Illinois Commerce Commission
Thermal Energy Network Report

Submitted to the Governor and
Illinois General Assembly

February 2024

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State of Illinois

Illinois Commerce Commission

Douglas Scott
Chairman

160 North LaSalle Street
Chicago, Illinois 60601

February 20, 2024

The Honorable Governor JB Pritzker
The Honorable Members of the Illinois General Assembly

Dear Governor Pritzker and Honorable Members of the General Assembly,

The Illinois Commerce Commission submits the Thermal Energy Network report in compliance with Public Act 103-0580, which directed the Commission to convene a workshop process for the purpose of establishing an open, inclusive, and cooperative forum regarding thermal energy networks. PA 103-0580 directed the Commission to submit a report to the Governor and General Assembly describing the stakeholders, discussions, proposals, and areas of consensus and disagreement from the workshop process and making recommendations regarding thermal energy networks.

Should you have any questions regarding the attached report, please contact Sarah Ryan, Director of Governmental Affairs, at (312) 965-5454, or by email at sarah.ryan@illinois.gov.

Sincerely,

Doug Scott
Chairman

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I. Introduction

Section 4-610, which was added to the Illinois Public Utilities Act by Illinois Public Act 103-0580 with an effective date of December 8, 2023 , directed the Illinois Commerce Commission ("Commission" or "ICC") to convene a workshop process for the purpose of establishing an open, inclusive, and cooperative forum regarding thermal energy networks. The workshops were to be designed to achieve the following objectives:

1. Determine appropriate ownership, market, and rate structures for thermal energy networks and whether the provision of thermal energy services by thermal network energy providers is in the public interest;
2. Consider project designs that could maximize the value of existing State energy efficiency and weatherization programs and maximize federal funding opportunities to the extent practicable;
3. Determine whether thermal energy network projects further climate justice and emissions reductions and benefits to utility customers and society at large, including but not limited to public health benefits in areas with disproportionate environmental burdens, job retention and creation, reliability, and increased affordability of renewable thermal energy options;
4. Consider approaches to thermal energy network projects that advance financial and technical approaches to equitable and affordable building electrification, including access to thermal energy network benefits by low and moderate income households; and
5. Consider approaches to promote the training and transition of utility workers to work on thermal energy networks.

Illinois Public Act 103-0580 further required the Commission, no later than March 1, 2024, to submit a report to the Governor and the General Assembly describing the stakeholders, discussions, proposals, and areas of consensus and disagreement from the workshop process, and making recommendations regarding thermal energy networks.

II. Workshop and Comment Process

The Staff of the Commission ("Staff") held a series of workshops on thermal energy network between November 15, 2023 and January 10, 2024. The first workshop held on November 15, 2023, provided stakeholders with an overview of thermal energy network technology. Speakers included Ania Camargo from the Building Decarbonization Coalition, who provided a national perspective on thermal energy networks, Isabela

Varela from the Home Energy Efficiency Team, who spoke about utility thermal energy network pilot project data, Aaron Power from Buro Happold, who provided a thermal energy network technology overview, Jay Egg from Egg Geo, who provided information on water issues related to thermal energy networks, and Bill Talbert from Salas O'Brien, who provided an overview of customer centered approaches to thermal energy networks.

The second workshop held on November 19, 2023, provided stakeholders with information regarding thermal energy network community involvement and impacts and workforce issues, as well as information on utility scale thermal energy network systems. Speakers included Angie Alberto from the Home Energy Efficiency Team who spoke about a utility-scale transition to thermal energy networks, Lisa Dix from the Building Decarbonization Coalition, who spoke about the New York Thermal Energy Networks Coalition, Dave Bowers from Apprenticeship and Skill Improvement Program Local 150, who spoke about thermal energy network labor and training, Nuri Madina from Blacks in Green and Andrew Barbeau from The Accelerate Group, who both spoke about the Sustainable Chicago Geothermal project, and Nikki Bruno from Eversource, who spoke about Eversource's utility networked geothermal pilot project in Massachusetts.

The third workshop, held on December 13, 2023, examined regulatory structures in other states. Speakers included Commissioner Megan Gilman of the Colorado Public Utilities Commission, Zeyneb Magavi from the Home Energy Efficiency Team, and Peggie Neville of the New York Department of Public Service, who provided thermal energy network regulatory information regarding, respectively, Colorado, Massachusetts, and New York.

Following the first three informational workshops, Staff hosted three more workshops that provided for an open discussion of topics, preceded by written comments filed by stakeholders. Workshop number four was held on December 19, 2023. The workshop focused primarily on the appropriate ownership, market, and rate structures for thermal energy networks and whether the provision of thermal energy services by thermal network energy providers is in the public interest. Prior to the workshop, comments were submitted by Ameren Illinois Company (Ameren or AIC), Blacks in Green (BIG), Commonwealth Edison Company (ComEd), the Indiana, Illinois, and Iowa Foundation for Fair Contracting (III FFC), Northern Illinois Gas Company (Nicor), North Shore Gas Company and The Peoples Gas Light and Coke Company (NS-PGL), The Accelerate Group, and the People of the State of Illinois – Attorney General's Office (AG).

The fifth workshop was held on January 3, 2024 focused on project designs that can maximize the value of existing State energy efficiency and weatherization programs and maximize federal funding opportunities to the extent practicable; whether thermal energy network projects further climate justice and emissions reductions and benefits to utility customers and society at large, including but not limited to public health benefits in areas with disproportionate environmental burdens, job retention and creation, reliability, and increased affordability of renewable thermal energy options; and approaches to thermal energy network projects that advance financial and technical approaches to equitable and affordable building electrification, including access to thermal energy network benefits by low and moderate income households. Prior to the workshop, comments were submitted by Ameren, III FFC, and Nicor.

The sixth and final workshop, held January 10, 2024 focused on approaches to promote the training and transition of utility workers to work on thermal energy networks. Prior to the workshop, comments were submitted by Climate Jobs Illinois, ComEd, III FFC, and Nicor.

After the conclusion of the workshops, Staff invited stakeholders to submit one final round of comments on or before January 31, 2024 addressing issues not previously addressed and recommendations regarding the thermal energy networks. Final comments were submitted by Advanced Energy United (AEU), Ameren, ComEd, Geothermal Exchange Organization, Geoff Bares, International association of Plumbing and Mechanical Officials (IAPMO) – Hydronics Industry Alliance (HIA-C), III FFC, Illinois PIRG Education Fund, Nicor, Attorney General's Office, NS-PGL, and Prairie Research Institute – University of Illinois (PRI).

The entirety of the materials shared during the webinar series and the Staff workshops can be found on the Commission's website at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers. This includes video recordings of the workshops, agendas, presentations, and written comments. Although much of the material presented, submitted or offered in comments is included in the summary information below, the report is not intended to be an exhaustive recollection of every presentation or comment received during the workshop process.

III. Background: Geothermal Energy and Thermal Energy Network Technology

A. Thermal Energy Technologies

Thermal energy networks have been recognized by the Illinois General Assembly as a potential means to affordably decarbonize buildings at both the community-scale and utility-scale, while helping achieve the decarbonization goals of the Climate and Equitable Jobs Act ("CEJA") (Public Act 102-662). Section 4-610 of the Public Utility Act defines thermal energy as using piped, noncombustible fluid for the transfer of heat into or out of buildings to provide comfort heating and cooling, along with, but not limited to, domestic hot water and refrigeration with the intent of reducing resultant greenhouse gas emissions from all types of heating and cooling processes. The Act further defines thermal energy networks as all assets owned, operated, used, or to be used for, in connection with, or to facilitate a distribution infrastructure project, of a utility-scale, for suppling thermal energy.

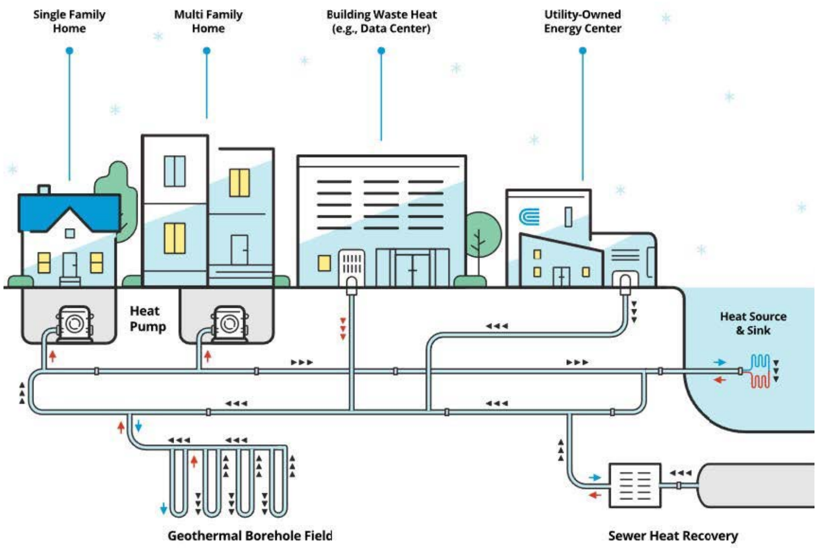

Diagram of a Thermal Energy Network System [1]

The core components of thermal energy networks include the energy source, energy transmission mechanism, energy convertor, and energy (end) use.[1] The energy source provides the network with thermal energy for either heating or cooling processes and can act as a heat sink when excess thermal energy is dispelled. The energy transmission mechanism is the piping and fluid used to transport the thermal energy throughout the network. The energy convertor is the heat pump and the electricity needed to operate the pump. The energy end use is the means to emit the output energy into the building.

[1] "District Energy & TENs," presentation by Aaron Powell of Buro Happold, ICC TEN Forum Workshop #1 Recording (Nov. 15, 2023), https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers

1. Energy Sources

Ground Source (Geothermal)

Ground source energy is commonly described as geothermal energy as it is the thermal energy produced by and stored by the earth.[2] This thermal energy is naturally and continuously occurring worldwide, which makes it an exceptional renewable energy source for heating, building climate control, and electricity generation.

Use of geothermal energy can be grouped into three use categories: direct-use, geothermal heat pumps, and electric power generation. Direct-use applications pull heated water or steam from hot springs and geysers and circulate it throughout a piped system for heating purposes.[3] Geothermal heat pump applications rely on the stable, moderate temperature conditions that are found within the subsurface layers of the earth's crust. Once below the frost line, the temperature within the earth maintains an average temperature around 55-65°F, at depths as far as 1000 feet below the surface.[4] In geothermal heat pump applications, the thermal energy within the ground is transferred to a heat pump by a series of looped piping filled with a fluid energy exchange medium, most often water or a water-based solution.[5] The heat pump converts this energy to provide heating or cooling at the end use. For electric power generation, much higher temperatures, 300-700°F, are needed as steam is often used for converting the geothermal energy into electricity.[6] The location and depth at which these higher ground temperatures are found depend on many geological factors.[7] The high temperature steam, vapors, or fluid is drawn from reservoirs in the earth up to the surface to produce steam, which is then fed to a turbine driving an electric generator. The geothermal energy is converted to mechanical energy by the turbine and the generator converts that energy into electricity.

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[2] https://www.eia.gov/energyexplained/geothermal/#:~:text=Geothermal%20energy%20comes%20from%20deep%20inside%20the%20earth&text=An%20inner%20core%20of%20solid,is%20about%201%2C800%20miles%20thick

[3] https://www.thecooldown.com/green-tech/geothermal-energy-the-earths-heat/

[4] https://www.britannica.com/science/geothermal-energy

[5] https://www.nrel.gov/research/re-geo-heat-pumps.html

[6] https://www.eia.gov/energyexplained/geothermal/use-of-geothermal-energy.php#:~:text=Geothermal%20electricity%20generation%20requires%20water,two%20of%20the%20earth's%20surface.&text=The%20United%20States%20leads%20the%20world%20in%20geothermal%20electricity%20generation.

[7] https://www.energy.gov/eere/geothermal/electricity-generation#:~:text=Geothermal%20power%20plants%20draw%20fluids,flash%20steam%2C%20and%20binary%20cycle

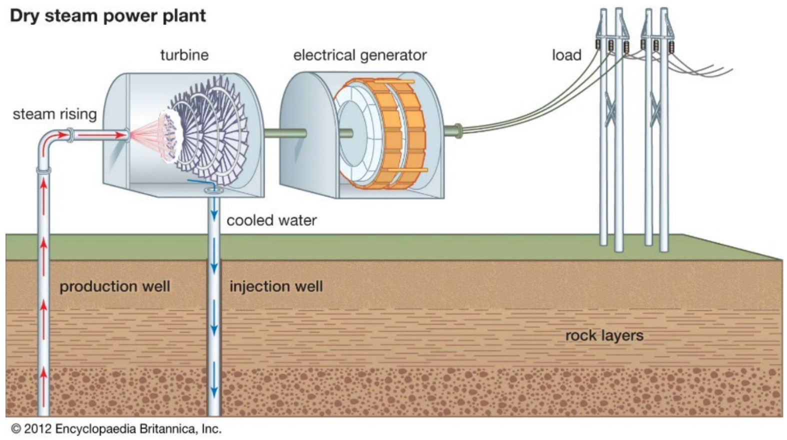

Diagram of Geothermal Electricity Generation [2]

Geothermal thermal energy has been used by humans for thousands of years for cooking, bathing, and even space heating.[8] The first known district heating system was installed during the 14th century in Chaudes-Aigues, France. The latter part of the 19th century saw an increased global interest in geothermal energy use due to its economic potential. In the United States, the first district heating system was installed in 1892 in Boise, Idaho, and by 1970, most of the city was using geothermal for space heating.

In 1960, the first geothermal power plant was commissioned in United States at The Geysers in northern California. Over the past several decades, The Geysers has grown to be the largest complex of geothermal power plants in the world with 18 plants producing around 835 megawatts of electricity.[9] In 2021, 19,077 gigawatt-hours of geothermal power was produced in the United States with an average, levelized electric cost of 4.9 to 8.5 cents per kilowatt hour.[10]

Water Source

Water is another energy source that is oftentimes categorized as Geothermal as all or much of the thermal energy contained by the water source is held energy from the earth.

When a water source is utilized for heat pumps, instead of entrenching a piped loop system into the ground, the open or closed loop system is installed within a body of water. As long as the loop system is installed at a predetermined water depth, the

[8] https://www.britannica.com/science/geothermal-energy/History
[9] https://www.usgs.gov/volcanoes/clear-lake-volcanic-field/science/geysers-geothermal-field
[10] https://www.irena.org/Energy-Transition/Technology/Geothermal-energy; https://www.iea.org/countries/united-states

temperature of the water will remain steady enough to provide energy for heating and cooling a building through use of a geothermal heat pump. On a larger scale, a loop system can be installed in a sizeable body of water to harness the energy from the naturally chilled water to provide conditioned air cooling for commercial, high occupancy residential, and industrial facilities. Further, with access to a notably large enough body of water to act as both a heat sink and energy source, individual facilities, or a network of facilities, that tend to produce excess heat or have a primary cooling demand, can utilize an industrial scale loop system for cooling. This type of application is referred to as deep lake water cooling ("DLWC").[11] Due to the thermal properties of water, large bodies of water remain steadily cool year-round, hundreds of feet below the surface. Such systems provide profound energy savings opportunities as the heat exchange process with the naturally cooled water reduces the need for chillers or large cooling towers.

The City of Toronto has used a DLWC system since 2004 to provide cooling to a network of over 100 buildings, including a hospital and a sports arena, with a resultant energy savings of about 70 percent or roughly 90,000 megawatts-hours of electricity annually.[12] Yet, the city's DLWC system doesn't just provide building cooling for the city's network. Before passing through the heat exchange process, the water is processed for potable use. Once filtered and treated, the water passes through the energy transfer station before making its way through the city's potable service mains.

[11] https://hvacprograms.net/deep-lake-water-cooling/

[12] https://www.washingtonpost.com/climate-solutions/interactive/2021/toronto-deep-latke-water-cooling-raptors/

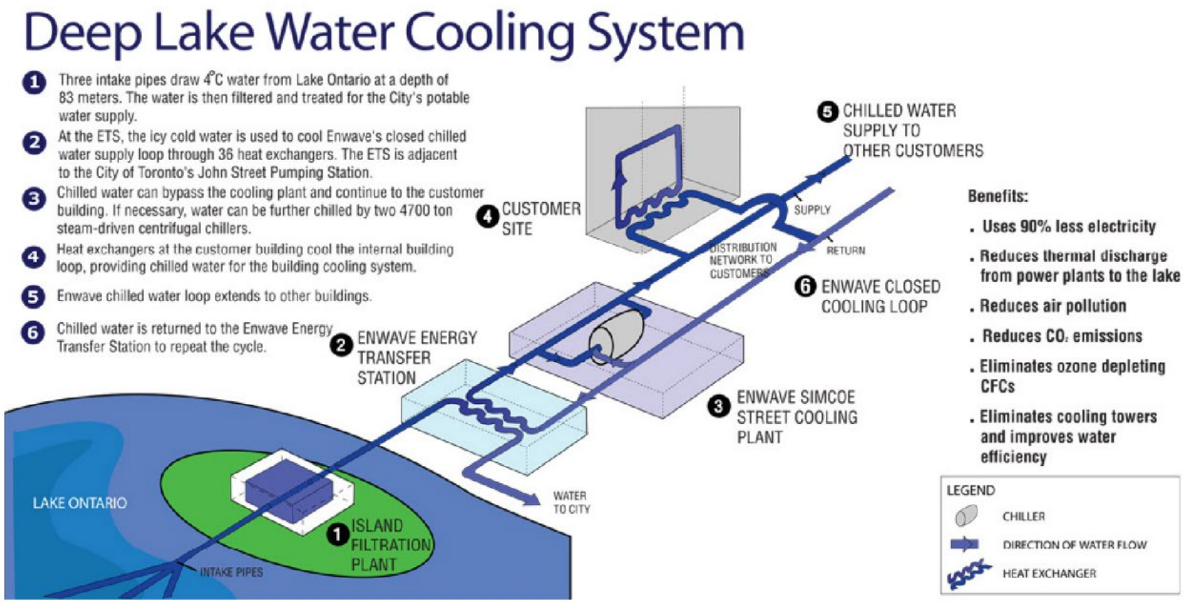

Diagram of the City of Toronto DLWC System [1]

Waste Heat

Within high populous communities there is thermal energy that is simply disposed of into the air or down the drain. Recovery of this wasted heat provides an opportunity for additional energy savings both individually and within a network system. In network systems, excess thermal energy can be reclaimed for individual buildings heating needs, or it can be shared within the network to keep the energy balanced.

