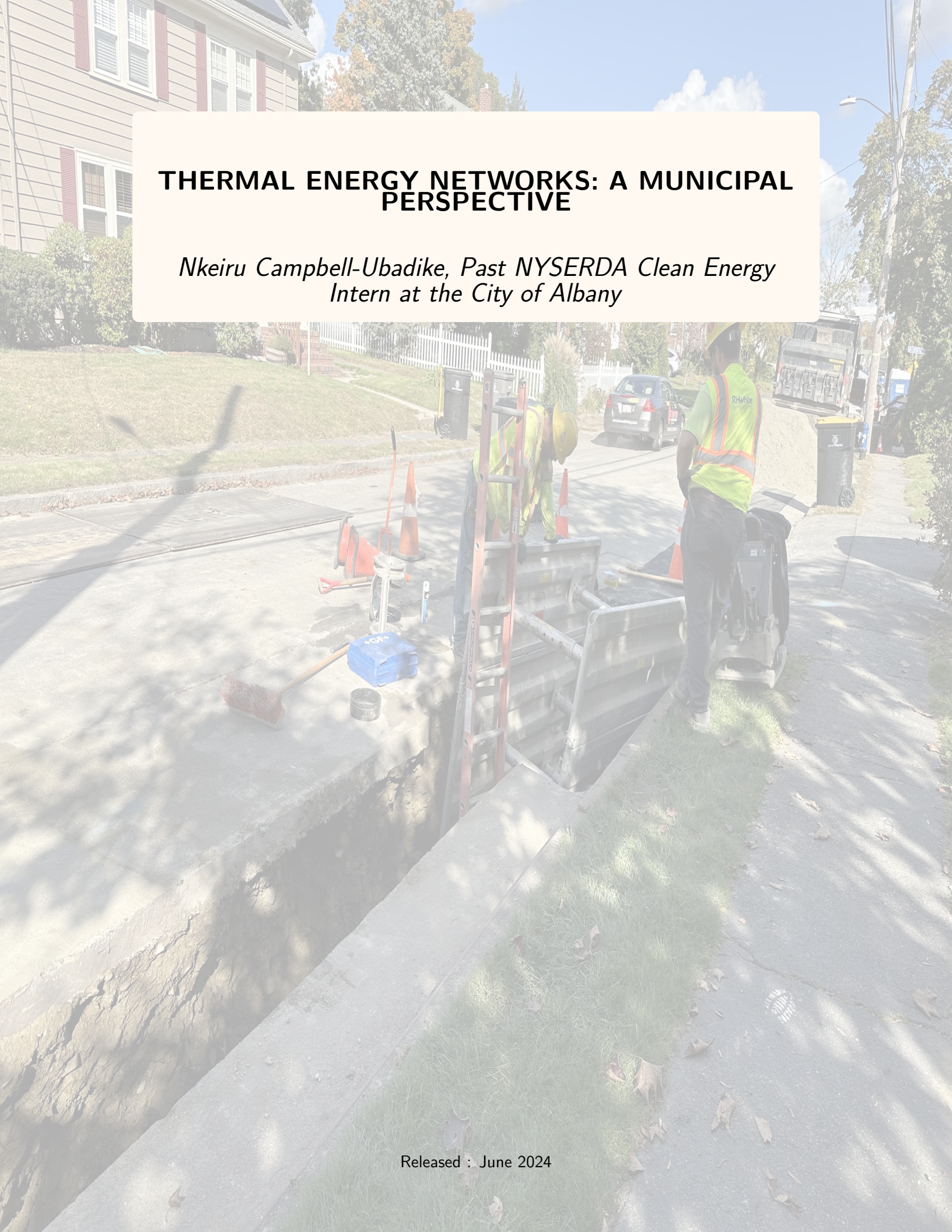

THERMAL ENERGY NETWORKS: A MUNICIPAL PERSPECTIVE

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1
Preamble

Federal and New York State governments are promoting the construction and operations of thermal energy networks (TENs) as an effective way to reduce greenhouse gas production in buildings.[1] [2] However, there are some questions about the implementation of such infrastructure projects by municipalities. The purpose of this report is to explore these questions and provide general recommendations for municipal officials, particularly in New York State. This report is designed to be modular so after reading the introduction, it is possible for the reader to go directly to the section of greatest interest.

Abbreviations

The abbreviations used in this report are as follows:

TEN: Thermal Energy Network
NYS: New York State
IRA: Inflation Reduction Act
UTEN: Utility Thermal Energy Network
UTENJA: Utility Thermal Energy Network and Jobs Act (NYS Legislation Passed in 2022)
NYSERDA: New York State Energy Research and Development Authority

Title Image Credit : John Ciovacco.
Image taken is of a thermal energy network installation in Framingham, Massachusetts.

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Introduction

Thermal Energy Networks in a Nutshell

There are three major physical infrastructure components of a TEN.[1] The following definition of a TEN is from the 2022 NYS Utility Thermal Energy and Network Jobs Act.[2]

> "Thermal energy networks consist of pipe loops between multiple buildings and energy sources carrying water at ambient temperature. Building owners can connect to the ambient temperature[a] loops with water source heat pumps installed within the building, which can be used for heating and cooling and hot water services".[3]
> Utility Thermal Energy and Network Jobs Act (UTENJA *p.1*)
>
> [a]Ambient temperature means that the water is at the same temperature as its surroundings.

