with key stakeholders in summer 2017 and recently completed a follow-up web survey in November 2018 about supply-side efficiency and EUI. Wilder conducted interviews around supply-side efficiency with 25 stakeholders, and 23 stakeholders of varying organization types completed the web survey. The findings from the first survey were incorporated into ongoing discussions at the stakeholder meetings, especially by helping to assess the relative importance of barriers. Findings from both surveys were incorporated into the Action Plan recommendations.

Findings from the stakeholder surveys include:

- 78 percent of stakeholders thought EUI is an important component of energy efficiency policy. However, only 43 percent agreed that there should be more emphasis on EUI savings in energy efficiency policy.
- 74 percent said that uncertainty about claiming savings is a barrier to implementing EUI projects, and most (70 percent) said that the Division of Energy Resources (DER) should invest more time to clarify the regulatory policy around claiming EUI savings.
- More respondents (91 percent) were familiar with the recent guidance "Claiming Energy Savings through Electric Utility Infrastructure Improvements and the Energy Savings Carry Forward Provision," than "Determining Normal Maintenance Activities and CIP Review Process for Electric Utility Infrastructure Efficiency Projects" (52 percent). Most stakeholders thought both pieces of guidance would make it at least somewhat more likely that utilities would implement future EUI projects, however, very few (<10 percent) thought they would make it much more likely.
- While almost a third of respondents were not sure about the 0.13 percent estimated savings potential identified in the efficiency-potential study, of those who responded (N=16), half said the EUI savings potential seemed about right, and 38 percent said it was too low.
- 43 percent of respondents said the 0.13 percent estimated savings potential identified would not make it more or less likely for utilities to implement supply-side projects.
- Half of participants were not sure about proportions of savings potential within the generation sector and about a third were not sure about the transmission and distribution sectors. However, almost all other respondents thought the proportions discovered in the potential study across sectors seemed accurate.
- Measure-based goals and metrics were the most highly preferred EUI measurement type. 61 percent ranked this as their first choice for EUI goals and metrics.

Identified Barriers

This section summarizes the barriers to implementation of EUI efficiency projects that were identified over the course of the project. The objective of this project is to reduce uncertainty surrounding EUI efficiency within CIP and drive implementation of infrastructure efficiency projects. In practical terms, the first step to achieving the goal is to identify existing barriers that prevent implementation. Once they were identified, the barriers were discussed by stakeholders over the course of the project and solutions to them were developed into the Action Plan recommendations to address them.

A list of possible barriers was developed by the project team prior to the first stakeholder meeting as part of the literature review. That list was used to prompt a discussion at the first stakeholder meeting on 7/28/2017. The discussion successfully solicited thoughtful responses including additional possible barriers and approximated the relative importance of each barrier in terms of difficulty to overcome. The barriers were then discussed throughout the project to hone our understanding and inform the development of effective recommendations to overcome them.

Table 9 lists all barriers identified over the course of the project. Following is a summary discussion of the most important barriers as they are understood at the end of the project. They are organized in approximate order of importance to stakeholders in terms of preventing EUI efficiency implementation (from most- to least-important). The order comes from actual numerical rankings collected at the first stakeholder meeting and adjusted over the course of the project subjectively in response to further stakeholder discussions.

Several of the barriers here include a summary of preliminary discussions about possible solutions. In fact, many barriers are addressed directly with recommendations in the Action Plan. However, some of the barriers and recommendations do not map 1-to-1 neatly, which is why they are presented separately. The rightmost column of the table can be used to cross reference which Action Plan recommendations grew from discussions of each barrier. The numbers in parentheses refer to recommendations presented in the Recommendations section and in Table 3. For an overall summary of barriers and recommendations together, Table 1 in the Executive Summary loosely groups them by broad topic area for easier reference.

Table 9 - Full List of Identified Barriers to EUI Efficiency

Barrier	Importance	Related Action Plan Item(s)
A) Lack of certainty in calculating eligible savings	High	Review EUI Guidance (3), Apply Screening Tools (4), Conduct Internal EUI Potential Assessments (8), Refer to TRM (9), Clarify Large NG Plant Exemption (14)
B) Lack of awareness of potential projects and their value	High	Connect Across Teams (1), Combine with Related Efforts (2), Review EUI Guidance (3), Apply Screening Tools (4), Review Potential Study Results (5), Establish EUI Project Repository (7), Conduct Internal EUI Potential Assessments (8), Review EUI Potential Study Recommendations (10), Discuss Performance Incentive Updates (11), Summarize Findings for Related Initiatives (13)
C) Capital cost recovery for certain projects may be uncertain or complicated	High	Apply Screening Tools (4), Streamline Rider (12)
D) Business case for conservation is not strong enough	High	Apply Screening Tools (4), Review EUI Potential Study Recommendations (10), Discuss Performance Incentive Updates (11)
E) General regulatory uncertainty	High	Review EUI Guidance (3), Reach Out to Commerce (6), Establish EUI Project Repository (7), Review EUI Potential Study Recommendations (10), Clarify Large NG Plant Exemption (14)