Data Centers[13]

One leading source of waste heat are data centers. Nationally, data centers account for about 2% of the total electricity consumed in the US, and of that, up to 40% is just for space cooling.[14] The high demand for cooling is due to the large amount of heat that is generated by data centers, positioning data centers as an excellent energy sharing opportunity for network energy systems.[15]

Chicago and its surrounding suburbs boast over 100 data centers, with more planned, making it one of the top data center markets in the country. Chicago is home to one of the largest district cooling systems in the US, providing cooling for nearly 53 million square feet of building space across 115 buildings in the downtown area.[16] This puts the

[13] https://www.sciencedirect.com/science/article/pii/S1364032123006342#bib38
[14] https://www.energy.gov/articles/doe-announces-40-million-more-efficient-cooling-data-centers
[15] "District Energy & TENs," presentation by Aaron Powell of Buro Happold, ICC TEN Forum Workshop #1 Recording (Nov. 15, 2023), https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers
[16] https://www.districtenergyaward.org/centrio-chicago-district-cooling-system-usa/

city in a position of opportunity to expand upon their existing district cooling system through the development of a thermal energy network system, allowing for the recovery and reuse of surplus energy produced by data centers for district heating purposes in effort to further Illinois' energy and net-zero carbonization goals.

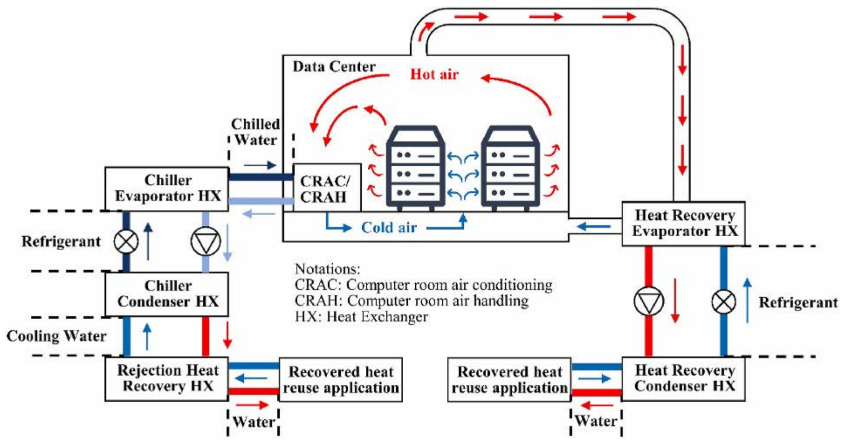

Diagram of Heat Recovery and Reuse of a Data Center [3]

Wastewater

Wastewater provides one of the largest energy reclamation opportunities as it is estimated that roughly 80% of the latent energy in wastewater is thermal.[17] The thermal energy waste from most commercial buildings is enough to provide that building with all of its domestic hot water needs. On a household level, it is estimated that an individual uses 82 gallons of water per day.[18] The heating and cooling of much of this water amounts to an estimated 1,300 gigawatt-hours of energy per day.[19] With nearly all of this water eventually ending up in the sewer, the disposal of the room temperature, 65-75°F, wastewater presents an opportunity for thermal energy recovery.

Recovery of wasted thermal energy can be done with the use of heat exchangers specially engineered to loop into a building's wastewater discharge piping. Not only can a wastewater energy recovery system reclaim thermal energy for heating purposes, in

[17] "Thermal Energy Network Infrastructure - Water Perspective," presentation by Jay Egg of Egg Geo, ICC TEN Forum Workshop #1 Recording (Nov. 15, 2023), https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers;
"Wastewater Energy Exchange is Making Sense to Energy Utilities". Jay Egg. April 15, 2022.
https://www.phcppros.com/articles/15315-wastewater-energy-exchange-is-making-sense-to-energy-utilities
[18] https://www.epa.gov/watersense/statistics-and-facts
[19] "Wastewater Energy Exchange is Making Sense to Energy Utilities". Jay Egg. April 15, 2022.
https://www.phcppros.com/articles/15315-wastewater-energy-exchange-is-making-sense-to-energy-utilities

warmer months the system can be used for building cooling by expelling excess heat from the building into the discharged wastewater.

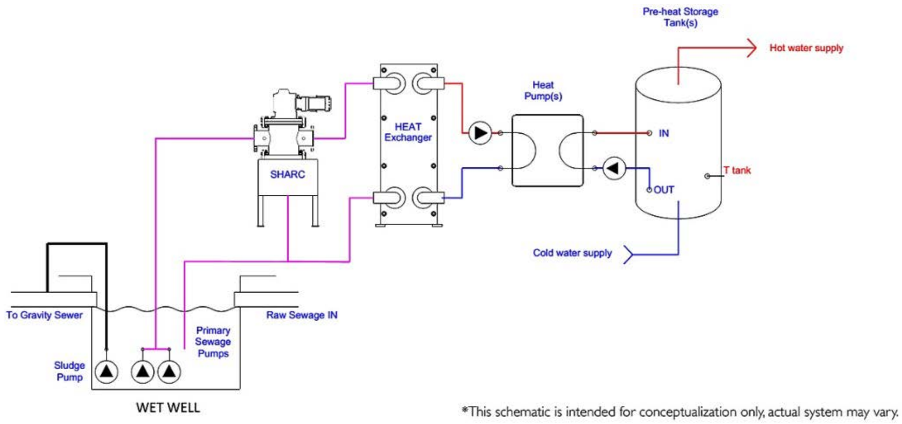

Diagram of Wastewater Energy Exchange System [4]

Since 2010, Vancouver, Canada has utilized such a system on a district scale providing hot water and heating to 6.4 million square feet of mixed-use buildings with reclaimed wastewater thermal energy.[20] The system operates with an estimated energy savings of 3.2 megawatts.

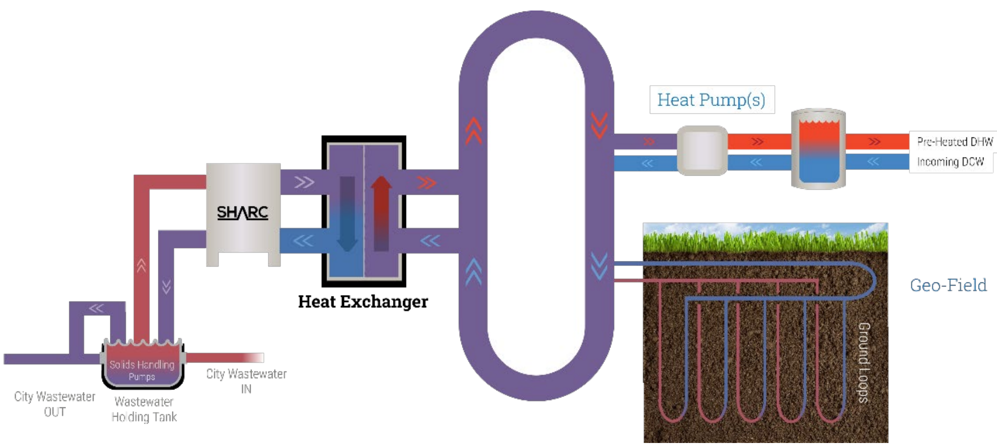

Diagram of Wastewater Energy Exchange System in a TEN [5]

[20] https://vancouver.ca/home-property-development/sewage-heat-recovery-expansion-project.aspx

Conduit Hydropower

Within every wastewater collection system and water distribution system, there are existing piping, tunnels, canals, and other manmade structures used to transport the wastewater or water to and from the sources, treatment plants, and customers. It is estimated that moving these fluids for various commercial, industrial, agricultural, and residential needs accounts for 4% of electricity consumed in the United States annually.[21] These collection and distribution systems have been recognized as a potential source for energy recovery, with a US Department of Energy supported study finding that opportunities exist nationally to provide back 1.41 gigawatts annually.[22] Illinois was determined to be the state with the 7th most generation capacity potential, with an estimated 101 gigawatt-hours annually.[23]

By fitting existing infrastructure with electric generation equipment, energy can be recovered from the existing and necessary movement or flow of the transported fluids.[24] Energy can additionally be generated from excess pressure produced in force main systems as it is often discharged without recovery.[25]

2. Transmission Mechanisms

Open Loop vs. Closed Loop Systems[26]

Geothermal heat pumps and thermal energy networks typically use high density plastic piping to carry the energy exchange medium either locally, for an individual system, or throughout the network of connected buildings. The piping is either installed in a closed loop or open loop manner. Water is commonly used as the fluid medium in both types of installation, but if local environmental regulations allow, a closed loop system may utilize an antifreeze solution or a refrigerant instead.[27] If a loop system is refrigerant based, then copper tubing is used to circulate the refrigerant instead of plastic piping.

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[21] Johnson, Kurt. "Energy Recovery Hydropower: Prospects for Off-Setting Electricity Costs…". Jan. 2018. Pg. v. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nrel.gov/docs/fy18osti/70483.pdf

[22] https://www.energy.gov/eere/water/articles/new-assessment-finds-opportunities-conduit-hydropower-development-across-united#:~:text=Conduit%20hydropower%20utilizes%20existing%20pipelines,basis%20for%20electricity%20generating%20equipment.

[23] Kao, Shih-Chieh, George, Lindsay, Hansen, Carly, DeNeale, Scott T., Johnson, Kurt, Sampson, Alden K., Moutenot, Marshall, Altamirano, Kevin, Garcia, Kathryn, Downing, Jim, Day, Mary Beth, and Rugani, Kelsey. An Assessment of Hydropower Potential at National Conduits. United States: N. p., 2022. Web. doi:10.2172/1890335.

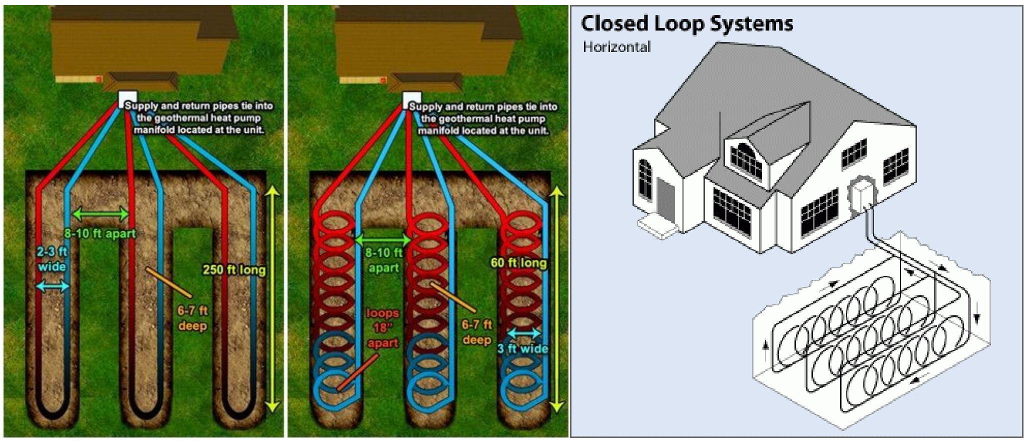
[24] https://www.hydro.org/policy/technology/conduit/

[25] Grimm, Sebastian. "Can NY Supply Water While Generating Clean Energy". July 2016. pg. 12. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.hydro.org/wp-content/uploads/2021/09/Grimm-Full-Report-NY-Conduits-1.pdf

[26] https://www.energy.gov/energysaver/geothermal-heat-pumps

[27] https://igshpa.org/about-geothermal/

The piping of a closed loop system can be installed in a horizontal or vertical manner. When sufficient land is available, horizontal installations are often more cost effective for residential, ground source applications. The most common horizontal installation arrangements use two pipes running parallel to each other with a u-bend at the end of the trench. If space allows, the pipes can be installed side-by-side along the boundaries of a 2 to 3 feet wide trench, or they can be buried at two different depths 2 to 3 feet apart. By laying the piping in a coil or “Slinky” pattern, even less land space is required, making this type of installation feasible for areas it would otherwise not be.



Diagrams of a Horizontal, Closed Loop Systems [6][7]

For vertical, closed loop installations, less land area is required as the piping is installed in deep bores. This type of installation is more favorable for larger applications, such as commercial buildings, schools, or large apartment buildings. Similarly, vertical installations can be used when soil conditions are unfavorable for horizontal installations. To install a vertical, closed loop system, deep holes are drilled into the earth, anywhere from 100 to 400 feet deep. Two pipes are installed with a u-bends at the bottom of each borehole to create a loop through each borehole. Due to the expense of drilling bore holes, this type of installation is often more costly than a horizontal installation.

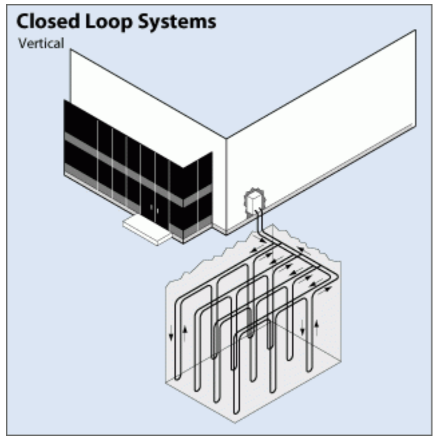


Diagram of a Vertical, Closed Loop System [7]

Another option for a closed loop system is to install the piping within a body of water. The water must be deep enough to prevent freezing, typically a minimum of eight feet, and of adequate volume and quality to meet system requirements. Similar to a ground source, horizontal installation, the piping is placed in a coiled pattern when installed.

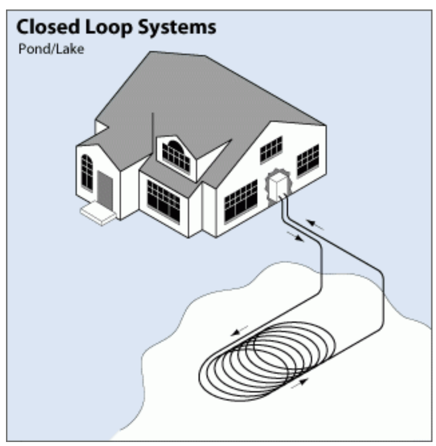


Diagram of a Water Source, Closed Loop System [7]

Open loop systems are another installation option for water sourced applications. This type of installation utilizes two pipes that remain open on one end. One pipe feeds the heat pump with the ground or surface water, which is used as the exchange medium, and the other pipe returns it back.

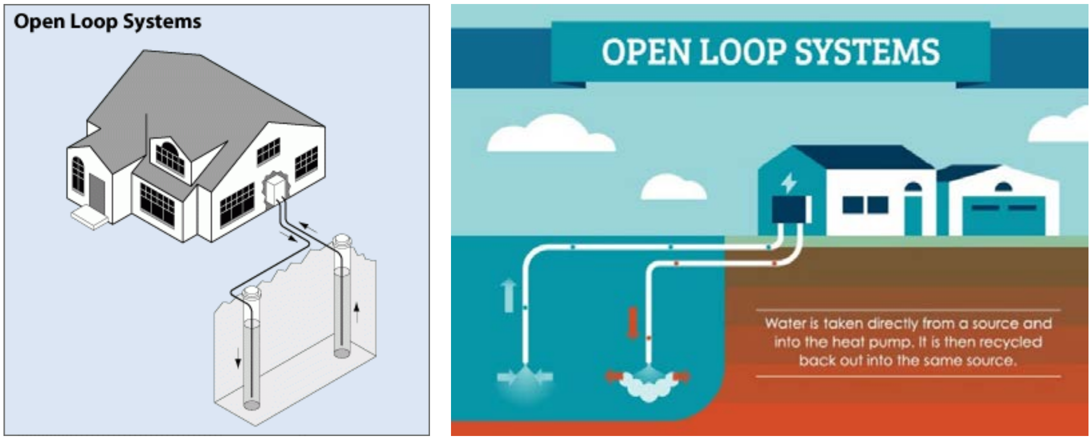


Diagram of a Water Source, Open Loop System [7][8]

When used in a network or district system, a variety of loop types may be utilized throughout the network to incorporate the use of multiple types of energy sources. Redundancies can be built into systems to include backup for peak demand processes. These hybrid applications allow for more flexibility in connecting a large network system and are particularly beneficial when cooling demands far exceed heating needs. The lifespan of loop system is 50+ years depending on the soil or water conditions they're installed in.[28]

3. Energy Convertor

Heat Pumps

Heat pumps pull thermal energy from the environment and convert that energy to provide both heating and cooling for a building. Heat pumps are often described as being air source, water source, or ground source. Air source heat pumps pull energy from the ambient air whereas water source pull from water sources and the ground source pulls from earth. Water source and ground source heat pumps are commonly referred to as Geothermal heat pumps ("GHPs") because the energy pulled from either source ultimately results from energy naturally produced and held by the earth.[29] GHPs are 2-3x more efficient than air source pumps and are used exclusively in thermal energy networks.[30]

[28] https://www.energy.gov/energysaver/geothermal-heat-pumps
[29] https://www.thecooldown.com/green-tech/geothermal-energy-the-earths-heat/
[30] https://heet.org/wp-content/uploads/2023/05/Net-Geo-General-FAQs.pdf