Below is a diagram of an optimal thermal energy network:

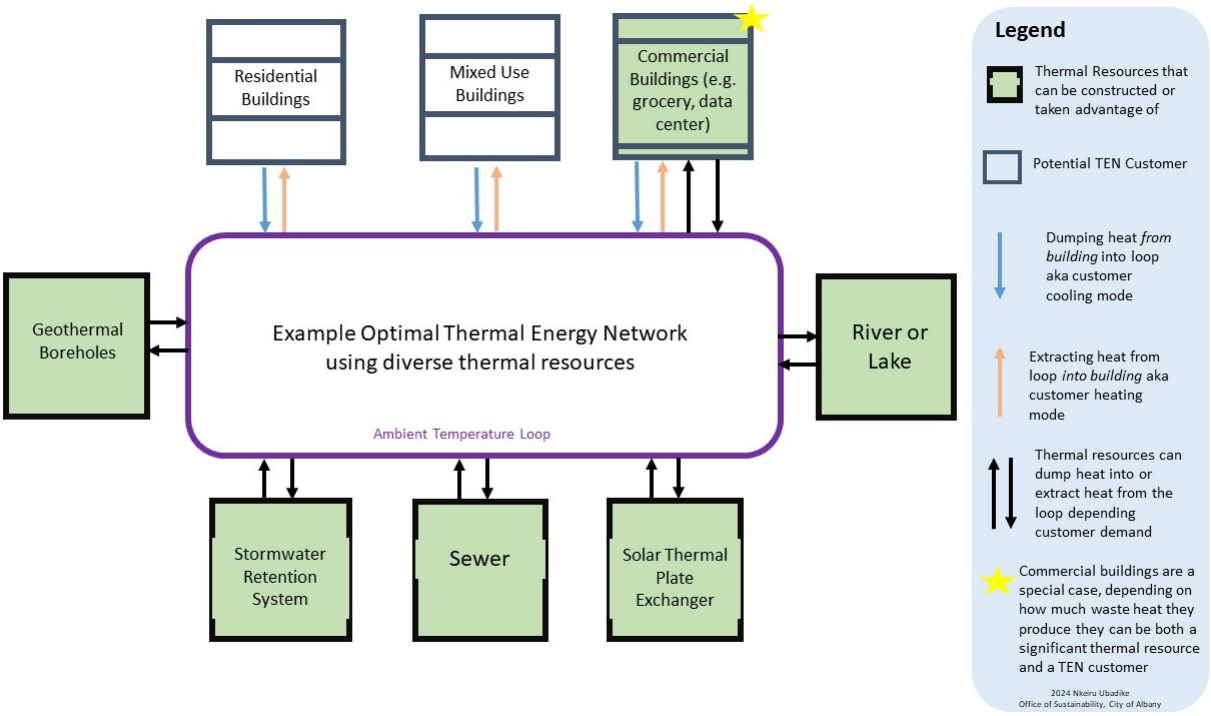

Figure 2.1: : Schematic Diagram of Optimal Thermal Energy Network with a variety of thermal sources and sinks. Note: This is not an exhaustive list of thermal sources and sinks.

[1] one could consider, a forth key component not listed below is a quality building envelope.
[2] More on this in section 4

Special attention should be given word "optimal". In an optimal situation, a TEN has a diverse set of thermal energy resources. TEN configurations can use some or all of the thermal resources above.[4]

> No matter the particular form, all thermal resources have this function in common: they are a place to extract heat from (to heat a building) or rejects heat to (to cool a building).

A key note is that while geothermal boreholes form an important basis for a TEN, they are not the only thermal energy resource. For example, boreholes can be combined with lake-source cooling if a TEN is near a lake.[3] Additionally, interesting parallels can be made between the way rooftop solar works in that TENs customers are both consumers and prosumers of the TEN. Rooftop solar users are connected to the grid and can receive electricity from it when solar production is insufficient and can provide electricity to it when solar production exceeds domestic needs. In a similar manner, TENs customers contribute (or reject) heat to TEN when they desire lower domestic temperatures and extract heat from the TEN when they want warmer temperatures. The following organizations provide more introductory TENs information: Egg Geo, Department of Energy, NYS-GEO, Geothermal Rising Symposium.

TENS and Transitioning to Electrification in an Equitable and Economical way

Building electrification is the process of converting from non-electric sources of energy such as natural gas or propane to electricity. According to the NYS Scoping Plan, it is hoped that up to two million energy efficient homes are electrified in NYS by 2030. Electrification can help lower emissions if the electricity is produced using clean and renewable sources.

The term *unmanaged electrification*, is a phenomenom greatly discussed in the TEN field. [4] It refers to the current situation where individual households transition away from gas and install individual heat pumps. These are often households with the most resources. As those with the resources to convert to individual heat pumps continue to do so, it leaves those with fewer resources behind on the natural gas network. These stranded properties with few resources are then responsible for the costs of maintaining that network. TENs facilitate managed electrification where entire neighborhoods are transitioned away from gas at once. The transition process benefits from the economies of scale: the community can be educated and supported en masse, rather than one household at a time. In the NYS Scoping Plan, the NYS Climate Action Council identifies it as a " key strategy to scale up building decarbonization from a "building-by-building" to a "community-by-community" approach."[5]

Why Municipalities?

