BUILDING DECARBONIZATION COALITION

April 18, 2025

Thermal Energy Network Work Group

Roundtable #3 - Policy Barriers and Opportunities for Thermal Energy Network Deployment

The Building Decarbonization Coalition (BDC) respectfully shares the following responses to the Great Plains Institute's request for the identification of policy barriers, solutions, and opportunities on behalf of the Minnesota Public Utilities Commission's Thermal Energy Network Work Group. As a national expert on the rapidly evolving area of gas utility implemented thermal energy networks (TENs) we appreciate the opportunity to assess and propose policy recommendations to remove barriers to the deployment of TENs via pilot projects and, eventually, the scale necessary to meet Minnesota energy goals. We welcome discussion on these recommendations with full acknowledgement that thoughts presented here are evolving day-by-day.

Respectfully,
Building Decarbonization Coalition

Participant-Identified Policy Barriers and Opportunities Related to Gas IOUs Deploying TENs in Minnesota

Potential Barrier: *Minnesota's definition of a "public utility" and its implications for cost recovery*		
Legislative or Regulatory Context	**Explanation**	**Thoughts/Recommendation(s)**
Chapter 216B.02, subd. 4 defines a "public utility" (excluding municipal and cooperative utilities) as "persons, corporations, or other legal entities, their lessees, trustees, and receivers, now or hereafter operating, maintaining, or controlling in this state equipment or facilities for furnishing at retail natural, manufactured, or mixed gas or electric service to or for the public or engaged in the production and retail sale thereof." Chapter 216B.02, subd. 6 defines a "service" as "natural, manufactured, or mixed gas and electricity; the installation, removal, or repair of equipment or facilities for delivering or measuring such gas and electricity." Chapter 216B.1635, subd. 4 establishes that MPUC can approve rate recovery of gas utility infrastructure costs for utilities consistent with the definitions provided above.	These statutes indicate that in Minnesota, public utilities provide electric and/or gas service. Comparatively, TENs provide heating/cooling service but not through the direct delivery of electricity or gas to end-use customers. Based on these statutes, it is not clear that MPUC would have the authority to approve a gas utility's proposed cost recovery schedules for recovering costs incurred for TEN deployment and operation (except for TENs/networked geothermal systems currently approved for deployment under utilities' NGIA plans). This establishes significant financial uncertainty for regulated gas utilities.	**Expand the definition of a "public utility" and "service" to include "Thermal Energy" and expand authority of MPUC to say gas "and thermal" utility infrastructure costs.** Prescriptive statutory definitions around utility service that require gas utilities to provide gas service were created to ensure Minnesotans had equal access to reliable heating solutions. Today, these outdated statutes confine gas utilities to specific fuels rather than a requirement for service as intended. Expanding definitions of service to include "thermal energy" would allow gas utilities to pursue innovative heating and cooling solutions for customers that are cost-effective and non-emitting and socialize these costs the same as they do for gas and electric infrastructure. Further, explicit statutory authority for gas utilities to receive approval from the Commission to implement TENs projects where they are cost-effective, logical, and in the best interest of ratepayers and Minnesota's climate targets via amendments to cost-recovery language in 216B.1635, Subd. 4 or supporting definitions is recommended. This statutory authorization removes this cost recovery barrier for gas utilities while still ensuring the Commission evaluates project proposals to ensure they are in the best interest of Minnesotans.
Potential Barrier: *Obligation to Serve/Standard of Service*		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
Utilities' obligation to serve is established under Chapter 216B.04, *Standard of Service*, which states, "Every public utility shall furnish safe,	TENs are most efficiently deployed when all customers in the target geography elect to forgo their gas service in favor of TEN interconnection. But if one or some customers in the area targeted for TEN deployment	For the reasons described in the explanation, a gas utility's obligation to serve represents a barrier for them to cost-effectively deploy TENs. Removing this