Barrier	Importance	Related Action Plan Item(s)
F) Lack of direct incentive mechanism	High	Discuss Performance Incentive Updates (11)
G) 1% Demand-side requirement before EUI savings count	High	Review EUI Guidance (3)
H) Efficiency is not a top priority	Medium	Connect Across Teams (1), Combine with Related Efforts (2)
I) Staffing challenges	Medium	Reach Out to Commerce (6)
J) Uncertain payback	Medium	Apply Screening Tools (4), Conduct Internal EUI Potential Assessments (8), Review EUI Potential Study Recommendations (10)
K) Projects may trigger a New Source Review	Medium	Review EUI Potential Study Recommendations (10)
L) Definition of "normal maintenance" unclear	Medium	Review EUI Guidance (3), Establish EUI Project Repository (7)
M) EUI spending does not count toward CIP spending requirements	Low	Not Addressed
N) There are easier CIP options than EUI	Low	Combine with Related Efforts (2), Apply Screening Tools (4)
O) EUI projects do not have a customer engagement component	Low	Not addressed – this is an inherent quality of EUI projects with no realistic solution
P) Unclaimed current projects	Low	Connect Across Teams (1), Review EUI Potential Study Recommendations (10)
Q) Some EUI conservation may not be captured by CIP metrics (fuel input, VAR)	Low	Continue Conversations Past this Project (15)

Discussion of EUI Barriers

A) Lack of certainty in calculating eligible savings

Stakeholders identified a lack of standardized calculation methodology to reliably estimate savings as a barrier. In fact, many utilities listed this as one of the most important barriers to implementation. This introduces uncertainty into the planning process, which prevents consideration of EUI efficiency projects. As part of this barrier, even when stakeholders are aware of the TRM measures with prescribed savings algorithms, there is still uncertainty due to the unclear meaning of "normal maintenance," which can affect the baseline chosen to calculate savings and the eligibility of projects.

Possible solutions discussed: Some measures are now defined in the TRM, which removes the uncertainty about savings methodology for those projects, so part of the solution may be raising awareness of the existence of EUI TRM measures. There is still room for improving the defined measures and more could be added in the future, but the highest value opportunities at least have a prescribed methodology as of late 2016.

Related Action Plan Recommendations: Review EUI policy guidance documents issued by Commerce; Apply excel-based high-level screening tools on Commerce website; Conduct internal, utility-specific assessments of EUI potential; Refer to the TRM for standardized EUI measures; Clarify the large natural gas generation automatic CIP exemption clause (Entries 3, 4, 8, 9, and 14 on Table 3 in the Recommendations section).

B) Lack of awareness of potential projects and their value

Many utilities may not be aware of infrastructure efficiency opportunities. Promoting some efficiency efforts may mean simply engaging utilities to discuss options they have for improving their system efficiency. Initially this barrier was ranked as low priority because stakeholders generally assessed their own awareness as sufficient. However, it became apparent that there is a key component of awareness that is often currently missing, which is communication between CIP personnel (aware of the opportunity) and infrastructure planning teams (not always aware).

Possible solutions discussed: This project is itself a partial solution that helps raise awareness of the opportunity to use EUI as a CIP tool. Overcoming this barrier may be the most effective route to drive EUI implementation because it only requires stakeholders from this project to reach out to infrastructure planning teams to remind them of the available opportunity. In at least one instance, a stakeholder identified opportunities that are already available to increase EUI efficiency without any additional hurdles beyond simply becoming aware that it can count towards CIP goals.

Related Action Plan Recommendations: Connect infrastructure design teams with CIP personnel; Combine EUI efficiency with overlapping Grid Modernization efforts; Review EUI policy guidance documents issued by Commerce; Apply excel-based high-level screening tools on Commerce website; Review EUI Potential Study results; Establish a repository for EUI project information; Conduct internal, utility-specific assessments of EUI potential; Review EUI Potential Study further recommendations; Discuss including some EUI projects in the performance incentive (Entries 1, 2, 3, 4, 5, 7, 8, 10, and 11 on Table 3 in the Recommendations section).