As with other municpal utilites such as water, municipal owned TENs have the potential to be key players in the TENs utility industry because they provide a locally-controlled, nonprofit alternative to large investor-owned for-profit utility companies. Municipalities are in a unique position in the TENs industry due to their ownership of crucial thermal energy resources like sewers. They have experience with owning and operating small-scale utilities and gaining infrastructure financing for projects for public benefit. They also oversee the right-of-way in which TEN pipe loops would be constructed. Municipalities may own large open spaces which could be used to construct geothermal boreholes.TENs can help municipalities achieve a variety of other goals.

[3] Lake source cooling uses a body of water to reject heat heat to. It can be seen in action in Toronto and in Ithaca

Municipal TENs may have the potential to help local governments and the communities they serve by reducing energy hardships on local residents, keeping resident dollars in the community, providing new data streams, fostering community engagement and of course, reducing greenhouse gas emissions.

The question of TENs may show up on the desks of municipal authorities for a variety of reasons. They will need to process permitting applications for the development of TENs in their communities whether the TEN is municipally owned or utility owned. Federal and State governments are funding the creation technical feasibility studies by private companies which may then bring them to municipal authorities.[6]

Clarifying TEN Language

There are numerous terms describing thermal energy networks.The specific technological implementation may vary from the definition given earlier. Other terms related to thermal energy networks include:

- district energy
- utility thermal energy networks (UTEN)
- community thermal energy network (CTEN)
- district thermal
- district geothermal and district heating and cooling
- geothermal district heating cooling and community heat pumps.
- community heat pumps

A number of the terms focus on a single thermal energy resource such as geothermal boreholes, others emphasize that a system provides both heating and cooling. District energy is likely the most recognizable term, domestically and internationally. The author chooses thermal energy networks because this is the term used in NYS laws such as the 2022 Utility Thermal Energy Network and Jobs Act (UTENJA) and by other NYS authorities such as NYSERDA. In this report, the focus is on fifth generation district energy systems or ambient temperature loops (ATLs) because of the author's proximity to such projects, however the best technological implementation of a thermal energy network in a particular area is subject to engineering study. Finally, TENs may not be an appropriate solution to every community's energy challenges..

3
What are the concerns for the community, climate justice and equity?

As discussed in the Introduction, TENs facilitate a systematic electrification and transition away from the natural gas system. Central to the idea of climate justice is the equitable distribution of the burdens of climate change and the efforts to mitigate it. Non-systematic or "unmanaged" electrification (i.e. buildings electrifying on an individual basis) is not ideal from a climate justice standpoint because it leaves the cost burden of maintaining the gas network on those least able to afford it.[4] [7] This is why it is said that thermal energy networks are among the best solutions to avoid exacerbating energy poverty and inequities as more buildings switch to individual heat pumps. TENs are also seen as a just transition for the skilled pipe trades and gas workforce because their skills can be used in the construction of TENs as gas networks are decommissioined.[5] Finally, TENs may help address the issue of vulnerable populations susceptible to health impacts from extreme temperatures further worsened by the urban heat island effect.[8] TENS allow for the provision of heating and cooling in one system. The addition of cooling capacity is of particular benefit to low income households that tend to rely on window units or fans.

In New York a number of TENs feasibility studies coincide with disadvantaged communities in part due to increased Federal and State grant funding amounts for designated DACs. While this investment in Black, Person of Color and low income communities is greatly welcome and necessary, TENs can only deliver on their full promises, if done collaboratively and equitably. A key finding in The New York State Climate Impact Assessment's Chapter 6 on Energy is

> "In the absence of targeted energy justice policy and practice, with vulnerable households and communities as a focal point, the potential benefits of a renewable energy transition ... will continue to be inaccessible to historically overburdened populations"[8]
> (New York Climate Impact Assessment. Chapter 6: Energy)

This section is not meant to be an exhaustive list of community, climate justice and equity concerns but rather a survey of issues that will have the biggest impact. Recommendations can be found in the section: Recommendations and Guidelines for the City of Albany.

Community engagement

Community engagement and the resulting information exchange is of utmost importance to the successful implementation of TENs. If a TEN were to be built today, there is no legal mandate that forces a building (residential or commercial) to connect to it. The rollout of TENs, at least currently, is dependent on willing customers to voluntarily sign up. Thus it is important to educate and inform communities that are candidates for TENs about their benefits. It is also important to hear from the community about their current energy related issues. This community engagement process is ideally two way and done before technical designs and operational plans are finalized because community input about their current energy related issues may help shape effective designs and plans. For example, if a TEN developer cannot get access to utility usage and billing information of potential customers, they may be left to estimate the heating and cooling needs (known technically as thermal loads) of the typical residential household in that particular community rather than use actual data on which to base system capacity designs. An effective

community engagement proecess may help make this sort of information exchange easier.

A lack of effective community engagement can heighten resistance to the construction and successful operations of TENs. In the ongoing UTEN Pilot Project proposal process, a utility has recently had to withdraw their pilot proposal project in Norwich, NY. The utility cited" insufficient interest from customers located within the project's footprint, resulting in technical infeasibility of the proposed system" as well as other challeneges.[9] This event further highlights the importance of effective community engagement.

Affordability

As previously discussed, transitioning disadvantaged neighborhoods away from gas on a neighborhood scale can help ensure long term energy affordability because properties unable to switch to individual heat pumps due to financial constraints won't be stranded on a gas system that has increasingly fewer ratepayers to share the cost burden among.