adequate, efficient, and reasonable service; provided that service shall be deemed adequate if made so within 90 days after a person requests service."	elect to remain on the gas system, the utility is generally "obligated" to provide them service. This means the utility must own, operate, and manage both the TEN *and* gas infrastructure to ensure that they continue to meet the standard of service. Because operating both systems would be costly, utilities would be unlikely to deploy a TEN in a region without full end-use customer buy-in.	barrier requires amendments to the statutes dictating the definition of "service" to expand it to include thermal energy. Doing so would not require any amendments to 216B.04.
Potential Barrier*: Uncertainty/risk around system-wide deployment post-NGIA pilot phase*		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
Under Chapter 216B.2427, *Natural Gas Utility Innovation Plans*, authorizes gas utilities to file innovative plans with MPUC for review and approval. The plans must include innovative pilot projects that would enable the gas utility to contribute towards reaching Minnesota's greenhouse gas reduction goals. Utilities can recover costs for the innovative pilots included in their plans, subject to MPUC review, approval, and oversight. Subd. 9 establishes that "Innovation plans filed after July 1, 2024, under this section by a utility with more than 800,000 customers must include spending of at least 15 percent of the utility's proposed total incremental costs over the five-year term of the proposed innovation plan for thermal energy networks projects. If the utility has developed or is developing thermal energy network projects outside of an approved innovation plan, the utility may apply the budget for the projects toward the 15 percent minimum requirement without counting the costs against the limitations on utility customer costs under subdivision 3."	There are pathways to achieve MPUC approval for the costs of constructing and operating pilot TENs deployed under NGIA, but there is not yet an established pathway for recovering those costs outside of the pilot construct established under NGIA. Regulated gas utilities may see risk in investing in TENs with an unclear post-pilot cost recovery. Meanwhile, customers may see risk in bearing uncertain levels of costs with the new technology without cost recovery guardrails.	Minnesota gas utilities should be authorized to propose and pursue TENs projects outside the confines of the NGIA and be required to demonstrate cost/benefit analysis, customer protections, and prudent spending no different than traditional gas system projects. Limiting cost recovery for TENs to the limited budget of NGIA that is required by statute to be spent largely on alternative energy solutions like renewable natural gas and hydrogen sets gas utilities on a course to be ill-prepared for TENs deployment at scale in their service territories across different geologies, end uses, and customer types. While pilots represent a crucial first step for gas utilities to gain experience designing and implementing TENs as well as develop the internal processes for managing such projects, gas utilities should be allowed to propose TENs as a resource no different than they currently propose pipe expansion, RNG blending, and other resources. Authorization for gas utilities to recover TENs project costs does not write them a blank check. Gas utilities must still have project proposals evaluated by the Commission to demonstrate proposed TENs are a prudent investment and protect the financial interests of ratepayers.

