# Utility Infrastructure Efficiency Opportunities and Barriers

## Stakeholder Meeting #4 Summary Report

Convened July 30, 2018


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# Contents

## Background

The State of Minnesota requires electric and natural gas utilities to invest in energy efficiency by statute.[1] For over three decades, Minnesota utilities have developed Conservation Improvement Programs (CIP) to meet their efficiency requirements. Most utility CIPs have focused on demand-side efficiency by providing incentives to customers for installing more energy-efficient end-use equipment.

Utilities' CIP efforts have not significantly focused on improving the efficiency of Electric Utility Infrastructure (EUI), or supply-side, of the system even though EUI accounts for approximately 12-15% of total electric consumption. Minnesota statute allows EUI efficiency to count toward conservation goals, but the number of such projects in the state remains relatively small.[2] The reasons for this include technical uncertainty as well as numerous policy questions.

## Meeting Purpose

On July 30 at the Wilder Foundation in St. Paul, the Department of Commerce and its project partners GDS Associates and Center for Energy and Environment hosted a fourth public stakeholder meeting exploring opportunities and barriers to utility infrastructure efficiency. This fourth stakeholder meeting is part of a U.S. Department of Energy (DOE) funded project aimed at clarifying the existing policy landscape concerning EUI efficiency and developing a roadmap to help drive future implementation.

The focus of the fourth meeting was to discuss pragmatic next steps to drive EUI efficiency in Minnesota, provide resources to inform decisions on EUI efficiency investments, and develop a framework for how EUI can complement ongoing processes on grid modernization:

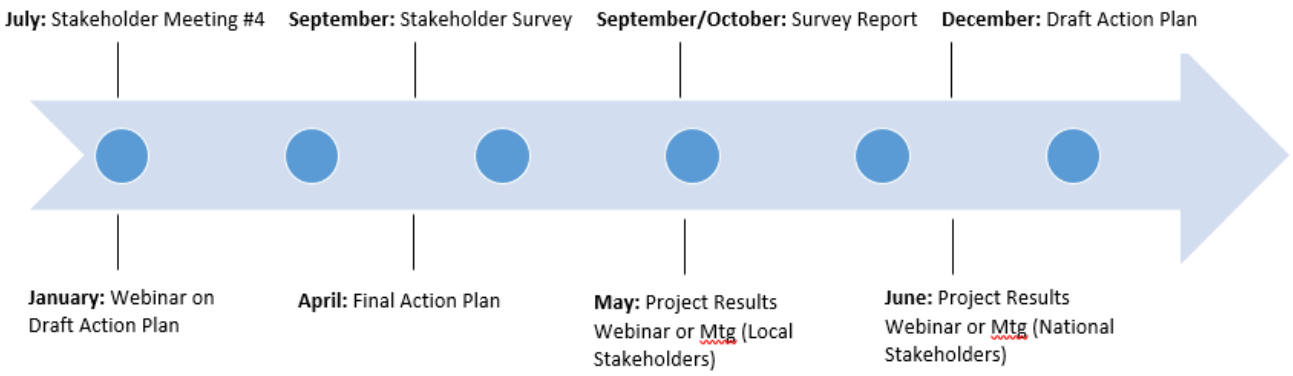
- Nancy Lange, Chair of the Minnesota Public Utilities Commission, provided remarks on how EUI efficiency can complement Minnesota's grid modernization effort.
- Travis Hinck, Energy Engineer at GDS Associates, presented an overview of the results from Minnesota's EUI Potential Study, highlighting the magnitude of statewide EUI efficiency savings.
- David Townley, Director of Public Affairs at CTC Global, and Jose Medina, Vice President of Smart Grid Development at OATI, discussed how to evaluate, plan, and implement effective EUI projects.
- Anthony Fryer, CIP Coordinator at the Minnesota Department of Commerce, provided an overview of Commerce's proposed policy guidance for claiming EUI savings credit through CIP.

**Resources from the fourth stakeholder meeting can be accessed on the project website [here]. Additionally, next steps in the stakeholder process are outlined in Figure 1, including the development and distribution of an Action Plan that distills the lessons learned from the project and includes policy recommendations to help address barriers to EUI efficiency. Periodic updates will distributed to stakeholders who have signed up to receive email updates about this project.**

[1] Minnesota Statutes §216B.241, subd. 1c(b) establishes an annual savings goal of 1.5 percent of average retail sales for electric and natural gas utilities.