However, clean energy transitions that result in excessive increases in utility bills are an unworkable proposition. Developers must implement TENs in the most cost effective way to minimize burdens on TENs rate payers. This may look like utilizing presently existing thermal resources where possible including commercial buildings that produce excess heat, rather than rely entirely on constructing new thermal energy resources.

Workforce Development

Strongly related to the previous points is the inclusionary development of a TENs workforce. Energy injustices often manifest in low access to clean energy jobs.[8] Efforts should be made to facilitate awareness and access to jobs associated with the construction and operation of TENs in disadvantaged communities. This may be done through partnership with educational and community institutions. This includes technical positions like pipe layers or non-technical like community liasons. Unions can be effective players in workforce development in disadvantaged communities through pre-apprenticeships programs because unions already work at scale to train skilled workforces.

Discussion and Summary

- A thermal energy network is identified among the best solutions for addressing inequalities to renewable energy access.
- However, the implementation of a TEN must be done with the community (and eventual customers) in mind. Early lessons from the UTENJA mandated Utility Pilot Proposals process is that that lack of early community engagement will scupper TEN implementation plans.
- Climate justice cornerstones of an equitable TEN implementation are community engagement, affordability, and workforce development.

4
What regulations apply?

The regulatory landscape for TENs can be divided into two phases:construction and operations.

4.1 Construction

As with any infrastructure construction project, normal construction permits apply. As defined in the introduction, the core infrastructure of a TEN is subterranean pipes carrying water and glycol (a liquid with anti-freezing properties) connected to heat exchangers and heat pumps. The table, on the next page (*p.9*), is sourced from the NYSERDA sponsored Pace Energy Center report "Overcoming Legal and Regulatory Barriers to District Geothermal in NY". In this table, the authors explored "the various potential permits and approvals required for a closed-loop district geothermal system that involves subsurface infrastructure crossing private property boundaries and various public rights of way, and may feature other design complications, such as sourcing thermal energy from a water body."[10]. This permitting scheme is by no means definitive but is presented to municipal officials to give a preliminary framework for what the permitting process for a TEN (private or municipal) may look like.

Due to the passing of UTENJA, the construction of TENs by utilities is a matter of"public use and purposes", just like the construction of the gas and electric networks.[3] To cross private property currently, easements would have to be requested and negotiated on an individual and case by case basis.

Geothermal borehole specific regulation

In 2023, regulation for drilling deeper than 500ft closed loop geothermal systems was lightened exempting them from permitting requirements originally designed for oil and gas drilling.[11] Although permitting requirements have been lessened, the details of this new regulation are still being worked out with the New York State Department of Environmental Conservation.

Other thermal energy resource regulation

The use of thermal resources such as sewer, solar thermal and rivers is likely informed by the owners and regulators of the resources. For example, how a sewer is used in a TEN is determined by a municipal water authority who in turn would ensure compliance with any regulatory standards imposed on them by state and federal authorities.

UTENJA Pilots and Construction Standards

UTENJA, required the seven largest utility companies in NYS to submit proposals for pilot projects across the State. [1]The proposals are currently going through an approval process. Pilot projects successfully approved by the PSC will begin operation by 2026. The role of the pilot projects are "to inform the development of rules and regulations for thermal energy networks."[12] To build pilot projects, utilites will likely use a combination of various industry accepted construction codes and internal utility standards.

[1]Locations of pilot projects can be found on page 16.

Possible Permit and Approval Requirements for District Energy (Geothermal) Systems	
Stakeholder	Permit or Approval
Municipality **Administrative Departments** Planning Public Works Engineering Fire Local Health Buildings Highway	Local departments e.g., Public Works, Planning and/or Building, Highway, or Engineering may establish a permit process to approve utility (TEN) work within a municipal right-of-way or request an easement for subsurface crossing of the right of way. One or multiple of these administrative bodies with input from local Fire and Health Departments may administer permit approvals for closed loop district geothermal. Responsible administrative bodies ensure compliance with local building setbacks from water supply wells, sewage disposal structures, stormwater recharge structures, potential sources of contamination, any on-site utility, sewage and water line, any building foundation, and property lines. All systems must comply with the New York State Uniform Building and Fire Code. Developers must fulfill permitting requirements, which may include submitting professionally certified (1) site plans, (2) plot plans, and (3) certifications that the proposed system complies with all applicable regulations.
County Department of Public Works County Department of Health	When located within a county highway, a county public works department may also establish requirements and standards for street works permits within and under the county's right-of-way. If connected to a water or sewer system or potentially affecting sewer and water pipes existing in the public right-of-way.
Utilites Electricity and Gas Water and Sewer Cable and Phone	Confirm no interference with subsurface power lines and utility infrastructure or conflict with utility franchise agreements. Developer working in a right-of-way where utility infrastructure exists to timely notify all utility operators of the intended project, wait until a set commencement date to begin construction, confirm utility response as "all clear" or that affected utilities marked the location of their infrastructure, confirm utility location and present utility-placed marks, and undertake all construction with care as to not harm existing utility infrastructure. If project design potentially interferes with infrastructure owned by other utilities, utility and developer may enter into an agreement on compensation, maintenance, decommissioning, and liability. Electrical approval and expansion to accommodate equipment like heat pumps and exchangers.