Potential Opportunity: *The Expansion Alternatives Analysis (EAA) under Minnesota's new gas resource planning framework offers a potential path through which gas utilities can analyze TENs as alternatives to gas system expansion*		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
MPUC's new gas resource planning framework, established in October 2024 via an MPUC order in Docket 21-565, directs utilities to complete an "Expansion Alternatives Analysis" (EAA) for a maximum of ten gas system expansion projects at or above a $1M cost threshold.	MPUC's order establishes a procedure through which gas utilities must evaluate potential alternatives to gas system expansion (including but not necessarily limited to TENs), within the prescribed parameters (up to ten projects at or above a $1M cost threshold). The EAA does not disallow gas utilities to assess TENs as alternatives to pipeline expansion projects, so TENs could be a potential alternative explored.	**Gas utilities should use the analyses they conduct through EAAs to implement projects they assess.** Expansion alternatives analyses represent a valuable opportunity for gas utilities to gain experience evaluating TENs as viable alternatives to traditional capital expansion projects via a robust cost-effectiveness analysis. However, EAAs are limited in their scope (just 2-3 analysis) and do not require utilities to fund and construct projects analyzed nor do they address the utility's statutory barriers to cost recovery for these projects or other barriers outlined throughout this worksheet. EAAs represent 1 piece of a much larger puzzle to TENs deployment for gas utilities.
Potential Barrier: ***Definitions of "district energy" and "thermal energy network" could interfere with ability to share expertise***		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
TENs are a type of district energy system, but not every district energy system is a TEN. Below are several examples of how TENs and district energy systems are defined in Minnesota statutes. Chapter 216B.2427, *Natural Gas Utility Innovation Plans*, Subd. 1(f) defines district energy as, "a heating **or** cooling system **that is solar thermal powered or that uses the constant temperature of the earth or underground aquifers** as a thermal exchange medium to heat or cool multiple buildings connected through a piping network." Subd. 6 of HF 5247 and Chapter 216B.2427, *Natural Gas Utility Innovation Plans*, Subd. 1(s) defines a TEN as, "a project that provides heating **and** cooling to multiple buildings connected via underground piping	There are several notable differences between how Minnesota defines district energy and TENs (a type of district energy system). One such difference is that district energy systems are defined as systems that provide heating **or** cooling, while TENs are defined as systems that provide heating **and** cooling. The differences in how these technologies are defined introduces potential regulatory complication. It also introduces a scenario in which district energy workers and firms with expertise may be constrained in the ways in which they can share their expertise with investor-owned utilities seeking to deploy TENs, which share numerous technical similarities and public benefits with district energy systems (including but not limited to greenhouse gas reduction).	Before evaluating legislative changes to existing definitions, this work group and the Commission should first establish the goals and values that we are collectively trying to achieve through the deployment of TENs and/or district energy systems. Baselining an evaluation of the definitions with a shared understanding here allows for a more productive review. Current definitions allow for multiple different kinds of system options that could easily be defined as either district energy or TENs. These definitions do not preclude any groups from participating or lending expertise into TENs stakeholder processes nor do they even preclude district energy providers from owners and operating systems classifiable as TENs under these definitions. Goals and values that could support an evaluation of these definitions could include reducing emissions, providing heating and cooling for residences and

containing fluids that, in concert with heat pumps, exchange thermal energy from the earth, underground or surface waters, wastewater, or other heat sources."		businesses, maximizing thermal and energy efficiency, maximizing system resilience, and ensuring system interoperability and ease of expansion.
Additional Participant Suggested Barrier: System Design and Environmental Regulations		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
Groundwater thermal exchange devices (GTEDs) and Bored Geothermal Heat Exchangers (BGHE), two categories of geothermal heat exchange technologies commonly used in thermal energy networks and individual building geothermal systems are defined and governed by the Minnesota Department of Health. Minnesota Rules, Chapter 4725 and Chapter 103I dictate design, construction, and permitting procedures for the installation and maintenance of these systems. Chapter 4725.1833 outlines permitting requirements for BGHE systems while Chapter 4725.1831 does so for GTEDs.	The variability of geothermal heat exchange technologies possible and present in TENs and geothermal systems in Minnesota present different challenges, suitability to the state's varying geologies, and environmental risks. GTEDs, similar to aquifer thermal energy storage (ATES) being used in St. Paul's The Heights, extract and reinject water through a heat exchanger. These systems are unique from closed-loop systems that absorb thermal energy from the ground via pipes in the ground or a bored heat exchanger, such as that from Darcy Solutions. Closed loop systems present fewer environmental considerations compared to those that move groundwater to capture heat.	Either via consultation with the Department of Public Health and relevant stakeholders in this work group's report process or a process following this work group's report, a comprehensive review of these current regulations and potential amendments should be conducted. Policy recommendations from this process should be delivered to the Department of Health and the legislature for consideration. Closed loop (e.g. BGHEs) and open-loop (e.g. GTEDs, ATES) geothermal exchange systems should face different regulatory scrutiny as they are cited and installed to support thermal loads of TENs. Current rules and statutes differentiate and establish stricter permitting requirements for open-loop systems. As TENs pilots begin in Minnesota and we think towards broader deployment that will dramatically increase the number of geothermal wells it will be important for regulations to be sufficient to protect groundwater while enabling permitting and siting appropriate to the technology being installed.
Additional Participant Suggested Barrier: Design Consistency for Interoperability		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**