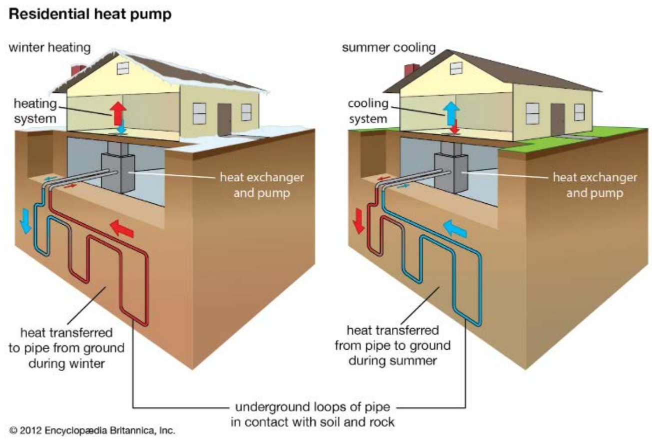
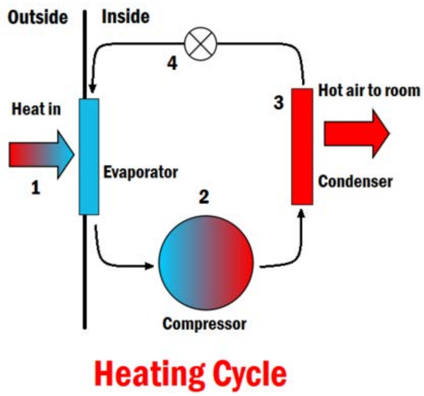
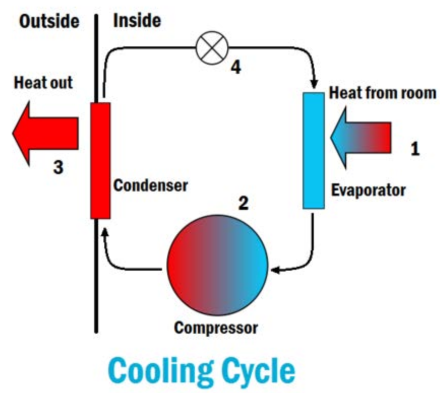


Diagram of a Residential, Ground-source Heat Pump System [2]

To provide heat to a building, a heat pump extracts heat from the energy source (air, water, or ground), through a reversed refrigeration cycle. During this heating cycle, air or the thermal exchange fluid is pulled into the pump. This exchange medium is directed through a heat exchanger (evaporator), allowing for the internal loop of the heat pump to extract the heat from the exchange medium. The internal loop of the heat pump is filled with a refrigerant which is at a liquid state when passing through the heat exchanger. As the refrigerant pulls in more heat, its liquid state changes into a gas. The gas is then moved through a compressor which increases its pressure and temperature further. The heated gas is then directed through another heat exchanger (condenser) to transfer the heat into the building by either blowing air across the output exchanger or transferring heat to the building's internal loop system. As the heated gas moves through the heat exchanger, the temperature of the gas drops, causing the refrigerant to return to a liquid state. The liquid refrigerant then passes through an expansion valve, which reduces the pressure and temperature further so the cycle can be repeated. This cycle repeats until the building set temperature is reached.[31]

[31] https://www.nationalgrid.com/stories/energy-explained/how-do-heat-pumps-work#:~:text=An%20air%2Dsource%20heat%20pump%20takes%20heat%20from%20the%20air,to%20existing%20gas%20central%20heating).





Diagrams of a Heat Pump's Heating and Cooling Cycles [9]

For cooling, the cycle is reversed, and the heat pump works to cool the building by extracting heat from it. Heat from the building is pulled into the internal loop of the heat pump. As the heat pumps cycles the refrigerant, heat is dispersed back into the air, water, or ground source.

An additional thermal loop can be integrated into a heat pump's internal loop for supplying the building with hot water. With the implementation of a small, auxiliary heat exchanger called a desuperheater, the residual heat from the superheated gas produced from the compressor can be used to provide supplemental heat for a water heater.[32] When operating in the cooling cycle, excess heat that would normally be dispelled can be used to provide most of the heating required for a building's hot water needs.[33]

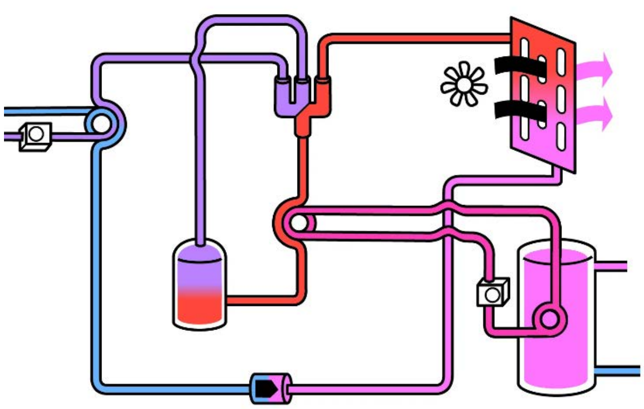


Diagram of a Heat Pump Cycle with a Desuperheater for Hot Water Supply [10]

[32] https://www.energy.gov/energysaver/heat-pump-water-heaters
[33] https://www.123zeroenergy.com/geothermal-desuperheater.html

Geothermal heat pump systems have been in use within the United States since the mid-1940s.[34] GHPs are extremely efficient as their design allows for them to extract and transfer a greater amount of energy than the pump consumes. Using only electricity, heat pumps are known to produce two to five times more energy output than their input electrical consumption by using the ambient temperature of energy sources, with source temperatures ranging between 25 and 110°F.[35] This impressive coefficient of performance is dependent on the starting and ending temperatures of its energy exchange process, but even at the lowest performance, energy usage, and subsequent greenhouse gas emissions, are reduced considerably, with the potential to eliminate emissions completely.[36]

Energy savings means cost savings for the end user as well, as no gas is required for heat pumps, and less electricity is used compared to traditional building heating and cooling methods. Heat pump systems additionally have minimal maintenance costs associated with them, with long estimated lifespans of over 50 years for the loop system and up to 24 years for the heat pump.[37] Most of the costs attached to heat pump systems are the upfront costs to purchase and install the system, but with resultant energy savings of 30-70%, many studies have shown that the end user will see a return on their initial investment in 5 to 10 years.[38] When incorporated within thermal energy networks, heat pumps are the most efficient repeatable way to provide electrified heat.[39]

4. Energy Use

Ducted Air[40]

The output energy from a heat pump is primarily used to provide heating and cooling to a building. When providing heating, the energy is often convected into the building by a blower forcing the hot air off the output heat exchanger to circulate within a building's ductwork. In cooling mode, the heat pump's cycle is reversed, and cool air is distributed throughout the ductwork by the blower. Ducted, heat pump systems are able to provide more comfortable climate control within a building because the air is distributed

[34] "District Energy & TENs," presentation by Aaron Powell of Buro Happold, ICC TEN Forum Workshop #1 Recording (Nov. 15, 2023), https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers
[35] "Wastewater Energy Exchange is Making Sense to Energy Utilities". Jay Egg. April 15, 2022. https://www.phcppros.com/articles/15315-wastewater-energy-exchange-is-making-sense-to-energy-utilities
[36] "District Energy & TENs," presentation by Aaron Powell of Buro Happold, ICC TEN Forum Workshop #1 Recording (Nov. 15, 2023), https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers
[37] https://www.energy.gov/energysaver/geothermal-heat-pumps ; https://igshpa.org/about-geothermal/
[38] *Id.;* https://www.rsi.edu/blog/hvacr/geothermal-hvac-work/
[39] "District Energy & TENs," presentation by Aaron Powell of Buro Happold, ICC TEN Forum Workshop #1 Recording (Nov. 15, 2023), https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers
[40] https://cleanheat.ny.gov/ground-source-heat-pump-for-a-two-story-home/

at a steady pace and at milder temperatures compared to traditional heating and cooling systems.

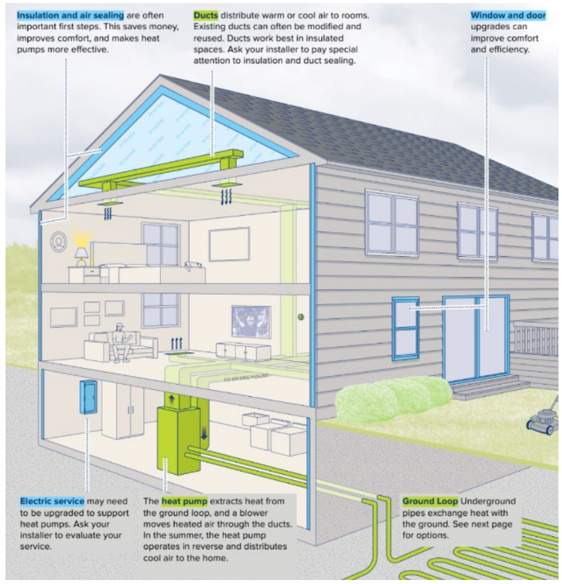


Diagram of a Residential, Ground Source Centrally Ducted System [11]

Low Surface Temperature Radiators[41]

The output energy from a heat pump can be transferred into a building through low surface temperature ("LST") radiators. Similar to traditional radiators, heated water is circulated through the radiator coils to distribute heat into the air, but the temperature of the water is at much lower temperatures, 30-50°C (86-122°F) versus 70-80°C (158-176°F).[42] Some benefits of usings LST radiators are their improved efficiencies compared to traditional radiators, improved climate control, and safety. Due to the lower output temperature, less energy is needed to heat the water and less heat loss occurs making LST radiators more efficient than traditional radiators. These radiators are more responsive to small temperature changes and make much quicker adjustments for more comfortable climate control than traditional radiators. LST radiators are not dangerously hot to touch, even at the highest operating temperatures. Because of their lower operating temperatures, LST radiators do require a larger surface area to fulfill heating demands for a room. To reduce the surface area required, some radiators have integrated fans to supplement the convection output, increasing the heat dispersed into the room.[43] These integrated fans are controlled automatically, providing this supplemental output on an as-

[41] https://global.purmo.com/en/the-indoors/radiators/a-guide-to-low-temperature-radiators; https://www.heatandplumb.com/blog/what-are-low-surface-temperature-radiators
[42] https://global.purmo.com/en/the-indoors/radiators/a-guide-to-low-temperature-radiators
[43] https://global.purmo.com/en/the-indoors/radiators/a-guide-to-low-temperature-radiators

needed basis, which further improves the efficiency and temperature control of the radiator.

Fan Coil Units[44]

Fan coil units ("FCU") are simple, stand-alone heating and cooling units that provide temperature control to individual rooms. FCUs do not require ductwork to serve a room with heating or cooling, but ductwork can be incorporated to allow for a single fan coil unit to serve multiple rooms. FCUs can be paired with heat pumps to provide or supplement heating and cooling for a building.

The primary components of a FCU are the filter, blower, coil(s), and a drip pan for condensate. Slight variations of FCUs are available but all operate under the same principles. Air is drawn into the unit by the blower, and depending on the placement of the blower, the air is then pulled across the coil(s) or forced across the coil(s) before reentering the space being served. Heated and chilled water or a refrigerant is circulated through the coil(s) to raise or lower the temperature of the air as it flows across. The air can then be recycled through the unit or returned outside.

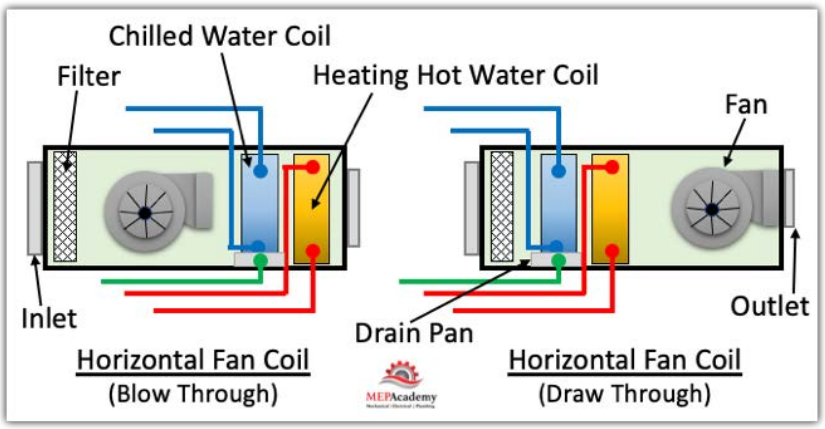


Diagram of a Horizontal, Water-based Fan Coil Unit [12]

As with any building climate control system, optimal insulation of the building is essential in providing the most efficient and comfortable environment. A well-insulated and sealed building allows for easier temperature control within the building, reducing both the energy load and losses of the system. This is significantly important with the use of heat pump systems because they operate at a much tighter temperature range, within ambient conditions, which allows for significant energy savings to be realized. The benefits of using heat pump systems extend beyond energy and cost savings. Heat pump

[44] https://thefurnaceoutlet.com/blogs/hvac-tips/fan-coil-unit-what-is-it-and-how-does-it-work

systems promote improved air quality within the building and minimizes the risk of carbon monoxide poisoning since heat isn't being provided from a fossil fuel combusted on-site.

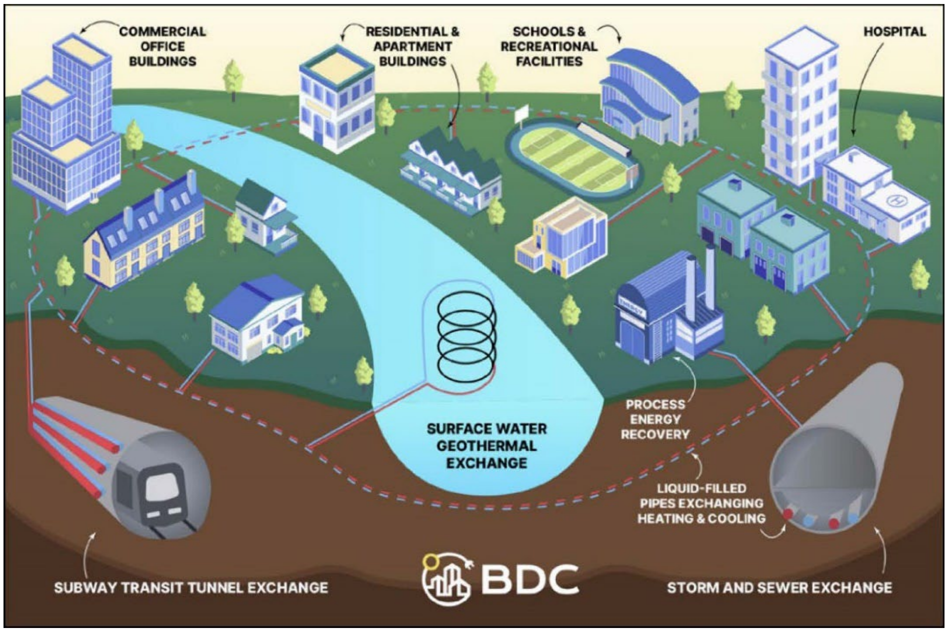


Diagram of a TEN System [13]

The diversity of these core components is what provides thermal energy networks with the flexibility to be implemented in various conditions and environments, along with the adaptability to change with growing networks. Within a TEN, increased system diversity results in a decreased collective load because thermal load balancing is possible with the enabled energy sharing. Connected buildings in the network will have varying energy demands, and when one building is rejecting excess heat into the network system, the other buildings have the opportunity to use it. With well-planned designs, thermal energy networks provide a path to reaching energy savings and decarbonization goals.

B. Selected Examples of Thermal Energy Networks

1. District Geothermal Cooling Systems

Toronto, Canada Deep Lake Water Cooling System[45]

Toronto is host to a system that uses a drinking water exchange design and a deep lake water cooling system. In this system three intake pipes draw water from Lake Ontario at a depth of 83 meters. The water at this depth is approximately 39 degrees Fahrenheit. The water is filtered and treated for Toronto's potable water supply. Before being routed to the city potable water system, the water drawn from the lake is routed through an energy transfer station, where 36 heat exchangers are used to cool a chilled water supply closed loop that is separate from the potable water system. The chilled water, which is mixed with glycol, in the closed loop cooling system can then be either routed directly to customer premises or, if necessary, further chilled by steam-driven centrifugal chillers. Heat exchangers at customer premises draw cooling from the closed loop system, which is used to cool each customer's premises through the customers' own internal building loops.

The system was built by Enwave in partnership with the City of Toronto and began operating in August of 2004. The 25 miles of underground pipe in the system serves over 190 buildings and more than 40 million square feet of real estate in downtown Toronto. Enwave calculates that the system displaces 55 MW of energy a year from Toronto's electricity grid.

Chicago Illinois, District Cooling System[46]

CenTrio operates a district cooling system in downtown Chicago that provides 101,000 tons of cooling for 53-million square feet of building space. The system connects and serves more than 115 buildings comprised of commercial office space, residential properties, hotels, retail properties, government buildings, entertainment facilities, schools and data centers. In operation since 1995, the system has proven to be reliable and capable of long-term phased growth.

Since its inception in 1995, the system has grown from a single central plant serving a handful of buildings, to large network of buildings served by five distribution

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[45] The information on this project comes from the presentations of Jay Egg of Egg Geo and Bill Talbert of Salas O'Brien at the ICC's November 15, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers and from Enwave's website at https://www.enwave.com/.

[46] The information on this project comes from the presentation of Aaron Powell of Buro Happold at the ICC's November 15, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers, from the presentation of Andrew Barbeau of the Accelerate Group at the ICC's November 29, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers and the CenTrio website at https://www.districtenergyaward.org/centrio-chicago-district-cooling-system-usa/

plants and several satellite chiller plants, all interconnected by approximately eight trench-miles of distribution piping. By design, the networked system provides critical redundancy as any building on the network can be served by any of the plants in the system.

