Building Momentum for Implementation of Electric Utility Infrastructure Efficiency Projects – An Action Plan for Utilities and Regulators

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ABSTRACT

Minnesota recently conducted a groundbreaking effort to apply proven, successful demand-side energy conservation policies to drive efficiency improvements in Electric Utility Infrastructure (EUI). EUI is defined as equipment operated by a utility used to deliver electricity to end users. It includes: substation and distribution transformers, transmission and distribution lines, and generation facilities. Infrastructure has been largely overlooked as a direct potential source of energy efficiency opportunity in the United States. A project supported by a U.S. Department of Energy (DOE) State Energy Program grant convened national, state, and local stakeholders from the public and private sectors to discuss how infrastructure can become a core component of state energy efficiency savings goals. Outcomes of the project include:

1. Guidance to reduce policy and regulatory uncertainty concerning the role of infrastructure in conservation programs
2. Technical tools to help utilities identify, evaluate and implement EUI projects
3. A Potential Study that estimated EUI savings in Minnesota can conserve over 2 million MWh over 20 years
4. Standardized savings calculation methodologies for common EUI projects
5. An Action Plan with discrete recommendations for stakeholders in Minnesota to unlock EUI conservation potential. The Plan includes preliminary strategies to apply the findings nationwide and incorporate them into related initiatives such as Grid Modernization

Over time, the tools developed by these projects will increase utilities' use of infrastructure efficiency projects to meet their energy conservation, emissions and environmental goals. As the backbone of the grid, infrastructure efficiency can be a core component of a clean energy future.

Background

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, Minnesota utilities are required to develop CIP plans to achieve energy savings equal to 1.5 percent of average annual retail sales. CIP in Minnesota is one among many examples across the country of state-level policy frameworks that successfully drive energy efficiency improvements.

Historically, Minnesota's utility conservation programs have focused on increasing the efficiency of demand-side applications; that is, improvements made on the customer's side of the electric meter. Figure 1 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 successfully met it energy efficiency targets under CIP, Commerce has heard concerns from stakeholders about being able to meet future CIP savings goals. 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.

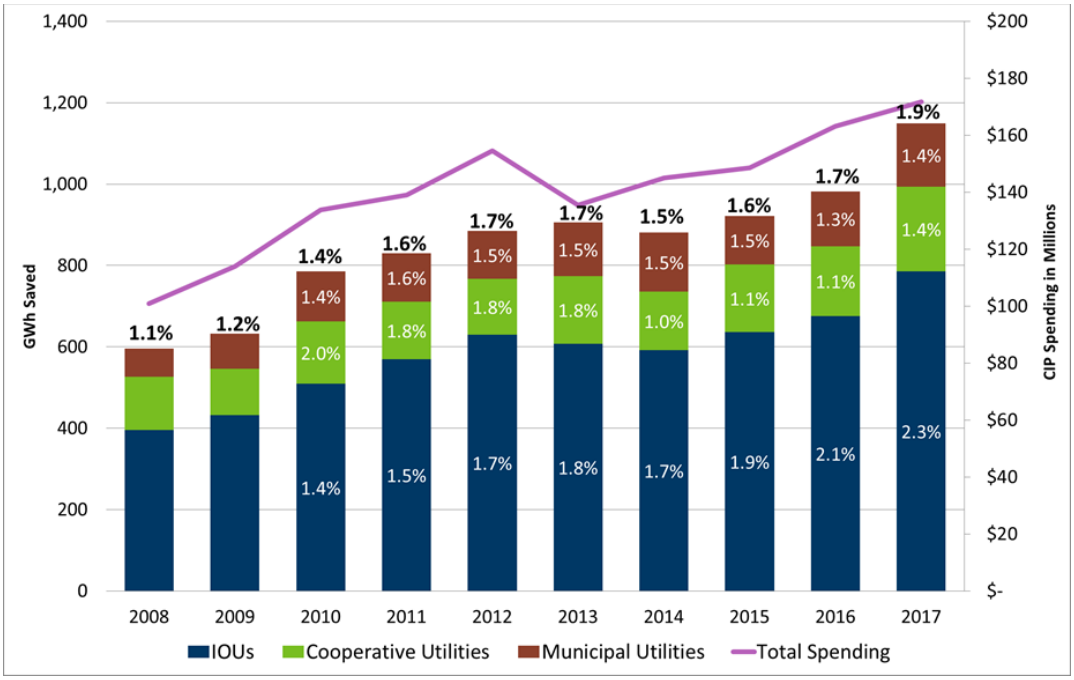

Figure 1. Energy efficiency spending and savings achievements by Minnesota utilities, 2008-2017