Chapter 216B.2427, *Natural Gas Utility Innovation Plans*, Subd. 1 defines a ten as, “a project that provides heating and cooling to multiple buildings connected via underground piping containing fluids that, in concert with heat pumps, exchange thermal energy from the earth, underground or surface waters, wastewater, or other heat sources.” Further, both Centerpoint (Docket No. 23-215) and Xcel (Docket No. 23-518) have approved TENs projects via their respective innovation plans under the authorization and requirement of Chapter 216B.2427 subdivision 9a.	The statutory definition of TENs and Commission requirements for assessing where to install Centerpoint and Xcel’s first pilot project provide some direction for the utilities to design their systems around. However, no current statute nor Commission order provides technical direction for utilities to consider how TENs will interconnect to waste heat sources, existing district energy systems, or other TENs systems in the future. Traditionally, systems that provide thermal energy can have 1, 2, or 4 pipes, provide heating, cooling, or both, and be from emitting or non-emitting sources. The complexity of traditional or historical designs does not always allow for efficient or cost-effective interconnection between systems.	Either via statutory or Commission direction, future pilots should be directed to follow a shared set of high-level technical design guidelines with the intention of ensuring consistency and interoperability. These guidelines should establish a preference for single-pipe ambient temperature loops with a diverse thermal load. Under these guidelines, gas utilities could serve instead as thermal utilities focused on thermal distribution using these interconnectable loops. While these guidelines should not be so prescriptive to limit TENs implementation in places where design conditions necessitate other solutions, some direction to all gas utility implementors will benefit the future of TENs in MN. It should be the job of the Commission to assess systems to determine necessary exceptions to these design conditions. New systems following these design guidelines doesn’t preclude them from interconnecting with existing district energy, open loop geothermal systems, or other external heat sources but ensures new systems most efficiently are compatible with one another.
Additional Participant Suggested Opportunity: Diverse Thermal Energy Ownership		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
Chapter 216B.166, Subd. 2 defines cogeneration as, "a combined process whereby electrical and thermal energy are simultaneously produced by a public utility power plant." This section establishes a general framework by which cost accounting for the generation and capture of thermal energy byproducts is done and declares the benefits of thermal energy capture to improve local energy security and offset imported fossil fuels. Chapter 216B.164, Subd. 2a provides a similar definition of cogeneration and	The commodity marketplaces for electricity and gas are well established due to the regulated monopoly models for sale and distribution effectively socializing the costs of building these systems and regulations over multiple centuries. Behind-the-meter distributed energy resources like solar and storage contribute to the electricity marketplace either by interconnection or offsetting customer load. On the gas side, delivered fuels like propane and fuel oil offset gas load for gas customers or eliminate the need for them to connect to the gas system altogether. While TENs require electricity to operate, the primary commodity being generated/captured and delivered to end-use customers is thermal energy.	In order to be prepared with marketplace and trading guidance for thermal energy, Minnesota should, via a robust stakeholder process including, at minimum, existing district energy operators, industrial heat producers, power plant and cogeneration facility owners, and utilities, establish a framework for a thermal energy marketplace designed to encourage diverse ownership of thermal energy sources for TENs, district energy systems, and other thermal energy end uses, and procure ratepayers the least cost thermal energy. Gas utilities should be directed under this framework to seek the lowest cost thermal energy sources whether by drilling their own bore holes and/or by