To produce chilled water for the network, four of the system's distribution plants use an ice battery for thermal energy storage. Coils of metal tubing, filled with a super chilled glycol, are used to cool water held within a concrete storage tank. As the super chilled glycol is cycled through the coils, ice forms on the exterior of the coils. The ice is built up at night and stored for daytime use in which it slowly melts down as water is moved through the storage tank for distribution into the system. Although the technology relies upon chillers to produce the system's chilled water, by operating the chillers at night, while energy demand and prices are the lowest, resultant cost savings is realized. As such, the utilization of ice thermal storage has a demonstrated capability to reduce electric grid demand by 50 MW.

System upgrades throughout the lifetime of the district system have additionally led to the incorporation of using the Chicago River to reject thermal energy from the system. Two of the distribution plants and one satellite plant currently utilize the river for heat rejection, which avoids the municipal water consumption of standard cooling towers and saves an estimated 143,000,000 gallons of water annually.

2. Thermal Energy Networks

Framingham, Massachusetts Utility-deployed, Networked Geothermal Pilot Program[47]

In Framingham, Massachusetts, work has started on the first utility-deployed geothermal network pilot project. The networked geothermal system relies upon energy exchange between connected buildings in the system while utilizing ground source energy and geothermal heat pumps, located within each building, to provide condition specific comfort heating and cooling for each building. The connected system of wells, piping, and pumps stabilizes the network by pulling the earth's heat out of the ground to warm buildings in winter and pumping excess heat from buildings into the ground in summer to cool them. The designed energy exchange between the networked buildings allows for increased efficiency of the geothermal system. The project will include three bore fields with a total of approximately 90 boreholes that will be drilled 600 or more feet

[47] The information on this project comes from the presentations of Ania Camargo of the Building Decarbonization Coalition and Isabela Varela of the Home Energy Efficiency Team at the ICC's November 15, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers, the presentations of Nikki Bruno of Eversource and Angie Alberto of the Home Energy Efficiency Team at the ICC's November 29, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers, from the City of Framingham's website at https://www.framinghamma.gov/3416/Geothermal-Pilot-Program, and from Eversource's website at https://www.eversource.com/content/residential/save-money-energy/clean-energy-options/geothermal-energy.

vertically into the Earth, a pump house with a supplemental boiler, and a closed-loop system of HTP piping. The project is approximately 1 mile long and connects a mixture of residential and commercial facilities comprised of 37 buildings (32 residential and 5 commercial) for a total of 140 individual customers. The project includes three parallel phases, including: (1) drilling borefields, (2) installing mains in the streets and service "Ts" for individual homes/buildings, and (3) performing insulation and weatherization work at customer homes/buildings.

This project, undertaken by Eversource Energy, was first approved as part of an NSTAR Gas Company (d/b/a Eversource Energy) rate case in 2020. The project will convert customers that rely on natural gas fueled heating, electric resistance heating, and delivered fuels (e.g., fuel oil) heating to heating and cooling supplied from the thermal energy network. The project is being conducted in an environmental justice community and will serve a variety of buildings including, for example a municipal building, a fire station, and single and multifamily housing.

Eversource will install, own, and maintain thermal energy equipment within the customers buildings. Customers may initially receive flat monthly charges for thermal energy network service. Costs not covered by thermal energy network charges will be recovered through natural gas service rates.

Whisper Valley Texas, Community-scale Thermal Energy Network[48]

Whisper Valley is a net-zero capable community, that at full capacity will include more than 7,000 homes, located 15 miles from downtown Austin Texas. The Community relies upon an EcoSmart Solution that combines geothermal infrastructure with additional energy resources. The community includes a network of vertical and horizontal piping that draws thermal energy from the Earth. Piping is inserted in boreholes up to 335 feet deep in front of each lot. All the geothermal in the neighborhood is networked together. The system is augmented by cooling towers to help meet peak cooling loads. The distribution pipes are connected to an energy center that regulates the system.

Each home is connected to underground distribution piping through a geothermal heat pump that provides heating, cooling, and hot water. Each of the homes in Whisper Valley is equipped with photovoltaic panels, that work with the geothermal systems, and some include energy storage systems as well.

[48] The information on this project comes from the presentation of Ania Camargo of the Building Decarbonization Coalition at the ICC's November 15, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers, from Whisper Valley's website at EcoSmart - Whisper Valley : Whisper Valley (whispervalleyaustin.com), from the EcoSmart website at https://ecosmartsolution.com/whisper-valley-ecosmart/, and from the Plastic Pipe Institute website at https://plasticpipe.org/.

Lowell, Massachusetts Networked Geothermal Project[49]

In Lowell, Massachusetts, National Grid is partnering with the University of Massachusetts - Lowell and the City of Lowell on a networked geothermal pilot. The project will use the thermal properties of subsurface rock to heat and cool buildings for part of University of Massachusetts - Lowell and nearby National Grid customers.

In April 2023, test boreholes were drilled 600 feet below a parking lot on the University of Massachusetts - Lowell campus for the project for demonstration of the drilling technology to be used for studying the bedrock in the area. Digging and installation of the project's pump house and circulation and distribution network is scheduled to begin in the Spring of 2024.

Chicago Illinois, Sustainable Square Mile[50]

In Chicago, the Department of Energy is providing funding for a Blacks in Green project. The project includes a shared community geothermal network across four city blocks in the West Woodlawn Community containing more than 100 multi-family and single-family residential buildings in a disadvantaged section of the city's south side.

The community geothermal system seeks to demonstrate the Better Heat model, a new carbon-free, modular, community-focused heat utility that can decarbonize the city's residential and small commercial building sectors. The Better Heat system will rely on geothermal technology, running fluid through pipes in the ground to use the ground's consistent temperature to help heat in the winter and cool in the summer. The shared underground heating loop will be built in the public rights-of-way and will be designed to be added to or joined over time. Homes and businesses will be able to opt-in at their discretion. Those that do, will connect to the shared loop through heat pumps.

The system will be designed so that it can be developed with between 4 and 8 initial customers and, as noted above, accommodate opt-ins by additional customers. As adoption of the Better Heat system grows in communities, additional efficiency, lower costs and system balancing can be achieved by connecting adjacent shared community loops to each other.

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[49] The information on this project comes from the presentations of Ania Camargo of the Building Decarbonization Coalition and Isabela Varela of the Home Energy Efficiency Team at the ICC's November 15, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers, from the University of Massachusetts Lowell's website at https://www.uml.edu/news/stories/2023/geothermal-pilot-project.aspx#:~:text=The%20university%20partnered%20with%20the%20city%20of%20Lowell,project%2C%20which%20state%20regulators%20approved%20in%20late%202021, and from National Grid's website at https://www.nationalgridus.com/Geothermal-Energy-Program.

[50] The information on this project comes from the presentations of Nuri Madina of Blacks in Green and Andrew Barbeau of the Accelerate Group at the ICC's November 29, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers.

Plymouth, England District Energy[51]

The United Kingdom's first thermal energy network is being built in Plymouth, England. This system connects building heat pumps with a warm and cold thermal energy network. Heat sources are planned to include a wastewater treatment plant, borehole based groundwater source heat pumps, sea water based heat pumps, data center heat recovery, air source heat pumps, and incinerator heat recovery.

IV. Background: Examples of Regulatory Structures in Other States

A. Colorado[52]

With SB21-264, Colorado, in 2021, enacted a law requiring utilities to submit Clean Heat Plans to reduce emissions from distribution and end-use of natural gas.[53] Colorado SB22-118 encouraged geothermal energy use by limiting fees that local units of government can place on geothermal systems, requiring the Colorado Energy Office to provide consumer education and guidance around geothermal energy, and permitting utilities to purchase electricity and renewable energy credits from community geothermal gardens.[54]

Colorado HB23-1252, enacted in 2023 and effective on August 7, 2023, took steps to promote thermal energy service.[55] In Colorado, as noted above, larger gas distribution utilities are required to file with the Colorado Public Utilities Commission a Clean Heat Plan, which demonstrates how the utility will use clean heat resources to meet clean heat targets for reducing carbon dioxide and methane emissions. Colorado HB23-1252 added thermal energy as an eligible clean heat resource for helping to meet clean heat targets.

Colorado HB23-1252, further provided that smaller gas utilities that the Colorado Public Utilities Commission regulates are authorized to apply for review and approval of

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[51] The information on this project comes from the presentation of Aaron Powell of Buro Happold at the ICC's November 15, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers and from the City of Plymouth's website at https://www.plymouth.gov.uk/district-energy.

[52] The Colorado information comes in part from the presentation of Commissioner Megan Gilman of the Colorado Public Utilities Commission at the ICC's December 13, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers.

[53] Colorado SB21-264, an Act Concerning the Adoption of Programs by Gas Utilities to Reduce Greenhouse Gas Emissions, and, In Connection Therewith, Making an Appropriation. See https://leg.colorado.gov/sites/default/files/2021a_264_signed.pdf.

[54] Colorado SB22-118 an Act Concerning the Encouragement of the Use of Geothermal Energy by Providing Similar Treatment to Solar Energy, and, in Connection Therewith, Making an Appropriation. See https://leg.colorado.gov/sites/default/files/2022a_118_signed.pdf.

[55] Colorado HB23-1252, an Act Concerning the Implementation of Measures to advance Thermal Energy Service. See https://www.leg.colorado.gov/sites/default/files/2023a_1252_signed.pdf.

the use of thermal energy networks in the gas utilities' service areas. Larger gas utilities are additionally required to propose pilot thermal energy network projects for the Colorado Public Utilities Commission's review and approval.

The Colorado Public Utilities Commission is required by Colorado HB23-1252 to initiate a proceeding on or before January 1, 2025, to determine if rule-making or legislative changes are needed to facilitate the development of thermal energy in Colorado.

B. Massachusetts[56]

In 2020, the Massachusetts Department of Public Utilities approved, as part of a rate case proceeding, the mixed-use, dense-urban-environment geothermal demonstration project in Framingham Massachusetts, as described above, for Eversource Energy.[57] In 2021, the Massachusetts Department of Public Utilities approved a petition from National Grid for approval of a geothermal district energy demonstration project consisting of ground-source heat pumps connected to a network of underground pipes that allow for highly efficient heat transfer at sites within the Company's service territory.[58]

In December 2023, the Massachusetts Department of Public Utilities issued an order in a general investigation concerning the role of gas local distribution companies in meeting the Commonwealths climate goals finding that consideration of non-gas pipeline alternatives defined broadly to include electrification, thermal networked systems, targeted energy efficiency and demand response, and behavior change and market transformation, is necessary to minimize investments in the gas pipeline system that may be stranded costs in the future as decarbonization measures are implemented.[59]

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[56] The Massachusetts information comes in part from the presentation of Zeyneb Magavi of the Home Energy Efficiency Team at the ICC's December 13, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers.

[57] Massachusetts Department of Public Utilities Order, In the Matter of Petition of NSTAR Gas Company doing business as Eversource Energy, pursuant to G.L. c. 164, § 94 and 220 CMR 5.00, for Approval of a General Increase in Base Distribution Rates for Gas Service and a Performance Based Ratemaking Mechanism, Dated October 30, 2020. See https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/12834214.

[58] Massachusetts Department of Public Utilities Order, In the Matter of Petition of Boston Gas Company d/b/a National Grid for Approval of a Geothermal District Energy Demonstration Program, Dated December 15, 2021. See https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/14305270.

[59] Massachusetts Department of Public Utilities Order, Investigation by the Department of Public Utilities on its own Motion into the role of gas local distribution companies as the Commonwealth achieves its target 2050 climate goals, Dated December 6, 2023. See https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/18297602

C. Minnesota

The Minnesota Legislature enacted an omnibus commerce, climate, and energy finance bill in 2021.[60] The omnibus bill includes the Natural Gas Innovation Act, which establishes a framework to allow natural gas utilities to meet Minnesota's greenhouse gas reduction and renewable energy goals through innovative resources, which may include district energy. District energy is defined by the Natural Gas Innovation Act as a heating or cooling system that is solar thermal powered or 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.

D. New York[61]

The New York Public Service Commission (NYPSC) authorized pilot projects and studies regarding thermal energy networks in the context of rate cases. For example KeySpan Gas East Corporation d/b/a National Grid (KEDLI) was approved to test two geothermal well systems to begin the evaluation of their cost effectiveness as a clean heating and cooling system, as an alternative technology to natural gas main extensions.[62] The first demonstration site was a shared geothermal well system at a residential community located in the Town of Riverhead, while the second demonstration site was a single geothermal well system for a veterans group home in the Hamlet of Medford, Town of Brookhaven. The Commission characterized this and similar approvals as "limited in scope and either specifically targeted at providing end-user incentives to defray the costs to install air source and ground source heat pumps at individual premises or bound by the limitations of Public Service Law (PSL) provisions in effect at the time."[63]

[60] Minnesota H.F. No. 6, 1st Engrossment, posted June 26, 2021. See https://www.revisor.mn.gov/bills/text.php?number=HF6&type=bill&version=1&session=ls92&session_year=2021&session_number=1.

[61] The New York information comes in part from the presentation of Peggie Neville of the New York Department of Public Service at the ICC's December 13, 2023 Workshop found at https://www.icc.illinois.gov/informal-processes/Thermal-Network-Energy-Providers.

[62] New York Public Service Commission, Case 18-M-0084, In the Matter of a Comprehensive Energy Efficiency Initiative, Order Authorizing Utility Energy Efficiency and Building Electrification Portfolios Through 2025 (filed January 16, 2020). See https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={06B0FDEC-62EC-4A97-A7D7-7082F71B68B8}.

[63] NYPSC, Case 22-M-0429, Proceeding on Motion of the Commission to Implement the Requirements of the Utility Thermal Energy Network and Jobs Act, Order on Developing Thermal Energy Networks Pursuant to the utility Thermal Energy Network and Jobs Act (filed September 15, 2022), at 4. See https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={FCD2CEF5-2A47-473F-BBC4-644977A948C7}.

The New York State Legislature enacted the Utility Thermal Network and Jobs Act in 2022.[64] The law: (1) removed legal barriers to utility development of thermal energy networks, (2) required the New York Public Service Commission to commence a proceeding to consider the appropriate ownership, market and rate structures for thermal energy networks and whether the provision of thermal energy by gas and/or electric utilities is in the public interest, and (3) required each of the several largest gas, electric, or combination gas and electric utilities to submit to the Commission between one and seven thermal energy network pilot proposals.

On September 14, 2023, New York's Public Service Commission issued guidance for further development of the Utility Thermal Energy Network (UTEN) pilot projects and requiring utilities to submit revised proposals by the end of the 2023.[65] If approved, these projects will move on to the next steps of engineering design and construction, with a target of being operational by 2025.

In its September 14, 2023 Order, the NYPSC established a phased implementation approach. Under this approach, Stage 1 will address pilot project scope and feasibility and stakeholder engagement. Stage 2 will address pilot project engineering design and consumer protection plans. Stage 3 will address customer enrollment and pilot project construction. Stage 4 will address pilot project operation and management. Finally, Stage 5 will address pilot project review, recommendations, and conclusions. The Order provided further guidance with respect to utility thermal energy network design options, the diversity of pilot projects, impacts on disadvantaged communities, customer protection plans, labor requirements, and regarding technical, economic, and operations aspects of the projects.

V. Comments in Anticipation of Workshop #4

Prior to workshop #4, workshop participants were asked to submit comments on the appropriate ownership, market, and rate structures for thermal energy networks and

[64] New York Act 10493, An Act to amend the public service law, the transportation corporations law, the labor law and the public authorities law, in relation to thermal energy networks. See https://legislation.nysenate.gov/pdf/bills/2021/A10493.

[65] NYPSC, Case 22-M-0429, Proceeding on Motion of the Commission to Implement the Requirements of the Utility Thermal Energy Network and Jobs Act, Order Providing Guidance on Development of Utility Thermal Energy Network Pilot Projects (filed September 14, 2023). See https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={80C1948A-0000-CD12-974A-0171B90CAAE9}.

whether the provision of thermal energy services by thermal network energy providers is in the public interest. The following summarizes this first round of written comments.

A. Ameren Illinois

Ameren observes that thermal energy networked systems are operated similar to how Ameren operates is natural gas and electric utility systems in that Ameren doesn't generate natural gas or electricity, but rather delivers energy generated elsewhere to its customers. The work to build out such a system is similar to building out a natural gas or electric system, as Ameren notes, because it requires the development of infrastructure and the engagement of the workforce and community. Ameren suggests that these are reasons existing distribution utilities are best equipped to own and operate thermal systems.

Ameren recommends that during the development of thermal energy networks, natural gas customers must receive safe and reliable service and that cost impacts of thermal energy network deployment on these gas customers must be considered. Ameren further says it must have the certainty of full cost recovery ahead of making investments that will benefit its customers.

Rate structures for thermal energy networks will need to be, says Ameren, developed collaboratively between stakeholders impacted by adoption of this technology. Ameren commits to working openly and collaboratively with stakeholders to develop an equitable rate design for both participants and non-participants of thermal network pilot demonstration projects.

With respect to whether such projects are in the public interest, Ameren says that factors such as safety, reliability, resilience, and cost, among other factors, all play a role in answering that question.

B. Blacks in Green

BIG states that the ultimate goal and design of a thermal energy network should be to provide energy sovereignty to the community. Each person and each community should have the right to the amount and type of energy necessary to sustain itself and its group, and the necessary resources to sustain it, provided it does not externalize negative environmental, social or economic impacts. This is particularly important for underserved communities in which a confluence of inequitable governmental and private policies have caused an inordinate burden of utility cost on them and disqualified them in many cases from most remediation and renewable efforts. The present model, says BIG, makes rate relief an almost insurmountable task for these communities.