4.2 Operations

Utility Thermal Energy and Jobs Act & NY Public Service Commission Regulation

TENs will join the ranks of gas, electric, water and internet as the latest utility in New York State. The passing of UTENJA also mandated the New York State Public Service Commission to create TENS regulation that address four areas:

(a) Create fair market access;

(b) Exempt small scale utility networks from commission regulation;

(c) Promote the training and transition of utility workers;

(d) Encourage third party participation and competition where it will maximize benefits to customers.

In September 2022, NYPSC initiated Case 22-M-0429: Proceeding on Motion of the Commission to Implement the Requirements of the Utility Thermal Energy Network and Jobs Act to formally begin the process of creating regulation for UTENs.

In February 2024, DPS staff released their initial proposals for UTEN regulation.[12] Proposed rules in areas a) and b) of the intitial proposals are of particularly relevant to municipalities. In addressing the creation of fair market access, staff write that utilities should not only be using sources that they own. This is relevant for municipalities that want to work with utilities to connect municipal owned thermal energy resources to utility owned TENs.

> "First, Staff proposes that thermal energy resources (e.g., bore fields, waste-heat sources) should not be limited to only those owned and operated by a utility." (Department of Public Service, Staff Proposal for Initial UTEN Rules 2024, *p.6*)

DPS staff wrote that they support the exemption of small scale UTENS operated by university campuses homeowners associations. They did not support this exemption for municipalities. However, they wrote that" the Commission may want to consider at some time in the future, whether some form of lightened regulation would be appropriate for municipally owned thermal energy networks."[12] *(p. 15-16)*

The PSC solicited public comments on these initial staff proposals from any interested parties.[2] Presently, DPS continues to formulate UTEN rules, in a public process that involves interested stakeholders such as utilities, renewable energy advocates, labour and other interested parties.

Discussion and Summary

- In conclusion, it seems that although the utility is new, the permitting process will draw upon precedent from current utility permitting procedures such as gas and water.
- Approvals have to be given by relevant municipal departments. Whether municipally or utility owned, easement would have to be requested on a per customer basis as part of customer sign up.
- Currently UTEN pilot projects will be constructed to inform the official NYS safety regulations. Internationally accepted standards (see Recommendations section) are currently being used to inform the construction of projects nationwide.

[2]For full disclosure, the author submitted public comments in response to the proposed regulation concerning municipally owned TENs.

5
What are the ownership models?

Ownership of a utility thermal energy network, like many infrastructure projects can vary from full public to full private to hybrid models.[1] Partnership with private entities is necessary no matter the ownership structure whether it be for financing, construction or operation. The ownership model of a TEN is not necessarily permanent and ownership can change hands over time as TENs operator's priorties and reources change.[13]

Within the realm of 100% public owned and hybrid models, three of the most promising models through which municipal leadership can develop thermal energy networks are identified below

- wholly municipal owned system ;
- Split assets (separate ownership of assets with contractual relationships);
- Municipal owned corporations or subsidiaries;

Pros and cons are hypothesized for each ownership model and they are by no means a definitive or exhaustive list. Fully private thermal energy networks are also discussed. Other ownership models include (but not discussed) joint ventures (various legal structures) and strategic partnerships (private ownership with public cooperation)

Wholly Municipal Owned System

The municipality owns the TEN, that is the piping infrastructure, the thermal sources and sinks and perhaps the water-source heat pumps attached to homes. The municipality would oversee TEN operation and maintenance (O&M). As the TEN matures, it is helpful to envision that this municipal ownership model could operate in a manner similar to a water department.

Possible personnel requirements

Municipal owned thermal energy networks or district energy ventures are typically housed in engineering and public works departments. No matter the exact department, it is worth considering placing it in the department with the power or mandate to spend allocated infrastructure dollars.[2] Drawing from the largest municipally owned district geothermal system in US (Boise, Idaho), a project coordinator/manager with a technical background leads the development of a strategy and implementation plan and might be responsible for the capture of capital and O&M financing through grant writing. An engineer leads development (mostly planning and construction) and the O&M. Other TEN functions are supported by various municipal staff and external contractors. These include community engagement& outreach, billing, system construction & maintenance and legal.[14] Detailed personnel recommendations for municipalities are outlined in the Recommendation section.

[1] The information in this section is, in part, sourced from April 3rd 2024 District Energy Clean Air Council Webinar Series District Energy Ownership Models. Webinar Recording.

[2] As opposed to an administrative department whose primary purpose is to create policy.

Pros	Cons
Control over billing structure and ability to ensure energy affordability Local knowledge of the community can drive equitable outcomes Greater control over use and development of local workforce	Solely responsible for finding sources of capital investment Responsible for attracting necessary technical personnel and expertise

Table 5.1: Potential pros and cons of full municipal ownership model

Split Assets

This is a hybrid model where the municipality owns certain parts of the TEN infrastructure components while private entity (for-profit or non-profit) owns other parts. For example, the municipality may own and be responsible for the pipe loops in the right-of-way and a private entity may own and operate the thermal resources like a solar thermal array or geothermal borehole field. There are a variety of ways a split asset ownership model may look like. It depends on municipal priorities, interest and capabilities of private entities and the required infrastructure of the particular TEN.

Possible personnel requirements

The municipality could still require an engineer and project coordinator to take care of municipally-owned assets. The contract with the private entity would outline how other TEN function responsibilities would be split.

