Expanding Municipal Options for Thermal Energy Networks

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Pace Energy and Climate Center

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Foreword

Thermal Energy Networks offer New Yorkers a potentially cost-effective, low-carbon means of providing heating and cooling to homes, commercial buildings and industry.

District geothermal, or thermal energy networks (TENs), use heat pumps to move thermal energy from sources, such as the ground, surface water, wastewater, and waste heat, to provide heating and hot water to one or more buildings, and to move thermal energy to sinks such as the ground and surface water to provide cooling to one or more buildings.

TENs operate on the principle of geothermal heat exchange. During the winter, fluid circulating through the underground pipes absorbs heat from the Earth, which is then transferred to buildings for heating purposes via a heat pump system. In the summer, the process is reversed: heat from buildings is transferred back into the ground, where it is naturally cooler, thereby providing efficient cooling.

This study evaluates the options available to New York State municipalities for implementing TENs in their communities, focusing on improving affordability by advancing municipal preparedness and providing insight into the estimated costs of operating municipally owned TEN utilities.

This report evaluates the following issues that affect the affordability of Thermal Energy Networks:

- Legal and tax considerations
- Business models
- Municipally owned utility functions
- Permitting regime considerations and proposed structure
- What New York State can do to enable municipally owned TENs

The affordability of municipal TENs in New York State depends on a comprehensive evaluation of the key factors that shape their cost structure and long-term viability. This report promotes affordability as a core objective, recognizing that reducing costs for consumers requires municipalities to carefully navigate legal, financial, operational, and regulatory challenges.

Legal and tax considerations shape the economics of TENs development and operation. Factors such as tax exemptions, incentives, or regulatory obligations can either reduce or increase project costs, ultimately influencing pricing for consumers. Business models also play a critical role – the structure of ownership, financing, and revenue generation determines how risks and costs are distributed between the TEN provider and its consumers. For example, municipally owned utility (MOU) models can offer cost savings by avoiding the profit requirements of investor-owned utilities (IOUs), but realizing those savings depends on efficient, transparent, and well-governed operations.

The functions of municipally owned utilities are equally important, as effective management of these networks – from system design and procurement to maintenance – must prioritize cost-efficiency and consumer-focused service delivery. This report includes a companion customizable spreadsheet (available upon request) developed by the Pace Energy and Climate Center to help municipalities estimate staffing and operational costs associated with billing, data management, services, and other functions required to operate a municipally owned TENs.

Drawing on salary and cost benchmarks from municipal electric utilities, the tool provides a flexible framework for estimating labor allocation, equipment needs, and contingency planning, and can be adapted to include project-specific development costs.

Additionally, permitting regimes have a significant impact on affordability by affecting project timelines and associated costs. Streamlined and predictable permitting processes help minimize delays and associated expenses, enabling municipalities to deploy geothermal technologies such as TENs more efficiently and pass resulting energy cost savings on to consumers.

Finally, this report outlines potential actions New York State can take to support the development of municipally owned TENs. These recommendations aim to empower municipalities to overcome financial, technical, and regulatory barriers through expanded funding, supportive policies, and regional collaboration. They emphasize enabling local control over energy systems while advancing decarbonization in a way that balances affordability with equity, sustainability, and community-centered planning.

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1 Tax and Legal Considerations

This section outlines key New York State and federal laws that affect the business models currently available to municipalities, as well as the economic feasibility of Thermal Energy Network (TEN) projects – including systems built by private developers under a range of potential municipal ownership models with varying degrees of control, investment, and responsibility. Legal and tax considerations play a critical role in shaping the TENs landscape, as they establish the parameters for ownership, regulation, and financial incentives.

The selected laws discussed in this section include:

- **New York State Laws Governing Municipal Powers and Utility Ownership** – These laws define the legal authority and limitations governing how municipalities may own and operate potential TENs – a form of district energy utility.

- **New York State's Utility Thermal Energy Network and Jobs Act (UTENJA)** – This legislation establishes the legal and regulatory foundation for TENs in New York, including evolving oversight by the New York State Public Service Commission (PSC), which UTENJA tasks with developing a regulatory framework.[1] The law opens the door for IOUs to invest in and explore TENs pilots while leaving space for non-utility actors to develop alternative ownership models.

- **Federal Tax Law and the Inflation Reduction Act (IRA) of 2022** – The IRA provides enhanced tax credits and other incentives for clean energy infrastructure, including geothermal systems.[2] These provisions can significantly improve the financial outlook for municipal TEN projects, especially when structured to take advantage of direct pay and transferability provisions.[3]

- **New York State Law Governing Local Development Corporations (LDCs)** – These laws enable municipalities to establish LDCs as quasi-public entities that can own, finance, and operate infrastructure such as TENs.[4] LDCs may offer municipalities greater flexibility in project development, financing, and partnerships with private entities.

1.1 Municipal Ownership and Operation of Geothermal Utilities

New York State's Municipal Home Rule Law grants broad authority to local governments to adopt their own regulations, giving municipalities the flexibility to plan, create, and manage geothermal energy networks tailored to local needs.[5] This decentralized authority enhances

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[1] Ch. 375, §2(2) of the Laws of 2022 of New York, commonly known as the *Thermal Energy Network and Jobs Act* (enacted July 5, 2022) ("UTENJA")(text of Senate Bill S9422 available here); and Case 22-M-0429, *Order on Developing Thermal Energy Networks Pursuant to the Utility Thermal Energy Network and Jobs Act* (issued September 15, 2022) ("Initiating Order").
[2] Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818. While there are discussions in Congress and the White House about weakening or repealing the IRA, as of the publication of this Report the provisions referenced herein remain in place.
[3] 26 U.S. Code §§ 6417, 6418
[4] See N.Y. Not-for-Profit Corp. Law § 1411 (governing the formation and operation of LDCs by municipalities).
[5] N.Y. Mun. Home Rule Law §§ 1-59

municipal preparedness by allowing localities to proactively address energy and climate goals. However, state law retains the power to preempt local law when necessary.

Under Article 14-A of the New York General Municipal Law, municipalities are authorized to establish, own, and operate public utility services permitted under Article 4 of the New York Public Service Law.[6] While this currently includes electricity and gas, it does not yet explicitly authorize geothermal services. This legal ambiguity poses a challenge to municipalities seeking to prepare for long-term decarbonization and energy affordability by investing in TENs.

An MOU is a not-for-profit entity owned and operated by the municipality it serves.[7] MOUs differ from IOUs, which prioritize shareholder returns, by instead prioritizing community interests and allowing residents a direct voice in utility operations and policy decisions.[8]

If geothermal services are authorized as a municipal utility activity in the future, Section 360.2 of the General Municipal Law would allow municipalities to construct, lease, purchase, own, acquire, use, and operate TEN utilities within and beyond their territorial boundaries. This statutory power would greatly enhance municipal capacity to plan and scale municipal district thermal energy systems.

Additionally, Section 361.2 of the General Municipal Law enables two or more municipalities to engage in the "joint ownership, leasing, construction, acquisition, use or operation of a public utility service within [their] combined territorial limits…". If the New York State Legislature expands municipal authority to operate MOUs to include district thermal services, Section 361.2 would permit multiple municipalities – including counties - to jointly develop, own, and operate municipally owned TENs. Such partnerships could play an instrumental role in scaling geothermal networks and sharing costs, thereby improving project affordability and reducing financial risk for smaller or resource-constrained communities. However, the statute's joint ownership provision does not extend to partnerships between municipalities and private entities, limiting opportunities for collaborative financing with the private sector.

Article IX §1(f)(1) of the New York State Constitution grants local governments the authority to earn a fair return on the value of property used to operate gas or electric utility services within their jurisdiction. This return is calculated "over and above costs of operation and maintenance and necessary and proper reserves," and an amount equivalent to taxes that a privately owned service would pay to the local government.[9] Article IX §1(f)(2) further permits local governments to use utility profits either to refund customers or for other lawful purposes.[10]

Section 360 of the General Municipal Law outlines the powers granted to "municipal corporations" (e.g., MOUs) to establish, own, and operate specific public utilities. It specifies the procedures for establishing an MOU and delegates authority to local legislative bodies to enact local laws and ordinances necessary for its creation.[11] Any proposed action must be submitted

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[6] N. Y. Gen. Mun. Law § 360; and N.Y. Pub. Serv. Law § 66
[7] N. Y. Gen. Mun. Law § 360
[8] See American Public Power Association, *Municipalization: Public Power for Your Community* (2021), https://www.publicpower.org/system/files/documents/municipalization-public_power_for_your_community.pdf.
[9] N.Y. Const. art. IX, § 1(f)(1)
[10] N.Y. Const. art. IX, § 1(f)(2)
[11] N. Y. Gen. Mun. Law § 360

for approval either by the electors of the jurisdiction to the supervising board or by the supervising board to the electors. Once established, the MOU's legislative body is responsible for setting its operational methods and utility rates.[12]

Further, Section 362 permits MOUs to levy taxes, in whole or in part, to finance their operations in the same manner as taxes are levied for permanent public improvements under the law.[13] However, taxes are not the sole financing tool available – MOUs may also issue bonds to raise capital for their operations and infrastructure. These flexible financing tools enhance both project affordability and municipal readiness to undertake long-term energy investments.

While geothermal services are not yet explicitly authorized by the New York State legislature to be offered by municipalities under state law, the legal framework governing MOUs for electricity, gas, and steam services offers a strong foundation for their future inclusion and, in the meantime, the preliminary development of early MOU models for TENs.

1.2 New York State Regulation Under UTENJA

The Utility Thermal Energy Network and Jobs Act of 2022 begins to expand the scope of services that gas and electric IOUs might provide to include utility-scale thermal energy for various uses. UTENJA directed the PSC to develop a regulatory framework for utility-owned thermal energy networks, or UTENs. This framework aims to scale affordable and accessible building electrification, protect consumers, and strike a balance between the role of incumbent monopoly utilities and other market and public actors.[14] In doing so, it seeks to address regulatory uncertainties that may hinder the affordability and deployment of TENs. This framework is ultimately intended to benefit municipalities and their partners in developing these projects; however, as of this report's publication, the extent of PSC regulation over municipally owned TEN systems remains unclear for the foreseeable future.

In New York, municipal electric and gas utilities are typically subject to a different regulatory regime than private or investor-owned utilities. Municipal utilities that are owned and operated by local governments generally enjoy greater autonomy from PSC regulation. They are governed instead by municipal boards or city councils accountable to residents and local government structures. This exemption from certain PSC regulations means that municipal utilities are not subject to the same rate-setting, service quality, and operational oversight applied to private gas and electric IOUs.

Despite receiving reduced PSC oversight, municipal utilities must still adhere to certain state and federal regulations. MOUs may voluntarily adopt some PSC guidelines to benefit from standardized practices, access to funding, or participate in collaborative efforts to improve service quality and infrastructure. Furthermore, the PSC retains oversight responsibilities related to safety, reliability, and certain financial aspects, even for municipal utilities. While municipal utilities are locally governed, they are still subject to state consumer protection laws, ensuring customers are treated fairly and have avenues for addressing grievances. These dual layers of

[12] *Id.*
[13] N. Y. Gen. Mun. Law § 362
[14] *UTENJA,* Ch. 375, §2(2) of the Laws of 2022 of New York, 2 (see text of Senate Bill S9422 available here).

oversight – local and state – are an important consideration for municipalities as they navigate the evolving landscape of utility regulation under UTENJA.