The best model will be one that maximizes local community ownership and control of the assets and production, in which the local community actually controls the significantly reduced rate. This then will result in a technology and infrastructure that will be in the public's interest.

BIG states that Federal Department of Energy funding has made the Chicago Sustainable Square Mile design, foundational study, and community engagement possible. The foundational study, which determines building topologies, existing heating and cooling systems and equipment, and existing fuel sources, will enable participation in Illinois energy efficiency and weatherization programs.

According to the US Environmental Protection Agency, "geothermal heat pumps are the most energy-efficient, environmentally clean, and cost-effective systems for heating and cooling." They are predictably low maintenance, do not burn expensive fossil fuels, and can reduce energy bills by 65% or even more. Along with rate reform, BIG says these projects promise to provide the relief to low-and moderate-income households the existing legislation, regulations and business models have failed to provide.

C. Commonwealth Edison

ComEd has accumulated significant ground-source heat pump technology engineering and implementation expertise. The Company has developed this expertise through implementation of its energy efficiency program where heat pump incentives were first made available to residential customers in 2016 and first made available to commercial customers in 2019. ComEd states that it has provided rebates for 48 heat pump installations in the past two years. It further partners with the Geothermal Alliance of Illinois to require training and accreditation for its system installers. As of December 2023, it has 15 such companies in its approved network.

ComEd remarks that while ground-source heat pumps can provide a reliable and highly efficient solution for homes or business heating and cooling needs, high up-front costs and site requirements of installation tend to limit growth of this technology. Such technologies may be particularly costly for leaky and under-insulated buildings. ComEd conjectures, however, that with grid decarbonization and more winter morning peaks when solar and wind may not be available, ground-source heating may provide a cost-effective alternative to shaving peaks as compared to other potentially high-cost technologies like hydrogen or long-duration energy storage.

ComEd expresses interest in further analysis of geothermal technologies, including analysis of whether community-scale geothermal systems can alleviate the barriers to adoption currently impeding the deployment of ground-source heat pumps.

ComEd, in partnership with other entities, has applied for support for two projects through the Department of Energy. Neither project was selected for funding by the Department. Nevertheless, they continue to follow other such projects, such as Eversource's Framingham project, and are reaching out to Blacks in Green to determine if there are ways in which ComEd can support the Chicago Sustainable Square Mile project.

D. Indiana, Illinois, and Iowa Foundation for Fair Contracting

III FFC identifies a need to promote alternate power systems, specifically thermal energy networks. Thermal loop technology, says III FFC, delivers environmental benefits and the benefits of reduced electric and natural gas volume and peak load that accrue to both geothermal network participants and non-participants.

III FFC points to the utilities' well-established access to capital, extensive experience with networked infrastructure in public rights-of-way, and the mandate to serve all customers as reasons why utilities are well-positioned to effectively develop and scale thermal energy networks. III FFC further notes that utility provision ensures accessibility for all customers and facilitates the coordination of thermal energy network development with the rightsizing of utility gas systems. III FFC recommends striking a balance between regulatory oversight and flexibility for market participants, stating that a well-regulated market encourages investment while safeguarding the interests of customers. III FFC recommends any natural gas, electric or combination utility with more than 100,000 customers consider creating a thermal energy network and proposing one to three pilot projects. III FFC recommends projects be reviewed and approved by the Commission and that the Commission foster a market structure that encourages innovation, competition, and consumer benefits.

With respect to rate structures, III FFC recommends adopting transparent pricing mechanisms that benefit customers, attract capital, and foster innovation. III FFC recommends that these issues, including recovery of research and development expenditures, should be addressed through a comprehensive stakeholder process.

III FFC states that it is essential to prioritize environmental sustainability, affordability, and accessibility when assessing whether the provision of thermal energy networks by thermal energy network providers is in the public interest. III FFC says that thermal energy networks are highly efficient and minimizes impacts on the grid and, therefore, a well-regulated industry will contribute positively to the public interest.

III FFC recommends coordination of thermal energy networks with State energy and weatherization programs to enhance the overall value of the projects.

E. Nicholas Fry

Mr. Fry recommends a tapered regulatory framework. He advises to begin with allowing gas utilities, electric utilities, private entities (housing cooperatives, planned communities, etc.), and energy service companies to be the owners and operators from the outset. He further recommends to not overburden these entities with Commission exposure. They should be allowed to fail to improve long term learning. The ones that last will be scalable examples which may then come under the purview of the Commission, or not, at a future date.

Mr. Fry recommends encouraging adoption by providing funding in the prefeasibility phases of the system development.

F. Northern Illinois Gas Company

Nicor recommends that the physical assets necessary to operate a thermal energy network should be owned in much the same manner that natural gas networks and associated equipment are owned today. Nicor explains that gas utilities typically own and operate the local distribution aspects of the natural gas value chain. While gas utilities do not own the upstream production and gathering infrastructure, which typically occurs in different geographic regions, for thermal energy networks production and gathering are more closely integrated with the local distribution system and are geographically collocated with the distribution network. The majority of thermal energy networks infrastructure costs are associated with the installation of the external thermal energy networks to bring the working fluids to end-use applications. The risks associated with the installation of the external networks can be mitigated if they are installed and managed by public and private utilities, which have the experience and expertise to manage the safety, operational, workforce development, community engagement and financial aspects of large utility networks. Therefore, Nicor says, the thermal energy production and distribution assets should be owned and operated by public and private utilities.

Regarding cost recovery, Nicor recommends that the costs associated with the external thermal energy network investment and ongoing operations can be recovered through a rate mechanism similar to that used for regulated natural gas pipelines. This will benefit the end-users by balancing the risks associated with the capital intensive external thermal energy network assets across a larger user base while allowing the customer to own the end-use equipment. Nicor recommends that end-use equipment and appliances should be owned by the end-user.

Nicor states that the rate structure and cost recovery mechanism ultimately will need to be determined through a combined legislative and regulatory process. One potential option is for a merged natural gas/geothermal rate base, in which case the cost of installing networked geothermal is spread over the entire combined natural gas and geothermal energy network customer base. If customers choose to make the transition to networked geothermal, this will minimize the impact to all customers, as the costs are spread over a larger customer base. As with natural gas rates, geothermal rates could include different rate classes for various customer types.

To the extent a thermal energy network is open access and provides energy to the general public based on convenience and need, Nicor recommends that operation of this network should be considered in the public interest. Thermal energy networks can increase the efficiency of end-use applications by exchanging heat with the earth and provide energy benefits to the customers with reduced/no carbon footprint. Moreover, thermal energy networks would be local to the customers, which provides a level of energy security. All these factors can motivate customers to utilize a networked thermal energy system if the costs and risks associated with the systems can be managed effectively. Regulated utilities are, says Nicor, uniquely positioned to effectively manage the costs and risks associated with these systems and provide clean, safe, reliable, resilient, and affordable energy to customers.

G. The Peoples Gas Light and Coke Company and North Shore Gas

NS-PGL state that public utilities as defined in Section 3-105 of the Act are best suited to own and operate thermal energy networks. Public Utilities have the requisite access to capital, expertise in safety protocol and qualification, experience with placing infrastructure in public rights of way, the existing energy infrastructure, and a skilled union workforce to partner with the State of Illinois in deploying thermal energy networks.

With respect to market structure, NS-PGL recommends the Commission look to the existing market structures, rules and regulations, and other long-standing regulatory regimes that apply to regulated public utilities in Illinois to help shape the deployment of thermal energy networks in Illinois. The various provisions of the Public Utilities Act that govern public utilities, gas utilities, and electric utilities could apply with equal force. For example, if a public utility wished to construct new “plant, equipment, property, or facility” to deploy thermal energy networks, then the Commission could require the filing of a Certificate of Public Convenience and Necessity (“CPCN”) pursuant to the applicable provisions of Section 8-406 of the Public Utilities Act. By using the CPCN process in the context of the deployment of thermal energy networks, NS-PGL says the Commission will retain its broad authority and oversight for any proposed construction and deployment under Article VIII of the Public Utilities Act. NS-PGL further suggests the Commission may wish to consider applying the expedited provisions of Section 8-406.1 of Public Utilities Act to the deployment of thermal energy networks.

With respect to rate structures, NS-PGL recommend, if the Commission is interested in deployment of thermal energy networks, the Commission should apply the appropriate rate mechanism that properly incentivizes public utilities to make the required investments. Rates should, says NS-PGL, be set consistent with the manner in which gas and water rates are set in Illinois and consistent with industry practice for regulated public utilities as outlined in the manuals and guidelines authored by the National Association of Regulatory Commissioners. For example, the applicable provisions of Article IX of the Public Utilities Act can govern the Commission's efforts to deploy thermal energy networks in Illinois, including the alternatives to rate of return regulation contained in the alternative ratemaking provisions in Section 9-244 of the Public Utilities Act. NS-PGL believe that public utilities who seek to operate and/or construct facilities obtain a Certificate of Public Convenience and Necessity pursuant to Section 5/8-406 et al. of Public Utilities Act.

NS-PGL says it is difficult to currently answer whether thermal energy networks are in the public interest. NS-PGL suggest that the Commission may wish to follow the lead of Massachusetts and take a measured approach to thermal energy networks by seeking pilot proposals for deployment by gas utilities in Illinois. Such a measured approach to the deployment can serve to better educate the Commission, public utilities, customers, and other stakeholders regarding the best means by which to deploy thermal energy networks in Illinois.

H. The Accelerate Group

The Accelerate Group states that, as communities across the State pursue efforts to eliminate carbon and other pollutant emissions from buildings, it is essential to identify the most cost effective and reliable methods for delivering carbon-free heat to dense urban environments and existing building stock. The Accelerate Group has worked to design the Better Heat model, which develops community-scale geothermal networks in the public right-of-way that residents and businesses can opt-in to over time, when they are ready. Through shared underground loops that leverage the Earth's temperature to heat and cool buildings, these systems can provide heat to buildings 5x more efficiently than gas heat, and help cool those buildings in the summer.

Thermal energy networks are not, according to The Accelerate Group, new to Illinois. For example, an existing, privately-operated district cooling network that sources from the Chicago river has been in operation in downtown Chicago for decades. Similarly, campuses and hospital districts have operated district heating and cooling dating back almost a century.

The Accelerate Group advises against defaulting to existing utility ownership. While a case can be made that the construction of such networks are beneficial to investor-owned utilities, it is not necessarily the case that investor-owned utilities are beneficial to such projects. While there may be some overlap in functionality around the distribution and collection of bills, The Accelerate Groups says there are significant knowledge and experience gaps between both power system planning, engineering, and repair and combustible gas distribution, with a locally-distributed pumped fluid operation. The physics and chemistries are fundamentally different. Similarly, they explain that the workforce similarities to gas utilities' actual personnel is limited. Community geothermal networks depend on a skillset that is largely established with contractors and others that employ trained operating engineers, and not necessarily a skillset that is unique or prevalent with existing gas utility employees.

The Accelerate Group points to how thermal energy networks can be built and operated as stand-alone or interconnected, neighborhood-scale systems for the notion that such projects can be designed around local community needs, and include opportunities for local ownership and wealth-building.

Current tax policy, The Accelerate Group explains, is important for which ownership models may be most viable. In particular, utilities may not be able to swiftly monetize Inflation Reduction Act tax credits, credits that may fund 30-50% of a project. Under current tax rules, utilities may need to delay realization of the full benefits of these tax credits for 30 years or more. With respect to non-profits and non-tax-paying public entities, The Accelerate Group indicates that such entities may be able realize investment tax credits, but may not be able to monetize depreciation as readily as other entities. Further, The Accelerate Group notes that guidance from the U.S. Treasury indicates that for any entity to see the IRA tax credits for energy property, all essential components of a system would have to be solely owned by a single entity or jointly owned by multiple entities. This suggests that any entity that owns the geothermal system must be able to own the "behind the meter" heat pump/air conditioning system in order to take full advantage of the IRA tax credits. The Accelerate Group is currently assessing whether there is a structure that would allow a new entity that could both own the networked loop and the heat pump, at least temporarily, to monetize tax credits and support the medium-term finance of the customer's new equipment. Through such a model, which could include a lease-to-own capability, the financial case could be beneficial to customers.

The Accelerate Group says that is important to approach the roll-out of a large-scale, transformational efforts such as this by recognizing that people will have to find ways to make the switch when they are practically, physically, emotionally, and financially ready. A deployment that relies on universal concurrent community investment is unlikely to succeed. Systems might be more inefficient at the start, but gain efficiencies over time as concentrations of participation in a project area increase. Financial and ratemaking projections should account for this dynamism.

The Accelerate Group recommends that project deployments be designed around community needs and desires. Communities should lead in this conversation, with them at the center of this conversation.

With respect to rate structures, The Accelerate Group references a structure wherein customers pay simply for the thermal exchange between their premise and the geothermal heating and cooling loop. In the winter, this would be therms of heat from the ground, and in the summer, this would be therms of heat out of the building and into the ground. A fee could be based on the total energy transacted, including potentially by measuring the heat and volume of temperature into and out of a heat pump/air conditioning unit or other heating and cooling systems on a customer's premise. Basing rate structures on volumetric usage would continue to incentivize energy efficient behavior and accurately apportion costs to customers based on cost causation principles. However, such systems are new and potentially difficult to measure without additional metering devices.

Another option The Accelerate Group references is a model of monthly participation fees to customers based on certain piped and size requirements for their systems. Such an approach benefits from simplicity. However, such a system would have the downside of disincentivizing additional energy efficiency, or accurately bill customers based on demand, usage, and impacts on the system.

The Accelerate Group points to expanded authority under the U.S. Department of Energy's Loan Programs Office, through which community geothermal projects can pursue low-cost loan guarantees at treasury rates. This can open the door to new types of owners of such projects that may not historically have had access to capital at such rates. Further, opportunities under the U.S. Environmental Protection Agency Greenhouse Gas Reduction Fund's National Clean Investment Fund create an opportunity for start-up, pilot deployment and equipment financing for such systems as a near-term proof of concept loan.

I. The People of the State of Illinois – Attorney General's Office

It is important, says the AG, that decisions be made regarding ownership, markets, and rate structure questions only after thorough consideration of issues and questions, and engagement with all stakeholders, including but not limited to state and local agencies (e.g., Illinois Department of Public Health, Illinois Environmental Protection Agency, Department of Commerce and Economic Opportunity), municipal utilities (e.g., Metropolitan Water Reclamation District, municipal water and energy systems), and third party developers that principally contemplates a data-driven approach that takes full account of costs and benefits. This is essential, says the AG, to ensuring consumer affordability and accessibility stay at the forefront of developing any potential thermal energy network initiative.

The AG states that thermal energy networks are expensive and capital intensive. Because existing gas pipes cannot be repurposed, deployment of a thermal energy network will require the installation of completely new pipes. It will, the AG states, require drilling hundreds of feet into the ground, which will necessarily implicate numerous parcels of property, permitting, and other community oriented, administrative, and regulatory challenges. None of these challenges are insurmountable, but they must be carefully considered in terms of transactional costs, especially in light of rising utility bills. The AG are, nevertheless, encouraged by the potential of thermal energy network to play a role in the energy transition.

Regarding ownership, the AG recommends that identification and consideration of existing and potential utility and private-sector, competitive business models, and of the ways each such model enables (and disables) the achievement of affordable and accessible economies of scale for thermal energy networks should be thoroughly examined. The AG notes that utility ownership would impact the competitiveness of existing business models and may stifle and/or weaken existing market discipline and emerging market advancements. These consequences must be identified, evaluated, and modeled to ensure next steps and related policies thoughtfully promote the market to incentivize consumer affordability and accessibility. AG notes that many stakeholders in the Chicago Sustainable Square Mile do not want gas utilities to own the thermal energy network.

The AG points to a 2021 report from the New York State Energy Research and Development Authority ("NYSERDA")[66] that identified conceptual business models along

[66] New York State Energy Research and Development Authority, Overcoming Legal and Regulatory Barriers to District Geothermal in New York State," June 2021. See https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjbl8vk-P-CAxWLv4kEHVnvCgEQFnoECBsQAQ&url=https%3A%2F%2Fwww.nyserda.ny.gov%2F-

a continuum that attempted to account for increasing legal, regulatory, and transactional complexities. The scenarios include:

- Single Property – Single Owner

  In this scenario, there is a single owner of both a property and a project.

- Single Property—Single Owner—Multiple Users

  In this scenario, there is a single-property owner who hosts a geothermal system on a single property that serves multiple users or tenants.

- Single Property—Build-Own-Operate-Transfer (BOOT)

  This scenario is a variant of the single property-single owner scenario where a developer builds, owns, and operates the geothermal system on a single property owned by a third-party, and eventually transfers ownership and operation of the system to the property owner at a contractually specified point in time.

- Single Property—Common Developer—Subdivide into Multiple Properties

  In this scenario, a developer installs geothermal on a single property to serve multiple users and later subdivides the property into separate properties for sale.

- Single Property—Multiple Users/Owners

  In this scenario, a geothermal system is installed on a single property that serves multiple users/owners and may be managed by a business association such as a corporation or a common property ownership arrangement such as joint tenancies.

- Multiple Properties—Multiple Owners Under a Common Agreement

  This scenario is a variant of the single property-multiple owners scenario where a geothermal system is installed across multiple properties that serve multiple users/owners under a common agreement. A common agreement for maintenance, management, pricing, and financial and other responsibilities of

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%2Fmedia%2FProject%2FNyserda%2FFiles%2FPublications%2FResearch%2FClean-Power-Innovation%2F21-22-Overcoming-legal-and-Regulatory-Barriers-to-District-Geothermal-in-NY.pdf&usg=AOvVaw1qb_TM026FfmnOVW9OYT_m&opi=89978449.

the system, and a common management body such as an owner's association or similar entity would be needed to be established for this purpose and supported by association charges.