Pros	Cons
Municipality not entirely responsible for capital investment Could spur other public-private partnerships	Split ownership of TENs assets may not be eligible for receipt of IRA tax credits. Detailed legal structures must be made documenting relationship between municipality and asset owner

Table 5.2: Potential pros and cons of split assets ownership model

Municipal Owned Corporations, Companies or Subsidiaries

This is a wholly municipally owned model where the construction and operation of the thermal energy network is carried out by a municipallly owned company. While possibly not the best model to start with, due to large upfront legal structures that may need to be set up, increasing size and scale of the TEN may necessitate a move to this ownership model.

Pros	Cons
Expenditure and borrowing would be independent of municipal accounts	Detailed legal structures must be made documenting relationship between municipality and subsidiary

Table 5.3: Potential pros and cons of municipal owned corporation ownership model

Fully Private Thermal Energy Networks

In New York State, the seven largest utilities have been mandated by State Law to submit proposal for thermal energy network pilot projects. National Grid has proposed TENs pilots in Troy, Long Island and other cities in its service areas. Depending on the outcomes of these pilot projects, utilities may build further TENs beyond these mandated pilot projects. Other private entities such as energy as a service companies (ESCOs) and home owners associations may also construct and operate thermal energy networks.

Pros	Cons
Potentially faster rollout due to ability to harness capital	Potentially slow arrival to Albany
May partner with municipality on thermal resources potentially establishing new revenue stream	Less ability to do effective community engagement
	Energy affordability concerns

Table 5.4: Potential pros and cons of fully private TEN ownership model.

Discussion and Summary

- There is a wide variety of ownership models on a spectrum from fully public, hyrbid to fully private.
- A selection of those ownership models, along with a discussion of their tentative pros and cons have been further discussed in this section.
- Municipal vision, resources, capacity and policy goals are strong determinants of the "best" ownership model for a thermal energy network. This looks different in every community.

6
TENs and Municipal Water and Sewer Departments

The question of the role of municipal water and sewer departments (WSD) inevitably comes up in the question of municipal owned TENs due to the following reasons:

- The infrastructure overseen by a municipal TEN is physically similar to the infrastructure currently managed by municipal WSDs: pipes filled with water in the right of way and connected to individual building
- Sewer and stormwater heat owned by municipal WSDs can be sold to municipal TENs, creating a possible revenue stream for investments in water and sewer investments.
- The relationship framework (easements, rate setting processes, dispute resolution etc.) between municipal WSDs and customers can be adapted to municipal TENs.

The nature of the relationship between TENs and municipal WSDs would be highly individualized. However, it is clear that a relationship should be encouraged given that it can be mutually beneficial.

What are other cities and municipalities doing?

In this section, a selection of other cities and other municipalities with thermal energy networks in their borders is presented and discussed. This list features a mix of public, hybrid and private owned TENs.

Boise, Idaho: A mature municipal owned and operated district geothermal system

It is the largest municipally owned district geothermal system in the US that has been in operation since 1983. It serves 96 buildings with heating via naturally (geothermally) heated water. They employ two full time employees to manage the system, an engineer/program manager and a program coordinator. Other services such as billing system construction and maintenance, legal, water rights management, community engagement and outreach are either supported by other city departments or by external contractors. Boise's geothermal utility operations are not regulated by the State Public Utilities Commission, like a private/investor-owned utility. However, the groundwater that is used to extract heat for the system is regulated by the Idaho Department of Water Resources.[14]

Richmond, Canada: Municipally owned and developer operated district energy system

The City of Richmond owns a municipal corporation entitled Lulu Island District Energy that has been in operation since 2013. There are 3 separate service areas within the City with differing rates determined by City of Richmond government. They oversee and partner with a private company for the day-today operations. Its fully funded by service fee revenue and has no impact on property taxes. The City of Richmond and Lulu Island Energy Company have been recognized in Canada and internationally for the design of innovative and sustainable district energy systems.

Framingham, MA: Municipally owned and developer operated district energy system

In Framingham, a TEN owned by utility, Eversource is under construction. The nonprofit climate solutions incubator called HEET played a major role in bringing a TEN to Framingham by advocating for it to the utility for several years.[1]There is no municipal ownership or operation. However, Eversource did work with the City on permitting. Test boreholes were drilled in 2022 and since then main and service pipe installation has been completed. In-home equipment conversion to the appropriate heat pumps is estimated to be completed in summer 2024.

Pagosa Springs, CO: Municipal owned district geothermal utility (heating only)

"The Town of Pagosa Springs owns and operates a geothermal heating system to provide geothermal heating during the fall, winter, and spring to local customers. This system heats many downtown businesses, and keeps sidewalks clear of snow during the winter."[15]

Other cities with district energy systems [2] include St.Paul, Minnesota[3] , Schenectady, NY (a private natural gas based district energy system[16]and Toronto in Canada.

New York Utility Thermal Energy Networks and Jobs Act Pilot Project Proposals

UTENJA, required the seven largest utility companies in NYS to submit proposals for pilot projects

[1]The organization goes by the name 'HEET' pronounced as 'heat'. It stands for Home Energy Efficiency Team but the scope of its work is well beyond energy efficiency.

[2]This is an alias for TENs, although the exact technological implementation may differ.

[3]Their district energy system launched as public-private partnership in 1983.

across the State. These are further discussed in the section: What regulations apply?

