



**Clean Energy Partnership
Q2 Board Meeting
May 18, 2026**



MN Thermal Energy Networks Site Suitability Study

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- What are Thermal Energy Networks (TENs)?
- Minnesota's buildings: Energy Use, Emissions, and Efficiency
- Where TENs Fit
- Site Suitability Study Overview
- Methods
- Results
- What's next

Thermal Energy Network (TEN)



Defined in statute (§216B.2427) 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.***

A TEN is a type of District Energy system.

Minnesota State Energy Office

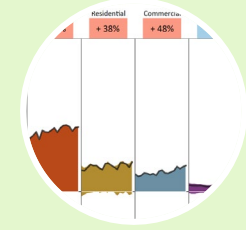
*Leading the transition to
a clean, equitable,
reliable, and affordable
energy system.*





42% of the state's total energy consumption

Minnesota Building Energy Use and Targets



15% of Greenhouse Gas Emissions, and rising



By 2035, reduce emissions from existing buildings by 50% compared to 2005 levels.

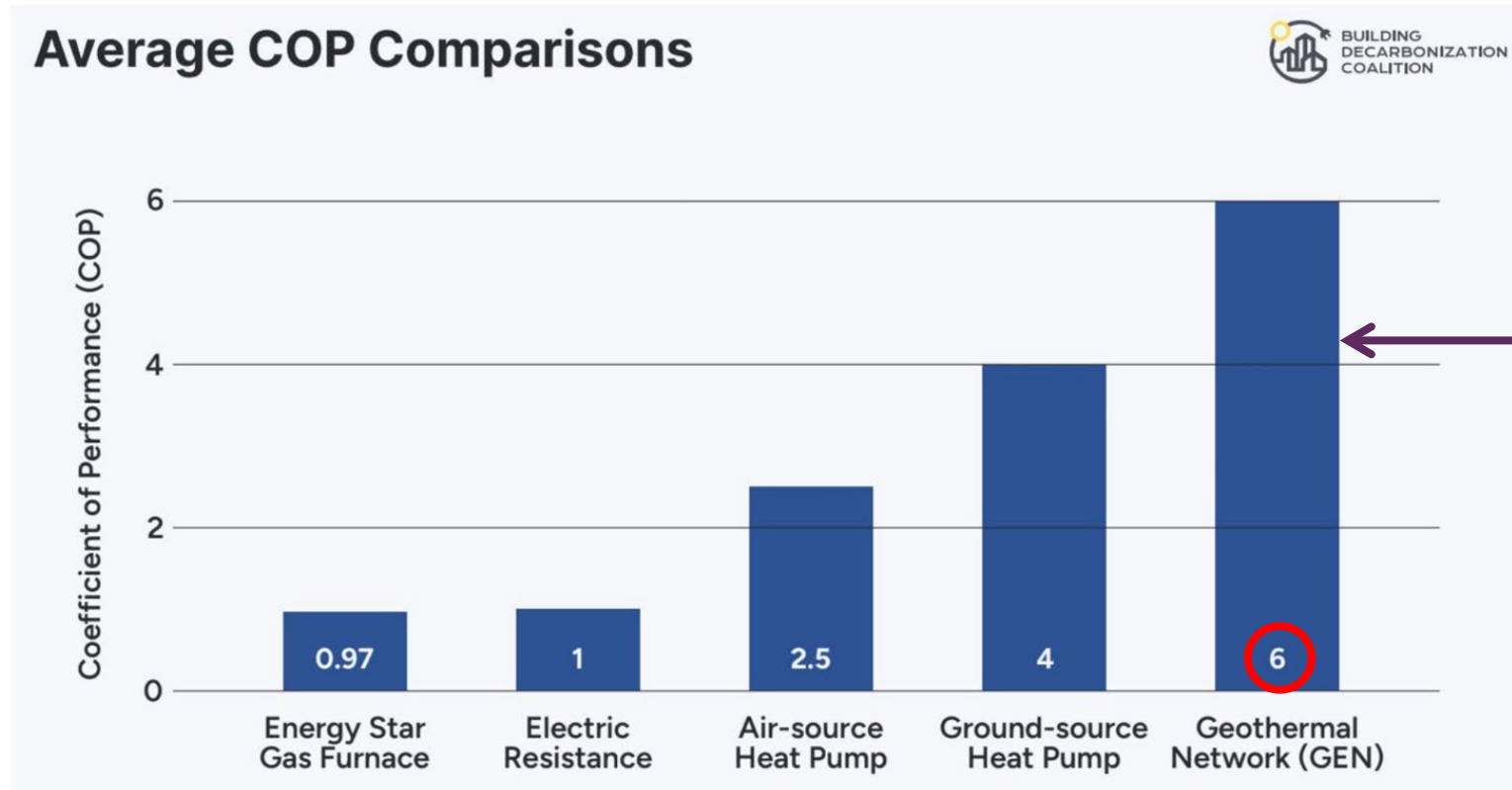


By 2040, all of Minnesota's electricity is carbon-free.



By 2050, we achieve net zero emissions statewide.

Building Heat Technology Comparison



Bigger networks with more diverse loads and geoexchange are most efficient.

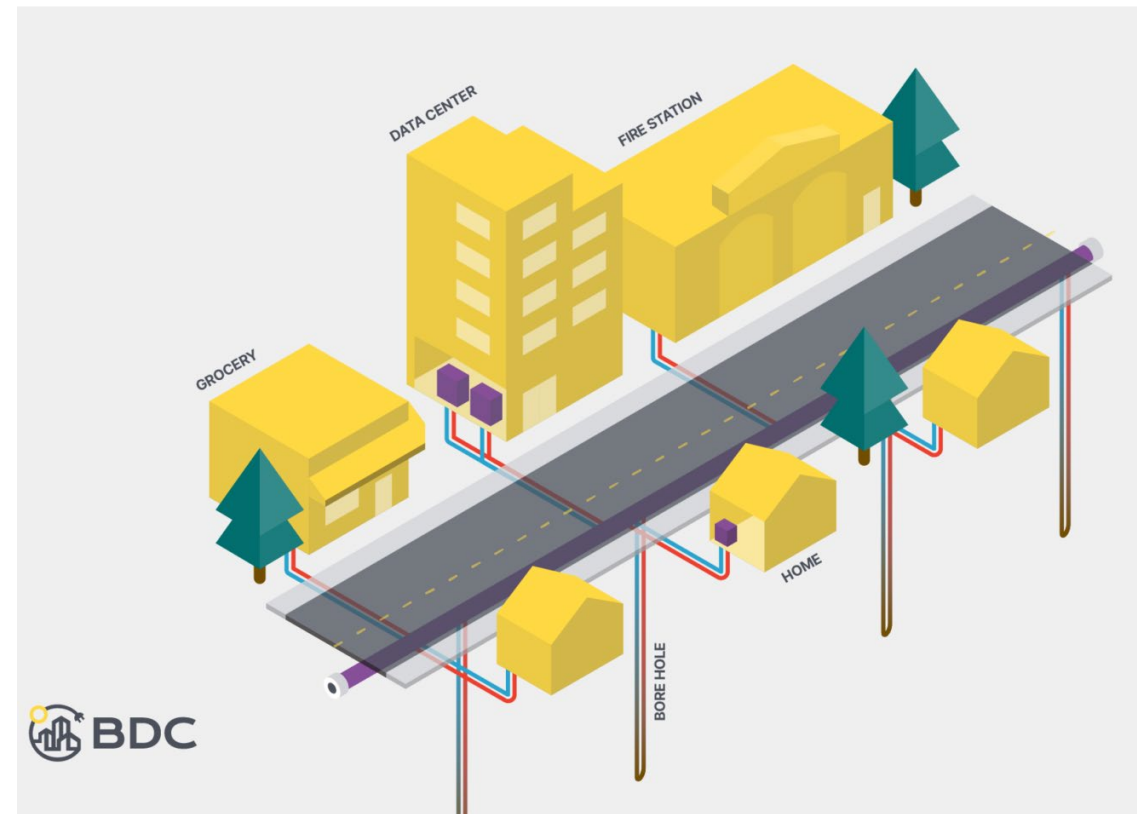
COP = Coefficient of Performance. Every unit of energy spent moves 6 units of heat in a TEN.

Geothermal TENs are efficient and resilient

Ground temperatures are stable throughout the year.