C) Capital cost recovery for certain projects may be uncertain or complicated

Recovering costs of EUI efficiency projects may require additional effort or justification on the part of the utility. There is a defined rider that regulated utilities can use to recover incremental costs of efficiency projects, but utilities are not interested in expending the additional effort required to file the rider. In fact, using the current, overly-cumbersome rider is essentially a non-starter. Without cost recovery it is nearly impossible to justify EUI improvements on conservation achievement alone.

Possible solutions discussed: It may be possible to consider redesigning the EUI rider to be more streamlined and likely to be used. Any change to the rider would require significant policy change, so the discussion is likely to continue past the completion of this project. If possible, it may be beneficial for investor-owned utilities to consider EUI projects far enough in advance to include them in their general rate cases, which removes the need for the rider, but does require a higher degree of certainty about costs and benefits of projects. Regardless of the rider, resources to evaluate costs and benefits of EUI projects would be helpful for all utilities, including coop and municipal utilities.

Related Action Plan Recommendations: Apply excel-based high-level screening tools on Commerce website; Discuss including some EUI projects in the performance incentive (Entries 4, and 12 on Table 3 in the Recommendations section).

D) Business case for conservation is not strong enough

The business case for improving EUI efficiency may not be strong enough, which may reduce the likelihood that utilities consider these projects. For regulated utilities, fuel is typically a pass-through cost to customers, so efficiency measures that result in reduced input fuel do not impact the utility's bottom line or provide a return on investment. For consumer-owned utilities, boards are not likely to approve EUI improvement projects that do not directly increase revenue. Addressing this barrier will be critical to increasing implementation.

Possible solutions discussed: If a simple cost recovery mechanism is available for infrastructure efficiency projects, especially if they qualify for a set rate of return, the projects may become more financially viable. Choosing to implement these projects may be a matter of treating them as a cheaper alternative to CIP compliance than other options. Also, if the project review process could be streamlined, the cost of EUI projects may be more easily understood and predicted, which would reduce uncertainty.

Related Action Plan Recommendations: Apply excel-based high-level screening tools on Commerce website; Review EUI Potential Study further recommendations; Discuss including some EUI projects in the performance incentive (Entries 4, 10, and 11 on Table 3 in the Recommendations section).

E) General regulatory uncertainty

Many stakeholders are interested in EUI efficiency and are intrigued by the possibilities, but don't know what the first step is toward implementation. This barrier was originally ranked as low priority, likely because it was poorly-defined. However, over the course of the project it rose in significance precisely because the poor definition of the barrier is part of the barrier. Stakeholders often do not even know how to ask the question of where to start, let alone know where to start.

Possible solutions discussed: The fact of completing this stakeholder process addresses this barrier in part. For many stakeholders, this project can provide a starting point to reference. More concretely, one of the policy guidance documents developed as part of this project lays out a step-by-step process

Commerce intends to follow to review submitted EUI projects. This Action Plan should provide a good starting point for a specific project a utility may consider undertaking.

Related Action Plan Recommendations: Review EUI policy guidance documents issued by Commerce; Reach out to Commerce with ideas or questions; Establish a repository for EUI project information; Review EUI Potential Study further recommendations; Clarify the large natural gas generation automatic CIP exemption clause (Entries 3, 6, 7, 10, and 14 on Table 3 in the Recommendations section).

F) Lack of direct incentive mechanism

Demand-side projects offer a financial incentive to implement conservation projects. An analogous incentive on the supply side would be given to the utility implementing their own projects and is currently not allowed. This makes EUI projects less cost-effective and more difficult to approve. Many stakeholders raised this issue as one of their main reasons they do not consider EUI efficiency projects.

Possible solutions discussed: There may not be a justification for addressing this barrier. The CIP financial incentive on the demand side is designed to reward utilities for investing in demand-side conservation efforts even though they result in reduced retail sales revenue. Most EUI projects will not reduce electric sales and therefore may be justifiably excluded from the incentive mechanism on principle. There may be some room to argue CVR projects should be allowed to claim the incentive. And on further reflection it may be in utilities' interest to consider EUI projects specifically because they achieve conservation goals without reducing revenues.

Related Action Plan Recommendations: Discuss including some EUI projects in the Shared Savings Financial Incentive Mechanism (Entry 11 on Table 3 in the Recommendations section).

G) 1 percent Demand-side requirement *before* EUI savings count

At the beginning of the project, statute could be interpreted as requiring utilities to meet 1 percent savings from demand-side programs *before* claiming EUI savings. That is, if utilities plan to meet 1 percent with demand-side conservation and 0.5 percent with EUI, but only achieve 0.9 percent on the demand-side, there was concern that none of the EUI savings will count at all. This prevented consideration of EUI projects because it makes the margin of error on meeting the demand-side goal narrower and the consequences of missing the goal much more dire. Note, this barrier is not focused on the *existence* of the 1 percent demand-side requirement – stakeholders recognize that rule will remain in place (to prevent EUI from displacing demand-side efforts entirely). Rather, the barrier is the uncertainty and concern for what happens if the 1 percent goal is missed in a given year.