- Multiple Properties—Different Owners—No Regulation

In this scenario, there are multiple property owners with a system that crosses properties that isn't governed by regulation but instead by contract law or other regulation not designed for geothermal systems. The project developer must price services based on market conditions and contractually provide for maintenance, management, financial and other responsibilities of the system, and a common management body. These arrangements would be contractual between the developer and systems users.

- Multiple Properties—Different Owners--Market Pricing

This scenario is a variation on the multiple properties—different owners model introducing regulation that specifies geothermal services are to be provided on a competitive basis with government setting standards for service but leaving pricing to the market.

- Multiple Properties—Different Owners—Regulated Utility

This scenario is another variation on the multiple properties—different owners model with a regulated utility model such as and investor-owned utilities with geographic monopolies regulated by the state Public Utility Commission for standards of service and pricing.

- Multiple Properties—Different Owners—Municipal Utility

Another variant of the multiple properties—different owners model, this scenario is a model of municipal owned and developer-operated systems, and potentially private systems granted franchise rights by the municipality.

- Multiple Properties—Different Owners—Fully Integrated Enhanced Geothermal

The final multiple properties—different owners variant is a scenario that includes regulation that mandates multiple utilities and service providers to coordinate their activities on a shared district geothermal system.

The AG included the following table, which reflects conditions in New York, from the NYSERDA report. The NYSERDA report explains that the table represents a stoplight analysis —green, yellow and red—indicating positive attributes for technical economies of scale, and three criteria indicating legal diseconomies of scale: ease of resolution of property issues, the complexity of regulatory issues, and ease of administration.

	Technical Economies	Property	Regulatory	Admin
Single Property—Single Owner	Red	Green	Green	Green
Single Property—Single Owner—Multiple Users	Green	Green	Yellow	Green
Single Property—BOOT	Green	Green	Yellow	Green
Single Property—Common Developer—Subdivide	Green	Green	Yellow	Green
Single Property—Multiple Users/Owners	Green	Yellow	Yellow	Green
Multiple Properties—Multiple Owners—Common	Green	Yellow	Yellow	Green
Multiple Properties—Different Owners—No Regulation	Green	Red	Red	Red
Multiple Properties—Different Owners—Market Pricing	Green	Red	Yellow	Yellow
Multiple Properties—Different Owners—Regulated Utility	Green	Red	Yellow	Yellow
Multiple Properties—Different Owners—Municipal Utility	Green	Red	Yellow	Yellow
Multiple Properties—Different Owners—Fully Integrated	Green	Red	Yellow	Yellow

The AG notes that the NYSERDA report states that it is essential for policymakers to take account of consumer affordability and environmental consideration and reduce the cost of utility geothermal by promoting competitive, transparent, and economically efficient markets before any other policy intervention is considered in respect to utility geothermal.

The AG further points to proposed Vermont legislation that would expand the entities that Vermont's public utility commission can authorize to operate geothermal networks beyond just existing utilities, and to enable those entities to recover their costs through rates paid by customers.

Illinois Public Act 103-0580, the AG points out, states that the process of determining potential development of thermal energy networks needs to protect utility customers. This is particularly important given affordability issues that remain an exigent concern among Illinois residents and policymakers. Protecting utility customers, the AG says, requires transparent disclosure of the costs of these initiatives that allows for consideration of cost-benefit analysis. The AG further states that, given current utility bill affordability issues, it is important to avoid imposition of more costs on customers to fund thermal energy networks. The AG advises consideration of demonstration projects, including examining results from Eversource's Massachusetts pilot, which should be given preference over utility ratepayer funding. The AG further advises that cost information is critical for stakeholders to better understand scalability, the cost to individual consumers who would like to use thermal energy networks, to determine what rate structures are most feasible, and to calculate direct and indirect cost impacts on utility customers.

The AG notes that projects like those in Whisper Valley Texas and Asheville North Carolina suggest that thermal energy networks with new development projects may be preferrable as these would not include the high costs that result from retiring and replacing existing natural gas networks and heating systems, and with retrofitting existing homes and buildings.

The AG notes that gas and electric utilities that are not combined gas and electric utilities may face data reporting and data sharing issues, as well as conflicts of interest, with respect to thermal energy network projects.

With respect to rate structures, the AG says that data is currently unavailable or incomplete given that few, if any, pilot projects are off-the-ground. The AG does point to several principles adopted by New York's Public Utility Commission and referenced in the NYSERDA report. These include (1) separation of utilities from generation assets, with partnerships between a utility and third-party service provider; (2) providing economic value for customers, the utility, and third-party service providers; (3) a competitive market in which a utility only acts as the service provider in exceptional circumstances, such as when a market remains unwilling to provide services on commercially acceptable terms, or to enable low- and middle-income customers to receive the benefits of DERs; (4) if demonstration projects are initially uneconomic, rules should promote the development of competitive markets; and (5) demonstrations should inform pricing and rate design modifications. The AG further points to the NYSERDA report recommendation that consumers remain free to choose to install their own household system because this imposes market discipline on utility geothermal providers and that any subsidization of utility geothermal consumers should only be justified after costs are reduced to the point these systems are economic, taking externalities into account, and then adopted on a targeted basis.

The AG references that the geothermal energy (or ground-source heat pump) market is currently receives subsidization through various tax benefits and grants at the federal, state/utility, and local level. For example, the AG notes that the Inflation Reduction Act increased the geothermal federal tax credit for residential installations from 26% to 30% until 2032. Ameren Illinois and Commonwealth Edison , as noted by the AG, offer heating and cooling rebates for ground-source heat pumps of $500 per ton (up to $25,000), and $1,500 per ton (up to $9,000). The AG advises that, while financial incentives can promote the deployment of thermal energy networks or other geothermal heat and cooling projects, the total cost of implementation is a key factor in assessing the most appropriate way to develop a market for such systems.

VI. Comments in Anticipation of Workshop #5

Prior to workshop #5, workshop participants were asked to submit comments on the appropriate ownership, market, and rate structures for thermal energy networks and whether the provision of thermal energy services by thermal network energy providers is in the public interest. The following summarizes this second round of written comments.

A. Ameren Illinois

Ameren recommends that its existing natural gas system infrastructure and experience building and operating underground electric distribution networks should be leveraged when designing thermal energy networks. Ameren states that the natural gas distribution system provides a reliable and affordable backup energy source to other energy systems. Ameren points to the six Commission-approved energy efficiency plans it has designed and implemented and states that these programs have delivered meaningful value to its customers. Ameren can, it says, draw on its proven track record of designing and building infrastructure, and its track record of designing and implementing customer-facing programs in coordination with a host of third parties in the development of any thermal energy network.

Stakeholders must, according to Ameren, share and exchange thermal energy network data in ways that foster collaboration and creative solutions in order for thermal energy pilot projects to be successful. Stakeholders will need to work to develop common understandings during the early stages of a pilot program development – and to the extent possible – define criteria under which the pilot program should be evaluated. Analysis on the impact of a thermal energy network on jobs will necessarily include input from local unions and stakeholders with job training experience. Analysis on the impact of thermal energy networks on reliability will necessarily include input and lessons learned from jurisdictions that have existing thermal energy networks. Analysis on the impact of a thermal energy work on affordability will necessarily include input from existing utilities, among other parties, since the buildout of an energy system can have a sizable cost impact on customers. Ameren Illinois believes that a thermal energy network pilot should aim to include program impacts on low and moderate income customers to assist with a goal of equitable and affordable building electrification.

B. Commonwealth Edison

ComEd has, it says, deep experience in the implementation of energy efficiency programs and specifically, along with partners at State and local levels, in the delivery of comprehensive retrofits to low- and moderate-income customers. A large body of building science research, ComEd states, has established the importance of approaching homes with a whole-building approach, which considers the building as an energy system with interdependent parts, each of which affects the performance of the entire system. ComEd recommends any demonstration project lay a foundation for success by first identifying and implementing appropriate building shell improvements (i.e., weatherization measures) as well as health & safety upgrades (common upgrades include roof repair, mold remediation, moisture mitigation, etc.). Doing so will reduce overall building heating and cooling loads, potentially allowing the entire thermal system to be size-optimized, and allowing most buildings to reduce upfront costs by optimizing required heat pump equipment. It may allow many ground source heat pump systems to provide buildings with 100% heating capacity even in extreme cold weather, eliminating the need for supplementary backup heating. Eliminating backup heating makes full building electrification possible, significantly reduces costs, protects customers from occasional bill spikes during extreme weather, and provides significant yet-to-be-quantified benefits to the electric grid. The whole-building approach has, says ComEd, the added benefit of dramatically improving occupant comfort and enhancing thermal resiliency in the case of extreme weather or a power outage.

The costs and barriers to implementing widespread weatherization are well known, says ComEd, but with long-running, robust State, local and utility-administered retrofit programs already in place Illinois is positioned to tackle the challenge. ComEd says the relatively high costs of heat pumps and other necessary upgrades will impede the pace and scalability of efficient electrification unless creative approaches are implemented in a widespread manner.

The thermal energy network concept is, states ComEd, inherently equity-centric if deployed in communities with high densities of low and moderate income customers as it reduces barriers to entry for homes that may not have otherwise been served through first-come, first-served-style program efforts focused on individual homes. It provides the opportunity for creative models of ownership including thoughtful approaches to local or community ownership. ComEd says a whole-block approach to geothermal resources combined with forthcoming incentives made available via the Inflation Reduction Act (which provide meaningful rebates for the full range of home electrification needs), plus the program administration experience and resources of utilities and State and local agencies, would be a powerful combination for scaling full home electrification retrofits.

C. Indiana, Illinois, and Iowa Foundation for Fair Contracting

The significance of thermal energy network projects in promoting climate justice, emissions reductions, and societal benefits becomes evident, says III FFC, when considering the inherent efficiency of these networks. By efficiently utilizing and exchanging thermal energy from diverse underground sources and buildings, these projects effectively minimize their impact on the electricity grid. The application of thermal energy networks not only enhances efficiency, says III FFC, but extends benefits to both participants and non-participants. This results in societal advantages, positively affecting the environment, and generating market benefits tied to the reduction of electricity and natural gas volume, as well as peak demand. Aligning with the state's interests, as outlined in the Public Utilities Act, these projects contribute to the efficient and reliable delivery of energy and safeguarding the state's energy infrastructure.

III FFC says that it is crucial to acknowledge utility corporations and other power suppliers duty to protect ratepayer resources invested in these projects. III FFC says this can be accomplished through establishing effective contractor qualification and performance standards, encompassing prevailing wage rates, bona fide apprenticeship criteria, and project labor agreements.

It is stated by III FFC, that the complexity of constructing thermal energy networks stems from the highly skilled and complex work of the construction industry. Establishing robust qualification standards for craft labor personnel becomes paramount to ensure the successful delivery of projects. This becomes particularly critical, notes III FFC, when considering the widespread skill shortages prevalent across the country. The construction of thermal energy networks aligns with the skill sets of the existing utility and building trades workforces, says III FFC, and this not only mitigates potential challenges posed by skill shortages but holds the potential for substantial job creation and retention within thermal energy networks and across a diverse spectrum of other construction projects. The integration of thermal energy networks into construction projects, supported by solid qualification and performance standards, addresses immediate skill-related challenges and contributes significantly to the overall sustainability and growth of the construction industry.

III FFC emphasizes the importance of a pilot program to assess the feasibility of these networks, particularly when integrating networks into existing building structures. It further emphasizes that inclusion of low and moderate-income housing in these projects is crucial in order to foster inclusivity.

D. Northern Illinois Gas Company

Nicor states that development of thermal energy networks in conjunction with other state, utility, and locally supported energy efficiency programs can maximize value and support cost savings. Weatherization programs can lower the overall energy demand for heating and cooling buildings making thermal energy networks less expensive to develop. Hybrid systems that integrate thermal energy networks with variable renewable energy resources can reduce the burden on the energy grid (both gas and electric), bolstering system reliability and resiliency. All of this can be facilitated through public-private partnerships that promote education, outreach, and workforce development.

Nicor recommends that thermal energy networks should use project designs that integrate with other utility and government initiatives and that project designs should incorporate and consider:

- Ensuring that buildings connected to the thermal energy network are highly energy efficient will lower the costs and improve the operating efficiency of the thermal network. For example, ensuring that houses connected to a residential network are weatherized and using other measures to lower heating and cooling loads (e.g., smart thermostats) will reduce the capacity of the thermal network and reduce its required investment. Weatherization will ensure that the households and businesses relying on the thermal network for space conditioning are more comfortable and satisfied with thermal network services.

- Ensuring that there is a sufficiently trained workforce for the thermal energy network will improve the delivery of this new service. Businesses and workers required to deliver thermal networks include, but are not limited to: 1) specialty drilling services for geothermal loops; 2) specialized HVAC technicians to design and install geothermal heat pump systems; 3) weatherization and other contractors to improve the efficiency of the building stock; 4) engineering and design professionals; and 5) program and project management professionals.

- The thermal network offering should be integrated with existing energy efficiency programs providing weatherization and other measures to low-income residential customers. These programs are currently offered through a successful partnership of Illinois utilities and the Department of Commerce and Economic Opportunity (DCEO). DCEO, in turn, deploys a combination of state and federal government funding. Utility programs are working with the Illinois EPA to coordinate utility program delivery with expanded funding for low- and moderate-income customers now available from the Inflation Reduction Act. These low-income programs primarily deliver weatherization services, but deliver low-cost measures (e.g., thermostats, low flow showerheads), as well as HVAC and appliance upgrades for customers with faulty equipment.

- The thermal network offering should be integrated with non-low-income programs serving other residential and business customers. These programs are currently offered through Illinois natural gas and electric utilities. These programs deliver weatherization, energy efficient equipment, boiler system upgrades in multifamily housing, low-cost thermostats and showerheads, and many other measures. The utility programs leverage federal tax credits that are already available for residential and commercial customers and utilities are working with the Illinois EPA to coordinate utility program delivery with expanded funding targeting non-low income customers now available from the Inflation Reduction Act.

- The thermal network offering should be integrated with the new demand response offerings being developed by Nicor Gas. Nicor Gas is developing a pilot program that leverages hybrid heating technologies and smart thermostats to provide peak demand savings. Integrating these technologies into the thermal network will further lower network capacity levels and correspondingly lower costs further.

- The thermal network offering should be integrated with existing utility and state workforce development programs. Utility programs work to increase both the number of businesses and workers available to meet the increasing demand for energy efficiency services. The utility programs focus their efforts in underserved communities to ensure that all communities served by the utility will have an opportunity to benefit from jobs and businesses created in the energy transition. The utility programs integrate with existing state and federal workforce programs.

- Funding for thermal networks should be clearly defined, similar to how budgets are defined for utility energy efficiency programs pursuant to the Illinois Public Utilities Act ("PUA"). For example, the PUA limits natural gas utility energy efficiency spending to 2% of total revenues. The Commission should determine if budgets for energy efficiency programs serving thermal network customers should come out of these existing budgets, or if new funding should be allocated to specialty energy efficiency services serving the thermal networks.

Nicor says that thermal energy networks are among technologies that could positively impact disadvantaged communities through increasing access to clean energy and clean energy jobs. Geothermal heat pumps can reduce energy consumption up to 44% when compared to air-sourced heat pumps and up to 72% when compared to electric resistance heating with standard air conditioning equipment. The higher energy efficiency of geothermal heat pumps and the inherent reliability of underground geothermal energy can reduce emissions and decrease the burden on the existing energy grid (electric and gas). Affordability (reducing energy poverty) is a pillar of energy equity, and better understanding cost-effectiveness and the scale of adoption required to make system maintenance and operations affordable is important in order to understand if and how the projects further energy justice.

In general, Nicor says, incorporating geothermal infrastructure as part of the planning and initiation of new construction will be more cost-effective than retrofitting premises due to changes needed to modify the existing premises and infrastructure. The capital cost associated with the installation of a thermal energy network is higher than the cost to connect end use applications such as the air-sourced heat pumps to the electric grid, putting upward pressure on the electric grid's costs. However, thermal energy networks enable end-use applications such as geothermal heat pumps, which are more energy efficient than the conventional systems for heating and cooling of buildings. This can lower the lifecycle costs of the thermal energy systems making it affordable for low- and moderate-income households. Therefore, it is critical to perform lifecycle cost analyses to determine the equitability and affordability of the thermal energy systems for customers.

VII. Comments in Anticipation of Workshop #6

Prior to workshop #6, participants were asked to submit comments on the appropriate ownership, market, and rate structures for thermal energy networks and whether the provision of thermal energy services by thermal network energy providers is in the public interest. The following summarizes this third round of written comments.

A. Climate Jobs Illinois

Climate Jobs Illinois says that the work required to decarbonize buildings can and must center on the existing, expertly trained, and unionized utility workforce, guard the state’s interests in reliable electrical power, and protect the state’s proprietary interest in promoting efficient projects to deliver renewable energy.

Climate Jobs Illinois says relying on the knowledge, experience, and expertise of the existing utility union workforce will ensure thermal energy network projects are affordable and accessible. The utility and building trades unionized workforce, asserts Climate Jobs Illinois, possess many of the same skills that will be used in the construction of thermal energy networks. This existing workforce can help the transition of workers to thermal energy networks and alleviate training by building on a workforce with an already-developed, necessary skill set. Climate Jobs Illinois recommends projects be required to hire for these positions from a priority pool consisting of transitioning utility workers who have lost, or are at risk of losing, their employment with a utility that is downsizing its gas transmission and distribution system. The Illinois Department of Labor should, Climate Jobs Illinois further recommends, be required to maintain such a list, updated and provided to gas, electric, or combination gas and electric corporations 90 days prior to the purchase, acquisition or construction of any thermal energy network.

Climate Jobs Illinois states that contractor qualification and performance standards should be established, including requirements for prevailing wage rates, bona fide apprenticeship criteria, promoting the use of pre-apprenticeship programs with systematic outreach efforts to recruit and assist persons from underrepresented and low income communities, and the utilization of project labor agreements in construction.