UTENJA directed the PSC to establish limited exemptions from regulation for small-scale TENs at an early stage of the regulatory regime's development.[15] Following the PSC's July 2024 *Order Adopting Initial UTEN Rules*, a TEN is initially exempt from PSC regulation if:

1) It is not owned by an entity that otherwise meets the definition of a gas, electric, or combination gas and electric corporation, **and**
2) It meets one of the following criteria:
    a) Thermal energy is provided in a *campus-style environment* where the TEN and the buildings it serves are on private property, owned by the same entity, with no provision of thermal energy to tenants for a fee; **or**
    b) Thermal energy is provided by a system that meets the definition of a TEN but was in operation prior to July 5, 2022; **or**
    c) Thermal energy is provided by a TEN for which the PSC has granted a project-specific exemption.[16]

The third exemption, in 2(c) above, allows developers of TENs that would otherwise be subject to full PSC regulation to petition for a project-specific exemption.[17] To qualify for this exemption, the petitioner or entity intending to own or operate the TEN must: (i) not meet the definitions of an electric or gas corporation in Public Service Law §§ 2(11) and 2(13), and (ii) must demonstrate that the proposed TEN will implement adequate consumer protections and ensure safe, adequate, and reliable service at just and reasonable rates without the need for PSC regulation.[18] This process requires consideration of proposed TEN's specific characteristics. Petitioners must show the system's design is substantially complete and demonstrate their development intent, rather than presenting hypothetical concepts.[19] Navigating this exemption process creates regulatory uncertainty and may complicate project timelines until further PSC guidance is issued.

In summary, under the *Initial UTEN Rules Order*, the PSC declined to categorically exempt municipally-owned TENs, as well as those owned and operated by homeowners' associations (HOAs) or associations of building owners, including cooperatives.[20] The PSC reasoned that categorically exempting municipally-owned TENs remains premature given the nascent state of regulation in New York and the Commission's desire to ensure sufficient safeguards for affordability, accessibility, safety, and customer protections in early systems.[21] As a result, municipalities developing TENs in New York must request individual exemptions and, if denied, may be required to comply with all or some of the regulations developed for IOUs. While this process adds complexity, it also offers local municipalities an opportunity to help shape the future regulatory framework that governs future TENs throughout the state.

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[15] Case 22-M-0429, *Order Adopting Initial Utility Thermal Energy Network Rules* at 26 (issued July 18, 2024) ("*Initial UTEN Rules Order*").
[16] *Id.*
[17] *Id.* at 25, app. B.
[18] *Id.*
[19] *Id.* at 25 – 26, app. B.
[20] *Id.* at 21.
[21] *Id.*

1.3 Federal Tax Considerations

The Inflation Reduction Act (IRA) of 2022 expanded the federal Internal Revenue Code (IRC) Section 48 Investment Tax Credit (ITC) to apply to geothermal technologies while offering municipalities and non-profit entities new opportunities for financial support.[22]

One of the most significant changes is the ability for these tax-exempt entities to receive a direct cash payment equivalent to the ITC available to taxable entities. This change is a significant feature of the ITC under the final rules, as it can substantially impact the economic feasibility of various TEN business models by providing cost-reduction options for developers and improving financial viability.

Though these changes can support municipal geothermal projects, other elements of the ITC's design under current regulatory interpretations, particularly regarding ownership requirements, may limit its availability for certain business models.

Key aspects of the § 48 ITC under the IRA include:

- ***Elective Pay and Transferability*** – The IRA introduced two mechanisms to enhance the ITC's impact. First, it allows tax-exempt entities, including municipalities and non-profits, to receive direct payments equivalent to the ITC.[23] Second, for taxable entities, it permits the transfer of ITCs to other taxpayers, providing greater flexibility and potentially increasing the overall value of the tax benefit.[24]

- ***Percentage of Credit*** – The ITC under Section 48 provides a base-credit deduction of up to 30% of eligible project costs for geothermal systems (referred to as the "energy property"). Projects larger than 1 MW must comply with prevailing wage and apprenticeship (PWA) requirements to qualify for the full base credit.[25] This percentage can be increased to 50% of eligible project costs by meeting bonus criteria related to domestic content and energy communities. Failure to meet PWA or bonus requirements will result in a reduced ITC.[26]

- ***Same Owner of Energy Property*** – The final rules defining "energy property" under Section 48 mandate that the same entity own all portions of the energy property to

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[22] *Inflation Reduction Act of 2022*, H.R. 5376, 117th Cong. (2022), https://www.congress.gov/bill/117th-congress/house-bill/5376/text; 26 U.S.C. § 48 (2022), https://uscode.house.gov/view.xhtml?req=(title:26%20section:48%20edition:prelim)%20OR%20(granuleid:USC-prelim-title26-section48)&f=treesort&edition=prelim&num=0&jumpTo=true.
[23] *Elective Payment of Applicable Credits*, Fed. Reg. (March 8, 2024), https://public-inspection.federalregister.gov/2024-04604.pdf.
[24] *Transfer of Certain Credits*, Fed. Reg. (May 1, 2024), https://public-inspection.federalregister.gov/2024-08926.pdf.
[25] *Increased Amounts of Credit or Deduction for Satisfying Certain Prevailing Wage and Registered Apprenticeship Requirements*, 89 Fed. Reg. 122 (June 25, 2024), https://www.federalregister.gov/documents/2024/06/25/2024-13331/increased-amounts-of-credit-or-deduction-for-satisfying-certain-prevailing-wage-and-registered.
[26] IRS, *Notice 2024-41*, June 15, 2024, https://www.irs.gov/pub/irs-drop/n-24-41.pdf; IRS, *Notice 2023-38*, May 31, 2023, https://www.irs.gov/pub/irs-drop/n-23-38.pdf; and IRS, *Notice 2024-30*, April 10, 2024, https://www.irs.gov/pub/irs-drop/n-24-30.pdf.

qualify for the ITC.[27] Under controlling regulations, energy property includes the functionally interdependent components essential for system operation, which must be unified and operational when placed in service. For municipalities, this ownership structure could present a barrier, especially if there are plans to incorporate multiple entities or stakeholders into the project's ownership model. For geothermal heat pump systems, ownership must encompass the ground loops and at least one connected heat pump. Separate taxpayers may purchase additional heat pumps connected to a TEN energy property system, but only if such components qualify for Section 25D credits available to residential homeowners, rather than the Section 48 ITC. The current rules thus require that entities aiming to qualify for the ITC ensure unified ownership of TEN-system components, which may include boreholes, group loops, energy distribution systems, and one or more geothermal heat pumps.

It is important to note that the IRA's ownership stipulations potentially conflict with New York State PSC's fair access rules and evolving regulatory framework under UTENJA. The PSCs initial rules permit TEN-infrastructure, such as boreholes and waste-heat sources, to be owned and operated by entities other than the utility managing the TEN, legally permitting split-ownership models that may not qualify for ITC credit benefits.

- ***20% Rule*** – Up to 20% of the total value of the Energy Property may consist of pre-existing equipment. This provision may allow municipalities to leverage existing infrastructure as part of their TEN systems, which could help reduce upfront costs. However, municipalities must ensure that any pre-existing equipment meets the requirements outlined by the IRA to qualify for the ITC.

1.4 New York State Local Development Corporations

Section 1411 of New York State's Not-For-Profit Corporation Law (NPCL) provides for the creation of Local Development Corporations (LDCs). In New York, LDCs are nonprofit entities designed to promote economic development and serve public purposes, particularly at the local level.[28] LDCs offer municipalities a unique opportunity to engage in economic development projects, including the establishment of TENs. As municipalities explore options for implementing TENs, LDCs could serve as a vehicle for organizing and financing these projects, providing flexibility in ownership and governance.

LDCs can potentially expand the options available to municipalities for establishing a TEN. These corporations can be formed by private individuals, municipal entities, or public officials to support local economic development. Governed by a board of directors typically comprising representatives from both the public and private sectors, this structure may help ensure a balanced approach to decision-making. Further, LDCs operate under strict state oversight to

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[27] *Definition of Energy Property and Rules Applicable to the Energy Credit*, 89 Fed. Reg. 78190 (Dec. 12, 2024), https://www.federalregister.gov/documents/2024/12/12/2024-28190/definition-of-energy-property-and-rules-applicable-to-the-energy-credit.

[28] N.Y. NOT-FOR-PROFIT CORP. LAW § 1411 (governing the formation and operation of LDCs by municipalities).

ensure transparency and accountability. They are required to submit annual financial reports and comply with regulations enforced by the Authorities Budget Office (ABO).

LDCs have already played key roles in fostering public-private partnerships, stimulating local economic growth, and enabling municipalities to finance large-scale public infrastructure projects without directly increasing taxes. For municipal TEN projects, LDCs could act as intermediaries, helping municipalities access financing and expertise while maintaining control over key infrastructure. By enabling municipalities to leverage private sector partnerships and resources, LDCs may help reduce the financial burden of TEN development, ultimately improving the affordability and accessibility of geothermal energy solutions. However, as with any financial structure, municipalities must carefully consider the potential costs of partnering with or setting up an LDC, as well as how the LDC's governance model aligns with local priorities and goals for TEN projects.[29]

[29] For further information, see Harris Beach PLLC, *Public Finance Handbook* ch. 10, "Local Development Corporations (LDCs)" (2023), https://www.harrisbeachmurtha.com/wp-content/uploads/2022/01/2023_Public-Finance-Handbook.pdf.

2 Municipal Thermal Energy Network Business Models

Several viable business models are available for municipalities to establish TENs in New York. The choice of business model determines the allocation of responsibilities among municipalities and partner stakeholders and significantly impacts the economics of heating and cooling services for consumers. Moreover, the chosen model may enable municipalities to monetize infrastructure, potentially unlocking new revenue streams.

Pace presents the following models while acknowledging the need for explicit authorizing legislation and the evolving regulatory regime in New York State. The PSC continues to actively explore options for TENs operated by private IOUs, municipalities, and other entities as it develops regulations under the UTENJA proceeding.

Choosing Among a Continuum of Options

When evaluating business models for TENs, municipalities should consider several key factors, including:

- **Financial capacity**
- **Technical capacity**
- **Administrative capacity**
- **Community priorities in relation to cost and transparency**

The business models for TENs can be visualized as a continuum, defined by tradeoffs between levels of municipal involvement and external partnerships.