Minnesota statute also specifically calls out EUI efficiency, meaning improvements made on the utility's side of the meter, as an additional tool to meet utility energy efficiency goals. 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.

For instance, Commerce commissioned an EUI Potential Study (Hinck, 2018) to estimate the energy savings potential of EUI efficiency projects in Minnesota. The EUI Potential Study's results indicate that aiming to capture EUI conservation under CIP is a worthwhile endeavor and could offset approximately 0.13 percent of annual electric sales (excluding CIP-exempt sales) toward conservation goals over 20-year period between 2020 and 2039. 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).

As a companion to the potential study, a stakeholder engagement project was conducted, concluding in 2019. The project was funded by a U.S. Department of Energy (DOE) State

Energy Program grant. The project team was led by GDS Associates (GDS) with major contributions from Center for Energy and Environment (CEE) and direction from Commerce.

The goal of the EUI stakeholder engagement project is to reduce uncertainty, create technical and policy tools, and develop recommendations for stakeholders to capture untapped EUI efficiency opportunities. All outcomes are meant to leverage the policy framework proven successful on the demand side and apply it to achieve efficiency improvements in infrastructure. The core of the project was a series of stakeholder meetings to discuss technologies, policies, and barriers to implementation. Ultimately, the findings of the project are distilled into a stakeholder Action Plan (Hinck 2019) to unlock the potential of EUI efficiency and build momentum toward implementation.

Figure 2 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 utility conservation goals, represented by Stage 3 in Figure 2.

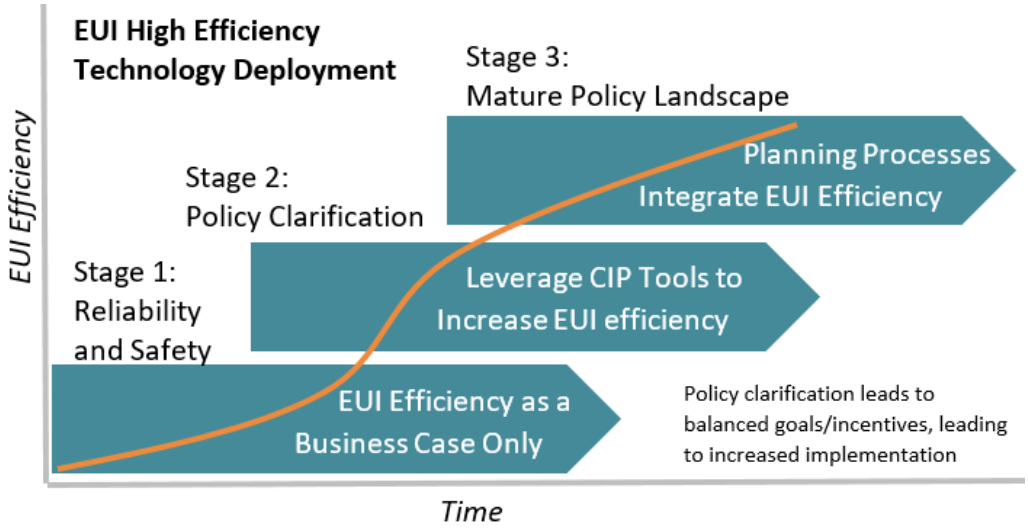

Figure 2. Envisioned Stages to Driving EUI Efficiency Implementation

Methodology

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)

The most important component of the process was a series of four open stakeholder meetings to facilitate conversations and reach consensus about EUI issues. The process also included two formal surveys, outreach to relevant technical and policy experts, and consultation with an Advisory Committee behind the scenes to steer the overall effort. Figure 3 illustrates the process followed to iteratively build from the existing understanding, identify barriers, propose solutions, and reach consensus on an Action Plan to drive infrastructure efficiency.