[2] Minnesota Statutes §216B.241 subd. 1c(d) allows a utility or association to claim energy savings resulting from EUI projects on top of a minimum energy savings goal of 1 percent from energy conservation improvements, provided the EUI projects result in energy efficiencies greater than what would occur through normal maintenance activity.

*Figure 1. Next Steps in EUI Stakeholder Process*




## EUI Stakeholder Project Overview – Travis Hinck, GDS Associates

- Overall Project Goals:
  - Conduct 4 public stakeholder meetings (Today is #4)
  - Develop roadmap to increase EUI efficiency
  - Funding from DOE grant
  - Minnesota is leading the country
- Today's Meeting Goals:
  - Present EUI potential study results
  - Discuss "Normal Maintenance" strawman proposal
  - Minnesota grid modernization initiative
  - Practical examples of opportunities
  - Wrap up and next steps

## EUI Potential Study Results – Travis Hinck, GDS Associates

- Goal of EUI Potential Study:
  - Quantify how much opportunity there is in Minnesota to conserve energy through EUI efficiency projects (i.e. generation, transmission, distribution).
  - Estimating EUI efficiency potential is a unique approach (few states have looked at supply-side efficiency).
  - We wanted to connect the EUI Potential Study with this concurrent EUI stakeholder process to help inform data-driven policy recommendations.
  - The EUI Potential Study's final report will be published in the next month or so.
- High value measures that we examined came from the MN Technical Reference Manual (TRM), including:
  - Heat rate improvements
  - High efficiency transformers
  - Low-loss conductors
  - Conservation voltage reduction
- Question: How do you divide the DSM and supply-side savings of CVR implementation?
  - The study counted both toward CIP savings.

- Generation Technical Methodology
    - Technical potential model is top-down
    - Compare each generation facility in the base data set to "Best-In-Class" by heat rate
    - Classes defined by fuel, technology, age, capacity, and capacity factor
    - "Best-in-Class" site chosen by generation expert as high-performing, but within reason
    - Each class designed maximum % savings
- Generation Technical Results
    - Cumulative statewide savings from 2020-2039: 1.4 million MWh.
    - Percent of annual CIP applicable sales: 0.09% (corresponding to 5.9% of projected CIP goals over the study period)
- Generation Achievable Methodology
    - Achievable model is project based
    - Heat rate improvement  project that passes total resource cost test and maximizes savings
    - One project per site (limit results)
        - More potential may exist, but modeling more than one project per site made modeling more challenging
    - Didn't look at potential opportunity for older solar and wind facilities, because don't measure improvement by heat rate. Could be opportunity to look at in the future.
- Generation Achievable Results
    - Cumulative statewide savings from 2020-2039: 786,782 MWH
    - Percent of annual CIP applicable sales: 0.05% (corresponding to 3.32% of projected CIP goals over the study period)
- Generation Achievable Methodology
    - Coal plants still have a lot of room for improvement
    - CT Gas more than half of potential
    - 65% IOU, 35% COU
- T&D – Technical Potential Methodology
    - Bottom-up approach
    - Apply TRM measures to existing infrastructure conditions
    - Develop estimates of units
- T&D – Economic Potential Methodology
    - Estimated incremental costs for each discrete measure
    - Included annual O&M, where applicable
    - Provided cost sources in reports
    - Used avoided costs from EE study
    - Screened measures with UCT B/C test
- Question: Did the study look at externalities?
    - Not explicitly, but we looked at what was already planned for upgrades at facilities.
- T&D – Technical Potential Results
    - Cumulative statewide savings from 2020-2039:  3,248,923 MWh,
    - Percent of annual CIP applicable sales: 0.21% (corresponding to 13.7% of projected CIP goals over the study period)
- T&D – Economic Potential Results