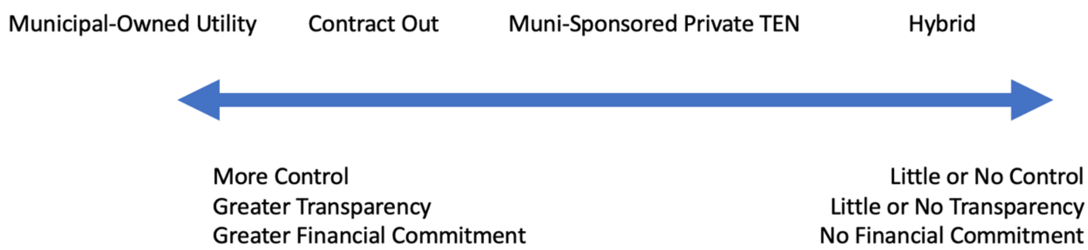
- **Complete Municipal Ownership** – At one end of the spectrum, the municipality finances, owns, and operates the TEN. This model is most beneficial for municipalities with strong financial, technical, and administrative capacities. Advantages include greater governance control and potential cost savings for consumers.

- **Partial Municipal Ownership with Outsourced Services** – Municipalities lacking sufficient technical or administrative expertise may choose to contract out these services while retaining ownership and operational responsibilities for the TEN. This approach allows municipalities to leverage external expertise while maintaining significant control.

- **Private or Utility-Owned TEN with Municipal Involvement** – For municipalities with limited financial resources, partnering with private developers or traditional utilities may be advantageous. In this model, the municipality neither owns nor controls the TEN but may secure enhanced governance participation and transparency compared to a traditional investor-owned utility model.

Across this continuum, the degrees of control, transparency, and cost implications for consumers vary. While specific arrangements influence these factors, broader project economics also depend on external elements such as efficiency. The tradeoffs among these models can be conceptualized as a balance between municipal control and reliance on external partners.

Figure 1: TENs Business Model Continuum



Source: Authors

Establishing and operating an MOU can provide significant economic advantages for consumers. Unlike private utilities, municipal utilities are not obligated to generate profits for investors, allowing revenues to be reinvested into infrastructure improvements, lower rates, or enhanced services. Freed from the requirement to deliver shareholder returns, municipal utilities can prioritize cost efficiency in order to produce long-term community benefits, such as maintaining affordable rates and supporting renewable energy projects.

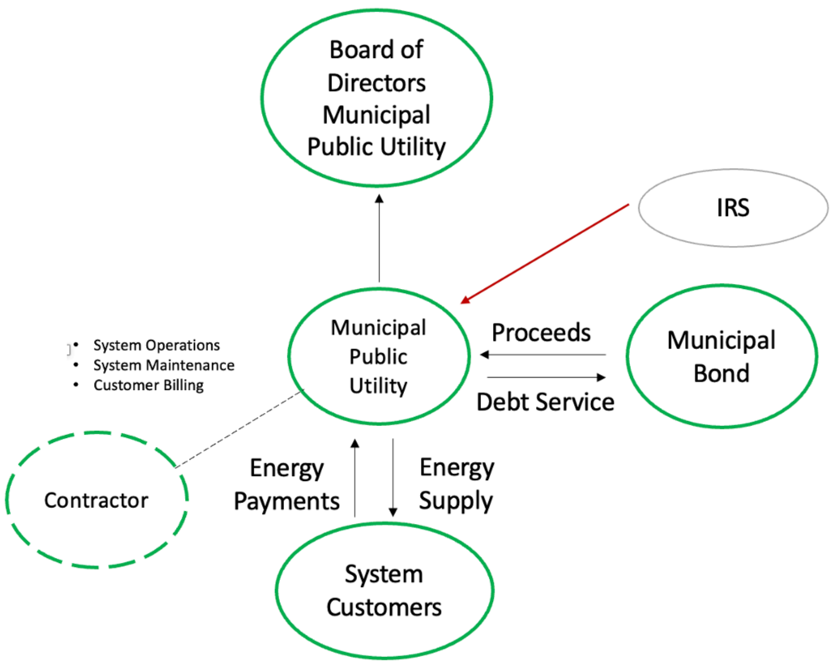
However, the economic success of an MOU depends on its efficiency, governance, and organizational culture. As with any type of utility, transparent governance and a strong culture of accountability are critical to preventing mismanagement or inefficiencies that could undermine cost savings. Additionally, the utility must prioritize service quality and cost-effectiveness to remain competitive with private utilities while aligning with community objectives. When well-managed, municipal utilities should be able to deliver lower cost services, foster public trust, and promote local economic development.

Our discussion focuses exclusively on options where the municipality plays a primary or dominant role in establishing and operating TENs. We do not address the investor-owned utility model, as it excludes municipalities from owning or operating TENs.

2.1 Municipally Owned and Operated Utility Thermal Energy Networks

A municipally-owned and operated utility represents a model of complete municipal control and ownership (Figure 2). This approach empowers communities with greater authority over system planning, governance, and consumer costs, enabling them to align utility operations closely with local priorities and goals.

Figure 2: Municipally-owned Utility



Source: Authors

As publicly owned entities, MOUs are governed by local officials or boards accountable to the public, aimed at ensuring that community interests remain a priority. Their primary mission is to provide reliable services at affordable rates rather than focusing on profit maximization. This model allows municipalities to align energy services with community goals, such as ensuring that geothermal energy services are sustainable and available equitably across the community. MOUs may also enhance public accountability and encourages greater community input in decision-making processes.

Municipally-owned utilities operate without shareholders, enabling any excess revenues to be reinvested in infrastructure improvements, energy efficiency programs, or returned to the community through reduced rates. Additionally, these utilities can lower service costs by leveraging the municipality's ability to issue bonds and borrow at lower rates. Furthermore, MOUs benefit from tax exemptions at the federal and state levels, and if properly structured, they may qualify for payments under the Inflation Reduction Act as tax-exempt entities.

Despite these economic advantages, the ability of an MOU to deliver geothermal energy cost-effectively compared to investor-owned utilities depends on the municipality's capacity to operate the utility efficiently. While geothermal systems are less operationally demanding than electricity or gas services, municipalities must still maintain staff for system maintenance, customer billing, and emergency response.

The municipally-owned utility model is likely most practical for municipalities already managing municipal water, sewer, or electric utilities. Such municipalities benefit from existing technical expertise, operational capacity, and established consumer relationships, which can reduce the time and resources required to establish a new utility under New York State law.

Finally, under current Public Service Commission rulings, a municipally operated TEN may be subject to the same level of regulation as an investor-owned UTEN unless it seeks and is granted an individual exemption. Full PSC regulation could impose a significant burden on a municipally-owned utility, potentially undermining the viability of this model.

2.2 Municipally Owned Utility Contracting Out Operations

The first variation on the municipally-owned model, a municipality may choose to contract out operations, maintenance, and administrative functions to a qualified TENs engineering or service company while retaining legal ownership. This approach allows the municipality to maintain greater control and achieve desired economic outcomes, while supplementing its staff with the necessary expertise it may currently lack or find uneconomical to develop internally.

Additionally, this model provides flexibility, as the decision to outsource specific functions can be reversed in the future if the municipality acquires the required expertise through staff training or new hires. This adaptability enables municipalities to gradually build capacity while ensuring the efficient and effective operation of the TEN.

2.3 Municipally Sponsored Private Thermal Energy Networks

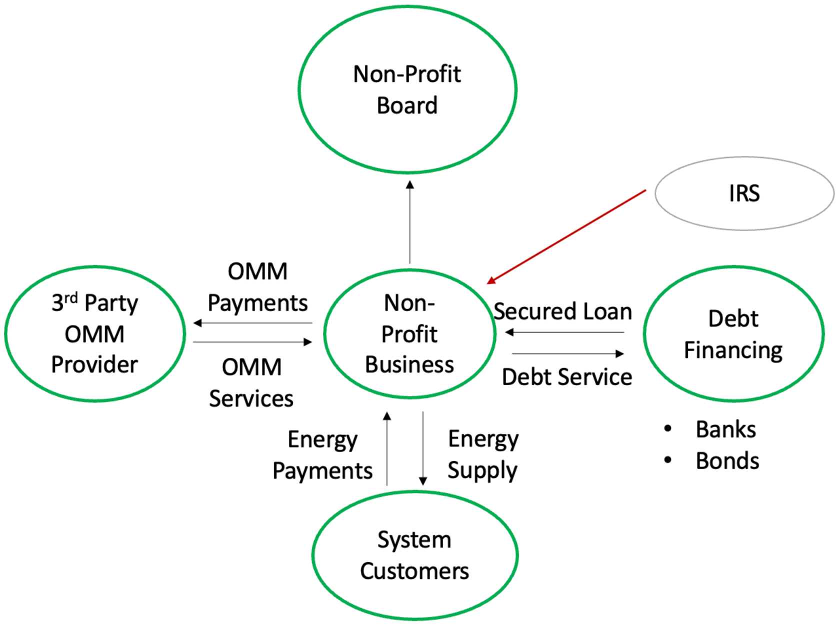
A further step along the continuum involves municipalities sponsoring a private entity to establish a TEN in their community. In this model, the municipality negotiates specific aspects of the TEN, such as participation in its governance or the use of municipal land.

One approach to a municipally-sponsored private TEN is the Captive Non-Profit Model (Figure 3). This model involves a privately-owned TEN that operates as a private utility and is organized as a non-profit entity for tax purposes. By obtaining tax-exempt status and structuring the entity to comply with applicable tax requirements, the non-profit is not subject to tax and may qualify for cash payments under the Inflation Reduction Act for tax-exempt entities.

In this model, the non-profit entity primarily serves financing and tax purposes. In its leanest form, the special-purpose non-profit entity raises financing to acquire the TEN system and retains ownership of the infrastructure. However, the entity itself typically does not have employees to design, build, operate, or maintain the system. Instead, funding is secured through traditional commercial channels, such as bank loans or project bonds, which are generally based on the expected revenues of the project and structured using conventional project finance approaches.

All operational aspects of the TEN – design, construction, operation, and maintenance – are outsourced to a qualified third-party service provider with expertise in geothermal engineering. This firm handles the technical and operational responsibilities under a contractual arrangement, allowing the non-profit entity to focus solely on ownership and financial stewardship.

Figure 3: Captive Non-Profit TEN Model



Source: Authors

Although the Captive Non-Profit Model employs a non-profit entity without shareholders, the profit component is embedded within the contract to the engineering firm responsible for designing, building, operating, and maintaining the TEN. To manage expenses and ensure the project remains financially efficient, municipalities should prioritize selecting cost-effective engineering partners through a competitive bidding process. This approach helps control overhead costs while reinforcing the model's commitment to financial stewardship.

Lastly, the captive non-profit structure is subject to regulation as a utility, potentially under the same regulatory framework that applies to investor-owned utilities.

2.4 Municipally Approved HOA Thermal Energy Networks

The next variation along the ownership continuum involves municipalities approving and supporting the development of TENs established by homeowner's associations (HOAs) to serve specific neighborhoods (Figure 4). In this model, the municipality facilitates the creation of an HOA-operated TEN by approving it as part of an HOA's common property under local zoning and building codes, and applicable state statutes and regulations.

In theory, an HOA-managed TEN may be established with a newly formed HOA or added to an existing one. This model is generally limited to residential neighborhoods where HOA governance is legally permissible under New York law, and thus may not extend to commercial, industrial, or public buildings, which typically fall outside the scope of HOA jurisdiction.