Figure 3. Illustration of the Iterative Stakeholder Engagement Process

The open meetings nurtured 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. Meeting attendees included: individual utilities, utility associations, environmental 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).

The process of conducting the stakeholder meetings and compiling the findings from conversations that took place produced the results of the study. The final outcome is the Action Plan comprised of recommendations for stakeholders to drive EUI efficiency implementation.

The remainder of this document presents important findings from the study in some detail. Interested parties are encouraged to review the full Action Plan for further details on the results, deeper explanations of the process to produce them and additional useful tools and resources. Links to the all project materials and the final Action Plan can be found in the final Action Plan report (Hinck 2019) including the project website.

Barriers to Implementation

Over the course of the project, stakeholders identified and discussed important barriers to the implementation of EUI efficiency projects within the existing conservation program regulatory framework. 17 discrete barriers were defined and addressed. Here, the barriers are listed, ranked by approximate order of importance to overcome to enable EUI efficiency implementation. Each of the identified barriers sparked interesting and productive conversations that helped to clarify the role of EUI efficiency and lead to eventual Action Plan recommendations.

1. Lack of certainty in calculating eligible savings
2. Lack of awareness of potential projects and their value
3. Capital cost recovery for certain projects may be uncertain or complicated
4. Business case for EUI conservation is not strong enough
5. General regulatory uncertainty
6. Lack of direct incentive mechanism
7. One percent demand-side requirement in statute complicates EUI savings understanding
8. Efficiency is not historically a top priority compared with operating and maintenance cost for infrastructure projects
9. Staffing challenges
10. Uncertain payback and value of efficiency improvements
11. Projects affecting generation facilities may trigger a New Source Review
12. Definition of "normal maintenance" referenced in statute is unclear
13. EUI spending does not count toward CIP spending requirements
14. There are easier CIP options than EUI
15. EUI projects do not have a customer engagement component
16. Current EUI projects with readily available, but unexamined more-efficient options
17. Some EUI conservation may not be properly captured by existing CIP metrics

Four of the barriers are described in some detail here to demonstrate the starting point for stakeholder discussions and the eventual development of Action Plan recommendations. Full descriptions of all barriers and their relationship to final recommendations can be found in the Action Plan report (Hinck 2019).

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 Minnesota Technical Reference Manual (TRM) EUI measures that include 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 were discussed with stakeholders. Some measures are now defined in the TRM including high efficiency transformers, low-loss conductors for distribution and transmission lines, conservation voltage reduction, and generation facility heat rate reductions.

Additional measures such as lighting and variable speed drives have been adapted from commercial versions to apply to utility-owned operations. These measures remove some of the uncertainty about how to appropriately calculate energy impacts of EUI efficiency projects in terms of conservation program metrics. Part of the solution to this barrier 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 at least some of the highest value opportunities do now have a prescribed methodology for calculating savings.

Lack of awareness of potential projects and their value

Many utilities may not be aware of infrastructure efficiency opportunities, or even that infrastructure efficiency is eligible to count toward conservation goals. 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 generally aware).

Some possible solutions were discussed. The stakeholder engagement project is itself a partial solution that helps raise awareness of the opportunity to use EUI as a conservation 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. Efficient EUI options are already well-understood and available, simply reevaluating to include the marginal value of CIP credit may potentially influence decision-making in favor of greater efficiency.

The business case for EUI 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 directly or provide a return on investment. For consumer-owned utilities, boards may not approve EUI improvement projects that do not guarantee a financial return for members in the short- to medium-term. Addressing this barrier will be critical to increasing implementation.

Possible solutions were discussed with stakeholders. The EUI situation now is analogous to demand-side conservation efforts several years ago in that there is a gap between the efficiency driven by the existing business case and greater efficiency that is technologically possible. The general solution to overcome this barrier is also analogous to the demand-side example. The whole purpose of this project is to design and clarify policies to align incentives in a way that closes the gap between the business and technically possible cases. In effect, the goal is to *improve* the business case for efficiency, not overcome it.