includes “waste heat” in the listed definition of distributed energy facilities.	The existing statute identified provides some initial guidance around thermal energy generation and use within district energy systems but falls short of providing broader structures to support a commodity marketplace for thermal energy that will be necessary to support widestream deployment of TENs post-pilots. While a heat marketplace necessary to support thermal energy networks at scale does not yet exist, we must anticipate the need and opportunity to leverage distributed sources of heat and provide regulatory and legal direction for their ownership. This represents a barrier within existing regulatory frameworks and Minnesota energy law because it is not clear how a regulated utility, private or governmental entity, and TENs operators should individually own heat sources such as lakes, borefields on public land, or waste heat from high heat producers like data centers and large commercial buildings. This presents a barrier to TENs development by regulated gas utilities who will need to identify private heat sources in communities where they may not be able to develop and drill their own borefields for utility-owned TENs systems.	buying thermal energy and storage from other sources. The MPUC should encourage pilot projects with diverse thermal resource ownership to assess the potential benefits prior to recommending final legislation or regulation.
Additional Participant Suggested Barrier: Develop Guidelines for Thermal Commons		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
BDC is not aware of any statute nor regulatory order that dictates geothermal energy utilized in individual geothermal or TENs as thermal commons. Chapter 103G.271, water appropriation permits, Chapter 103I.621, permits for groundwater thermal exchange devices, and Minnesota Rules, Chapter 4725 collectively dictate water usage and permitting for geothermal systems. These statutes represent a framework by which water commons guidelines guardrail usage of one shared resource that these systems use.	Historically, modestly sized individual geothermal systems accessing thermal energy from substantial aquifers, bedrock, or large bodies of water have not had to realistically consider the thermal impact they have on the thermal source. As geothermal district energy and TENs systems begin to be deployed throughout Minnesota on shared aquifers, in close proximity to one another, and using shared lakes, streams, or rivers, it’ll become increasingly important to track and manage the thermal exchange between different systems to avoid overextraction or deposit of heat between geothermal projects and the thermal sources. Regulated gas utilities’ access to economies of scale and the ability to socialize costs across ratepayers are primary reasons why TENs deployment is promising via	Minnesota should establish thermal commons guidelines that, like water, dictate thermal energy exchange allowances and track thermal exchange on shared aquifers, bodies of water, and proximate bedrock. Though the near term need for guidelines like this are likely not pressing, the long-term trajectory of Minnesota’s reliance on geothermal energy to heat homes and businesses and increase domestic energy independence alongside the potential for largescale TENs deployment by gas utilities suggests this may become a need in time. Thus, it would be in the best interest of stakeholders, the Commission, and gas utilities to see these policy structures in place. This may be achieved independent of this report by establishing a temporary working group at the

	them. However, the potential of scale represents risk to heat sources that utilities rely on to manage TENs loop temperatures if TENs are deployed at scale. Though this risk is minimal for systems owned and operated by a single utility, the reality is that not all heat source nor TENs loops will be owned by a single utility.	Commission to convene stakeholders to develop these guidelines or legislative recommendations to do so.
Additional Participant Suggested Barrier: Strategic Deployment		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
MPUC's new gas resource planning framework, established in October 2024 via an MPUC order in Docket 21-565, directs utilities to complete an "Expansion Alternatives Analysis" (EAA) for a maximum of ten gas system expansion projects at or above a $1M cost threshold. This order, however, is independent of TENs projects via utilities' NGIA innovation plans and, at this point, will not functionally direct TENs deployment by utilities to replace planned gas system expansions.	Prioritizing TENs deployment in areas that are strategic for utilities, cost-effective for ratepayers, and reduces the most gas system emissions is to the benefit of all stakeholders. TENs can be most effectively deployed at the end of existing gas lines that are nearing the end of their useful life, are nearing full depreciation, or are set to be replaced or repaired because of leaks. Looking towards TENs in these scenarios offers gas utilities the opportunity to save money on maintenance and replacement of these pipes and avoid charging ratepayers for multiple forms of pipes in the ground. Utilities may further be able to find cost-effective implementation if they can align TENs projects near large industrial or institutional customers that have behind-the-meter (BTM) capital replacement projects planned for their heating and cooling needs by leveraging this private capital BTM and increasing project viability. This is especially the case for state, county, or city owned campuses and buildings. No current statute or regulation clearly directs utilities to deploy TENs in this way. EEAs direct utilities to assess expansion projects to determine cost-effectiveness of TENs as a resource but do not include requirements for deployment. Further, in order for utilities to be able to engage in this kind of strategic placement of TENs within their portfolio they must have robust system mapping tools.	Assessment criteria for site suitability for new TENs systems, either outlined in statute or via Commission direction, should be inclusive of these considerations for strategic implementation. If not already developed, Minnesota gas utilities should develop internal distribution planning and mapping tools to assess planned replacement, depreciation, leaks, end of line cost-effective decommissioning, and more to be able to accurately predict where strategic TENs deployment actually exists. This would be further supported by joint gas and electricity utility infrastructure planning and the Commission should require this coordination for new TENs project suitability siting. Though the success of strategic deployment in some instances may be dependent on amendments to the utility obligation to serve for gas utilities, establishing these considerations are important in site suitability assessments even now is useful for instances where customers may be interested in exiting the gas system in favor of TENs or electrification.
Additional Participant Suggested Opportunity: Leverage Avoided Electric System Expansion Costs		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**