Brentwood	Syracuse
Buffalo	Troy
Rochester	Mount Vernon
Haverstraw	Rockefeller Center, NYC
Ithaca	Chelsea, NYC
Brooklyn	Poughkeepsie

In particular, the UTENJA pilot project that is proposed in Troy that has a unique ownership structure. The unique thing about this proposal is the third party or non-utility ownership of a thermal energy resource. Troy Local Development Corporation (LDC) will own and operate a thermal resource (geothermal boreholes) that will feed into the TEN that will be constructed and operated by National Grid. Troy LDC will receive a thermal fee from National Grid for this service. [17]

NYSERDA Community Heat Pump Systems Pilot Program (Program Opportunity Notice (PON) 4614)

In 2021, projects located in the following municipalities in NYS received funding from the Community Heat Pump Systems Pilot Program to study the feasibility of or, construct TENs.

Troy (downtown neighborhood)	Syracuse (downtown neighborhood & Syracuse University)
Rochester (University of Rochester)	New Rochelle (mixed-use complex & masonic community)
Sleepy Hollow (hospital)	Dobbs Ferry (Children's Village educational facility)
Utica (downtown neighborhood)	Oneonta (majority of buildings in the city)
Queens (mixed-use complexes)	Bronx (mixed-use complex)
Buffalo (mixed-use complex)	Coney Island (mixed-use complex)
Staten Island (Wagner College)	Brooklyn (mixed-use complex & multifamily residential complex)

U.S. Department of Energy (DOE) Community Geothermal Heating and Cooling Design and Deployment Funding Opportunity Announcement (FOA) recipients

"The U.S. DOE Geothermal Technology Offices's Community Geothermal Heating and Cooling Design and Deployment (CommGeo) initiative is supporting 11 community coalitions in 10 states to plan and design community-scale geothermal heating and cooling systems". [6]

Ann Arbor, MI*	Chicago, Il
Duluth, MN*	New York, NY
Framingham, MA	Carbondale, CO
Seward, AK *	Hinesburg, VT
Shawnee, OK	Nome, AK
Wallingford, CT	

Table 6.1: *The municipal authority is the project lead

Among the numerous European cities with district energy systems, Aarhus, Denmark (geothermal district heating) is among the among the latest to specifically incorporate geothermal as a thermal resource.

Discussion and Summary

- Thermal energy networks or as they arer more widely known as, district energy has existed in the America's since the 19th century.
- In New York, UTENJA mandated the largest utilites to submit pilot TEN proposals. Currently, twelve UTENJA pilot TEN projects are under way. In Massachussetts, Framigham is nearing completion of the construction of thermal energy network, utility owned and advocated for by non profits. On the West Coast, open loop geothermal systems have been powering thermal energy networks for decades.
- The federal government's Department of Energy is funding eleven thermal energy networks projects across the US. Further afield in Canada, there are numerous cities with TENs or district energy, with several having plans to construct.

7
A Municipality's Role in Possible Utility Owned Thermal Energy Network Projects.

It is possible that the local gas utility decides to construct and operate a UTEN within municipal limits. This has been permitted through NYS law with the passing of UTENJA. UTENJA amended existing state law to declare the construction of thermal energy networks by utilities as a matter of "public uses and purposes" (as is the construction of gas and other utility infrastructure).[1] However, just as with the construction and maintainance of gas and other utiliity infrastrucuture, a utility company may only construct TENs within municipal limits with the consent of municipal authorities and "under such reasonable regulations as they may prescribe". Excerpts from section 9 of UTENJA is quoted below.

> "A gas corporation and a gas and electric corporation shall have power to manufacture gas, and to acquire thermal energy or natural or artificial gas and to mix the gases and to sell and furnish thermal energy for heating or cooling or gas for light, heat or power; and to lay conductors, pipes, conduits, ducts and other fixtures for gas or thermal energy networks in the streets, highways and public places, in each city, village and town in the county or counties named in its certificate of incorporation, with the consent of the municipal authorities of such city, village or town, and under such reasonable regulations as they may prescribe." (Utility Thermal Energy Network and Jobs Act *p. 4-5*)

There are various ways in which a municipality can shape how a utility owned TEN will look in a municipality. The following are some suggestions for how the municipality may do so. These suggestions are by no means an exhaustive list.

Permitting

Various departments in a municipality would play a major role in the permitting process. A possible permitting scheme (and the possible departments involved) is provided in the section: Possible Permit and Approval Requirements for District Energy (Geothermal) System.

Municipal Thermal Energy Resources

A municipality may enact laws and policy to encourage the use of municipal thermal energy resources to promote sustainable practices and generate revenue. Sewer systems and storm water retention systems can be valuable thermal energy resources, producing much waste heat which is generally thought to be owned by the sewer authority. Policy can be implemented to encourage use of these resources by utilities who would have to compensate for its use via a thermal resource fee. Suggestions for such polices can be found in the section: Recommendations and Guidelines for a municipality .

Others

A municipality may lease or provide access to municipal land to utilities or an intermediary entity for the construction of geothermal boreholes.

[1] Public uses and purposes" is a legal requirement in the U.S. Constitution, that owners of property seized by eminent domain for "public use" be paid "just compensation." "reasonable regulation".

Discussion and Summary

- In New York, the construction of a thermal energy network by a utility company, is now deemed a matter of "public purposes" and can be constructed under the consent and "reasonable regulation" of municipal authorities.
- There are several ways in which several departments may shape the construction of a TEN within municipal limits. Permitting, provision of municipal thermal energy resources and land leasing are just some the ways the municipal could be involved.