Several specific ideas for improving the business case arose during discussions. There is an existing rider to allow EUI projects to claim cost recovery outside a normal rate case, but the process is too complicated to use, so streamlining the rider could improve cost effectiveness.

There is also an existing financial performance incentive mechanism to reward utilities for investing in efficiency, but infrastructure projects are currently excluded. Updates to that mechanism may improve the evaluation of EUI efficiency costs. Finally, utilities may not have a starting point for understanding whether an EUI efficiency project is even worth considering in detail, so high-level screening tools to help focus resources on the most cost-effective options could be helpful.

Stakeholders also discussed the broader picture for framing EUI efficiency as cost-effective. Ultimately, infrastructure improvements should be thought of as a tool to help utilities comply with their conservation requirements. As some of the "low-hanging fruit" opportunities on the demand side (such as lighting and air conditioning efficiencies) are increasingly scarce and more expensive to capture, new tools may become more competitive as relatively cost-effective compliance options. From this point of view, overcoming the cost-effectiveness barrier is external to this project. The goal at this time is to lay the groundwork to *enable* evaluation of EUI as a possible efficiency option.

Unclear if demand-side requirement must be met before EUI savings count

According to Minnesota Statute §216B.241 subdivision 1c, electric utilities in Minnesota are required to achieve energy conservation equal to 1.5 percent of retail sales annually. 1 percent must come from demand-side efficiency programs, but EUI can be used to meet some or all of the remaining 0.5 percent of the goal. Before this project, statute was widely interpreted as requiring utilities to achieve demand-side conservation of 1 percent before claiming any EUI savings. Utilities were concerned that if they failed to meet the 1 percent requirement for demand-side conservation, none of their EUI savings in that year would count at all. This prevented consideration of EUI projects because it made the margin of error on meeting the demand-side goal narrower and the consequences of missing the goal much more dire

This is an example of a very specific policy barrier to EUI implementation that we were able address with policy clarifications over the course of the project. Stakeholders discussed the issue and reached a consensus for clarifying policies to interpret statute in a way that alleviates the concern. One of the outcomes of the project was formal policy guidance issued by Commerce to codify the consensus from stakeholder discussions, including the two following guidance documents:

1. Determining Normal Maintenance Activities and CIP Review Process for Electric Utility Infrastructure 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.
2. Claiming Energy Savings through Electric Utility Infrastructure Improvements and the Carry Forward Provision. This guidance describes the utility requirements for claiming energy savings from electric utility infrastructure projects, and it outlines the use and parameters for carrying forward annual energy savings in excess of 1.5% to succeeding years.

Action Plan Recommendations

The main outcome of the project is to distill what was learned from our extensive collaborative discussions into an Action Plan of discrete recommendations for stakeholders to

unlock the potential for EUI efficiency to help meet conservation goals. The final Action Plan consists of fifteen major recommendations and twenty-nine specific sub-recommendations. Many of the recommendations reference additional materials developed over the course of the project. Those materials and the Action Plan itself can be found on the project website. The following list is a summary of what the project team sees as the five most important overall recommendations.

1. Utilities and third-party service providers/ DSM managers should review the policy guidance documents developed by Commerce to clarify the role of EUI efficiency within CIP.
2. Utilities should consciously build connections between infrastructure planning teams and conservation-focused personnel to increase awareness of EUI efficiency options and to identify opportunities to leverage conservation resources in the infrastructure planning process.
3. 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.
4. 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.
5. 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.

These and the remaining recommendations on the full list are meant to help stakeholders navigate the landscape of infrastructure efficiency within the conservation policy framework. In particular, from the first recommendation above, interested parties should become familiar with the guidance issued by Commerce titled “EUI Project Review and Approval Process”. This document provides a foothold for stakeholders wondering where to even begin to evaluate a possible EUI project. From this starting point, EUI fits into CIP and how EUI projects will be evaluated.

While the above recommendations are focused on utilities and partners – as important early adopters – the full set of recommendations emphasizes as a priority the need for continued education on energy efficiency for a broader set of stakeholders.