This HOA-owned TEN model operates as a private utility, with the HOA organized as a nonprofit entity for tax purposes. In New York State, HOAs are generally organized under the Not-for-Profit Corporation Law (NPCL).[30] By obtaining tax-exempt status and structuring the entity to comply with applicable tax requirements, the HOA may qualify for direct-pay tax benefits under the Inflation Reduction Act.

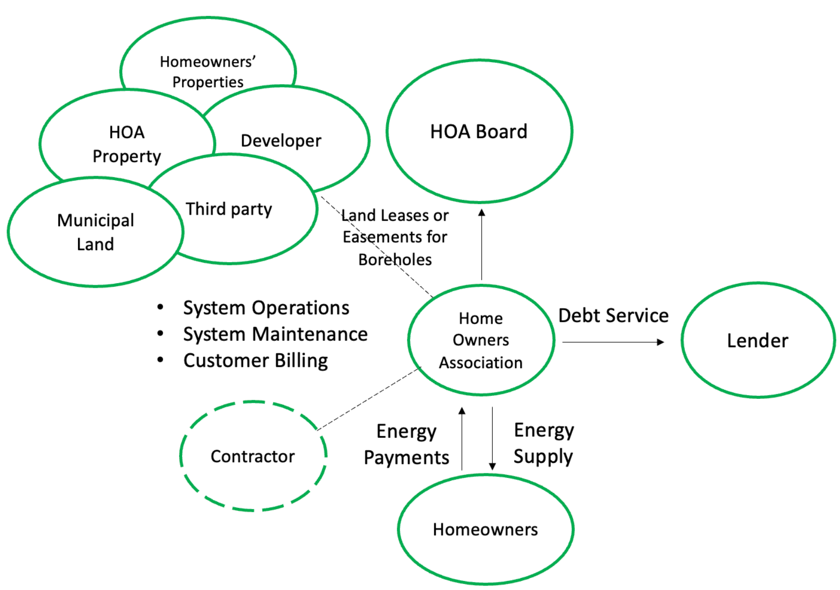
In this model, the HOA nonprofit entity primarily serves financing and tax-related functions. In its leanest form, the special-purpose nonprofit raises capital to acquire and own the TEN system. It does not usually directly employ staff for design, construction, operation, or maintenance. Instead, funding is secured through traditional commercial channels, such as bank loans or project bonds, generally structured based on a project's anticipated revenues using standard project finance approaches.

All operational aspects of the TEN, including design, construction, operation, and maintenance, are outsourced to a qualified third-party service provider with geothermal engineering expertise. This firm assumes technical and operational responsibilities under a contractual arrangement, ensuring the system's efficiency and reliability.

If the HOA does not possess viable common property for borehole fields, land may be leased or secured through an easement from a variety of potential properties, such as the municipality, individual HOA homeowners, a developer (if applicable), or contiguous third-party landowners.

As with the prior private model, any profit component is embedded within the contract to the engineering firm. To manage expenses and ensure the project remains financially sustainable, competitive bidding for these services is essential.

Figure 4: HOA Non-Profit TEN Model



Source: Authors

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[30] N.Y. Not-for-Profit Corp. Law §§ 102, 201–204.

New York State courts have upheld exempting HOAs that provide energy services exclusively to their members from extensive PSC regulation under the private sale doctrine.[31] Still, under initial rules implementing UTENJA, an HOA seeking to own a TEN must apply for and obtain a small-scale system exemption from PSC oversight and regulation under the Public Service Law.

An HOA-owned TEN must also consider compliance with applicable state regulations governing HOAs.[32] To establish an HOA as a nonprofit under the NPCL, a sponsor files Articles of Incorporation with the Secretary of State. The formed HOA is then subject to NPCL provisions concerning governance, member rights, and asset management, as well as its Articles of Declaration and Bylaws. If the HOA bundles membership interests or cost recovery with home sales or other investment offerings, disclosure obligations under the N.Y. General Business Law may apply.[33]

The Office of the New York State Attorney General (OAG) also holds jurisdiction over certain matters involving HOAs, including the ownership and maintenance of common property.[34] When forming an HOA, developers must submit an offering plan to the OAG. Under Cooperative Policy Statement No. 7 (CPS-7), certain newly formed HOAs with "de minimis cooperative interests" may qualify for a simplified registration process and are not required to submit a full offering plan under Part 22 of Title 13 of the NYCRR. These de minimis interests typically involve common elements, such as shared roofs, hallways, or open space, that impose minimal maintenance obligations on the HOA.[35] However, CPS-7 expressly excludes from streamlined treatment significant mechanical and utility systems, including HVAC systems. Given the likely ongoing maintenance needs of a TEN, it remains unclear whether an HOA-owned system would qualify for CPS-7 treatment. Regulatory clarification is needed to resolve this uncertainty and guide prospective HOA-owned TENs.

2.5 Hybrid Municipal and Investor-Owned Utility Thermal Energy Networks

A Hybrid Municipal-Investor-Owned Utility Model, utilizing a New York Local Development Corporation (LDC) as the TEN sponsor, combines public and private elements to leverage the strengths of the municipality, the LDC, and the investor-owned utility (Figure 5).

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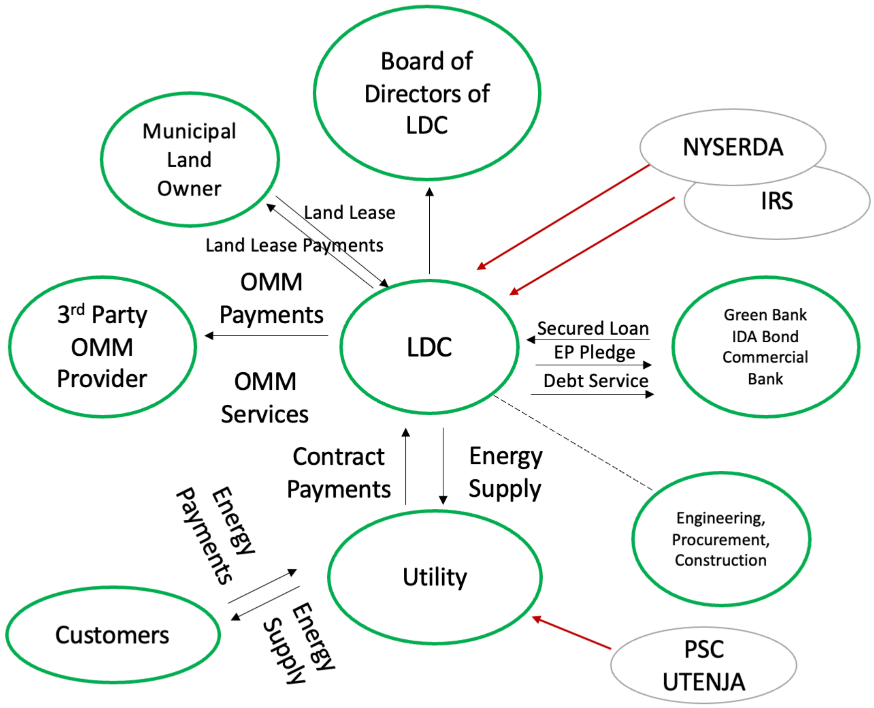
[31] N.Y. Pub. Serv. Law § 2(13) (defining an "electric corporation" as one providing electric service to the public for compensation); see also Case 91-E-0501, Re Woodbury Heights Estates, Order Determining Complaint (N.Y. Pub. Serv. Comm'n July 23, 1992) (finding that electric sales limited to tenants of a mobile home park did not constitute service to the "public" and therefore were not subject to PSC regulation).
[32] Homeowners Protection Bureau, LLC, *New York HOA Laws and Resources* (last visited April 22, 2025), https://www.hopb.co/new-york#google_vignette.
[33] N.Y. General Business Law §§ 352–359-h
[34] NYS Office of the Attorney General, *Homeowners Associations* (last visited April 22, 2025), https://ag.ny.gov/resources/individuals/tenants-homeowners/homeowners-associations.
[35] New York State Office of the Attorney General, *Cooperative Policy Statement No.7*, https://ag.ny.gov/sites/default/files/regulatory-documents/cooperative_policy_statement_7.pdf.

Figure 5: Hybrid Municipal-Investor-Owned Utility Model



Source: Authors

This model is characterized by a split ownership and operational structure. An LDC, acting as a nonprofit entity, oversees the energy generation component, in this instance to be located on municipally owned land. The LDC contracts with engineering firms for the construction of the TEN and separately contracts with a utility as the off-taker of thermal energy, which the utility then supplies to the public. The LDC can raise capital through its bonding authority or via commercial loans.

However, in this structure, the LDC's ownership of the TEN's generation components and the IOU's ownership of the distribution system may render the project ineligible for federal tax benefits, as the energy property would be split between two entities.

As discussed above, Section 48 of Internal Revenue Code requires generation and distribution components that are deemed functionally interdependent to be owned by the same entity. Pace recommends seeking advice of tax counsel to structure the transaction to secure ITC tax credits if this structure if considered.

The engagement of the LDC provides municipalities with expanded financing options for TEN developments while minimizing direct financial exposure. LDCs, operating independently of municipalities, can secure funding through private activity bonds, Green Bank loans, or commercial loans backed by revenue agreements with utility partners. This financial independence enables the LDC to cover infrastructure development, debt service, and operational expenses through utility payments.

The nonprofit status of the LDC also allows for the issuance of tax-exempt bonds, potentially lowering borrowing costs. Additionally, LDCs are not subject to the competitive bidding and appraisal requirements that apply to municipalities.

The IOU partner, regulated by the PSC, manages the distribution network. This includes extending the thermal loop to end-users and providing customer support, billing, and regulatory compliance services. Leveraging the expertise and infrastructure of investor-owned gas and electric utilities, the IOU partner contributes capital and operational capacity needed to build and maintain large-scale distribution networks, ensuring reliable service to customers of early TEN systems – an essential consideration for the NY PSC under initial rules.

Municipalities can earn revenue by leasing land to the LDC for borehole fields or above-ground facilities. By delineating roles clearly, each party operates within its strengths: the LDC manages public assets, while the utility focuses on energy delivery.

This structure involves significant complexity and high up-front costs for establishment, requiring careful coordination and allocation of responsibilities among stakeholders.

3 Municipally Owned Utility Functions

A municipality considering the development of a TEN should evaluate its role within various business model options from both capacity and financial perspectives. To assist in this assessment, Pace has developed a customizable spreadsheet, available upon request, to help municipalities estimate the operational costs required to support a TEN under a directly municipally owned utility model.

Municipalities must determine their own staffing levels based on the specific functions they plan to perform, as well as factors such as the size of the network, the number of customers, and the degree of integration with other infrastructure or operations. For instance, municipalities that already operate electric, gas, or water utilities may be able to utilize existing staff to support TEN operations.

The Pace spreadsheet allows municipalities to specify the percentage of time each staff member allocates to the TEN. For example, an accounting staff member might dedicate 40% of their time to TEN-related work, with the remainder devoted to other municipal duties. This flexibility helps municipalities more accurately model staffing requirements.