Possible solutions discussed: This is a relatively straight forward issue of clarifying existing policy to confirm a reasonable interpretation is accurate. That is, if a utility misses the demand-side goal, they do not lose the EUI savings. In fact, policy guidance was issued during this project to address exactly this issue. There are additional details about how to treat the failure to meet goals, but fear of an unexpected loss of a large chunk of EUI savings should not be a barrier any longer.

Related Action Plan Recommendations: Review EUI policy guidance documents issued by Commerce (Entry 3 on Table 3 in the Recommendations section).

H) Efficiency is not a top priority (compared to reliability and safety)

Reliability, safety, and low rates are always higher priorities than efficiency. An obvious barrier to efficiency implementation is that there are simply higher priorities. An organization has limited resources to focus on priority issues and there may not be funds available to staff a performance engineer to develop EUI efficiency options.

Possible solutions discussed: Any tools or resources that can help minimize the effort required by utilities to estimate the value of EUI projects will help to increase their value and relative priority. Conservation goals will need to be met, so if EUI projects become predictable enough they will naturally become more viable options as part of the CIP portfolio.

Related Action Plan Recommendations: Connect infrastructure design teams with CIP personnel; Combine EUI efficiency with overlapping Grid Modernization efforts (Entries 1, and 2 Table 3 in the Recommendations section).

I) Staffing challenges

All phases of implementing EUI efficiency projects (planning, designing, financial analysis, technical documentation, CIP filing) require effort by the utility. Especially for small utilities, dedicating staff resources to EUI projects is difficult.

Possible solutions discussed: First, the TRM measures and screening tools should help to predict savings and streamline CIP reporting somewhat. Further, new guidance was developed over the course of the project to outline the review process Commerce will follow. Possibly as more projects are completed they will provide a template for how to implement and claim savings may become available. Smaller utilities can apply lessons learned as larger ones complete projects. These are not complete solutions, but should lower the barrier somewhat.

Related Action Plan Recommendations: Reach out to Commerce with ideas or questions (Entry 6 on Table 3 in the Recommendations section).

J) Higher cost, longer lifetimes, and rapid changes all mean an uncertain payback

EUI projects have unique characteristics that mean they may not fit into the current CIP planning process well. It will take time to learn how to plan EUI projects to predictably meet goals.

Possible solutions discussed: There are some clear ways to lower this barrier. Pre-implementation project review, guidance on EUI carry-forward provision, and learning from early projects will all help to overcome this barrier. Further, guidance issued to outline Commerce's EUI project review process may reduce this barrier to a surmountable level.

Related Action Plan Recommendations: Apply excel-based high-level screening tools on Commerce website; Conduct internal, utility-specific assessments of EUI potential; Review EUI Potential Study further recommendations; (Entries 4, 8, and 10, on Table 3 in the Recommendations section).

K) Projects may trigger an otherwise unnecessary New Source Review

If utilities consider generation projects to achieve conservation, they may trigger a New Source Review (NSR). Not only is the NSR process itself burdensome, but older facilities may need to invest additional funds to achieve NSR compliance that would be unnecessary otherwise. This barrier prompted a follow up discussion between the project team and the Minnesota Pollution Control Agency (PCA) to better understand the results of the potential study and how the NSR process works.

Importance: Medium - According to several stakeholders, the desire to avoid a New Source Review is the single greatest impediment to considering major generation facility efficiency projects. This does not impact T&D or some generation projects, but for those it does impact may prove insurmountable.

Possible solutions discussed: After the conversation with the PCA, the project team's understanding of the NSR process indicates the barrier may not be as formidable as it seems. It is unlikely that the marginal impact of conservation considerations will change a project's NSR status. That is, if a project requires an NSR, it would even in the absence of EUI conservation. The practical solution to this barrier may be to address the perception of NSR as an absolute roadblock and encourage utilities to consider EUI projects to find they likely will not trigger an unexpected NSR.

Related Action Plan Recommendations: Review EUI Potential Study further recommendations; (Entry 10 on Table 3 in the Recommendations section).

L) Definition of "normal maintenance" as the baseline is not always clear

The conservation statute requires that eligible infrastructure projects must be more energy efficient than would otherwise be implemented in the course of "normal maintenance activity," which is not clearly defined by the statute. The barrier was understood to be an issue early in the project, but it became increasingly clear over time that it was actually one of the more important barriers to overcome.