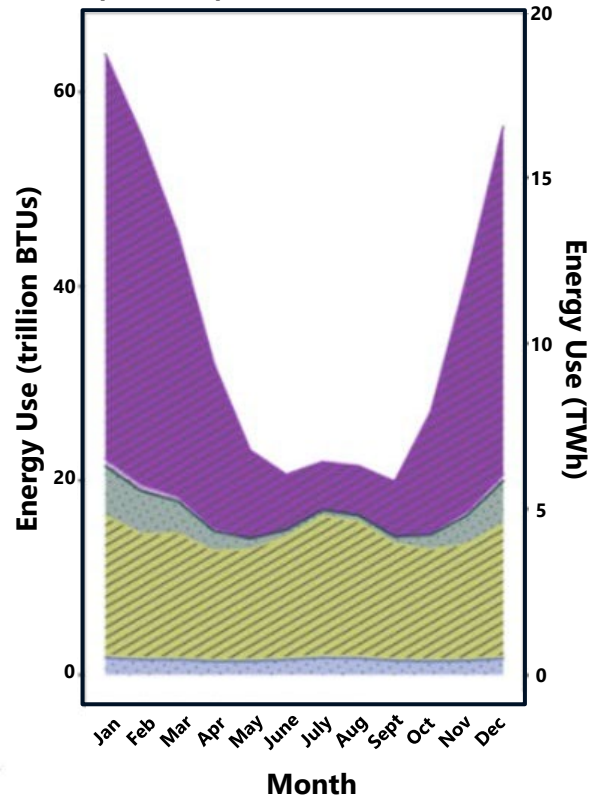
Using the ground as a thermal resource means:

1. Heat pumps run optimally year-round.
2. Low usage spikes due to seasonal or extreme weather.

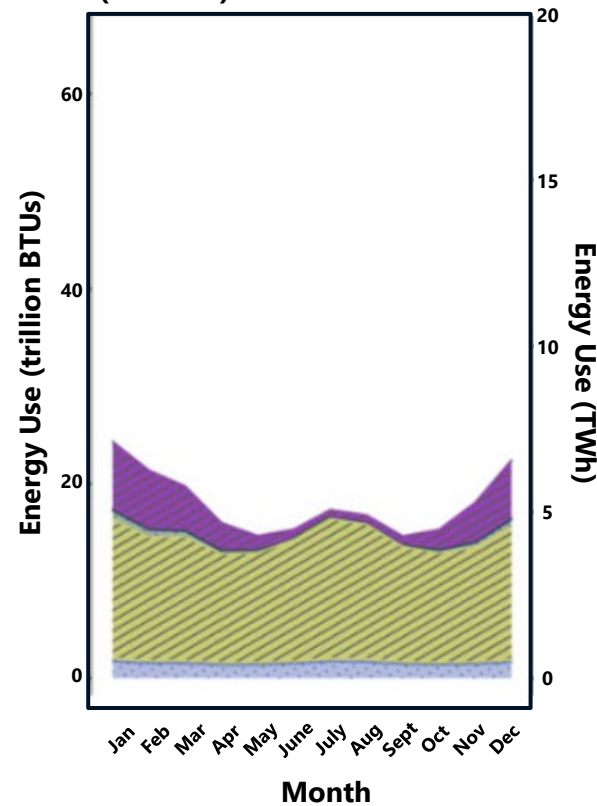


MN Falcon Curve







Energy demand with 100% of existing building fossil fuel use converted to electricity (COP = 1)



Energy demand with 100% of existing building fossil fuel use converted to electricity (COP = 6)



Energy Type

-  New Electricity
-  New Electrical System (Direct Use and T&D)
-  New Electrical System (T&D Losses)
-  Electricity
-  Electrical System (Direct Use and T&D)
-  Electrical System (T&D Losses)

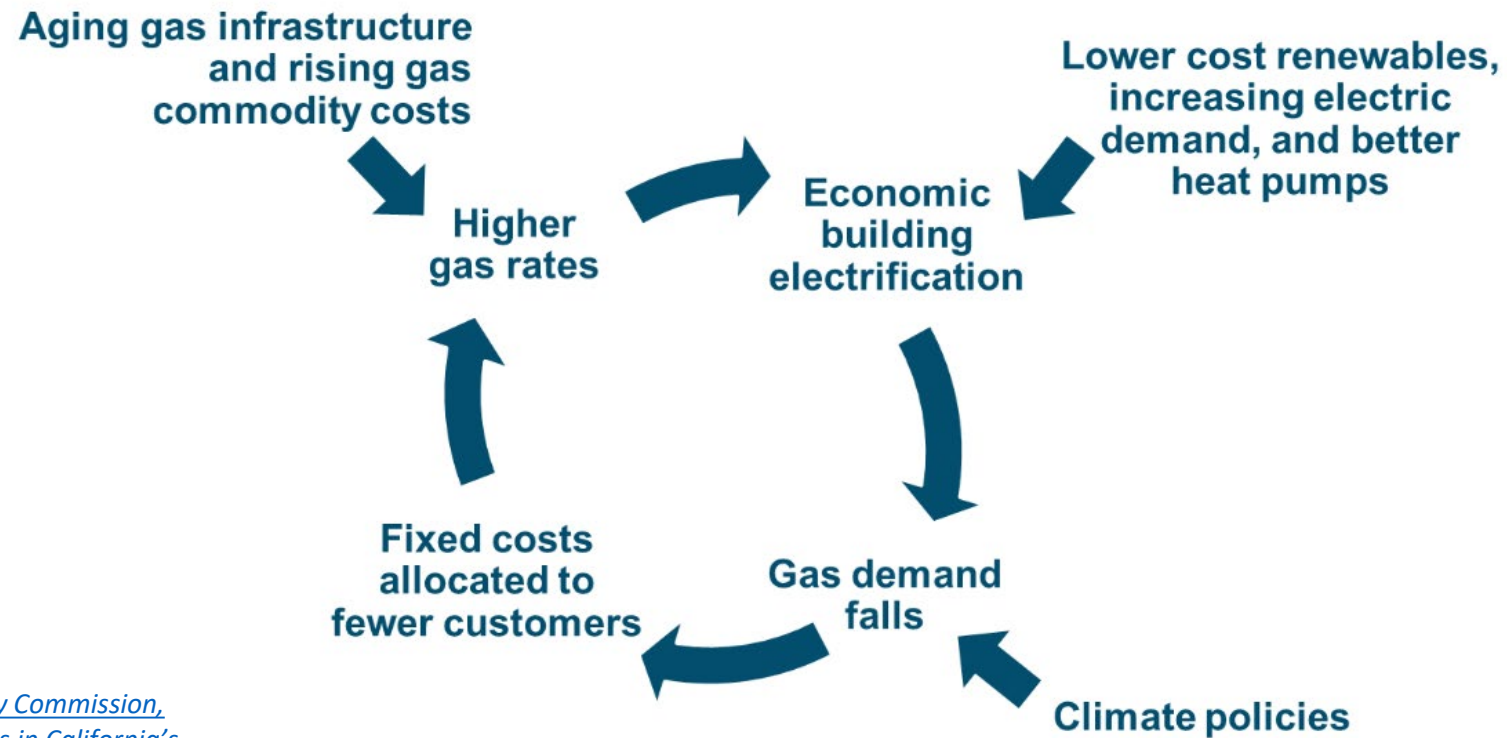
Adapted from

[Brian Sousa et al., "Understanding Seasonal Variations of U.S. State Energy Demand." 2022 AGU Fall Meeting.](#)

[Zeyneb Magavi, "Untitled, MN May 2025", Minnesota Public Utilities Commission Thermal Energy Network Deployment Workgroup Informational Workshop #4, Docket 24-275.](#)

Utility TENs as natural gas system decarbonization solution

Building decarbonization could create a feedback loop to drive up gas prices



Aas et. al., California Energy Commission, "The Challenge of Retail Gas in California's Low-Carbon Future". 2020