The spreadsheet was created in consultation with existing electric MOUs in New York State. Since New York does not yet have TEN-specific MOUs, the staff salary cost estimates are based on the 2023 Municipal Electric Utilities Association (MEUA) of New York's Wage Salary Survey data, which provides state averages for electricity MOU staffing costs (Table 1).[36]

Table 1: 2023 MEUA Selected Wage Salary Survey Data

	Average salary	Reporting municipalities
Manager or Commission Chair	$25,684.55 (annual charge to electric department)	11
DPW or Electric Superintendent	$69,818.93 (annual charge to electric department)	29
Assistant to Electric Superintendent	$73,701 annually	6
Chief Engineer	$94,921 annually	2
Chief Financial Officer	$29,713.41 (annual charge to electric department)	22
Line Foreman	$41.21/hour	18
Chief Foreman	$40.30/hour	16
Apprentice Lineman	$28.87/hour	23
Journeyman Lineman	$39.63	20
Stand-by Time	13.89/Reg	4
Substation Technician	$43.94/hour	6
Groundsman	$25.79/hour	8
General Laborer	$25.01/hour	8
Meter Repairman	$34.66/hour	8
Senior Clerk or Treasurer	$28.96/hour	22
Clerk	$22.09/hour	29

Additional operational cost estimates, including annual and monthly office expenses, capital expenditures for office equipment, and insurance, were developed in consultation with electric MOU operators and based on the average of the figures they provided. Users can adjust the

[36] The 2023 MEUA Wage Salary Survey results are on file with the authors and available upon request.

provided salary and operations costs to reflect regional rates and account for the specialized skills required for TEN operations.

Infrastructure construction and maintenance costs should be developed separately in consultation with a TEN engineering firm. While the Pace spreadsheet focuses exclusively on the municipal staffing component of TEN operations, it includes clearly designated areas where project-specific upfront building and financing costs can be integrated.

The following sections summarize each major component of the spreadsheet, including staffing salaries, office and equipment costs, services, start-up costs, financing, and contingency planning. It begins with key considerations related to billing and maintenance workforce for municipal utilities.

Billing

Utilizing advanced metering infrastructure (AMI) can significantly reduce personnel costs associated with billing. In municipal electric utilities that use AMI, a single office staff member can collect meter data and generate customer bills. Based on consultations with municipalities, a small MOU can read all AMI electric meters in approximately four hours, with an additional few days required to generate and mail bills.

The cost of AMI systems is approximately $10,000 per unit. Billing software typically costs between $15,000 and $18,000 per year and is cloud-based, including IT support. Office internet services average $150–$170 per month.

Maintenance Workforce

Retaining skilled workers to maintain energy infrastructure is a persistent challenge for municipal electric utilities and is likely to be difficult for municipal TENs. Private industry often offers higher wages, resulting in a common cycle of hiring and training line workers before losing them to private employers. Municipalities should factor this dynamic into salary projections and consider strategies to improve workforce retention.

Salaries

Salaries are divided into *annual salaried* and *hourly staff* categories, with sample average values derived from the 2023 MEUA Wage Salary Survey. These salaries reflect the portion of wages allocated to the utility's budget, rather than the employee's total compensation.

If a MOU already operates an electric or water utility, several of these positions may already be staffed, eliminating the need for duplication. However, if a municipality is starting without an existing utility, it may need to hire most, if not all, of the listed positions. The flexible spreadsheet allows municipalities to determine how many people will be needed for each position (including whether a given position is needed at all).

A space is also provided for a *contingency value* for hourly staff members. This feature may help account for unexpected overtime, particularly in response to weather events. Municipalities may choose to apply the contingency percentage feature or opt for a 0% contingency. An additional opportunity to apply an overall contingency fee is available at the end of the spreadsheet, as discussed later.

A column to include a *benefits package* for both salaried and hourly staff is also included. The default benefits rate is 40% of the employee's annual or hourly wage. This figure reflects the average of benefits package provided by New York State municipalities operating electric utilities. The actual value of benefits packages may vary depending on factors such as length of employee tenure and the selected health insurance plan. This value is adjustable in the tool, and municipalities may recalculate accordingly.

Office Function — Annual Cost

This category is intended to capture costs associated with office operations on an annual basis. At present, the only value added is for *billing software*, estimated at $16,500 per year, based on an estimate provided by electric MOUs. Municipalities with existing utilities may already have compatible billing software. If a municipality already operates any utility, it is likely that billing software is in place, and this cost might be reduced or avoided entirely for TEN operations.

Office Function — Monthly Cost

This category is intended to capture costs that derive from use of office space each month, such as utility bills and rent charges. While no sample values are provided, these costs should be relatively straightforward for municipalities to estimate based on their existing operations.

Office Function — Capital Expenditures

This category is intended to account for office equipment purchases that do not occur on a monthly or annual basis. Examples include computers and printers. This allows municipalities to list specific equipment purchased, estimate the equipment's useful life in years, and use the spreadsheet to calculate the corresponding annual cost to pay of that equipment.

Municipalities with existing utilities are encouraged to share equipment where possible to reduce expenses.

Utility Equipment — Capital Expenditures

This category is intended to account for equipment costs necessary to operate an electric or geothermal utility. Types of equipment may include consumer meters, uniforms, and shop tools. As with the "Office – Capital Expenditures" category, the intent is for the spreadsheet to help determine the annual costs required to pay off larger office equipment purchases that do not necessarily occur monthly or annually.

Municipalities operating existing utilities may already possess some or all of the equipment required, enabling reductions in overall costs.

Services

This category includes services such as legal support, marketing, and insurance. No estimated values are provided, but municipalities with existing utilities can estimate these costs based on prior experience.

Start-Up Cost

This category intends to capture the costs associated with planning and building a district geothermal or TEN system. No sample values are currently provided, as these numbers have proven highly variable between projects and complex to determine. Private utilities often determine "costs" at a higher value than what a municipality may be able to achieve, and many start-up costs should be amortized over time. Municipalities are encouraged to establish start-up costs for their specific TEN project(s) in consultation with a TEN engineering firm.

The spreadsheet allows municipalities to enter costs as either *itemized values* or as a *lump-sum estimate* provided from a contractor.

Financing

This category is intended to help municipalities account for costs related to project financing, such as debt and taxes. The debt interest rate is set at 8% in the spreadsheet as a placeholder. Users should adjust this based on secured funding sources and market conditions.

Contingency

A contingency feature is included to help municipalities reserve budget for contingencies. Large infrastructure projects often exceed initial cost estimates, so it is important municipalities account for contingencies in planning. The spreadsheet allows municipalities to select a percentage of their total costs to set aside as a contingency. It then calculates the corresponding dollar amount for the contingency and adjusts the overall project budget accordingly.

4 Risk-Based Permitting Regime for Geothermal & Thermal Energy Networks

A dedicated municipal permitting regime for TENs can assist building owners and developers in planning TEN projects by reducing uncertainty and, in turn, lowering the cost of scaling TENs within a community. A clearly defined permitting framework also supports municipal officials in advancing the deployment of geothermal and TEN technologies locally.

This section presents a conceptual permitting and approval framework for consideration by New York State municipalities. The proposed framework adopts a risk-based approach, in which the level of permitting oversight scales with the complexity and potential risks of a geothermal project. This framework is designed to focus municipal resources on projects warranting greater scrutiny, such as multi-property, district-level TENs and projects involving sensitive environmental considerations, while streamlining approval for single-owner, single-property systems that pose minimal risk.

The framework classifies geothermal and TENs projects into four permitting categories – Types A, B, C, and D – based on project complexity, environmental factors, and design considerations. Pace believes that a tiered permitting approach promotes streamlined adoption for low-risk projects and more robust oversight for higher-risk installations.

When designing their permitting scheme, Pace recommends municipalities pair the adoption of a flexible, risk-based permitting structure with targeted training for building department staff and other municipal personnel on geothermal heat pump technologies and TENs. Such efforts would help prepare administrative departments to guide residents to make informed decisions about geothermal heat pump systems. Members of local administrative and legislative bodies, including planning boards and Zoning Boards of Appeals, should also receive similar training.

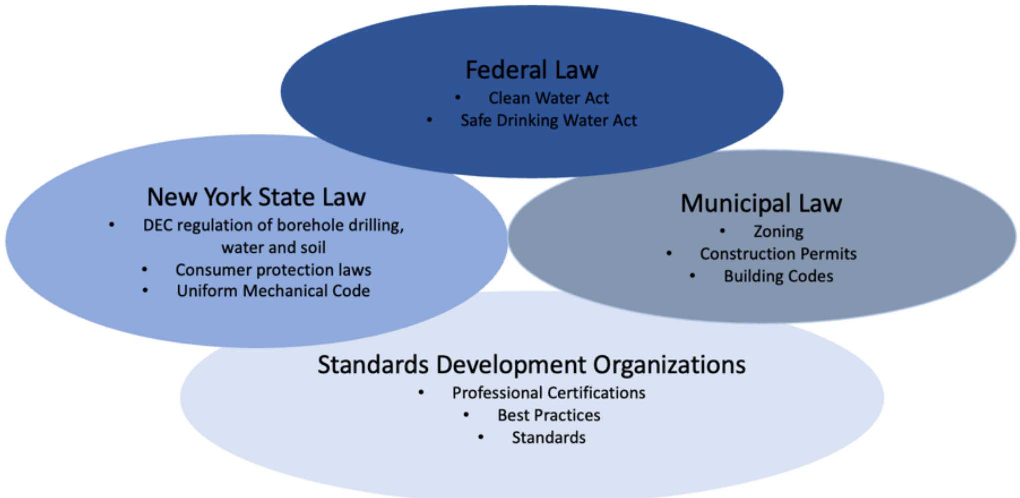
In Pace's view, combining a flexible, risk-based permitting regime with targeted municipal workforce and consumer education is essential to reduce project costs, expand adoption, and scale district geothermal technologies.

Pace recognizes that this proposed framework is a starting point and urges further discussion and refinement of this conceptual regime. Pace recommends that municipalities seek input from New York State agencies, including the New York State Energy Research and Development Authority (NYSERDA) and the New York State Department of Environmental Conservation (NYSDEC), as well as industry experts and their own legal counsel, when evaluating and implementing any elements of this framework.

This proposed regime was developed through consultation with municipalities, industry stakeholders, and subject matter experts. At Pace's request, the New York Geothermal Organization (NY-GEO) convened a series of discussions with Pace and its members to discussion various key aspects of geothermal permitting. While these discussions informed the development of this framework, the proposed regime is not endorsed by NY-GEO and does not reflect the views of organization or its individual members.

As further described below, Pace proposes a permitting regime in which municipalities support geothermal project development through local approvals, while remaining subject to state and federal regulations, and embracing industry standards to ensure project integrity. Together, these layers of state and federal oversight, local permitting, and technical standards should form a cohesive framework to both regulate and enable scaled TEN deployments.

Figure 6: Regulatory Hierarchy



Source: Authors

Following the presentation of the proposed framework, this section concludes with a discussion of selected issues at the center of ongoing discussions around local permitting of geothermal technologies. Pace aims for this discussion to support ongoing stakeholder dialogues, promote deeper stakeholder understanding, and aid in the development of evidence-based policies that enable successful TEN implementation.