Minnesota Statutes § 216B.241, Subdivision 12(a)(2) authorizes the Commission to approve fuel switching measures under a gas utility's ECO plan if the program proposed is "cost-effective, considering the costs and benefits to ratepayers, the utility, participants, and society."	TENs use of geothermal energy as a baseline for system operation significantly reduce their overall strain on electric demand compared to traditional forms of electrification via air source heat pumps or electric resistance heating that exists already in Minnesota homes or would be installed in order to electrify. This grid benefit has the potential to avoid electric demand increases where they are installed and save electric utilities significantly on avoided transmission and distribution grid infrastructure costs. In areas that are already facing electric transmission or distribution capacity constraints, TENs may be a viable solution to avoid grid buildout as communities grow and add new load. BDC is not aware of existing statutory or regulatory precedent for leveraging these avoided costs to be used towards projects on the gas side like TENs. Some statutory direction for the Commission to evaluate the costs and benefits to the grid, ratepayers, and society might provide the broad authority for these kinds of considerations in approval of proposed TENs projects from utilities.	We recommend prioritizing TENs deployment by gas utilities in areas facing increased load from new building development or electrification and sharing cost savings from avoided electric infrastructure investments onto the gas/thermal customer side to pay for TENs projects. This kind of cost-sharing scheme across utilities and rate bases requires close coordination between electric and gas utilities with overlapping customers and clear direction from the Commission on cost recovery.
Additional Participant Suggested Barrier: Post-Pilot Rate Structures		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
Chapter 216B.2427 authorizes gas utilities to recover the costs of TENs via ratepayers and Centerpoint (Docket No. 23-215) and Xcel (Docket No. 23-518) have both included broad direction on how projected capital costs will be spread across their rate base.	In current statute, the question of how gas customers opting in to participate in TENs pilots will be charged for the thermal energy they receive is not prescribed. The way in which infrastructure costs will be spread across Centerpoint and Xcel's rate base is explored in preliminary filings via project cost estimates. Gas utilities must be able to establish through these pilots the appropriate rates and mechanisms for TENs cost recovery that is equitable and still allows for the broad socializing of capital costs across ratepayers. Charging only the customers on a TEN for the cost of the TEN would lead to unrealistic energy bills due to the high cost capital costs of TENs at the outset and is misaligned with how gas infrastructure costs are recovered. However, current thinking among gas	This work group, as well as the Commission via separate ongoing processes as pilots begin to be designed, sited, and deployed, should evaluate TENs project costs, rate design structures, and reasonable cost of thermal energy, and design a rate structure for TENs customers. This rate design process should factor in electric system savings as a result of TENs including avoided infrastructure costs and peak electricity usage savings.