    - Cumulative statewide savings from 2020-2039:  2,515,143 MWh
    - Percent of annual CIP applicable sales: 0.16% (corresponding to 10.6% of projected CIP goals over the study period)
- T&D – Achievable Potential
    - Cumulative statewide savings from 2020-2039: 1,342,519 MWh
    - Percent of annual CIP applicable sales: 0.08% (corresponding to 5.7% of projected CIP goals over the study period)
- Overall Statewide Results
    - Achievable conservation potential = 0.13% of non-CIP-exempt sales (corresponding to 9.0% of statewide CIP goals over the course of the study)
    - Technical EUI potential is approximately 0.29% of non-CIP-exempt sales (corresponding to 19.6% of statewide CIP goals over the course of the study)
- Conclusions – Review Context
    - Models applied to representative samples
    - No separation of economic from achievable potential in generation modeling
    - Remember this is a unique approach
    - Several types of measures of facilities not included
- Conclusions
    - Potential is large enough that utilities should pursue, but not so large that we need to worry about displacing DSM activities (on average, over time).
    - There are likely policy options to shift some technical potential to become achievable by lowering barriers and calibration incentives.
- Utility Recommendations
    - 16 utility recommendations identified to capture EUI potential
    - Included in final report and factsheet
- EUI Potential Study Outcomes
    - All project materials to be posted to web at: https://www.mncee.org/mnsupplystudy/home/
    - Full final report
    - Factsheet and Utility Recommendations
    - High-level project screening tools

Discussion/Feedback

- We may want to review our CO2 emissions conservation outcomes. When estimating grid heat rate, did our method drop out renewable resources (it shouldn't). For generation, the specific fuel conserved was used to calculate CO2 impacts.
- We may want to discuss related/enabling technologies in the report. Those that do not directly achieve conservation, but enable it. Such as battery or thermal storage, AMI, and distributed generation citing or hosting capacity consideration.
- There are some specific comments that our CVR methodology may be underestimating the potential, especially considering new developments in the technology. We should mention the possibility in the report (at this point, we are not going to change the models).

## EUI Strawman Proposal – Anthony Fryer, MN Dept. of Commerce

- The Department wants to figure out policy clarifications that can help increase the predictability of EUI project planning. Provide utilities with a consistent and predictable process through EUI project reviews.
- Normal maintenance is one of the biggest and most confusing statutory barriers related to EUI efficiency. EUI measures can be claimed toward CIP energy savings goals when they are above normal maintenance – but statute does not define what is and isn't normal maintenance.
- We have drafted a strawman proposal as a first attempt to better define/determine normal maintenance and provide a step-by-step process to standardize EUI project review and approval.
- The strawman proposal will be posted on e-dockets, which will give a chance for stakeholders to provide written comments. The docket # and details will be sent out to everyone.

Discussion/Feedback

- For the proposed guidance, "Determine" Normal Maintenance baseline is more appropriate than "Define" Normal Maintenance baseline.
- We should clarify in the document the process where approval is needed. Step 4 approves the chosen baseline and step 7 verifies that the project is completed as proposed.

## Conductor Efficiency and Reducing Transmission & Distribution Losses – David Townley, CTC Global

- Overview of High Performance Conductors (HPC)
    - Technologies have been around for decades, but recognizing them for energy efficiency is new.
    - HPC is more widely implemented in Europe, but catching on in US. Several companies worldwide developed HPC designs to address thermal sag in ACSR lines
        - Thermal sag – expansion of the conductor as it heated from temperature and $I^2R$ line loss heating
    - Most designs focused on replacing the steel supporting core wire with another material that does not expand as much as steel does when heated
    - No HPC project in Minnesota yet, but Xcel did one in Texas.
- ACCC Conductor – Example of High Efficiency
    - Carbon fiber core is smaller, lighter, but stronger than the steel it replaces
    - 28% more aluminum for same weight and diameter
    - Annealed aluminum is more conductive
    - Minimal expansion at high temperatures
- Some observations upfront
    - ACCC alone has 95 projects in the US since 2005 (500+ worldwide)
    - Recognizing GPC for energy efficiency as well as for reliability/resiliency is "new"
- New/Rebuild T&D Right-of-Way (ROW)
    - For new line or when structures must be replaced, HPC can:
        - Eliminate the need for larger structures and ROW expansions