The State should, says Climate Jobs Illinois, safeguard its proprietary interest in the efficient and reliable ongoing delivery of energy and maintenance of the energy infrastructure of the State as reflected in the Illinois Public Utilities Act. This goal can be facilitated asserts Climate Jobs Illinois, by requiring that covered projects utilize labor peace agreements. Climate Jobs Illinois recommends that contractors and subcontractors developing thermal energy networks with public funds should be required to demonstrate that the gas, electric or combination gas and electric corporation developing the project has entered into a labor peace agreement with a bona fide labor organization of jurisdiction that is actively engaged in representing or seeking to represent gas, electric, and combination gas and electric corporation workers– including with respect to employees engaged in the maintenance and operation of such thermal energy networks.

B. Indiana, Illinois, and Iowa Foundation for Fair Contracting

III FFC says that the construction of thermal energy networks aligns with the skill sets of the existing utility and building trades workforces. This alignment not only mitigates potential challenges posed by skill shortages but holds the potential for substantial job creation and retention within thermal energy networks and across a diverse spectrum of other construction projects. The integration of thermal energy networks into construction projects that are supported by labor qualifications and training standards, III FFC asserts, addresses immediate skill-related challenges and contributes significantly to the overall sustainability and growth of the construction industry. III FFC recommends prioritizing the hiring of transitioning utility workers who may face job loss due to downsizing in gas transmission and distribution systems. This approach ensures a skilled workforce ready to contribute to the development and maintenance of thermal energy networks.

III FFC advocates for the implementation of project labor agreements in publicly funded projects, providing an added layer of support to facilitate the transition of workers and uphold the State's proprietary interest in the seamless and uninterrupted delivery of energy through thermal energy networks. These agreements, says III FFC, encompass various essential elements, including requirements for prevailing wage rates, bona fide apprenticeship criteria, promotion of pre-apprenticeship programs, and systematic outreach efforts targeting the recruitment and assistance of individuals from underrepresented and low-income communities. The utilization of project labor agreements in construction, asserts III FFC, contributes significantly to fostering a stable working environment, thereby ensuring the continual success of these pivotal projects.

C. Northern Illinois Gas Company

Nicor says that the construction of thermal energy networks aligns with the skill sets of the existing utility and building trades workforces and that natural gas utilities are in a unique position to train their personnel to work on thermal energy networks. Natural gas employees, Nicor states, are highly skilled and possess many of the necessary skills required for thermal energy network installation, such as drilling and underground pipe installation. Natural gas utilities, says Nicor, have extensive experience with workforce development, training employees to safely install and maintain utility scale systems and the new thermal energy skillset can be integrated into this workforce development. Nicor notes that natural gas utilities operate under strict safety standards which will be incorporated into the thermal energy network training. Natural gas utilities have relationships with the union workforce, local businesses, and communities, which will play an important role in the thermal energy network installation process.

VIII. Final Stakeholder Comments and Recommendations

Workshop participants were asked to submit any final comments including proposed recommendations following the workshops. The following summarizes this final round of written comments.

A. Advanced Energy United

Advanced Energy United (AEU) states that the decarbonization of buildings is one of the most challenging technological advancements currently being faced. They find that thermal energy networks are an attractive means to eliminate fossil fuel use for heating and cooling of buildings, without a need for duplicative gas systems, in order to further climate justice, emissions reductions, and benefits to utility customers and society at large, especially related to public health and affordability.

Advanced Energy United believes that with intentional regulatory structure and system design, thermal energy networks will likely increase affordability of building heating and cooling while also improving air quality from the elimination of burned fossil fuels for building climate control. While AEU does not support the inclusion of duplicative gas systems within thermal energy network systems, they understand that immediate replacement of all gas end-uses within the buildings of a thermal energy networks may not be possible upon construction and accept sustaining such gas service for so long as there is no further investment made into the infrastructure of the gas system unless for emergencies.

It is further inferred by AEU, that the industry leading efficiencies of geothermal heat pumps are proven, especially within networked thermal energy systems, and the resultant energy savings make geothermal heat pumps valuable tools in achieving economic and environmental justice for underserved communities.

Addressing concerns with current pipeline fuels used, Advanced Energy United expresses their concerns with the abilities of gas utilities to transition into a clean energy business and advocates that proposed developments for thermal energy networks in Illinois should not be limited to utilities but should rather allow for a more competitive process by allowing proposals from different ownership types. They state that pilot programs in Illinois are not necessary for proving the technology or benefits of thermal energy networks but are instead necessary for determining which ownership structure and business model will provide customers with the most affordable service.

Advanced Energy United concludes by recommending the expeditious deployment of such projects while federal incentives are available, and emphasizes that selected projects should promote energy justice, create good jobs, provide scalability, generate good data, and do no harm to non-participating customers in addition to promoting affordability of service.

B. Ameren

In its final comments, Ameren Illinois expresses their gratitude for the robust discussion and emphasizes continued dialogue on the topic.

Ameren maintains its advocacy for utility ownership and operation of thermal energy networks, citing its extensive experience in operating electric and natural gas distribution systems. Ameren suggests leveraging existing utility infrastructure to make thermal energy network development more efficient and cost-effective, while also highlighting the importance of collaboration with stakeholders in developing equitable rate structures. While acknowledging the need for legislative and administrative action to establish a regulatory framework for large-scale thermal energy networks, Ameren proposes itself as a prime candidate to helm a pilot program due to its experience as an electric and natural gas utility.

Ameren concludes by reaffirming its commitment to work with stakeholders to develop a framework for thermal energy networks that provide safe, reliable, and cost-effective energy to customers.

C. Commonwealth Edison Company

In final comments provided by the Commonwealth Edison Company (ComEd), they emphasize the importance of minimizing electric delivery and service costs, and highlight potential roles and support they could offer to thermal energy network pilot programs developed in their service territory. ComEd provides that with their experience and resources they could offer support for facility-focused resiliency studies and deployment of weatherization and home electrification initiatives for program participants, and take on leadership roles in some aspects of the pilot investigation.

ComEd suggests that partnerships for funding or non-financial support from existing programs and initiatives should be considered with thermal energy network pilot programs to mitigate the substantial costs of certain aspects of system development like weatherization and building electrification. ComEd shares several examples of costs allocated to the weatherization programs of relevant projects aimed at low-income customers.

In their discussion of candidate sites selection and prioritization, ComEd advocates for building diversity within selected pilot programs and emphasizes the need to ensure that customers are not subjected to burdensome infrastructure risk, with additional consideration taken for financially vulnerable customers. ComEd suggests for the careful analysis of how the operation and ownership of thermal energy network infrastructure might affect the outcome and costs to ensure that customers will be best served by the new infrastructure.

ComEd concludes by stressing the importance of comprehension of future energy cost dynamics in order to identify opportunities that will bolster investment justification for piloting thermal energy networks.

D. Geothermal Exchange Organization

The Geothermal Exchange Organization (GeoExchange) emphasizes the efficiency of geothermal heat pumps (GHPs) and says that thermal energy networks provide an opportunity for wide scale deployment of GHPs to benefit all Illinoisians. GeoExchange asserts that utility ownership of thermal energy networks has the potential to drive the transition to clean heating and cooling and says that state governed oversight is essential to ensure the reliability and affordability of thermal energy network service. GeoExhange commends the Illinois Commerce Commission (ICC) for their efforts and informative workshop process to discuss the potential of geothermal heat pumps (GHPs) use within Illinois and states its willingness to assist in further efforts of developing thermal energy network policies and procedures.

E. Geoff Bares

Mr. Bares says that the provision of thermal energy networks is in the public interest for purposes of driving reliability, carbon reduction, and technology uptake which must be taken into consideration when acknowledging the upfront, capital intensive costs of system implementation. He states that it is difficult to support a compelling need for defined ownership at the state level but provides support for municipal or local scale ownership due to inefficiencies with long distance transmission of thermal energy – inefficiencies that received little attention in the workshops. In further discussion of developing small scale thermal energy networks, Mr. Bares says that market competition would be in the form of self-generation and states that within a single geographic area, the market and public right-of-way would not typically be able to support competing thermal utilities. He believes that rate structures would be similar to those already established with other utilities and emphasizes the importance of cost transparency with customers.

Mr. Bares asserts that defined project designs are not necessary for estimating applicable federal funding opportunities as many of the core technologies utilized within thermal energy networks can qualify for funding and he cautions the establishment of a comprehensive thermal energy network project design as local conditions often dictate the design and application of thermal energy network systems.

In stating that thermal energy networks do promote further climate justice and emissions and benefits to utility customers and society at large, Mr. Bares says thermal energy networks have been proven to reduce emissions and provide collective carbon reduction through energy exchange and recovery technologies that would not be practical for an individual home or business to implement. Mr. Bares affirms that thermal energy networks benefit the health of the public by improving air quality through the removal or reduction of gas burning appliances.

F. International Association of Plumbing and Mechanical Officials (IAPMO) – Hydronics Industry Alliance (HIA-C)

The Hydronics Industry Alliance (HIA-C), a committee organized under the International Association of Plumbing and Mechanical Officials (IAPMO) group, opens their comments by providing a background of their organization and involvement in developing nationally recognized provisions for the creation, education, testing, and development of geothermal and hydronic technologies. Noted involvement by the committee includes the Uniform Mechanical Code (UMC) and Uniform Solar Hydronics, and Geothermal Code (USHGC) accredited under the American National Standards Institute (ANSI). HIA-C identifies chapters that are specific to geothermal energy systems and ambient loop systems and strongly recommends the integration of these established standards and codes for successful rollout of thermal energy networks. The committee believes the utilization of these specified codes will provide confidence to the statewide effort of developing thermal energy networks and can significantly contribute to the objectives given in the thermal energy network forums. In closing, HIA-C emphasizes the importance of utilizing and referencing its guidance with planning and execution efforts related to geothermal energy systems and advocates for the incorporation of their expertise in thermal energy network initiatives.

G. Indiana, Illinois, and Iowa Foundation for Fair Contracting (III FFC)

In its final comments, the Indiana, Illinois, and Iowa Foundation for Fair Contracting (III FFC) organization reiterates its commitment to advocating for the integration of thermal energy networks and emphasizes the importance of developing plans that strikes a balance which encourages investments while protecting consumers interests. The group further emphasizes the importance of comprehensive pilot programs to address the diversity of variables related to changing weather conditions and characteristics of existing infrastructure across the state of Illinois. In recognizing the multifaceted nature of variables that affect the ultimate greenhouse gas reduction with thermal energy networks, III FFC says that continued analysis of pilot programs is of critical importance for assessment of real-world implications and allows for modifications to be implemented to ensure optimal benefits for the community and environment. III FFC asserts that with pilot programs, the thorough evaluation into the feasibility of integrating thermal energy networks serves a proactive means to assess and resolve the challenges associated with Illinois climate and aging infrastructure. Therefore, enabling relevant deciding bodies and stakeholders to make informed decisions related to the implementation of thermal energy networks.

In its provided discussion surrounding labor standards, III FFC advocates for aligning utility and building trades workforces' skill sets with thermal energy network construction to mitigate skill shortages and create jobs. It proposes prioritized hiring of utility workers facing potential job loss due to the transition to thermal energy networks and states its strong support for project labor agreements in publicly funded projects to ensure a smooth workforce transition and project success.

The III FFC concludes their comments by underlining its belief for transparent and fair rate structures, and states that the inclusion of low and moderate-income housing in network projects is crucial to fostering inclusivity and addressing broader societal challenges.

H. Illinois PIRG Education Fund

The Illinois PIRG Education Fund (PIRG) says that thermal energy networks should continue to be explored through the development of pilot programs which analyze both the implementation within new developments and retrofitting networks into existing infrastructure. It states that while new development projects would be more cost effective, it is of critical interest to consider the viability of integrating thermal energy networks into existing infrastructure with gas service and advocates for the implementation of pilot programs which focus on retrofitting to better assess the scalability and cost of such. PIRG states that the opportunity to deploy pilot programs should not be limited to just existing utilities and alternative ownership models should be explored alongside utility ownership. PIRG states that although existing utilities, especially those providing gas services, are vested in the continuation of gas services, it believes that when implementation of thermal energy networks are developed with the inclusion of weatherization and building efficiency improvements then a backup heat source will not be needed. PIRG asserts that inclusion of a backup service to provide heat will diminish emission reductions possible, while adding unnecessary costs to the customers.

PIRG says the transition of gas service to thermal energy networks should be approached at a neighborhood and community level. PIRG asserts that this approach will lower the total cost to complete the clean energy transition and therefore will avoid severe rate hikes and ensures reliable service while benefiting from the transition to clean energy.

Due to the significant costs of implementing thermal energy networks, PIRG states that alternative approaches should be considered carefully. PIRG says notable consideration should be given towards the benefits of building decarbonization, global emission reduction, customer affordability and health while taking into account subsidization from state and federal programs and funds.

I. Prairie Research Institute - University of Illinois

In comments provided by Dr. Andrew Stumpf, PhD, a principal research scientist at the Prairie Research Institute (PRI) located within the University of Illinois Urbana-Champaign (U of I), he shares his expertise regarding the geoscience and geoengineering aspects of technologies applicable to thermal energy networks. He states that he is working on multiple, ongoing research projects to characterize the affects that underground geological conditions have on the design and efficiency of geothermal energy systems.

Dr. Stumpf explains that real-time data is collected from active projects deployed within the U of I campus, which makes the gathered information particularly valuable to the implementation of community or district thermal energy networks within Illinois. He says having baseline data from these projects has been shown to reduce installation costs by applying the most suitable technology to the thermal energy network.

He describes relevant research projects conducted by PRI over its long-established history of over 50 years and shares that current research, occurring over the last decade, is focused on how groundwater flow impacts the design and operation of geothermal energy systems.

Dr. Stumpf provides a non-exhaustive list of various geothermal technologies that could be utilized within community or district scale geothermal networks with detailed background discussion of each technology and how they might be implemented within Illinois networks. He explains the suitability of utilizing technologies like geo-exchange, open loop systems, deep direct-use geothermal, and borehole thermal energy storage (with repurposed abandoned oil and gas wells) and says that climate and geological conditions found within the Midwest make it ideal for the development of geothermal systems.

He concludes by stating PRI's willingness to provide further technical assistance with developing regulatory structures for utility thermal energy networks in Illinois.

J. Nicor Gas Company

In its final comments, Nicor Gas Company (Nicor) reiterates its belief that gas utilities are best suited for ownership and operation of thermal energy networks. Nicor states that utilities possess the necessary experience and expertise to manage large utility networks effectively. Nicor asserts that defined ownership of tangible assets related to the operation of a TEN should be similar to existing gas utilities, and advocates for utility ownership of the distribution assets and customer ownership of the end-use equipment and appliances.

Nicor says that recovery of capital-intensive costs associated with the implementation and operation of thermal energy networks can be done through a similar rate mechanism used with regulated gas pipelines, ensuring balanced risk distribution across a larger user base.

In its discussion of TEN workforce development and training, Nicor highlights its experience with developing a well-trained and skilled workforce to safely install and maintain utility-scaled gas systems. Nicor states that the overlap of skillsets and safety standards allows for the integration of thermal energy skillset into existing workforce development programs established by the utility. Nicor further states that relationships between gas utilities and local businesses, communities, and labor groups will have an important role in the deployment of networks.

Emphasizing the importance of weatherization programs, Nicor says the integration of state, local, and utility supported energy efficiency programs with the development of thermal energy networks can maximize value and support cost savings. Affordability, Nicor says, is a pillar of energy equity, and understanding the scalability of potential, realized cost savings is important for furthering energy justice. Nicor envisions that disadvantaged communities will benefit from the deployment of thermal energy networks through increased access to clean energy and associated jobs. Societal benefits, Nicor says, will be additionally realized from reduced emissions and decreased energy consumption.

For the reasons provided in their final comments, Nicor urges that any recommendations resulting from the workshops should not exclude utilities from providing thermal energy network services in the future.

K. The People of the State of Illinois – Attorney General's Office (AG)

With full consideration of all material presented throughout the six workshops, the AG states that a comprehensive, longer-term planning process is the necessary next step to evaluate the potential for thermal energy network (TEN) development in Illinois and is essential for adequately addressing the outstanding complex and critical questions surrounding prospective TEN development in Illinois.

The AG says that although the workshops generated good dialogue, with open and inclusive discussion, significant information gaps were exposed by fundamental questions left unanswered, and the workshops were insufficient to meaningfully, comprehensively, and critically address the five statutory objectives intended to "promote the successful planning and delivery of thermal energy networks…" in Illinois. 220 ILCS 5/4-610(d)(1)-(5).

In further concern, presentations on the utility TEN pilot programs at various stages of development in Massachusetts and New York revealed the high cost of these programs that raises additional questions of affordability, equity, and cost-causation principles, says the AG. It is the assertion of the AG, that the high costs and related ratepayer funding of these pilot programs conflict with Illinois General Assembly's stated intent to "protect utility customers" and "…decarbonize in a manner that is affordable and accessible…" *Id.* at 4-610(a)(1). Even further, says the AG, complicated and often overlapping technical, financial, tax, and legal questions related to ownership, rate structuring, and prospective federal funding were revealed throughout the workshop process.

Even with the noted insufficiencies, the AG states that the short, two-month workshop series provided a helpful, preliminary first step for stakeholders and policymakers to begin assessing the questions raised in greater detail. Given this preliminary status, the AG recommends for a longer-term comprehensive planning process for further comprehensive evaluation of the potential of TEN development in Illinois to ensure that the development reasonably achieves decarbonization in manner that offers affordability, accessibility, and protection to utility customers consistent with current Illinois regulatory law.