	utilities around rates and monthly charges to participating customers is that these costs need to be low enough to get customers interested in participating in the pilots. This translates to a subsidized, fixed-fee model that doesn't accurately reflect the anticipated cost of delivering thermal energy. All-in-all, the learnings about how future TENs systems post-pilot phase will charge and bill customers for system construction, operation, and thermal use are not clearly available via current rate ideas in pilots.	
Additional Participant Suggested Opportunity: Eliminate Regular System Emissions & Maintain Reliability		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
216H.02, Subd. 1 establishes Minnesota's statewide net zero emissions target by 2050. 216B.2427 Subd. 2 dictates that utility NGIA plans must include "total lifecycle greenhouse gas emissions that the utility projects are reduced or avoided through implementing the plan."	Minnesota's net zero emission by 2050 goal alongside planning, accounting, and emission reduction requirements at the heart of NGIA demonstrate Minnesota's intention to reduce greenhouse gas emissions. Thermal energy networks, via their use of geothermal energy and emissions-free thermal sources such as waste heat, are capable of being 100% emissions free, even on Minnesota's coldest and warmest days. These systems operate extremely energy efficiently and with reliability thanks to the constant temperatures of the earth beneath the frost line and with the support of thermal backup systems to regulate loop temperatures in case of emergency. Eversource's Framingham pilot, for example, includes a backup electric boiler that can help maintain the temperature of the system should heat demand reach peaks.	Comply with Minnesota's net zero emissions reduction goals and the emissions reduction goals of NGIA through the deployment of TENs that are designed to be emissions free. Leverage the reliability of geothermal energy to meet heating needs of Minnesota's cold winters while ensuring backup thermal systems are in place for system reliability.
Additional Participant Suggested Opportunity: Job Transition for Gas System Workers		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
216H.02, Subd. 1 establishes Minnesota's statewide net zero emissions target by 2050.	Minnesota's net zero by 2050 goal makes clear that all sides of Minnesota's economy will need to decarbonize rapidly, including the gas utility sector. There are, and should be, a wide array of strategies employed to get gas utilities in compliance with their share of emissions	Include gas system worker labor requirements in pilots and future TENs projects, develop programs in partnership with labor unions to ensure gas system workers are being cross-trained on the skills and techniques necessary to install and maintain TENs and geothermal, and ensure the jobs being made

	and progress towards this goal, including TENs and forms of electrification like air source heat pumps. However, a transition of this magnitude must be managed in order to protect workers who rely on traditional emitting systems for their livelihoods. An unmanaged transition depicted by the wealthiest people who can afford to electrify on their own puts those left on the gas system at risk of shouldering fixed costs and puts the jobs of those maintaining the gas system at jeopardy. A default to full electrification via air source heat pumps or other technologies that don't provide clear pathways for gas system trades like pipefitters, steamworkers, operating engineers, and more is ripe for inequities along the way.	available for the installation and maintenance of TENs are union.
Additional Participant Suggested Opportunity: Data Tracking and Sharing		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
Both Centerpoint (Docket No. 23-215) and Xcel (Docket No. 23-518) have approved TENs projects via their respective innovation plans under the authorization and requirement of Chapter 216B.2427 subdivision 9a.	Under current pilot approvals there are no guidelines or requirements for the kinds of information and learnings that the utilities nor the Commission must glean from TENs pilot implementation, likely as a result of TENs being a new technology to regulate for the Commission and to critique and evaluate from stakeholders. Collecting and sharing data on TENs pilot construction, maintenance, and performance between projects across the country better positions Minnesota utilities to implement better and better projects going forward.	Minnesota gas utilities may choose to collect and share data on pilots in any number of categories. Types of data being collected in other pilots and shared across implementers includes: before and after gas, electricity, water, and delivered fuel usage, buildings served, loop length and characteristics, load characteristics and diversity, heat sources, install, design, and maintenance costs and time, water usage, job creation quality, quantity, and duration, customers served and engagement rates. The LeGUp project by HEET is a national convening place around this kind of data sharing and learning.
Additional Participant Suggested Opportunity: Take Advantage of Incentives		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
The 25D federal tax credit offers a tax incentive equal to 30% of the project costs for geothermal heat pumps. The federal Investment Tax Credit (ITC) allows thermal energy networks (like geothermal or ambient-loop systems) to receive a 30% tax credit on eligible project costs if they meet prevailing wage and apprenticeship requirements.	External sources or funding from the federal government for gas utilities themselves or in-state funding for BTM customers' costs represent an opportunity to offset costs of installation for TENs systems.	As long as available, Minnesota gas utilities should apply for all federal fund opportunities and seek to help participating customers leverage in-state programs for BTM costs.