        - Carry up to twice the ACSR current with greatly reduced thermal sag
        - Reduce line losses by 25-40%
            - Efficiency can be traded for capacity and cost – policy guidance can direct/influence choices
- Case Studies
    - AEP Energized Reconductor Example
        - Replaced 1,440 miles of ACSR conductor with ACCC
            - Completed eight months ahead of schedule and over $100M below budget
            - Completed at small fraction of cost of traditional rebuild
            - Reduced line losses by 30%
                - Savings $15M/year ($300,000 MWh at $50)
                - Reducing CO2 emissions by approx. 200,000 metric tons per year
                - Freeing up 28 MW of generation
    - SCE Reconductor Project – Big Creek Corridor
        - Objectives
            - Remove N-1 constraint; load shed
            - Increase 4 hour emergency rating
            - Increase capacity to allow for load growth
        - What SCE received
            - Total project cost was reduced to $87M (from $135M)
            - 4 hour emergency rating increased by 62%
            - Increase in ROW operating capacity (>>20%)
            - Project completed ahead of schedule
            - Line losses reduced by 28% (very low load factor line)
    - Xcel Reconductor Project – Muleshoe, TX
        - Estimated cost of $10-15M
        - Objectives
            - Increase capacity
            - Use existing towers
        - What They Received
            - Total project cost of $7-8M
            - Operating capacity increase of about 50%
            - Quick project completion under maintenance practices/permits
            - Line losses reduced by 27% saving 7,140 MWh/year
- Reconductor Avoids Costly Rebuilds
    - Much lower cost than rebuilding (typically ½ price)
- Policy Considerations
    - T&D EE Policy Guidance
        - Policy should direct utility attention to incremental investment for loss reductions

        - EE savings should include costs for energy/fuel savings, C02 savings, water reduction savings, etc.
        - All T&D projects should have EE savings included in the B/C analysis at the planning stage
        - Follow approved guidance for end-use EE projects
        - Register T&D EE projects?
- Cost/mile for reconductoring with ACCC: approx. $600-700K/mile
- While not seen as much, there could be value in utilizing this technology to handle variability of distributed energy resources

## Grid Modernization: Distribution System Planning Update – Nancy Lange, MNPUC

- Grid Modernization – March 2015 Launch Takeaways
    - The grid is at a time of significant change. PUC is seeing increased requests from utilities to modernize their infrastructure.
    - Changing customer demands, new technologies, and evolving public policy will drive increased deployment of new grid technologies and DER
    - Development of tomorrow's grid is already underway, and investments are being made today that will influence the capabilities of the future grid
    - Updates to distribution planning process will be needed
        - August 2016 – ICF's Integrated Distribution Planning Report
- Distribution System Planning Questionnaire
    - How do MN utilities currently plan their distribution systems?
    - What does each utilities' current year plan look like and assume?
    - Are there ways to improve or augment the utilities' planning processes?
    - Takeaways
        - Stakeholder Summary
            - General support for distribution system planning of some kind
            - Variation in outcomes and expectations of a DSP
            - Variation on whether plans should be approved or constitute prudency
            - Stakeholder participation is important
            - Similar planning concepts should apply to all utilities, but how they are applied will vary
        - How can utilities be indifferent between DER and capital projects? ("No wires" approach)
- Xcel will file its first IDP November, 2108. OTP, MP and Dakota Electric, November 2019. Information from Commerce's EUI potential study and policy review can be important inputs into the utilities' IDPs.

Discussion/Feedback

- This stakeholder project could develop comments to submit to the performance metrics docket
- The final Action Plan could discuss how our findings can inform the Integrated Distribution Planning process. We could also develop comments to submit to the IDP docket.

- Getting EE considerations into the planning process is a recurring theme – reconfirms our EUI potential study and Action Plan findings that suggest we should target design/planning processes

## Conservation Voltage Reduction and Improving System Efficiency – Jose Medina, OATI

- CVR Overview
  - Potential for 3-6% demand reduction
  - Highly effective demand reduction tool – approximately 0.5% to 4% reduction depending on the feeder.
- CVR Benefits
  - Reduced demand and energy charges
  - Enhanced system observability
  - Better load balancing across phases
  - Improved power quality/better customer service
  - Closed loop CVR constantly monitors grid conditions and adjusts feeder tap voltages to maintain required end-of-line voltages efficiently
- CVR case studies demonstrating results summarized above

## Next Steps in EUI Stakeholder Process – Travis Hinck, GDS Associates

- Next steps in the stakeholder process are outlined in the figure below, including the development and distribution of an Action Plan report that distills the lessons learned from the project and includes policy recommendations to help address barriers to EUI efficiency. Periodic updates will distributed to stakeholders who have signed up to receive email updates about this project.

*Figure 2. Next Steps in EUI Stakeholder Process*