Applying Findings

Over the course of the project there were many intermediate findings along the path from the identified barriers preventing EUI efficiency implementation to the ultimate Action Plan for stakeholders to overcome those barriers. The Action Plan recommendations reference these additional findings to provide deeper understanding and additional tools for stakeholders. Intermediate results include:

- Summaries of discussions outlining the links between stakeholder recommendations and the barriers they’re meant to overcome

- A central repository of resources for stakeholders interested in exploring EUI issues - housed on the project webpage. These include presentations from technology and policy experts and meeting notes and summaries
- Policy guidance issued by the Department of Commerce to clarify effects on EUI
- Findings from a concurrent EUI potential study quantifying the magnitude of EUI efficiency improvement opportunity in Minnesota
- Technical Reference Manual measures to prescribe protocols for calculating energy savings from common EUI measures
- Two formal surveys of stakeholders measuring awareness of EUI as a conservation tool and evaluating effectiveness of possible recommendations
- EUI screening tools to help utilities quickly and cost-effectively evaluate potential EUI projects at a high level (see Figure 3 below)
- Multiple webinars presented to a variety of audiences to outline the findings

Figure 4 shows a screenshot from a screening tool developed to help stakeholders quickly evaluate a potential high efficiency transformer project. The tool is designed to reduce one barrier to eventual EUI implementation by giving utilities the ability to assess a possible project at a high level before expending any resources on detailed design, scoping, or sourcing materials. The tool is based on the TRM measures that prescribe algorithms to calculate energy savings from EUI efficiency projects. Therefore, as project specifics are finalized and confirmed, the inputs to these tools can be updated to be used in the final stages of claiming EUI projects toward utilities' conservation goals, which further streamlines the process and reduces barriers.

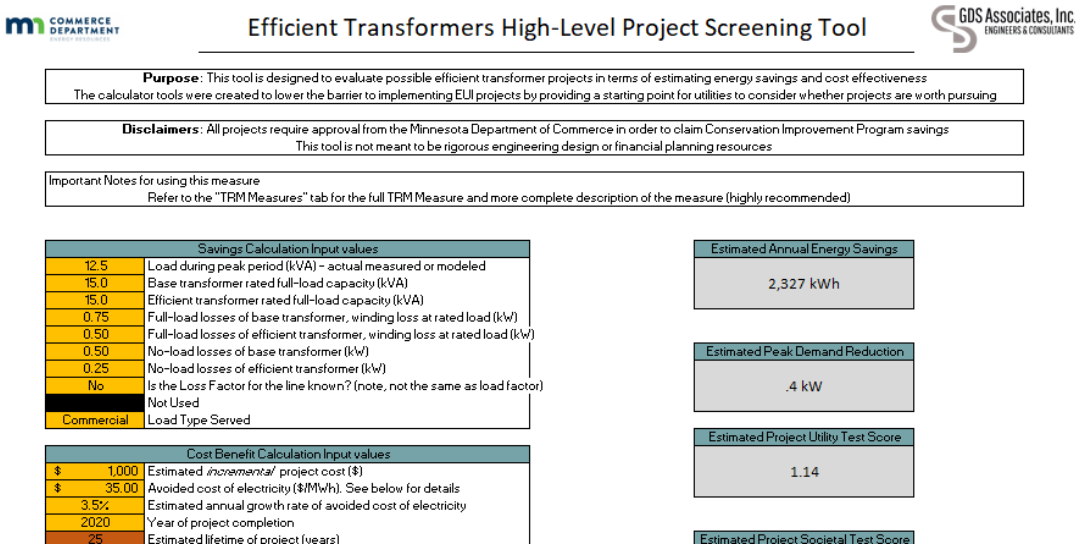

Figure 4. Screenshot of a high-level screening tool used to quickly evaluate EUI efficiency projects

Beyond Minnesota

During the study period other states expressed interest in the project. Discussion are ongoing with at least ten (10) states across the country on EUI measures, including new infrastructure as well as conservation voltage control. While COVID-19 has delayed those

efforts in the near-term, discussion around stimulus has reignited conversations on the need for transmission infrastructure to support state energy goals. For those states that wish to drive infrastructure efficiency using existing conservation tools, there are lessons learned from Minnesota. The first key to unlocking the value of EUI efficiency is the explicit inclusion of EUI projects in the state's conservation statute. However, in other states, that may not be as explicitly clear. Therefore, a likely first step other states can take is to clarify whether EUI projects can count toward existing conservation goals. Once that hurdle is cleared, the general findings of this study can apply to any jurisdiction and with state-specific modifications, they can help drive EUI efficiency across the country.