In its discussion for a longer-term comprehensive planning process of TEN development in Illinois, the AG elaborates upon three primary supporting matters. In details provided, the AG highlights the potential of pilot programs to generate comprehensive data to answer the many unanswered or unaddressed fundamental questions raised, with concurrent assessment of the costs and benefits of TEN implementation. In its second case made, the AG says that forthcoming data from other states' pilot programs is likely to help Illinois address many of the outstanding, complex, and critical questions identified, and this data should be thoroughly analyzed for purposes of efficient TEN deployment in Illinois. Last, the AG says, that further analysis is necessary for comprehensive assessment of the potential of utility TEN development.

L. Peoples Gas Light and Coke Company and North Shore Gas Company

Peoples Gas, Light and Coke Company (PGL) and North Shore Gas (NS) recognizes the efforts made to engage with stakeholders in discussion of thermal energy networks in Illinois and says that recommendations produced from the workshop process have the potential to affect the decarbonization of buildings, the health and welfare of Illinois citizens, the environment, and skilled labor in the State including that within PGL-NS.

In their final comments, PGL-NS reiterates their position on system ownership structure, stating that public utilities are best suited to own and operate these types of networks due to their access to capital, experience, safety protocols, and workforce. PGL-NS asserts that similar sentiments for such ownership structure were echoed by other parties involved with the workshop process and that public utility ownership appears to be a clear choice of ownership for other states with TEN projects currently being deployed or investigated.

In further support for a public utility ownership structure, PGL-NS states that is it beneficial to have a single point of contact for ongoing maintenance or repairs to the network, along with simplifying coordination efforts for public improvements projects and relocation work. In addition, PGL-NS says that customers would not be burdened with the concern of whether a non-utility entity is financially sound to address potential major repairs or projects if needed.

PGL-NS acknowledges that thermal energy networks in Illinois have historically been owned and operated by non-utility entities and contends that this past ownership model should not be definitive of the appropriate ownership structure for this new legislative directive. PGL-NS asserts that, although the workshop participants did not come to a consensus on the topic of ownership structure, it is the belief of PGL-NS that current law can be interpreted to denote that public utilities are the only entities allowed to provide public service as authorized under the Illinois Public Utilities Act. As such, PGL-NS continues to recommend that public utilities are best suited for ownership of thermal energy networks and asserts that if other entities should be allowed ownership, then statutory clarification with regards to the provision of public service through a TEN will be necessary. Nevertheless, PGL-NS states that public utilities should not be excluded from ownership of thermal energy networks.

Throughout their discussion of market and rate structures, PGL-NS continues to advocate for public utility ownership and operation of thermal energy networks within Illinois. PGL-NS states that with public utility ownership, existing market structures, rules and regulations, and other regulatory directives and provisions in place would be applicable and otherwise should be relied upon for shaping the regulatory deployment of thermal energy networks in Illinois. Similarly, PGL-NS says the applied rate mechanism for widespread deployment of thermal energy networks under public utility ownership should be consistent with the way public utility rates are set in Illinois and industry practice as authored by the National Association of Regulatory Commissioners.

With continued emphasis on the importance of well-defined ownership, market, and rate structures, PGL-NS recommends utilizing pilot programs to evaluate the best means for thermal energy networks deployment. Pilot programs, PGL-NS says, offer a measured approach to analyzing the development of thermal energy networks and its resultant benefits.

They propose that the development of thermal energy networks should leverage existing energy efficiency and workforce development programs, along with existing infrastructure to maximize the value of integration and promote environmental justice. PGL-NS states their general support of various project designs and features recommended by Nicor Gas and highlights outlined concepts related to weatherization programs, workforce development, service affordability, funding programs, and job creation.

PGL-NS concludes their comments by stating their support for the transition of utility personnel to work on thermal energy network projects and expresses their readiness to collaborate further on thermal energy networks development with the State and other stakeholders.

IX. Recommendations

It is apparent from the feedback received from stakeholders during this thermal energy network workshop process that there is a diversity of views regarding if and how Illinois policy makers should foster and/or regulate the deployment of thermal energy networks in Illinois.

As noted above, Public Act 103-0580 directed this stakeholder process to examine several objectives. First, participants were to determine appropriate ownership, market, and rate structures for thermal energy networks and whether the provision of thermal energy services by thermal network energy providers is in the public interest. With respect to ownership, there was a vast divide in views. The Accelerate Group asserts that it is not necessarily the case that investor-owned utilities are beneficial to such projects, citing the adverse tax consequences and the benefits to communities from local ownership. On the other end of the spectrum, Nicor says, the thermal energy production and distribution assets should be owned and operated by public and private utilities because the risks associated with the installation of the external networks can be mitigated if they are installed and managed by public and private utilities, which have the experience and expertise to manage the safety, operational, workforce development, community engagement and financial aspects of large utility networks.

With respect to market structures, Nicholas Fry recommends that providers should, at least early in the development of the market, not be overburdened with regulation and that they should be allowed to fail to improve long term learning. NS-PGL advises that the various provisions of the Public Utilities Act that govern public utilities, gas utilities, and electric utilities could apply with equal force to thermal energy network providers and that the long-standing regulatory regimes that apply to regulated public utilities in Illinois can help shape the deployment of thermal energy networks in Illinois.

Eversource is currently piloting a project where thermal energy network costs are recovered through natural gas service rates. NS-PGL recommends that rates should be set consistent with the manner in which gas and water rates are set in Illinois and consistent with industry practice for regulated public utilities as outlined in the manuals and guidelines authored by the National Association of Regulatory Commissioners. The AG cautions that ensuring consumer affordability and accessibility should stay at the forefront of developing any potential thermal energy network initiative and that given current utility bill affordability issues, it is important to avoid imposition of more costs on customers to fund thermal energy networks. Beyond such cross subsidization issues current pilot projects may provide some insight into the efficacy of various rate structures. For example, Eversource is considering recovery of thermal energy network costs through flat monthly charges.

One area that Stakeholders appeared to generally agree upon is that that there will be some circumstances in which deployment of thermal energy networks are in the public interest. For example, III FFC states that thermal energy networks are highly efficient and minimize impacts on the grid and, therefore, a well-regulated industry will contribute positively to the public interest. BIG states says these projects promise to provide the relief to these low-and moderate-income households the existing, legislation, regulations and business models have failed to provide. What is clear, however, as the various pilots and other projects included in this report show is that when, where, and what types of thermal energy projects are in the public interest is driven by numerous factors including, but not limited to, local geography, building density, the building stock use (e.g., for residential housing versus data centers), building stock age, and the state of repair of the building stock.

The second area Public Act 103-0580 directed this stakeholder process to examine is to consider project designs that could maximize the value of existing State energy efficiency and weatherization programs and maximize federal funding opportunities to the extent practicable. Input in this area was somewhat limited, with general agreement that projects should take advantage of such opportunities whenever possible. The Accelerate Group did offer several ideas for fully leveraging tax credits and certainly the BIG-led Sustainable Square Mile project in Chicago serves as an example of how federal funding can be used to demonstrate thermal energy network projects.

The third area Public Act 103-0580 directed this stakeholder process to determine whether thermal energy network projects further climate justice and emissions reductions and benefits to utility customers and society at large, including but not limited to public health benefits in areas with disproportionate environmental burdens, job retention and creation, reliability, and increased affordability of renewable thermal energy options. With respect to these questions, there again appears to be consensus that there instances when thermal network energy projects can be expected to further benefits to utility customers and society at large. The Sustainable Square Mile project promises, in particular, to provide insight into how thermal energy network projects can benefit a disadvantaged section of the city's south side. Pilot projects like that being conducted by Eversource promise to provide insight into if and how thermal energy network projects can benefit existing utility customers.

The fourth area Public Act 103-0580 directed this stakeholder process to examine is financial and technical approaches to equitable and affordable building electrification, including access to thermal energy network benefits by low- and moderate-income households. As explained above, diverse views were expressed on approaches to deployment of thermal energy networks from recommendations to allow the thermal energy network market to develop without intervention to recommendations that thermal energy networks in essence be classified as public utility infrastructure -- permitting the cross subsidization between utility service and thermal energy network service.

The final area Public Act 103-0580 directed this stakeholder process to consider approaches to promote the training and transition of utility workers to work on thermal energy networks. The stakeholder process revealed that the Local 150 International Union of Operating Engineers Geothermal Well Drilling Operator Apprenticeship program is housed in northern Illinois. The William E Dugan Training Center is equipped to provide trainees with year-round training on heavy equipment. This program offers workers in Illinois the opportunity to receive the training to adopt many of the new technologies found in geothermal work. ComEd noted that it partners with the Geothermal Alliance of Illinois to train and accredit heat pump installers.

Opinions differ regarding how the training natural gas utilities provide their employees translates to thermal energy network work. The Accelerate Group states that community geothermal networks depend on a skillset that is not necessarily unique or prevalent with existing gas utility employees. NS-PGL says that gas utilities have the requisite expertise in safety protocol and qualification, experience with placing infrastructure in public rights of way, and a skilled union workforce to partner with the State of Illinois in deploying thermal energy networks. In evaluating this question, it is important to consider the engineering and design complexity of thermal energy networks. While utilities may have workforces with practiced skillsets that allow for them to transition into a geothermal labor role with fairly minimal additional training, the same may not be true with respect to the engineering oversight required for the design, application, and management of thermal energy network systems. Utilities may need to rely on engineering firms or consultant groups that specialize with geothermal systems for engineering support.

While there may be little consensus on what Illinois policymakers should do, numerous options are available.

A. Gather More Information Before Making Legislative or Regulatory Changes

As detailed above, there are currently several pilot projects involving development and deployment of utility-scale thermal energy networks by regulated investor owned utilities in the United States, including, for example, those in Massachusetts and in New York. One option for Illinois is to monitor these projects and evaluate their results before adopting thermal energy network related legislative or regulatory changes in Illinois. Information regarding thermal energy networks may be forthcoming within the Commission's recently opened proceeding to explore natural gas issues – the Commission's Future of Gas proceeding. This proceeding will explore the issues involved with decarbonization of the gas distribution system, develop recommendations for future Commission action, and develop recommendations for any necessary legislative changes. Information will be forthcoming from projects being developed in Illinois by non-utility entities, for example, projects like the Sustainable Chicago Geothermal project. Waiting for information to be made available from all of these different sources might allow Illinois to craft focused policies and legislation based upon experience with thermal energy networks and design and construction methods that prove to be tried and true.

Allowing thermal energy networks to be developed by competitive providers without regulatory intervention may allow thermal energy networks to develop without the operational market complications that arise when utilities providing currently regulated services enter the market to provide new unregulated services. In such a case, it may be difficult to determine, when providers of regulated utility services provide thermal energy networks, if and when the regulated utilities are cross subsidizing the thermal energy network service through their regulated utility rates. Such cross subsidization has the potential of disrupting the operation of the development of a market for thermal energy networks and will, by definition, increase rates for regulated utility services above costs.

Allowing networks to develop absent regulatory intervention may also allow small scale communities or cities/municipalities to have control over such systems. Heat pumps are already becoming a more popular replacement to traditional, residential heating and cooling systems. Allowing home and building owners to make individual choices means that they will have the option to "opt out" and maintain more traditional means for heating and cooling of their building if they choose too.

As development and deployment of utility-scale thermal energy network systems continues, costs and risks may continue to be high and/or unknown. Allowing competitive providers to bear this risk may shield residents and businesses from bearing the burden of unsuccessful business models that they might otherwise incur if provided in a regulated utility model.

B. Incentivize Deployment by Non-Utility Providers of Thermal Energy Networks

An option for Illinois policymakers is to directly provide support to facilitate thermal energy networks through tax breaks, grants, or other incentives similar to what the federal government is currently doing. Within Public Act 102-0662 (known as the Climate and Equitable Jobs Act or CEJA) Illinois policymakers found that reducing pollutant emissions improves the health of Illinois communities and air quality in eligible communities who disproportionately suffer from emissions. Because pollutant emissions related costs often accrue to entities that are not the source of these emissions, they do not always factor into the business decisions of companies that provide services with associated pollutant emissions. One method for combating these market externalities is to offer support to businesses or entities that can provide services like space heating without producing associated pollutant emissions.

The information presented in this workshop process indicates that geothermal heat pumps operate at efficiencies multiple times greater than traditional mechanisms used for building climate control and growing data confirms further improvements in efficiencies of networked energy systems are being made. This information suggests that incentivizing these technologies can further Illinois' environmental goals.

It may be further possible to incentivize thermal energy networks by ensuring that thermal energy network providers have a solid base of skilled labor. While some laborers have an established foundation of skills that would allow for a fairly seamless transition into working on thermal energy networks, additional training may be necessary. Such programs could be implemented, as many are today, by various professional and labor organizations. Legislation could also be developed to provide for workforce incentives comparable to what CEJA provides for with respect to other clean energy jobs (e.g., solar installations). Not only could this incentivize thermal energy networks, but it could provide support to workers and contractors from disadvantaged communities.

C. Impose Consumer Protections on Thermal Energy Network Providers

Network services like thermal energy networks with high fixed costs may be impractical for multiple firms to provide and lead to the development of natural monopolies. This will, of course, diminish some concerns regarding the potential entry into the market of a regulated utility. That is, the absence of entry by the regulated utility may mean that another firm assumes the position of a monopoly provider of the thermal energy network service implying a choice between monopoly providers instead of a choice between a monopoly and competitive provider. If so, an option is for Illinois to take no legislative or regulatory action to allow current utility service providers to enter the market for thermal energy networks, but to consider thermal energy networks as a potential monopoly service that requires regulation in a manner comparable to how current utilities (such as gas, electric, and water utilities) are regulated. Regulation of this type might look to impose requirements that ensure the provision of adequate, efficient, reliable, environmentally safe and least-cost thermal energy network services at prices which accurately reflect the long-term cost of such services and which are equitable to all citizens. Presumably such regulation would follow models currently contained in the Illinois Public Utilities Act.

Because thermal energy networks are relatively nascent, imposing regulation follow models currently contained in the Illinois Public Utilities Act has the potential to dampen or impede the growth of this market.

D. Provide for Current Regulated Utilities to Provide Thermal Energy Networks

As noted above, Illinois policymakers have already recognized the determinantal impact that pollutant emissions have on Illinois citizens. No less important, however, is that Illinois citizens and businesses have access to safe and reliable space heating, water heating, and other services currently provided using natural gas supplied by Illinois' natural gas public utilities. If Illinois is to expeditiously decarbonize the natural gas sector as it is doing in the electricity sector with CEJA, then one option is to manage the transition by amending current utility regulation to both allow existing utilities (natural gas, electric, and/or water/sewer utilities) to deploy thermal energy networks in combination with their existing regulated service offerings and to regulate such offerings.

Residential and business end user customer reductions of natural gas usage has a direct impact on the business of providing natural gas delivery service. If demand for natural gas delivery service significantly decreases this can reduce economies of scale in natural gas delivery service and increase natural gas prices, it can create stranded assets and either increase natural gas prices or make continued provision of natural gas service less financially viable, and it can reduce dependency on the natural gas workforce. Allowing natural gas companies to provide thermal energy networks in a regulated utility manner may allow these utilities to mitigate some of these potential issues. For example, a natural gas company may be able to target areas within their networks that require costly upgrades that might be served at lower costs through the deployment of thermal energy networks, transition these areas to thermal energy networks, and eliminate the need to deploy and maintain natural gas delivery service in the area.

While allowing public utilities to provide thermal energy networks is an option, stakeholders, as noted above, have provided several reasons that such a model may not be beneficial to Illinois citizens, businesses, and ratepayers. For example, if circumstances warrant, for safety, reliability, or other reasons, that thermal energy networks must be backed up with natural gas delivery service, then environmental benefits to ratepayers of such a transition may be offset in part or full by increases in the costs of space heating and other services. These cautions suggest that if utilities are afforded the opportunity to deploy and provide thermal energy networks that a pilot may provide a way to assess the efficacy of this approach prior to wide-scale and potentially irreversible change. AEU advises, pilot programs may be necessary for determining which ownership structure and business model will provide customers with the most affordable service. Markets with a mix of regulated and unregulated providers can, however, prove problematic for allocating costs and risks in a manner that protects both ratepayers and competitors. It will be important to provide for flexibility that allows for projects to be piloted under varying circumstances by including project deployments that potentially vary not only by ownership model, but by local geography, building density, building stock use (e.g., for residential housing versus data centers), building stock age, state of repair of the building stock (including and excluding the inclusion of weatherization and building efficiency improvements) and other factors. Projects should also be selected to avoid, based on reasonable estimates, undue adverse impact on participants or other utility customers. If this is done through Commission review, then allowing for staggered proposals may ensure the Commission is given adequate time to review projects.

If current utilities are permitted to provide thermal energy networks as a regulated service, there are choices that will need to be made with respect to how such systems are regulated. Utility regulation is not one size fits all. For example, due to the energy transfer medium fluid being low in temperature and pressure, and often just water, there may be fewer safety concerns associated with establishing thermal energy network systems compared to pressurized natural gas systems. It may not be necessary to impose current regulations comparable to current natural gas pipeline safety regulations on thermal energy network systems. With thermal energy networks, the line between primary functioning network components within the utility system and components that reside on or in customer owned facilities (the heat pumps) may be less easily demarcated for regulatory purposes than are services where the utility network stops at the meter at the customers premises. In this case, current utility regulation may need amending to adjust to the differing technological considerations presented by thermal energy networks.

The options identified above are not always mutually exclusive. For example, Illinois could offer tax, labor or other incentives to thermal energy network providers and either regulate the providers or not.

X. Conclusion

The Commission and Commission Staff thank all of the parties that made presentations at the workshops, participated in the workshops by attending and asking questions, and participated by filing comments. Despite the diversity of views on many topics, the discussions were insightful, collegial, and informative. The Commission and Commission Staff look forward to continuing to work with stakeholders and Illinois policymakers on issues related to thermal energy networks as well as related Future of Gas issues.

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