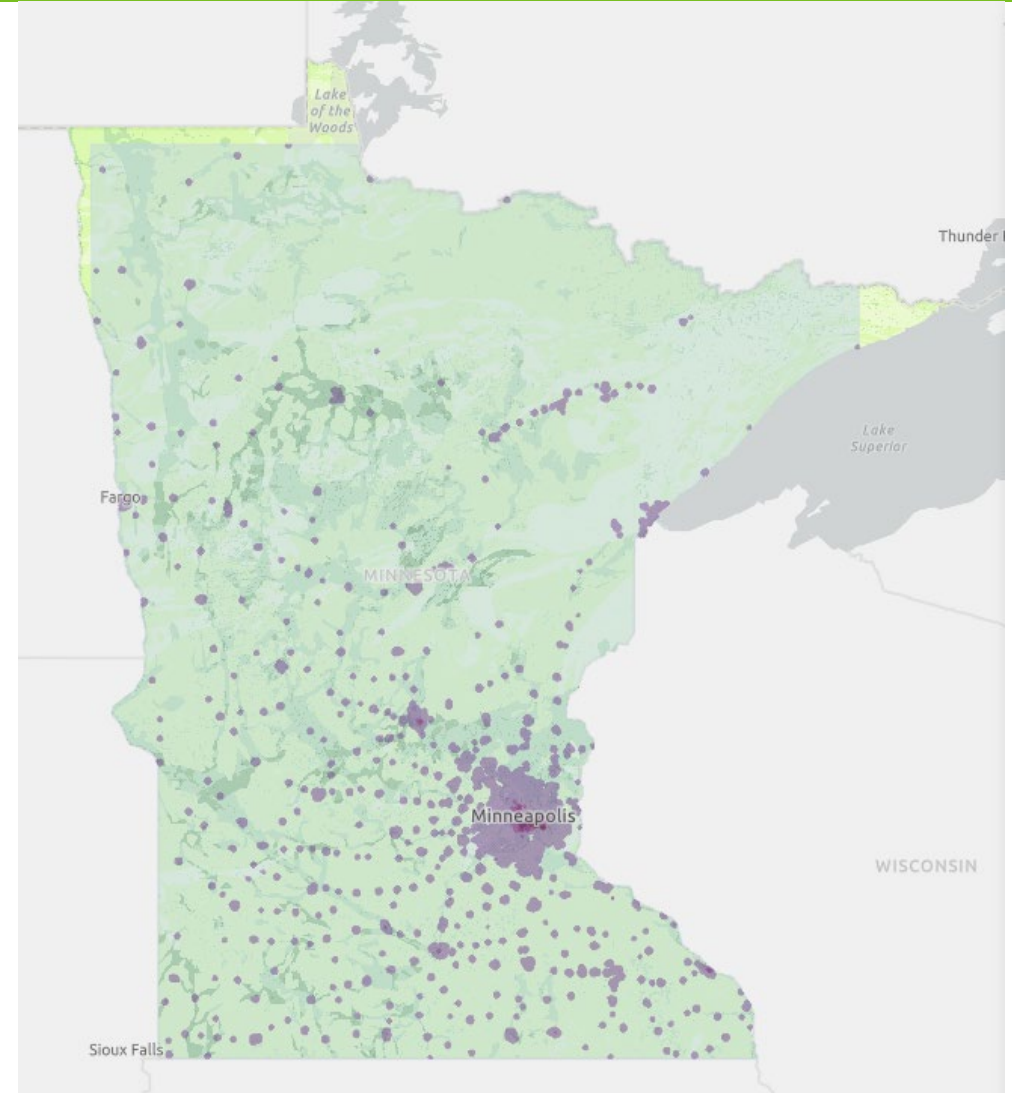
MN TENS Site Suitability Study

Evaluation of TENS suitability across the state

- Geospatial mapping
- Stakeholder interviews
- Site-level evaluation

BURO HAPPOLD

slipstream

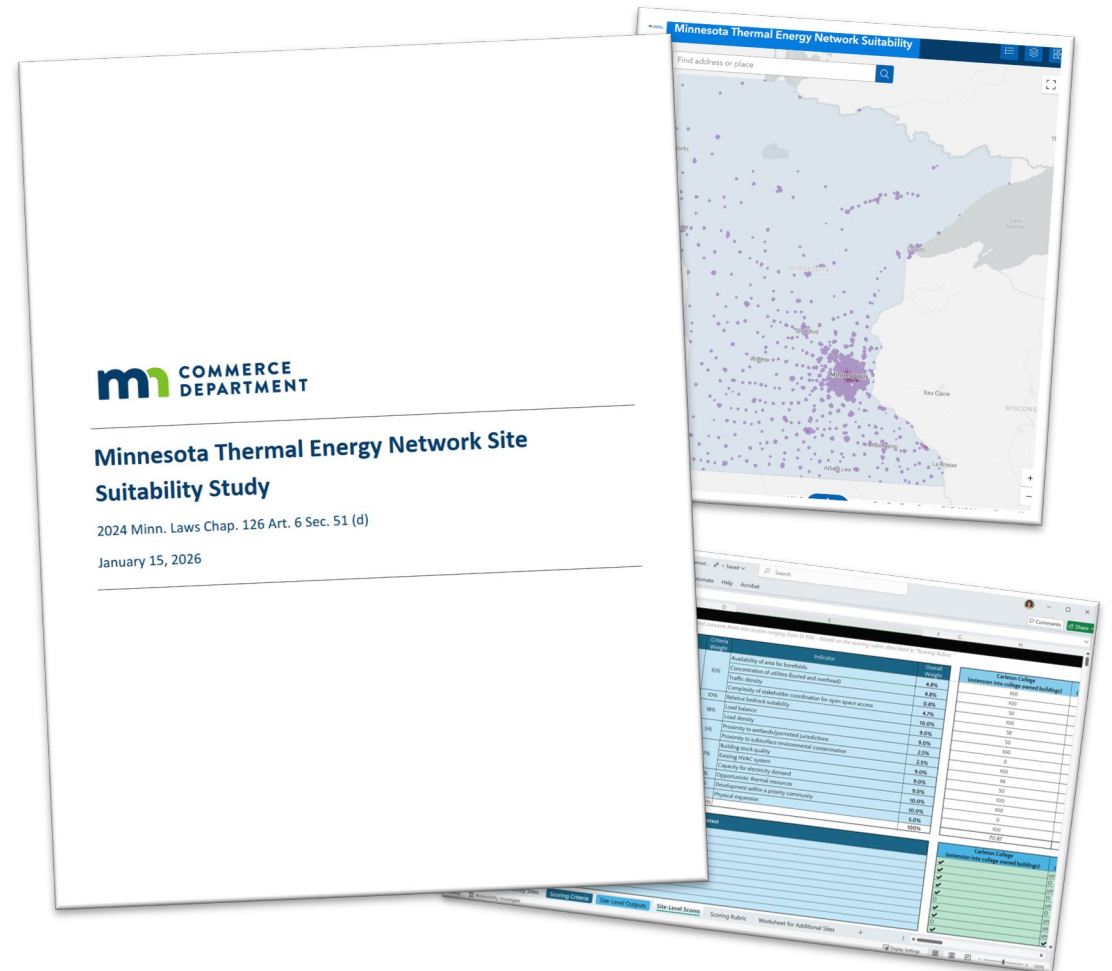


Hotspots from multi-criteria mapping study (available on ArcGIS Online platform)