Related Initiatives

One of the most important Action Plan recommendations is to connect the EUI study findings 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.

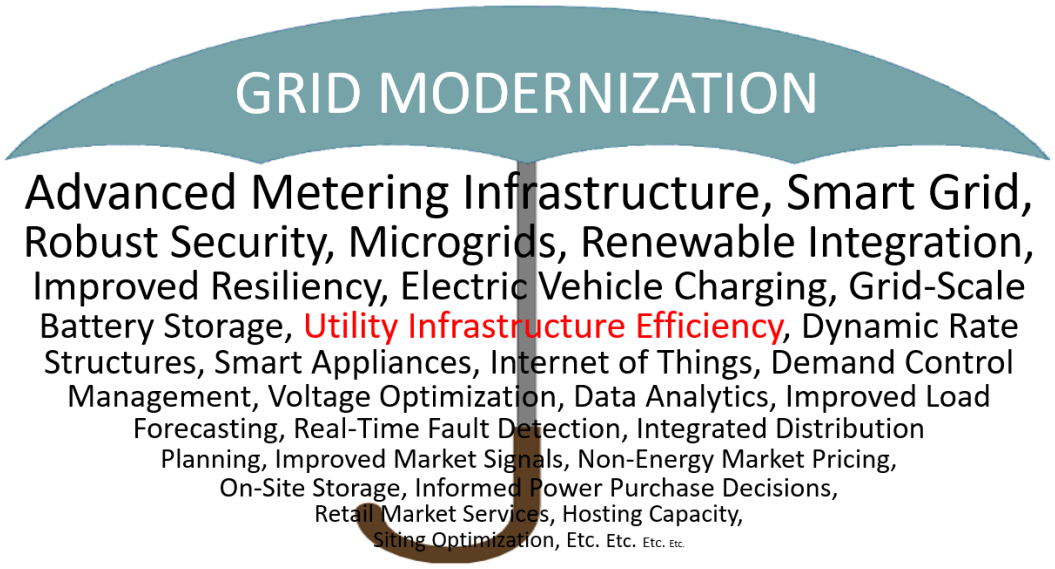

Figure 5. Illustration of the role of EUI efficiency under the umbrella of Grid Modernization

Grid Modernization is an umbrella term that applies to any number of technologies and strategies for upgrading grid performance as illustrated in Figure 5. 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. For example, as utilities add EV chargers, they could also consider more efficient distribution transformers to serve the increased end-use load and achieve conservation goals at the same time. 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 conservation compliance tools) to achieve common goals.

Five specific initiatives were discussed in the Action Plan report that are likely to benefit from considering EUI efficiency. These initiatives could benefit from applying EUI efficiency directly to accomplish overlapping goals or use the findings from this project to add value to their efforts. The list below highlights a few examples that illustrate how improvements to infrastructure efficiency are just one component of ongoing modernization of the grid. Initiatives include:

- Integrated Distribution Planning processes (multiple states)
- National Association of Regulatory Utility Commissioners (NARUC) Task Force on Comprehensive Electricity System Planning (this effort is supporting 16 states in aligning existing distribution and resource plans)
- Minnesota PUC Docket on possible updates to utility performance metrics
- Grid Modernization Efforts led by the MN Public Utility Commission
- The Department of Energy's Grid Modernization Initiative

References

Hinck, T. 2019. *Building Momentum for Implementation of Electric Utility Infrastructure Efficiency Projects: An Action Plan for Minnesota Utilities and Regulators*. Minnesota: GDS Associates.
https://www.mncee.org/MNCEE/media/PDFs/MN-EUI-Potential_FINAL.pdf

This paper is a summary of the Action Plan report cited above with no additional references. The Action Plan itself relies on approximately 50 citations and contains an Appendix of Useful References for Utilities. Readers interested in the subject are encouraged to start with the Action Plan and use the references it contains as a guide to further reading.