4.1 Conceptual Permitting Framework

The permitting framework will operate at the municipal level, supplementing existing municipal laws and regulations, including building codes and electrical and mechanical codes, particularly those relating to HVAC systems.

Further, federal and state law, which are superior to municipal law, will also govern TENs projects. Federal laws potentially applicable to TENs development include:

- **National Environmental Protection Act** (NEPA) – Environmental review for projects involving federal permits, funding, or land.[37]
- **Clean Water Act** (CWA)[38] – Regulation of discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES).[39]
- **Safe Drinking Water Act** (SDWA) – Protection of underground sources of drinking water.[40]

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[37] 42 U.S.C. §§ 4321–4370h
[38] 33 U.S.C. §§ 1251–1387
[39] 33 U.S.C. § 1342
[40] 42 U.S.C. §§ 300f–300j-27

- **Rivers and Harbors Act** (RHA) – Protection of navigable waters from unauthorized obstruction or alteration.[41]
- **Endangered Species Act** (ESA) – Protection of federally listed species and their habitats.[42]
- **National Historic Preservation Act** (NHPA) – Protection of historic and archaeological resources potentially affected by project activities.[43]

At the state level, several state and municipal laws and regulatory programs may govern borehole drilling and TEN project development across all permit classes, including:

- **NYSDEC Regulations for Closed-Loop Boreholes over 500 Feet** – Existing and future DEC regulations for closed-loop boreholes over 500 feet, including those in development under current DEC rule making and related Generic Environmental Impact Study (GEIS) to fulfill New York State Environmental Quality Review Act (SEQRA requirements) for the rule making process.[44] The rules may include:
    - Project-specific drilling permit application requirements
    - Qualified contractor certification
    - Drilling, design, setback, and decommissioning standards
    - Streamlined environmental (SEQR) review through a GEIS

- **Solid Waste Management Regulations for Drilling Waste** – NYSDEC drilling waste rules for managing drilling cuttings and fluids, including disposal exemptions under 6 NYCRR 364-3.2(b)(14) where no petroleum is present. Applicable to all geothermal boreholes regardless of type.

- **New York State Environmental Quality Review Act (SEQRA)/City Environmental Quality Review (CEQR)** – SEQRA (New York State) and CEQR (New York City) require state and local agencies to consider environmental factors in the planning, review, and decision-making processes regarding permits, zoning changes, or government funding for major projects.

- **Clean Water Act Enforcement Under the State Pollutant Discharge Elimination System (SPDES**) – SPDES permitting administered by NYSDEC under 6 NYCRR Parts 703 and 704.

- **Various Additional New York State Water, Wetlands, and Species Protection Laws**

    - **Water Resources Law and Protection of Waters Program** – Through the Water Resources Law, codified as Article 15 of the NYS Environmental Conservation Law (ECL), and its Protection of Waters Program, the NYSDEC governs water withdrawals and activities that impact protected surface or groundwater resources and adjacent areas.

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[41] 33 U.S.C. §§ 401–467n. The primary section used for permitting activities (Section 10) is codified at § 403.
[42] 16 U.S.C. §§ 1531–1544.
[43] 54 U.S.C. §§ 300101–320303.
[44] NYSDEC, *Geothermal Wells Deeper Than 500 Feet* (accessed April 10, 2025), https://dec.ny.gov/environmental-protection/oil-gas/well-owner-and-applicants-information-center/regulated-well-types/geothermal-wells-deeper-than-500-feet.

- **Freshwater Wetlands Act** – Article 24 of the ECL governs protection of freshwater wetlands. Recent amendments expand jurisdiction to include unmapped wetlands greater than 12.4 acres (shifting to 7.4 acres in 2028).
- **Tidal Wetlands Protection Act** – Article 25 of the ECL and 6 NYCRR Part 661 govern regulation of tidal wetlands and adjacent areas.
- **Endangered and Threatened Species Regulations** – State-level protections for listed species and their habitats are established in 6 NYCRR Part 182.
- **Water Well Contractor Registration and Water Withdrawal Permitting** – Applicable particularly for open-loop geothermal systems exceeding 100,000 gallons per day.

- State laws governing provision of utility services and consumer protection, including the **Public Service Law** and **Home Energy Fair Practices Act**, if applicable.

- **Municipal Codes** for all building electrical and mechanical equipment, as well as applicable local zoning requirements.

Type A: Notice Filing for Low-Risk Systems

Scope

- Applies to small-scale, closed-loop geothermal heat pump systems for single-family homes or single-owner properties that pose no design or known environmental risks.

- Streamlined requirements promote adoption of ground-source heat pumps while limiting scope to low-risk projects, thereby ensuring public safety and environmental protection.

Conditions

- Eligible for systems using propylene glycol, detoxified ethylene glycol or glycerin-based anti-freezes (all known as “heat transfer fluids”), in each case with National Science Foundation (NSF) approved inhibitors, due to their non-hazardous, non-flammable characteristics.

- No known soil contamination on the site.

- Site not located in a zone designated as environmentally sensitive.

- No intrusion into public rights of way or utility infrastructure.

- Does not involve connection to public infrastructure (e.g., water or sewer systems).

- Borehole setbacks:

  - Setback of 15 to 20 feet from property lines to minimize risk of drilling outside the property. Where adjacent properties observe the same setback, a 15-foot setback would maintain a minimum 30-foot surface separation between neighboring boreholes. DEC is considering setbacks for closed-loop geothermal boreholes deeper than 500 feet.

  - Horizontal loop systems must meet standard municipal construction setbacks.

Procedures

- Property owner or contractor files a notice with the municipality for a geothermal heat pump system.
- Ordinary construction and permit requirements apply, including relating to insurance or other financial assurance.
- Subject to superseding municipal codes and regulation, recommended adoption of CSA/ANSI/IGSHPA *C448 Series: 25 Design and Installation of Ground Source Heat Pump Systems for Commercial and Residential Buildings* into local requirements.
- No engineering stamp required.
- Property owners bear liability for remediating damage to private or public property.

Type B: Expedited Review for Low-Risk Systems

Scope

- Includes more complex closed-loop systems that exceed the simplicity of Type A projects but do not involve the complexities of Type C or D projects.
- Excludes open-loop systems.

Conditions

- Broader range of heat transfer fluid solutions available.
- No known soil contamination on the site.
- Site not located in a zone designated as environmentally sensitive.
- No intrusion into public rights of way or utility infrastructure.
- Any private easements required have been obtained, recorded and noticed.
- Does not involve connection to public infrastructure (e.g., water or sewer systems).
- If connecting multiple properties, no infrastructure intrudes into public rights-of-way or connects to public infrastructure (e.g., sewer or water systems). Municipality may relax this requirement for public right-of-way if risk is deemed negligible.
- Setbacks:
  - Setback of 15 to 20 feet from property lines to minimize risk of drilling outside the property. Where adjacent properties observe the same setback, a 15-foot setback would maintain a minimum 30-foot surface separation between

neighboring boreholes. DEC is considering setbacks for closed-loop geothermal boreholes deeper than 500 feet.

  - Horizontal loop systems must meet standard municipal construction setbacks.

Procedures

- Developer certified by IGSHPA as an Accredited Installer or by the Association of Energy Engineers as a Certified GeoExchange Designer.
- No engineering stamp required.
- Subject to superseding municipal codes and regulation, recommended adoption of CSA/ANSI/IGSHPA *C448 Series: 25 Design and Installation of Ground Source Heat Pump Systems for Commercial and Residential Buildings* into local requirements.
- Expedited review streamlines permitting for low-risk systems while maintaining safety and environmental standards.
- If multiple properties connected, review should encourage potential for additional connections to be made to the TEN where possible without increasing costs.

Type C: Open-Loop Systems

Scope

- Open-loop systems
- Water resources and their environmental significance vary widely across New York State. Further, the water draw of open-loop systems and their design also varies. While water resources are primarily regulated under New York State law by the DEC, municipalities have regulated geothermal ground source systems based on concerns to protect water resources. Subject to federal and New York State law concerning surface and ground water resources, Pace proposes a separate category for open-loop systems for municipalities to evaluate proposed use of surface and ground water resources through an evidence-based process in relation to environmental factors, water draw and replacement, and other design factors.
- Pending DEC issuance of regulations concerning geothermal drilling, discussed further below in Section 4.2, Pace believes regulation of open-loop systems requires careful consideration by New York State and municipalities. We therefore set out Type C Open-Loop Systems as its own category.

Conditions

- Open-loop systems do not use heat transfer fluids.

- Design and operation of open-loop systems are potentially subject to regulations protecting surface and ground water, including State Pollutant Discharge Elimination System (SPDES) requirements governing pollutant discharge or heat transfer impacts.

- For open-loop or standing column geothermal systems of any depth, the well driller must be registered, and all drilling activities must be supervised on-site by an individual who has passed the required examinations. Additionally, open-loop wells drilled to depths up to 500 feet, ECL §15-1525 requires that a preliminary notice and a well completion report be submitted to the Division of Water.

- IGSHPA guidelines specify extended setbacks for geothermal heat pump boreholes in relation to water wells and water resources. Variation in setbacks may be appropriate among municipalities based on the degree of infrastructure and other subsurface conditions, as well as consideration of the impact of withdrawal on neighboring water users.

Procedures

- Developer certified by IGSHPA as an Accredited Installer or by the Association of Energy Engineers as a Certified GeoExchange Designer.

- In New York State, open-loop systems of any depth can only be drilled by a water well driller licensed by the DEC, which requires the driller to be certified under the National Groundwater Association program.[45]

- Whether to require an engineering stamp should be further considered based on project characteristics. If public infrastructure is involved in the project, an engineer's stamp should be required.

- Subject to superseding municipal codes and regulation, recommended adoption of CSA/ANSI/IGSHPA *C448 Series: 25 Design and Installation of Ground Source Heat Pump Systems for Commercial and Residential Buildings* into local requirements.

Type D: Comprehensive Review for Complex Systems

Scope

- Includes systems with higher degrees of complexity, environmental sensitivity, or technical risk, including:
    - Projects in areas designated as sensitive by the municipality or state agencies (e.g., near aquifers, gas deposits, or historical sites).
    - Connects to public infrastructure or public right of way.
    - All other projects that do not fall into Types A, B or C permit categories.

[45] ECL §15-1525.

Conditions

- Potentially additional setback requirements or easement sharing (as applicable), based on project design and risks. DEC is considering setbacks for closed-loop geothermal boreholes deeper than 500 feet.