If the project meets additional conditions, such as being in an energy community or using domestic content, the credit can rise to 40% or even 50%. Minnesota Department of Commerce, other State agencies, and utilities themselves provide BTM incentives for energy efficiency and electrification programs with eligible technologies inclusive of those installed during TENs construction such as ground source heat pumps, water-to-water heat pumps, induction cooking, insulation and weather sealing, and more.		
Additional Participant Suggested Opportunity: Capture Waste Heat		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
As discussed in the diverse thermal ownership section above, Chapter 216B.166, Subd. 2 and Chapter 216B.164, Subd. 2a are two areas of statute that discuss waste heat from regulated gas utility activities but BDC is not aware of any direction or requirements for waste heat capture or even retrofit ready waste heat capture for many industries who generate large amounts of heat in statute or regulation.	Waste heat capture represents a significant opportunity to heat Minnesota homes and businesses without using new fuel resources and create a revenue stream for heat producers. This capture boasts added thermal efficiency between systems and lower-emissions compared to letting that heat go to waste. Without direction or requirements for gas utilities implementing TENs to pursue waste heat as a primary thermal source it is unlikely it will happen naturally. Waste heat capture from private sources like data centers, wastewater treatment plants, ice rinks, etc. requires added business complexity and interconnection that is new for gas utilities in Minnesota who have never owned and installed TENs.	Gas utilities should be encouraged to use wastewater heat recovery and other waste heat capture in their TENs system design and required to demonstrate in their feasibility studies filed with the Commission how they considered these sources in their site suitability selection. As discussed in the thermal ownership section, when waste heat capture begins to be implemented at scale we will need to figure out how this process is centrally managed and accounted for. This would be the job of a thermal market or associated regulation.
Additional Participant Suggested Opportunity: Evolve Gas Utilities Into Thermal Utilities		
Legislative or Regulatory Context	**Explanation**	**Recommendation(s)**
Chapter 216B.02, subd. 4 defines a “public utility” (excluding municipal and cooperative utilities) as “persons, corporations, or other legal entities, their lessees, trustees, and receivers, now or	Current definitions of public utility and service prescribe gas and electricity as fuels to be delivered by utilities. As Minnesota’s energy economy changes and evolves to the state’s changing needs, climate change, and	Gas utilities in Minnesota should evolve, through the implementation of TENs and other technologies that at their core are just the delivery of thermal energy, to become thermal utilities. Via this process, the Commission and legislature should work

hereafter operating, maintaining, or controlling in this state equipment or facilities for furnishing at retail natural, manufactured, or mixed gas or electric service to or for the public or engaged in the production and retail sale thereof." Chapter 216B.02, subd. 6 defines a "service" as "natural, manufactured, or mixed gas and electricity; the installation, removal, or repair of equipment or facilities for delivering or measuring such gas and electricity."	technological innovations, it is imperative that the structures by which utilities serve customers follow. Through TENs ownership and operation, gas utilities are no longer operating business as usual. Where gas was the commodity of choice for gas piping, thermal energy becomes that commodity for water pipes in TENs. As a result of TENs pilots, gas utilities will be using the statutory authority they have under NGIA to participate in the construction of TENs, socialization of associated infrastructure costs, and procurement, distribution, and sale of thermal energy to participating customers. These are the fundamentals of a thermal utility. Under this structure, gas utilities operating as thermal utilities maintain service to their customers, their service territory, the revenue and profit structures that sustain them, and the workers that rely on jobs utilities create.	collaboratively to redefine the regulatory structures utilities work within to allow for them to expand their thermal business offerings while protecting the ability for them to maintain service to their customers and protect existing and new jobs in the thermal delivery sector.

List Activity Instructions

In the table above, you discussed legislative and regulatory barriers and opportunities with specific implications for investor-owned gas utilities' ability to deploy TENs in Minnesota.

In this secondary activity, please feel provide **broader/higher level feedback regarding barriers and opportunities related to TENs.** For example, the group has widely discussed the ways in which TENs could help lead to greenhouse gas emissions reductions and could support a skilled driller workforce. The group has also identified cost as a general barrier. Please use this section to list any higher-level barriers or opportunities such as these and to provide your thoughts/recommendations related to what you believe to be the best path(s) forward with respect to these barriers/opportunities.

List of barriers to TEN deployment

Barrier	Recommendation(s)

List of opportunities associated with TEN deployment

Opportunity	Recommendation(s)
Diverse TENs ownership beyond just gas utilities	Develop policy frameworks that allow ownership and operation of TENs by many different parties including traditional district energy providers, cities, the State, communities, and more. Ownership could look different depending on the party involved and could be done fully independent of gas utilities or in partnership.