MN TENs Site Suitability Study

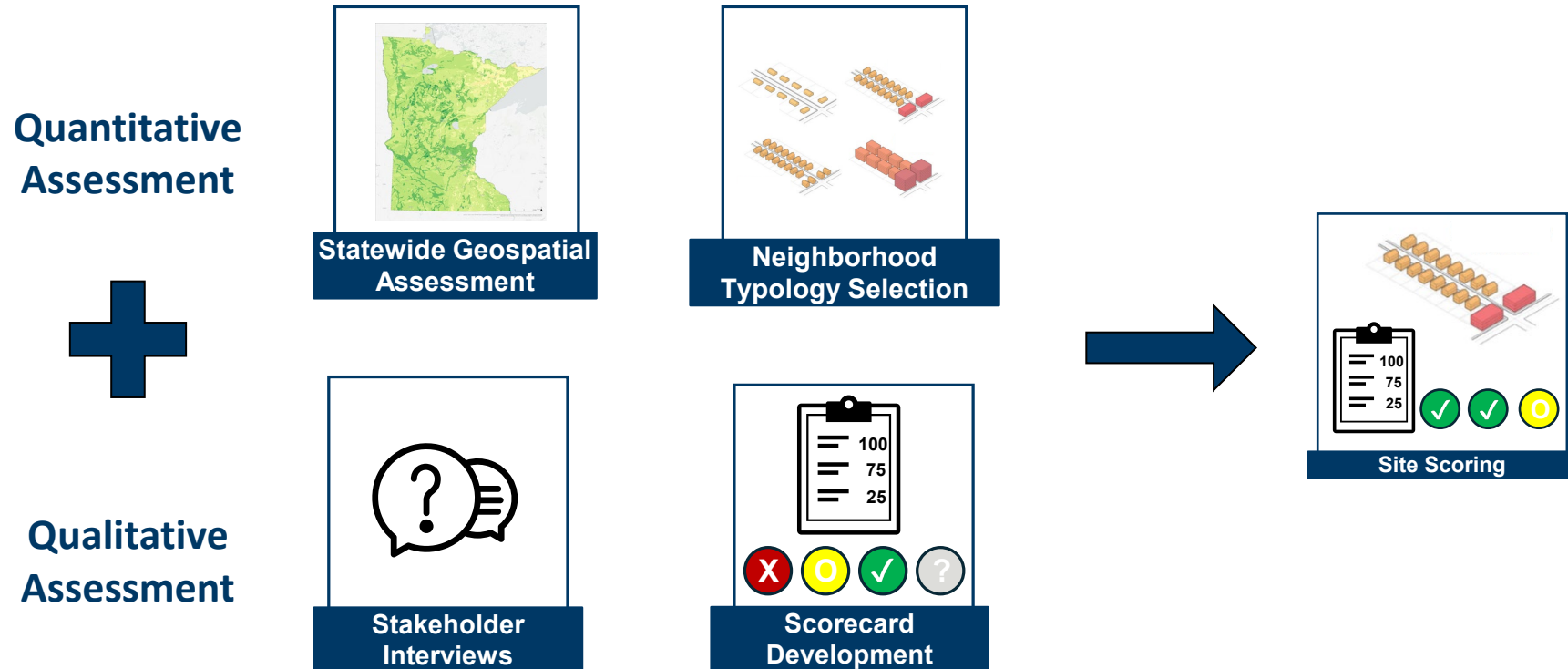
Deliverables

- Review of policy, regulatory, and market landscape for TENs
- GIS mapping tool of conducive conditions for TENs in Minnesota
- Quantitative and qualitative scoring methodology (“scorecard”) to help communities identify optimal sites to develop TENs



MN TENs Study Approach

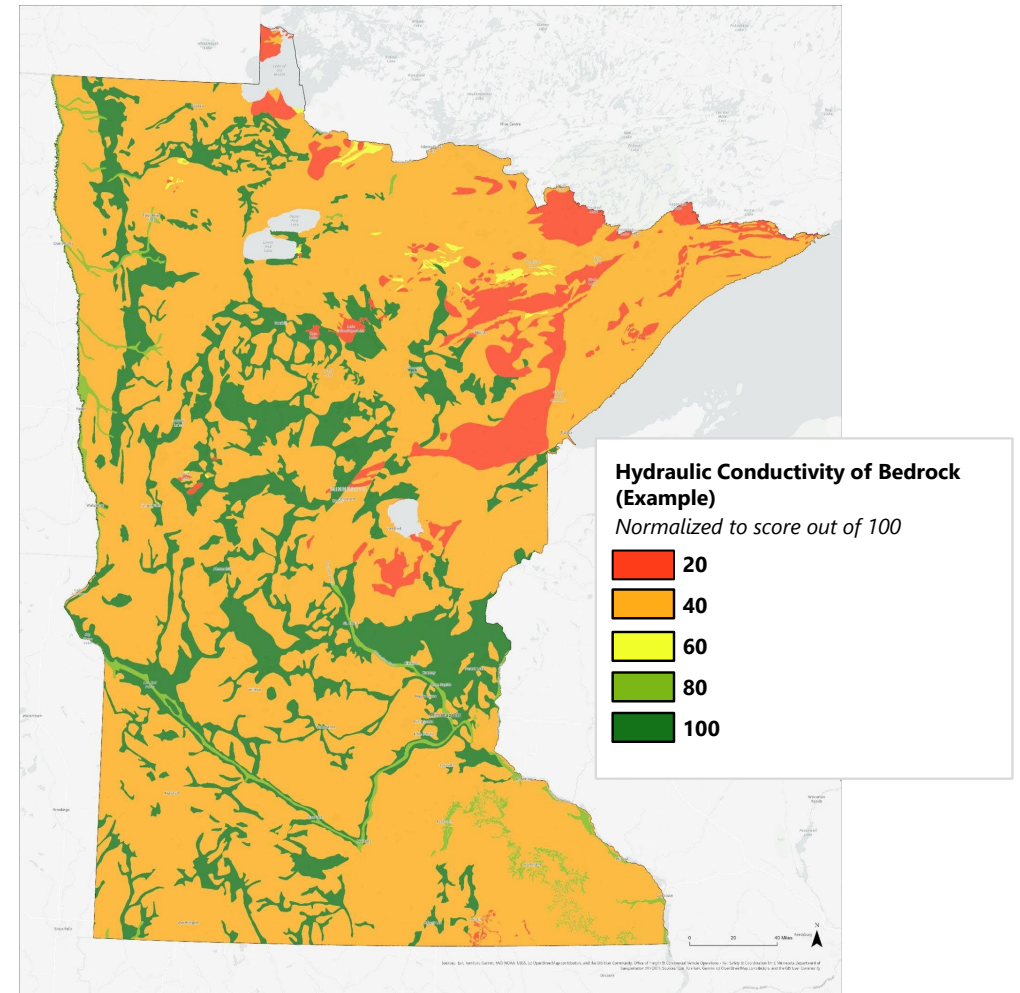
Holistic site suitability required blending technical feasibility with stakeholder engagement to understand project barriers and opportunities



Geospatial Mapping

Statewide map integrates relevant publicly-available data:

- Building stock information (building age, use types, HVAC systems)
- Typical building energy consumption (and benchmarking data where available)
- Hydro and geologic conditions of bedrock
- Protected environmental areas or contaminated sites
- Thermal resources for heat recovery (e.g., manufacturing sites, ice rinks, data centers)
- Priority communities and demographics
- Areas of significant population growth and/or new development



Quantitative Scoring Approach

Criteria	Criteria Weight	Indicator	Overall Weight
Borehole/Borefield Accessibility and Construction	15%	Availability of Area for Borefields	4.8%
		Concentration of Utilities (Buried and Overhead)	4.8%
		Traffic density	0.8%
		Complexity of Stakeholder Coordination for Open Space Access	4.7%
Geologic Conditions and Thermal Conductivity	10%	Bedrock Suitability	10%
Load Characteristics	18%	Load Balance	9%
		Load Density	9%
Environmental Constraints	5%	Proximity to Wetlands/Critical Ecosystems	2.5%
		Proximity to Subsurface Environmental Contamination	2.5%
Behind-the-Meter Costs and Complexity	27%	Building Stock Quality	9%
		Existing HVAC System	9%
		Capacity for Electrical Demand	9%
Opportunistic Thermal Resources	10%	Opportunistic Thermal Resources	10%
Disadvantaged Communities	10%	Development within a Priority Community	10%
Viability for Future System Expansion	5%	Physical Potential for Expansion	5%

Identification of representative neighborhoods

Selected site “typologies” aim to represent broader diversity of neighborhoods across Minnesota



Greenfield /
New Development



College / University
Campus



High-Density Mixed Use



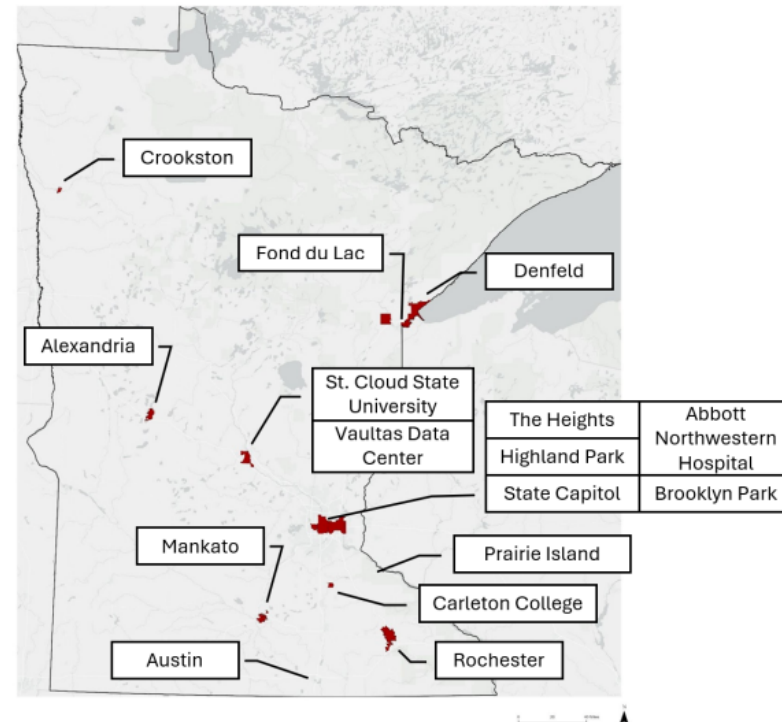
Medium-Density Mixed
Use



Residential
Neighborhood

Objective was to identify a set of neighborhoods that could represent diversity of towns and communities across the state:

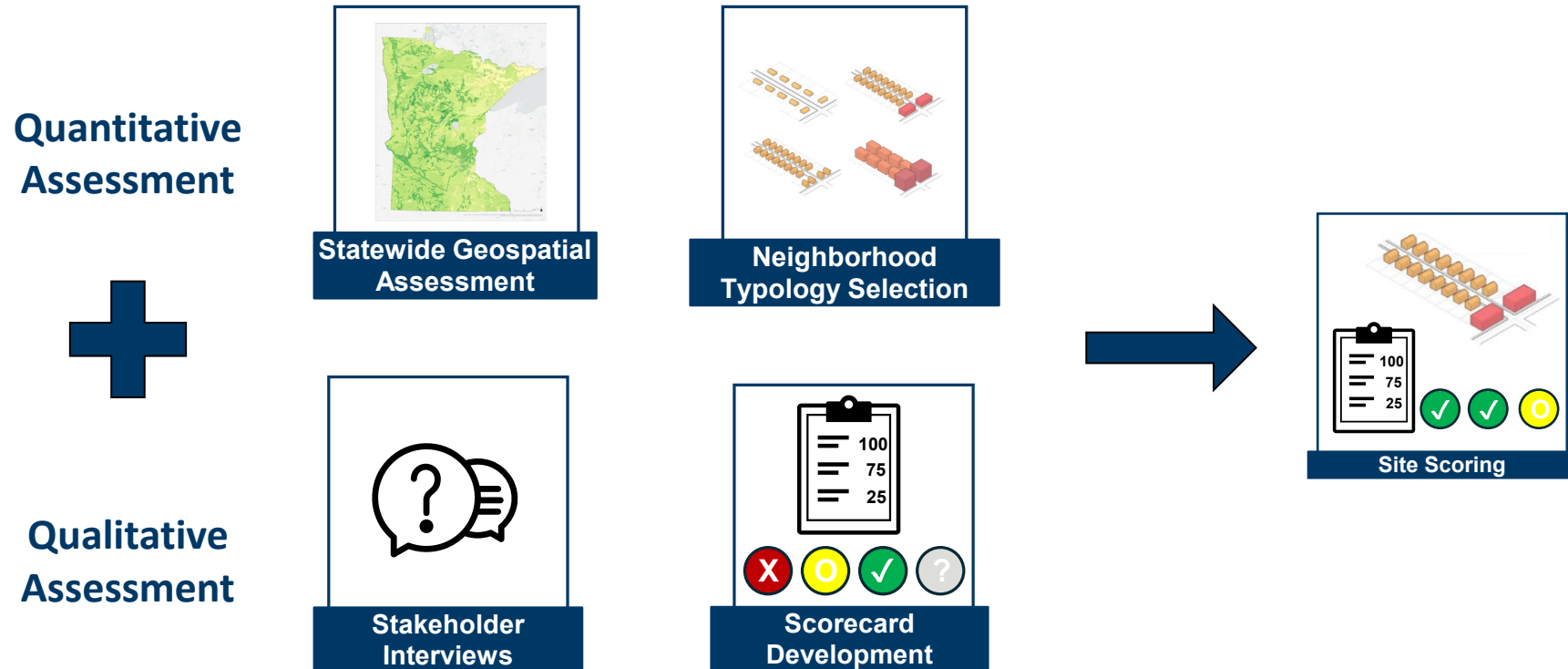
- Geological conditions
- Urban densities
- Campuses and individual building uses
- Heat recovery opportunities and availability of natural thermal resources
- Demographics



16 representative sites selected for suitability scoring

MN TENs Study Approach

Holistic site suitability required blending technical feasibility with stakeholder engagement to understand project barriers and opportunities



Common themes from 35 stakeholder interviews on TENs:

- Project champions - community based organizations and political leaders are key.
- Community engagement and ongoing support are necessary.
- Great path for meeting clean energy, resilience, and workforce goals.
- Ownership and regulatory considerations need to be resolved.
- Infrastructure alignment and timing sensitivities are important factors.

Stakeholder Interviews & Scoring

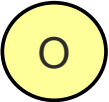
Through interviews and research, 10 qualitative criteria were developed:

#	Criteria	Description
1	Neighborhood/User Support	TENs developments are not suitable in areas where owners and residents do not want to connect to it.
2	Project Champion	Projects require a dedicated steward in the form of local government, community org, utility, etc to move the project forward.
3	Capacity for Risk	Financing systems requires creation of debt, issuance of bonds, or other types of financial risk by a leading entity.
4	Project Economics	Anchor customers with consistent revenue is crucial for system's business model to be financially viable.
5	Broader Community Support	Local community organizations to advocate and garner interest increases success factors for TEN systems.
6	Population & Growth Trends	Alignment with population growth trends increases long-term revenue viability and system expansion.
7	Sustainability Goals	Local government, state, or private sustainability goals create leverage for TEN system investments.
8	Navigable System Ownership	Ownership of system, participating buildings, and equipment being among fewer entities makes systems more feasible.
9	Planned Infrastructure Alignment	Project aligned with other utility or infrastructure projects with similar characteristics.
10	Workforce Availability	Sufficient workforce available and willing.

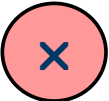
Traffic Light Methodology for Qualitative Scoring



This site clearly is currently in positive alignment with this criterion.



This site currently has some resemblance of alignment with this criterion.



This site does not currently have alignment with this criterion.



There is not currently enough information to determine alignment with this criterion.

Site Name	Neighborhood Support	Project Champion	Risk Capacity	Project Economics	Community Support	Population Growth	Sustainability Goals	Navigable Ownership	Infrastructure Alignment	Workforce Availability
Carleton College	✓	✓	✓	✓	?	○	✓	✓	○	✓
The Heights	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Downtown Crookston	○	✓	✗	○	✓	✗	✓	○	?	○

STATE CAPITOL, ST. PAUL



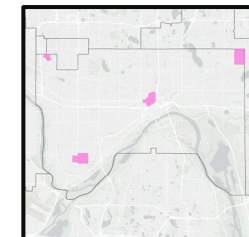
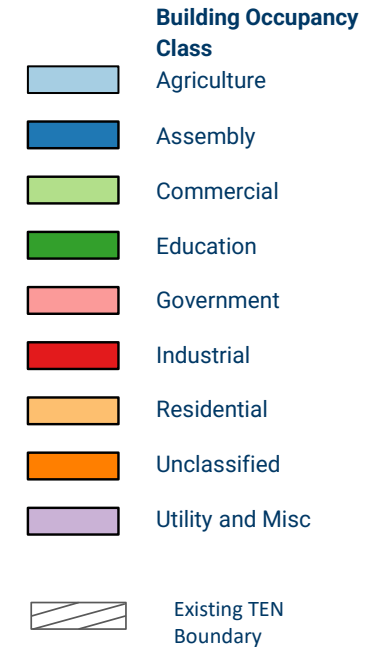
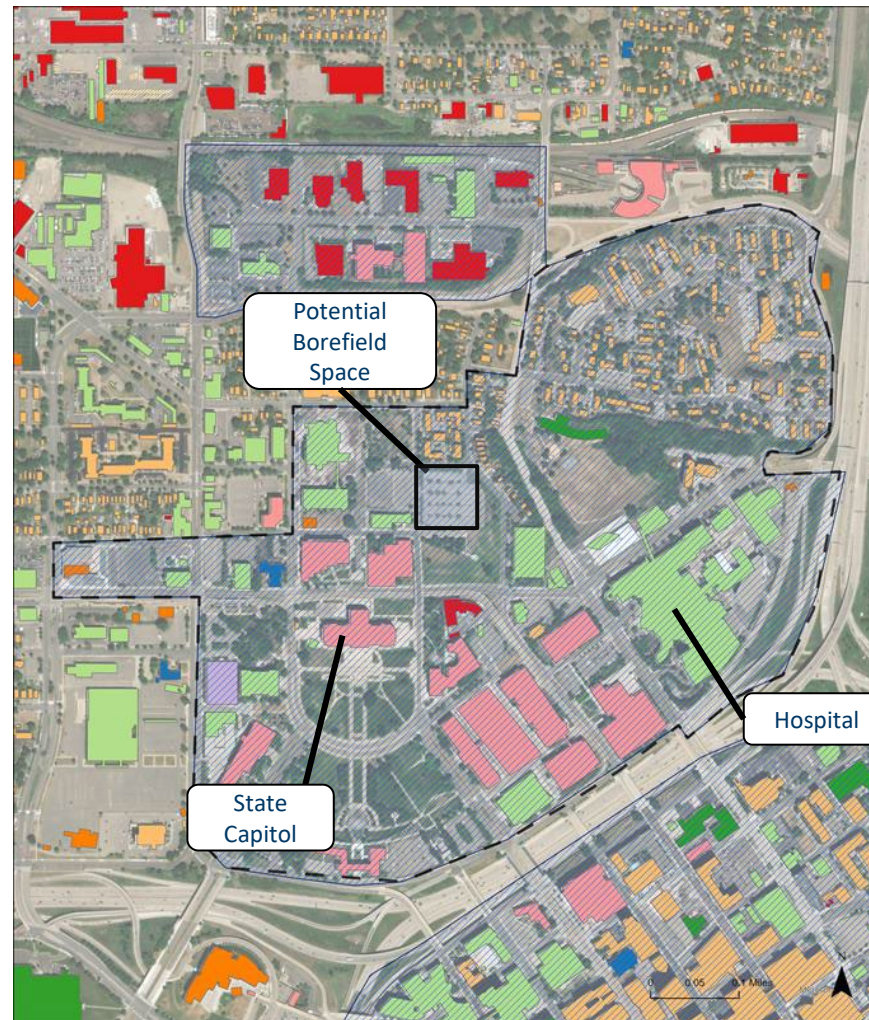
Quantitative Score: 59.70