Procedures

- Developer certified by IGSHPA as an Accredited Installer or by the Association of Energy Engineers as a Certified GeoExchange Designer.
- Engineer stamp required.
- Subject to superseding municipal codes and regulation, recommended adoption of CSA/ANSI/IGSHPA *C448 Series: 25 Design and Installation of Ground Source Heat Pump Systems for Commercial and Residential Buildings* into local requirements.
- Municipal consent to use of any public rights-of-way or public property.
- Coordination with utilities and consent by utilities for use of utility right-of-way.
- Environmental review under SEQRA/CEQRA where applicable, and review for compliance with any overlapping regulations from NYS DEC, NYS Department of Health, the State Historic Preservation Office, and local codes.
- If multiple properties are connected, review should encourage potential for additional connections to the made to the TEN where possible without increasing costs.
- Compliance with any New York Department of Public Service and Public Service Commission requirements.
- For high-density TEN installations, review for project economics, performance and tenant safeguards.

4.2 Discussion of Selected Issues

This section discusses key regulatory, technical, and policy issues identified through stakeholder engagement, focusing on areas where municipal action intersects with emerging state-level geothermal permitting frameworks.

- **Overlapping State and Local Law, Regulation, and Standards**

New York municipalities develop local permitting regimes within a legal framework that includes federal and state laws while retaining strong authority to enact their own regulations under the New York State Constitution and the Municipal Home Rule Law. This authority may only be curtailed where the legislature has clearly expressed an intent to preempt local regulation. In *Wallach v. Town of Dryden*, 23 N.Y.3d 728 (2014), the Court of Appeals upheld local zoning prohibitions on oil and gas drilling, emphasizing that zoning is a core municipal power, and that preemption will not be inferred absent a clear legislative statement. Similarly, in *Albany Area Builders Ass'n v. Town of Guilderland*, 74 N.Y.2d 372 (1989), the Court found municipal authority preempted only where a comprehensive state statutory scheme occupied the field. These decisions affirm that municipalities retain significant discretion over land use and permitting decisions, including the siting and regulation of geothermal wells, unless explicitly displaced by specific state legislation.

The New York State DEC regulates certain geothermal well activities. For open-looped systems, DEC has regulatory authority to require registration and supervision of water well drillers regardless of depth. For closed-loop systems, DEC oversite varies based on depth.

Currently, geothermal wells drilled to depths of 500 feet or less are not subject to direct DEC permitting requirements. For projects that do not plan to exceed the 500-foot depth and thus would not require DEC oversight, municipalities are encouraged to rely on recognized best management practices, industry-wide standards, and the future rules for deeper closed-loop geothermal wells to inform local permitting decisions and oversight for shallower installations. Incorporating these practices can help municipalities protect public health, safeguard water quality, and promote responsible geothermal development even in the absence of direct state regulation.

The DEC's Division of Water (DOW) oversees the registration of drillers for geothermal boreholes, though this registration does not yet involve testing or certification for drilling closed-loop wells. Regulation for closed-loop wells is currently limited to requiring drillers to adhere to industry-accepted standards, such as those developed by the International Ground Source Heat Pump Association (IGSHPA) and the National Groundwater Association (NGWA).

The DOW has requested the voluntary submission of completion reports for closed-loop boreholes deeper than 500 feet drilled since October 2023, pending formal adoption of this requirement through the ongoing rulemaking process.[46] While this requirement may eventually extend to boreholes drilled to depths of 500 feet or less, such installations are not currently addressed in existing or proposed DEC regulations.

As noted above, the DEC is actively developing new regulations specific for closed-loop geothermal boreholes drilled deeper than 500 feet.[47] Previously, such wells were regulated under DEC's oil and gas drilling framework, but the agency has recognized that geothermal wells are distinct. The forthcoming regulations are expected to include provisions covering:

- **Permit Application Requirements** – A project-specific permit may be required, covering single or multi-borehole projects.
- **Qualified Contractor Program** – Permits will only be issued to "Qualified Contractors" who hold valid certifications or accreditations related to borehole drilling or decommissioning.
- **Borehole Design, Drilling, and Installation Standards** – Technical specifications to ensure structural integrity and groundwater protection.

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[46] NY-Geo, *Closed Loop Borehole Voluntary Reporting*, https://www.ny-geo.org/closed-loop-borehole-page/ (last visited Apr. 14, 2025).
[47] Kevin Moravec, Carrie Friello, and Dave Hermantin**.** "Update on NYS Geothermal Drilling Regulations", *Presentation at NY-GEO 2024 Conference* (October 23, 2024). On file with the author.

- **Setbacks and Surface Restrictions** – Required minimum distances from property boundaries, wells, and sensitive features.

- **Reporting Requirements** – Mandatory completion and decommissioning reporting, including required registration of all geothermal boreholes or wells deeper than 500 feet, which could involve a notice filing and potentially a nominal fee.

- **Decommissioning Requirements** – Standards to ensure boreholes are safely sealed upon decommissioning.

Concurrent with the rulemaking, DEC is developing a Generic Environmental Impact Statement (GEIS) to assess the environmental risks posed by closed-loop geothermal borehole drilling deeper than 500 feet. The DEC contemplates these evaluations would account for subsurface geological conditions, such as the presence of gas, oil, and brine. Projects that fall within the scope of the GEIS and meet its predefined environmental thresholds can bypass the full project-specific review typically required under SEQRA. Instead, DEC may issue a permit based on a simplified consistency review, reducing administrative burden and expediting approvals.

All geothermal drilling projects must comply with New York State's solid waste management rules, which govern the handling and disposal of drilling fluid, groundwater, and cuttings. Disposal options vary depending on waste composition, including exemptions for certain materials under 6 NYCRR Part 364.[48] These materials either may remain on-site within DEC limits or be transported to licensed disposal facilities, depending on the content of the waste.

Further, DEC contemplates that geothermal borehole drillers will not need to provide financial assurance in relation to borehole closure, relaxing the requirements from the oil and gas drilling regime. Notably, DEC has clarified that operators of closed-loop stratigraphic wells – meaning wells drilled deeper than 500 feet solely for geothermal conductivity testing and fully sealed at construction – will not be required to furnish financial security.[49]

Within the state's evolving framework, municipalities have a vital role to play in developing permitting regimes to enable TENs in their communities. Pace recognizes that municipalities are required to rely on the regulatory framework being developed by the DEC to govern drilling practices within the scope of DEC's statutory authority. DEC is the most qualified authority to assess drilling risks, and, as a practical matter, will be defining the market for drilling through its regulations. Pace further advises municipalities to consult with the DEC regarding any questions about borehole regulation.

Notwithstanding our recommendation, Pace also recognizes that municipalities retain critical Home Rule authority to regulate environmental and land use matters within their jurisdictions unless explicitly preempted. In advance of DEC's final closed-loop geothermal regulations, Pace believes that municipalities may appropriately consider adopting additional local protections,

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[48] Additional guidance is available through "Managing Solid Waste from Geothermal System Installations: A Guide for Industry," developed for the April 2025 NY-GEO Conference and available from DEC's Division of Materials Management.
[49] NYSDEC, *Program Policy DMN-3: Relief from Requirements to Furnish and Maintain Financial Security for Closed Loop Stratigraphic Test Wells Deeper than 500 Feet* (July 2024), https://dec.ny.gov/sites/default/files/2024-07/dmn3-fs-strat.pdf.

especially in relation to open-loop systems that touch on water resources. Potential measures may include:

- **Financial Assurance Requirements** – One such measure may include whether to require financial assurance from property owners, developers, or drillers in geothermal ground source and TENs projects. Potentially important for urban and high-density locations, financial assurance may include insurance policies meeting specified liability coverages and terms, which drill operators should carry in the ordinary course of business. These policies should be reviewed by an insurance specialist to ensure that the policy is underwritten by a creditworthy insurer, and its scope, liability amounts, triggers and carve-outs meet municipal requirements and protects the municipality, adjacent property owners, and the subject property owner. Additional forms of financial assurance, such as surety or performance bonds, letters of credit, or deposits may also be considered, and should be evaluated considering municipalities existing requirements, as well as the project complexity and risk relative to the cost of these additional requirements.

- **Use of Updated Standards** – Additionally, standards development organizations like AHRI, ANSI, ASHRAE, CSA, IAPMO, IGSHPA, and others offer codes and standards that inform and supplement state regulation. New York State adheres to the International Code Council's (ICC) Uniform Mechanical Code, which governs a wide range of building and mechanical issues. IGSHPA, together with the CSA, developed CSA/ANSI/IGSHPA *C448 Series: 25 Design and Installation of Ground Source Heat Pump Systems,* a geothermal TEN design and installation standard applicable to both residential and commercial systems.

Balancing the split regulatory oversite between local governments and New York State, municipalities are uniquely positioned to draw on their intimate knowledge of local conditions and to use zoning, permitting, and other land use tools to foster safe and effective TEN development, provided their frameworks do not intrude into areas of exclusive state control.

- **Consistency of Rules Across Ground-Source and Air-Source Heat Pumps**

Industry participants raised the issue of whether regulatory requirements for ground-source and air-source heat pumps should be uniform. Pace's engagement primarily considered ground-source systems, which may include ground or water bodies as thermal sources and sinks. Pace believes that ground-source systems present distinct technical and environmental considerations, and that identical regulatory treatment may not always be warranted.

- **Project-Based Certification Requirements**

Pace recommends tailoring professional certification requirements based on project design and associated risks.

For projects involving public infrastructure – such as those that connect to municipal water systems – engineer-stamped designs should be mandatory. These projects often have broader implications for public safety, utility infrastructure, and environmental impact, warranting the expertise and liability coverage of licensed engineers.

However, imposing such costly certifications for all geothermal heat pump projects is unnecessary and burdensome, especially for smaller, less complex installations. Over-regulation in these cases can stifle adoption by increasing costs without proportional benefits. For projects that pose minimal risks and are located on private property, designs certified by a professional accredited by the International Ground Source Heat Pump Association (IGSHPA) should be deemed sufficient. These individuals are trained in geothermal system design and installation and are well-suited to oversee typical residential or small commercial systems. In cases involving low-risk single-property systems that use non-toxic, widely accepted heat transfer fluids—such as inhibited propylene glycol—and that present no significant environmental or mechanical complexities, certification requirements may be waived altogether, in our scheme a Type A permit.

Tailoring certification requirements to the risks and complexities of a specific project will make many geothermal systems more accessible and affordable. By limiting engineer stamps to higher-risk projects and allowing system design by an-IGSHPA accredited profession to suffice for low-risk systems, municipal regulators could encourage the widespread adoption of geothermal energy while ensuring public and environmental safety.

- **Setbacks from Property Boundaries and Wells**

Pace engaged in discussions with industry stakeholders, including contract drillers, developers, standards organization representatives, and municipal officials about setbacks from property boundaries. Discussions included presentation of borehole logs evaluated by US Geological Survey geologists on an anecdotal basis.

Potential drift due to deflection varies with borehole depth, subsurface geologic conditions (differing rock formations), condition of drilling equipment, and other factors such as a driller's skill level. Estimating drift is difficult on an ex-ante basis, exacerbated by the lack of reliable subsurface data until well logging has been performed on initial boreholes.

A setback provides a margin to mitigate the risks of drilling outside property boundaries and interference among boreholes.

The DEC Division of Minerals is considering setbacks in its rulemaking for closed-loop geothermal boreholes over 500 feet. No current rules are being considered for shallower wells.