Possible solutions discussed: For the TRM measures developed, the issue was addressed as well as possible. From early stakeholder discussions it became clear that the definition of normal maintenance may become a major source of uncertainty and possibly contention. A proposed method to determine the meaning of normal maintenance on a project-by-project basis was developed for discussion among stakeholders and resulted in the issuance of policy guidance. This guidance should mitigate the issue to a reasonable degree, but it is also clear that there is no one definition of normal maintenance that covers all possible use cases, so there may need to be updates in the future as EUI projects are better understood. If there is any question about how normal maintenance is defined for a given project, the utility may want to request a pre-install review by Commerce.

Related Action Plan Recommendations: Review EUI policy guidance documents issued by Commerce; Establish a repository for EUI project information; (Entries 3, and 7 on Table 3 in the Recommendations section).

M) EUI spending does not count toward CIP spending requirements

Utilities cannot claim infrastructure costs toward their CIP spending goals. Most utilities do not have a problem meeting the spending requirement with the investments made into demand-side conservation. However, some utilities may be below the spending requirement and when choosing whether to invest in a demand side program vs. infrastructure, the fact that the expenditure would not satisfy the spending goal may tip the scales away from the infrastructure project.

Possible solutions discussed: the obvious solution to the barrier would be to allow utilities to count EUI spending towards goals, but a full conversation about second-order effects and the difficulty of changing the requirement must be held first and there are several valid reasons to think the solution may have unintended consequences. At the outset of the project, this barrier was conflated with the related issue of the financial performance incentive (separate barrier above). Additional conversations may be warranted to consider the possibility of including EUI spending in the CIP tracker (with appropriate exemptions applied for the performance incentive), but once disentangled from the performance incentive, the project team no longer believes this barrier is a significant obstacle for most utilities and most potential EUI projects.

Related Action Plan Recommendations: Not addressed directly with Action Plan recommendations.

N) There are easier CIP options than EUI

There is no urgent need to invest in infrastructure efficiency while demand-side efficiency programs are still meeting conservation goals today.

Possible solutions discussed: Part of the inspiration for this study is to lay the groundwork to develop infrastructure as an efficiency tool as the “low-hanging fruit” of demand-side programs begins to dry up in coming years. As EUI projects become better understood and DSM projects become more complicated there will be a natural uptick in EUI interest.

Related Action Plan Recommendations: Combine EUI efficiency with overlapping Grid Modernization efforts; Apply excel-based high-level screening tools on Commerce website (Entries 2 and 4 on Table 3 in the Recommendations section).

O) EUI projects do not have a customer engagement component

Infrastructure projects do not engage customers. For some utilities, especially rural co-ops or municipal utilities, part of the goal of demand-side efficiency programs is to engage customers and visibly provide a service.

Possible solutions discussed: there is no realistic solution to this barrier. EUI is at a disadvantage to DSM activities with respect to customer engagement.

Related Action Plan Recommendations: Not addressed directly with Action Plan recommendations - this is an inherent quality of EUI projects with no realistic solution

P) Unclaimed current projects

Some current infrastructure projects already achieve greater efficiency, but they don't claim savings due to the added filing difficulty.

Possible solutions discussed: these projects would be classified as free-ridership, so there doesn't need to be an effort to specifically include them. That is, this is not really a barrier at all. As awareness grows, utilities will likely be on the lookout for low-hanging fruit EUI conservation opportunities

Related Action Plan Recommendations: Connect infrastructure design teams with CIP personnel; Review EUI Potential Study further recommendations (Entries 1 and 10 on Table 3 in the Recommendations section).

Q) Some EUI conservation may not be captured by CIP metrics (fuel input, VAR)

The CIP electric conservation metric is kWh, which does not capture some infrastructure efficiency potential that results in reduced reactive power losses.

Possible solutions discussed: This issue could be addressed by updating the policy to allow VAR or Volt-Amp conservation to fulfill CIP goals. This would be similar to the process of incorporating non-energy benefits to change the value of CIP metrics. This would open up possible measures like Volt-VAR management, which could deliver significant additional efficiency savings at minimal additional cost compared to Conservation Voltage Reduction. Discussions of potential changes to the metrics used by CIP opened up a broad area of discussion about how CIP might be updated long term to better achieve its intended purpose including possible changes to metrics, goals, and reporting requirements. This does not result in immediate recommendations but does encourage continued discussion of the vision for CIP long-term.

Related Action Plan Recommendations: Continue discussions of long-term vision for EUI within CIP (Entry 15 on Table 3 in the Recommendations section).

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