Qualitative Score:

- ✓ 8
- 0 1
- ✗ 1
- ? 0

Key Takeaways:

- Campus and surrounding area currently utilize a district heating and cooling network
- Large municipal tenants and surrounding mixed-use buildings provide significant thermal loads
- Mall provides ample open space for further borefield development
- Strong alignment with demonstration of the technology to the public





THE HEIGHTS (PLANNED TEN)

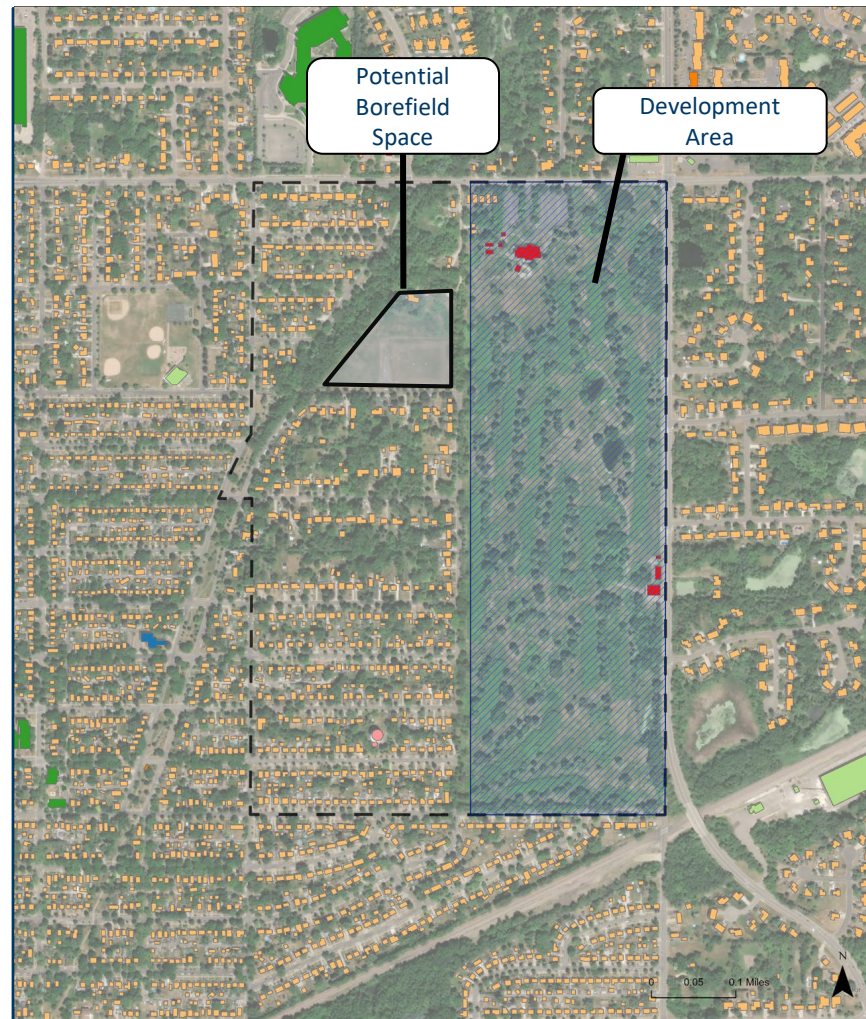
Quantitative Score: 72.04

Qualitative Score:

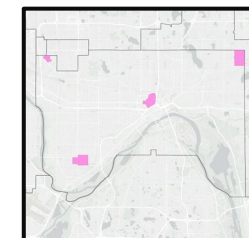
✓	10
○	0
✗	0
?	0

Key Takeaways:

- Planned development on a greenfield site
- Ideal load characteristics due to development of mixed residential, commercial, light-industrial buildings
- High existing electrical demand in the area also presents a barrier to grid interconnection
- No significant opportunities for thermal capture



Building Occupancy Class	
	Agriculture
	Assembly
	Commercial
	Education
	Government
	Industrial
	Residential
	Unclassified
	Utility and Misc
	Planned TEN Boundary



Note: proposed borefield siting is not publicly available



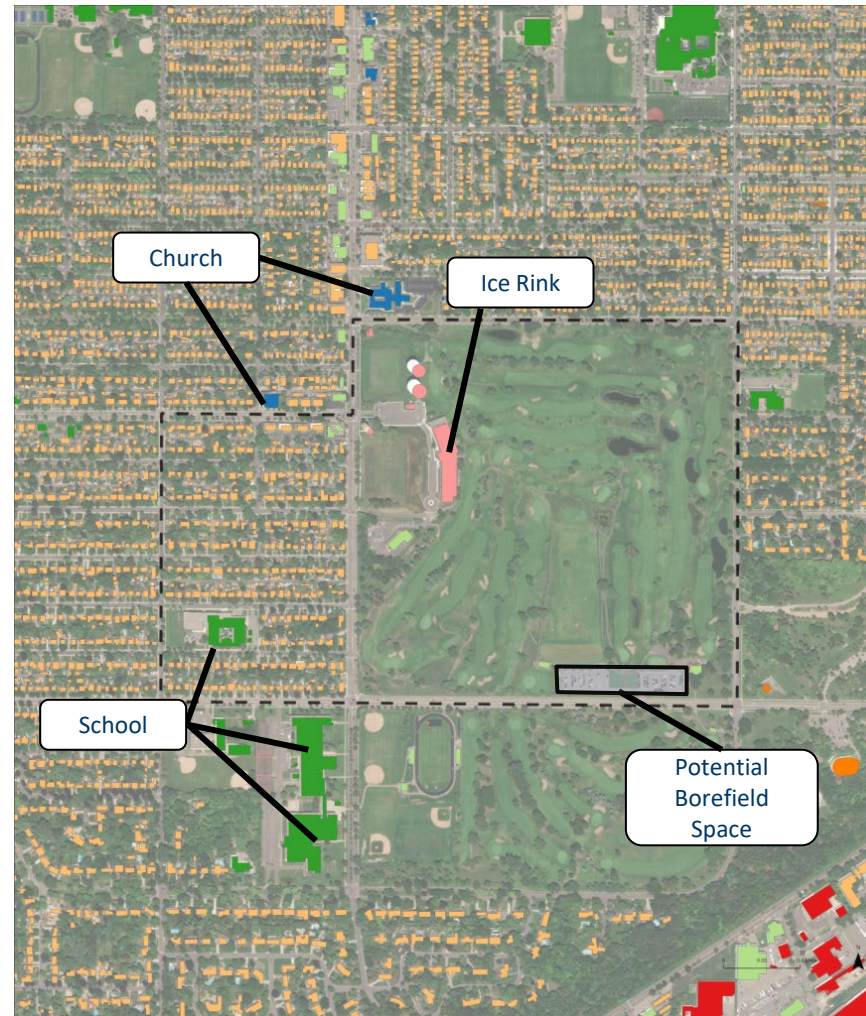
HIGHLAND PARK, ST. PAUL

Quantitative Score: 45.95

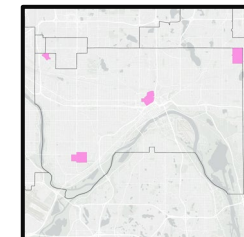
Qualitative Score: Not qualitatively assessed

Key Takeaways:

- Highland Park schools and multiple churches are excellent community-oriented anchor tenants, with additional opportunity to leverage waste heat from ice rink for additional network heating capacity
- Lack of load diversity may inhibit system performance
- Relatively poor bedrock composition for thermal exchange
- Older building stock which may require additional retrofits
- Securing landowner agreement for borehole drilling (on residential lots or golf course) may prove challenging



Building Occupancy Class	
	Agriculture
	Assembly
	Commercial
	Education
	Government
	Industrial
	Residential
	Unclassified
	Utility and Misc



ABBOTT NORTHWESTERN HOSPITAL, MINNEAPOLIS

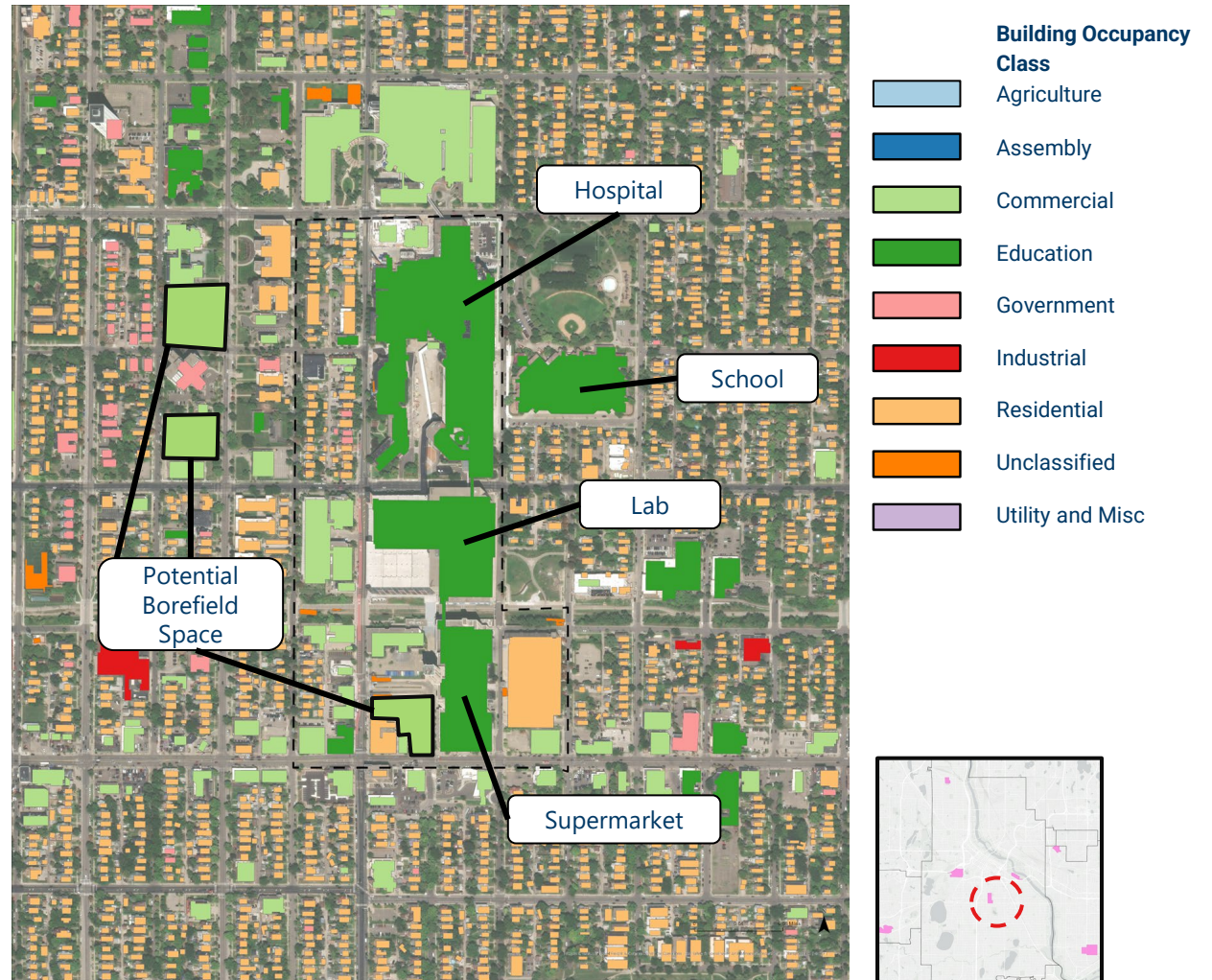


Quantitative Score: 60.52

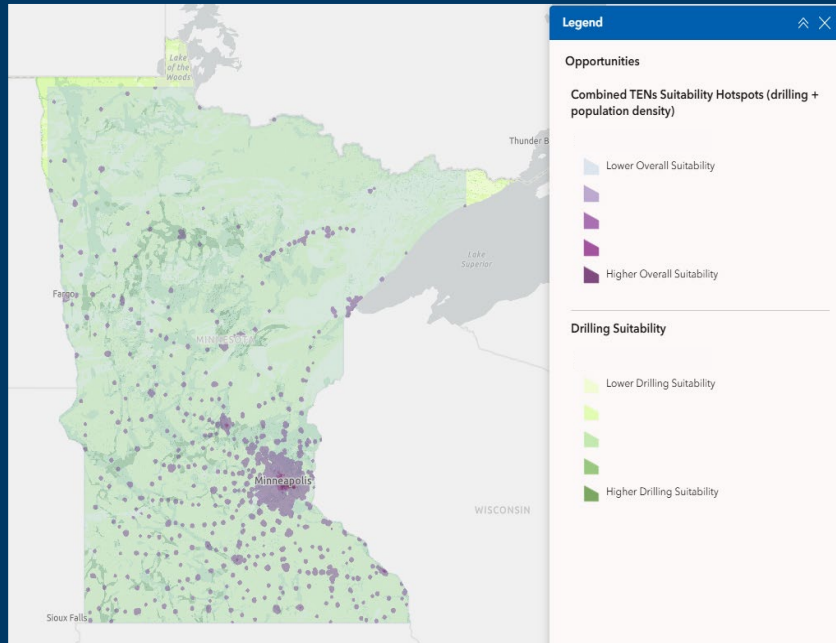
Qualitative Score: Not qualitatively assessed

Key Takeaways:

- Abbott Northwestern is a strong anchor tenant due to its high and diverse thermal loads, presence in broader residential community
- Surrounding commercial facilities add further diversity to network load characteristics
- Construction at a hospital may introduce increased complexity around disruption mitigation
- Presence of subsurface contamination may increase costs for remediation efforts



Siting Conclusions



TENs can work in many places across the state.

- **TENs are most technically feasible in dense, mixed-use areas and neighborhoods, and should be especially considered in early-stage planning of new developments**
- Where possible, TENs should look to both natural and human-made thermal resources (e.g., surface water exchange, geo-exchange, data centers, manufacturing) for performance gains
- Ownership and permitting complexity represent the largest challenges to TENs

Recommendations



Municipal and State-Level Officials

- Unlock funding, financing opportunities
- Establish equitable and streamlined policy
- Develop statewide TENS development roadmap



Developers, Owners, & Operators

- Engage key stakeholders early
- Secure funding and incentives
- Align project with state, local goals



Communities and Advocates

- Evaluate TENS through your community
- Site suitability scorecard and ArcGIS online platform available through MN Department of Commerce

Thank You!