8
Recommendations and Guidelines for municipalities

The construction and operation of TENs can be feasible from an equity, legal, technical and economic standpoint whether owned and operated by a municipality or not. As a result of the research done in this report, the following general series of actions are recommended:

1. Keep up to date with NYPSC Commission Filings for Case 22-M-0429 - Proceeding on Motion of the Commission to Implement the Requirements of the Utility Thermal Energy Network and Jobs Act through the Department of Public Service Document and Matter Management System DMM. This case is responsible for creating regulation for utility thermal energy networks including municipal owned thermal energy networks.(even if outside cause)

2. Continue to build expertise on the role of sewer, wastewater and surface water in TENs within relevant departments. This may include sustainability, water and public works department. This may include creating sewer heat map which can help the municipalities assess suitable locations for sewer heat recovery connection if the municipality wishes to adopt policies to encourage use of municipal thermal energy resources as discussed in Section 7: A Municipality's Role in Possible Utility Owned Thermal Energy Network Projects.

3. Keep up to date with Federal Government's Department of Energy Geothermal Technology Office (GTO) through newsletter. This office is at the forefront of innovation in and adoption of geothermal district heating and cooling.[6] Potential updates include the final selection of community thermal energy network pilot projects in GTO's Community Geothermal Heating and Cooling Design and Deployment (CommGeo) initiative in summer 2024.

4. Foster local workforce development including through partnerships with unions, trade organizations, vocational schools.

5. Develop expertise in TEN related codes. These codes may help inform or provide a framework for the creation of municipal code if a municipality wish to develop codes around pipe loop installation in the right-of-way or ground source heat pumps for buildings. The following construction codes and standards are well accepted in domestic and international industry:

    - C448 Bi – National Standard for Ground Source Heat Pump installations.
      Developed by the American National Standard Institute (ANSI), the Canada Standard Association(SCA) and the International Ground Source Heat Pump Association (IGSHPA).
    - The (still developing) ambient temperature loop code Z1381.
      Developed by the International Association of Plumbing and Mechanical Officials (IAPMO®), ANSI and SCC.

In the case that a municipality wishes to develop a municipal owned TEN

1. Incorporate TENs into municipal climate action plans. Including TENs into municipal climate master plans provides a framework to be able to attract and retain funding for any possible projects.

2. Hire the personnel cited below and create an Office of District Energy or Thermal Energy Networks. Ideally, it is placed in the department with the ability to make decisions about large infrastructure projects.

- Consultant (TENs Subject Matter Expert): They would create a comprehensive TEN planning and execution process. Experience with municipal thermal energy network planning process would be required. Potential consultants can be found in vendor information folder provided with the report.
- Engineer: They would manage the technical TEN design process. Backround in civil and related engineering would be required ideally with an interest in climate or sustainabilty.
- Project Coordinator:They would capture grant opportunities and coordinate community engagement effort. Their background may be in a variety of fields including sustainability, science, engineering or business.

3. Start the TEN implementation process with two way community engagement effort. This means that there is both an inflow and outflow of information. Potential incoming information that would need to be collected include energy related issues or barriers that residents in possible TENs service areas face. This can help inform final TEN design as discussed in the section: What are the concerns for the community, climate justice and equity?. Information that would need to be disseminated include the benefits and requirements to connect to the TEN. Partnerships can be made with non profit organizations such as local community and environmental organizations to reach residents.

4. Municipal coordination with the public housing autorities (if applicable) on TEN development plans.

5. Develop a "TEN-ready" zoning plan. In potential TEN service areas, mixed-use density should be encouraged. The efficiency of a TEN benefits from having a mixture of building types with differing thermal loads. [13] For example, having commercial buildings that produce excess heat can provide that heat to nearby residential buildings through the TEN.

6. Connect interested TENs customers with relevant State energy efficiency programs (such as Empower Plus) to do necessary building envelope improvements before or soon after they wish to connect to the TEN. This can also coordinated with local clean energy hubs or community coordinators. Insulation and air sealing upgrades are important because providing heating and cooling to drafty and under-insulated buildings will result in waste of energy and money for the customer and TEN operator.

In the case that a utility or privately owned TEN project is proposed within municipal limits:

1. If legally sound, pass a law that requires private TENs in the municipality to submit an engineering feasibility study examining the ability of the private TEN to connect to municipal thermal energy resources such as sewer, wastewater or stormwater heat recovery systems. This recommendation is intended as a means to encourage the use of municipal thermal energy resources as discussed in the section: A Municipality's Role in Possible Utility Owned Thermal Energy Network Projects

Guidelines

- Municipalities are not beholden to single technologies or vendors for TENs.
- Be mindful of sticker shock when it comes to TEN costs: The construction costs of a TEN consists of different facets: the ambient temperature loops (the pipes themselves), residential and commercial building conversions to appropriate heat pumps, envelope improvements, engineering and consulting services. A variety of funding sources can be leveraged to pay for different components.

9
Conclusion

This report is based on the questions received from municipal officials. Through literature research, conference and webinar attendance and interviews, these questions were explored. The finer details of thermal energy networks are still being worked out in New York State and thus some open questions remain. However, a key message in this report that municipalities have significant (untapped) agency when it comes to the implementation of TENs in the communities they serve. It is hoped that this report and its recommendations serve as a starting point for consideration by municipal officials.

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