Report: www.lrl.mn.gov/docs/2026/mandated/260051.pdf

Questions or for follow-up:

Ilana Percher

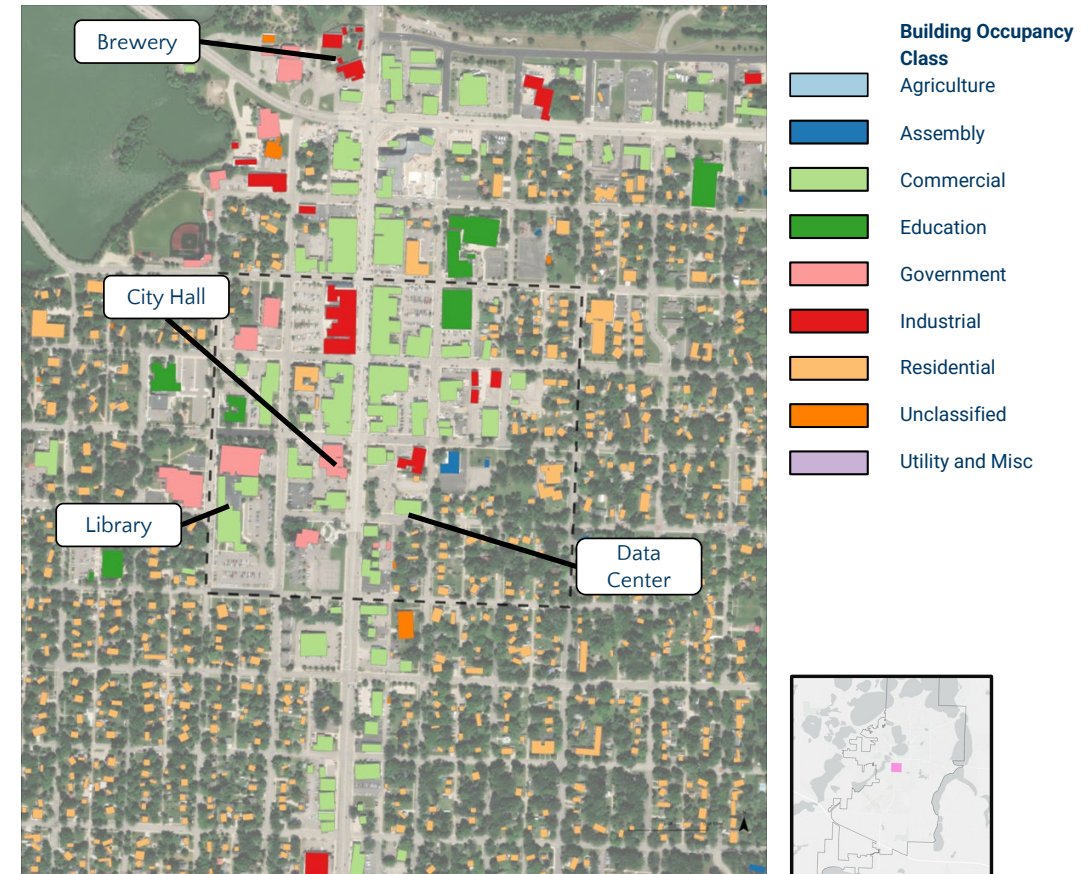
ilana.percher@state.mn.us

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Site Selection for Scoring and Engagement

How do you identify smaller neighborhoods for site suitability across an entire state?

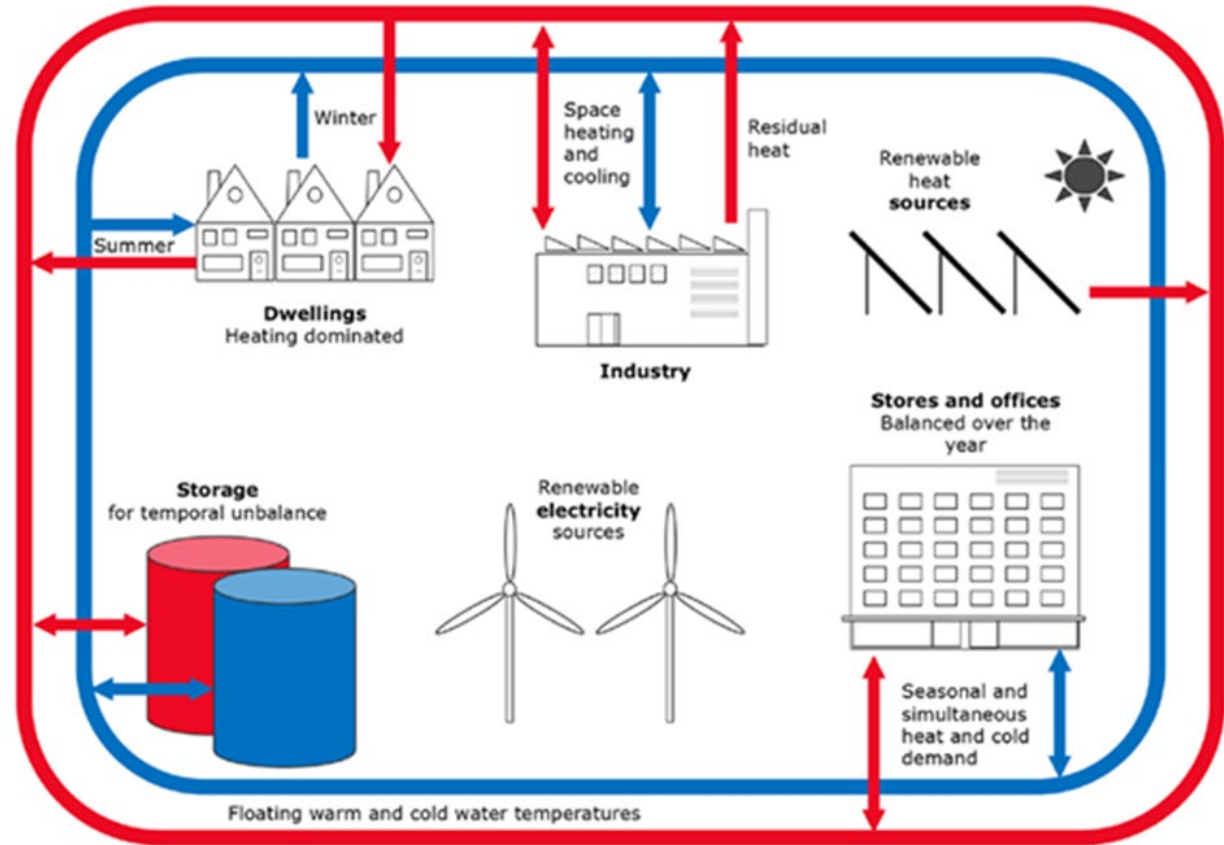
- Site selection is often driven by identifying “anchor sites”
 - e.g., municipal buildings, schools, community hubs to kickstart engagement
- After identifying an anchor site, surrounding buildings can be identified as opportunities to include in the broader thermal network
- Hot spots were used to identify cities and towns for further evaluation
- Local knowledge and community leaders helped to identify key neighborhoods or anchor sites



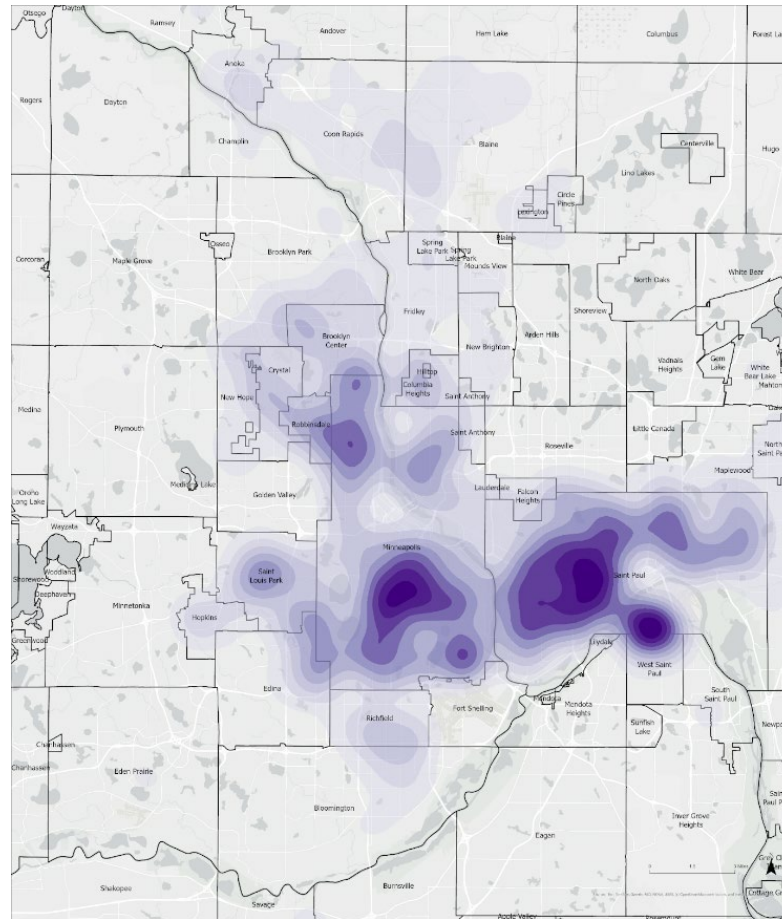
Example neighborhood and anchor site opportunities for suitability scoring

Other Thermal Assets

- Networks can take advantage of other sources / sinks of thermal energy
- Solar heat recovery, wastewater systems, data centers, industry, irrigation, etc.
- These can be used to balance a network or provide low-cost energy sources that supplement borefields



*5th generation district heating and cooling systems as a solution for renewable urban thermal energy supply, 2019



Suitability Heatmap



Less concentrated suitability

More concentrated suitability