During stakeholder discussions, anecdotal evidence from a single borehole log of a 490-foot-deep borehole suggested that 10- to 15-foot setbacks from property lines — resulting in a combined distance of 20 to 30 feet between boreholes — would adequately address risks related to drift in that case.

IGSHPA recommends borehole spacing of 15 to 20 feet for closed-loop vertical systems to minimize thermal interference and ensure thermal productivity. ASHRAE guidelines for ground heat exchange design consider 15 feet or more as typical spacing for residential systems, with adjustments for site-specific conditions.

The recommended distance between an open-loop geothermal system and a water well varies depending on local or state environmental regulations, as well as site-specific hydrogeological factors such as groundwater flow direction, soil composition, and the risk of contamination. Many state-level environmental agencies recommend maintaining a minimum separation of at least 50 feet between a geothermal discharge point and a potable water well. The U.S. EPA Underground Injection Control program's Class V well requirements for injection of non-hazardous fluids sets a default rule for injection wells of 100 feet from property boundaries, which can be varied upon request.

IGSHPA, in the 2016 version of its ANSI/CSA/IGSHPA C448 standard, adopted these open-loop system setbacks. Its 2025 will no longer establish a prescriptive setback requirement, leaving room for local discretion. Pace believes that municipalities should consider adopting a default separation distance informed by local hydrogeological conditions. Default guidance can be cost saving, as opposed to requiring assessments to be performed. A default could be adjusted through a case-by-case assessment if an area variance is granted, usually by a local zoning board of appeals, upon the request of geothermal system developers or neighboring property owners. Such an approach balances the need to protect groundwater resources and stakeholder interests while avoiding unnecessary permitting costs, reserving more detailed evaluations for instances where they are warranted.

Pace further believes that default setbacks should be based on empirical data. A broader, evidence-based analysis of borehole drift would help inform appropriate regulatory thresholds.

- **Water Resources**

Open-loop geothermal systems extract groundwater or surface water to use as a direct thermal exchange medium, returning the water to the source or discharging it elsewhere. These systems often require water withdrawal permits to manage their impact on aquifers and surface water levels. Excessive withdrawal can deplete water resources, harm nearby wells, or reduce flow in streams and wetlands, especially in areas with limited water availability. Additionally, the discharge of used water must comply with water quality standards to prevent thermal pollution. If discharged water is reinjected or returned to surface water bodies, its temperature and quality must not disrupt aquatic ecosystems. Regulatory agencies may require testing and treatment to meet these standards. Moreover, open-loop systems located near wetlands or other protected areas are subject to stricter reviews and permitting requirements to ensure minimal ecological impact, as these regions are often safeguarded under federal laws like the Clean Water Act and various state regulations.

Closed-loop systems circulate heat transfer fluid solutions through buried pipes to transfer heat without withdrawing water. While they are less disruptive than open-loop systems, they still pose risks, particularly in areas near water bodies. First, heat itself is considered a pollutant under 6 NYCRR Part 703/704 governing SPDES; any temperature changes to the surrounding waterbody from the closed-loop thermal system could trigger a SPDES permit. Second, many closed-loop systems use heat transfer fluids, such as inhibited propylene glycol, ethylene glycol, methanol, or ethanol. Spills or leaks of these substances could contaminate soil and groundwater, raising concerns about toxicity and environmental harm. Regulations and standards often encourage the use of low-toxicity anti-freezes, such as propylene glycol, to minimize these risks. Additionally, some jurisdictions require secondary containment measures, such as leak detection systems, to prevent contamination. Installation near water bodies, such as lakes, rivers, or wetlands, is subject to additional scrutiny due to the potential for leaks or thermal impacts, and permitting agencies may require setbacks and detailed site assessments to address these risks.

Both open-loop and closed-loop systems share common regulatory challenges, particularly regarding their proximity to water bodies and environmentally sensitive areas. Improperly managed TENs systems can cause thermal pollution, altering water temperatures and impacting aquatic ecosystems.

In wetlands and other ecologically sensitive areas, federal and state laws impose restrictions on development to protect biodiversity and hydrological functions. Groundwater contamination arising from chemical leaks in closed-loop systems utilizing toxic heat transfer fluids or improper discharge from open-loop systems both pose concerns. Federal and state groundwater protection laws, often enforced by the DEC, aim to mitigate these risks through regulatory oversight. If a proposed TEN is in proximity to protected water resources, the DEC may require the developer to obtain additional relevant permits, including a Tidal Wetlands Permit,[50] a Protection of Waters Permit,[51] and a Freshwater Wetlands Permits.[52] If such resources are present on or near a proposed TEN site, early consultation with DEC is recommended.

To balance environmental protection with the adoption of geothermal heat pump technologies, Pace proposes a risk-based regulatory approach that differentiates closed-loop and open-loop systems and allows for variation in municipal regulation based in New York State's Home Rule Law to consider water resources. Low-risk systems, such as closed-loop designs using low-risk anti-freeze like propylene glycol and installed far from sensitive areas, may require less intensive permitting processes. In contrast, open-loop installations with significant water use or proximity to wetlands should undergo thorough environmental impact assessments and regular monitoring.

- **Heat Transfer Fluid Options for Geothermal Systems**

Geothermal heat pump systems, particularly closed-loop systems, often require heat transfer fluids to prevent freezing in colder climates and ensure efficient heat transfer. Common anti-freeze options include propylene glycol, ethylene glycol, methanol, and calcium chloride, each with distinct advantages and risks. New heat transfer fluid options are being developed with thermal efficiency, safety, and cost-effectiveness as objectives.

Propylene glycol is a commonly used heat transfer solution for geothermal systems due to its environmental safety. It is classified as "Generally Recognized as Safe" (GRAS) by the FDA and is widely used in applications where contact with potable water or the environment is possible, including winterizing seasonal homes on septic systems, RVs and boats. Propylene glycol biodegrades readily, making it a sound choice for residential and commercial systems where environmental and human health risks must be minimized. NSF approved inhibitors should be included in the propylene glycol heat transfer solution (inhibited propylene glycol). Propylene glycol is generally more expensive than other options.

Ethylene glycol is toxic if ingested and poses risks to human health and the environment if discharged in concentrated form, and is flammable. It has a sweet taste, which increases the

[50] Article 25 of the ECL, 6 NYCRR Part 661.
[51] Article 15 of the ECL, 6 NYCRR Part 608.
[52] Article 24 of the ECL, 6 NYCRR Parts 664, 665.

likelihood of accidental ingestion by humans or animals. Spills or leaks into groundwater or surface water can cause environmental contamination.

Methanol, valued for its high heat transfer efficiency and low cost, is flammable and toxic, posing risks to both human health and the environment. Proper handling and containment measures are critical to minimize risks associated with its use.

A fourth commonly used anti-freeze in geothermal systems is ethanol, valued for its low cost, environmental safety, low viscosity, and effectiveness in preventing freezing. However, it is highly flammable in concentrated form. While less toxic than methanol or ethylene glycol, ethanol still poses risks for ignition and must be handled accordingly.

Given the varying risk profiles of these heat transfer solutions, Pace proposes a risk-based regulatory approach in which inhibited propylene glycol, due to its environmental safety, could be permitted for use by any installer or homeowner, without regulatory oversight. Options like methanol and ethanol have a proven track record when handled by certified professionals with the necessary expertise to ensure safe installation, handling, and containment. This approach balances environmental and public health protections with flexibility for system designers and installers, ensuring that anti-freeze selection is based on both system needs and risk mitigation.

Heat transfer solution options are expanding as new solutions are developed by industry. New glycerin-based anti-freeze solutions and detoxified ethylene glycol solutions have been developed and are coming onto the US market. These solutions are non-toxic and non-flammable, and they perform well relative to other options, albeit at greater cost. As with propylene glycol, NSF approved inhibitors should be included in these heat transfer solutions.

Importantly, IGSHPA standards encourage the use of non-toxic, non-flammable solutions, specifically propylene glycol, glycerin-based heat transfer fluids, as well as detoxified ethylene glycol, all with NSF-approved inhibitors.

Pace suggests that, consistent with an evidence-based approach to permitting, municipalities revise permitting regimes to incorporate new non-toxic, non-flammable solutions as they become available.

The following resources are available for evaluating anti-freeze options:

- ***Ethylene Glycol***

  EPA Hazard Summary: https://www.epa.gov/sites/default/files/2016-09/documents/ethylene-glycol.pdf

- ***Methanol***

  EPA Hazard Summary: https://www.epa.gov/sites/default/files/2016-09/documents/methanol.pdf

  OSHA Occupational Chemical Database: https://www.osha.gov/chemicaldata/474

- ***Ethanol***

  EPA – Inert Reassessment: https://www.epa.gov/sites/default/files/2015-04/documents/ethyl.pdf

OSHA Occupational Chemical Database: https://www.osha.gov/chemicaldata/1034

- ***Propylene Glycol***

  FDA/21CFR184.1666 (GRAS):
  https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/cfrsearch.cfm?fr=184.1666

5 Recommendations to Enable Municipally Owned TENs in New York State

Developing municipal TENs presents significant challenges, even as these systems hold transformative potential for reducing greenhouse gas emissions, enhancing energy efficiency, and providing equitable heating and cooling solutions. Municipalities face complex technical, financial, and regulatory hurdles in pursuing geothermal district systems and TENs. These challenges include high upfront infrastructure costs, limited capacity to implement geothermal technologies, and the need to align local energy planning with state-level decarbonization goals.

Despite these challenges, municipalities do not have to navigate them alone. As noted in Section 1.1, section 361.2 of New York State's General Municipal Law enables two or more municipalities to engage in the shared ownership, development, use and/or operation of public utility services within their combined territorial limits.[53] Should the New York State legislature authorize municipal utilities to provide district thermal services, section 361.2 would allow multiple municipalities – including counties – to collaborate in the development, ownership, and operation of municipally owned TENs.

Coordinating such systems across multiple jurisdictions introduces additional complexity and requires strong inter-municipal collaboration and governance structures. However, by forming partnerships with neighboring governments, municipalities can share expertise, resources, and costs – creating efficiencies that are more difficult to achieve independently. Such collaboration can also amplify their collective voice, enhancing their ability to secure state and federal support. Municipalities working together can pilot innovative governance models, such as joint utilities or cooperatives, to manage and operate TENs more effectively, while ensuring community benefits remain a priority.

To address the barriers municipalities face, this section offers a series of recommendations for local leaders to advocate at the state level. By clearly articulating their needs for funding support, technical assistance, and streamlined regulatory frameworks, municipalities can collaborate with state officials and other stakeholders to lay the foundation for widespread deployment of TEN systems. These recommendations are designed to help municipal leaders take proactive steps, enabling them to align their efforts with state policy goals while addressing the unique needs of their communities.

Policy Alignment and Governance

- ***Legislation and Standards*** – Clear state policies should mandate that municipalities develop heat supply plans incorporating district energy and TENs where feasible.
- ***Regional Collaboration Framework*** – The New York Legislature should establish, or direct relevant state agencies to establish, financial and regulatory incentives that encourage municipalities to collaborate on inter-municipal geothermal projects. Shared governance models, such as joint municipal utilities or cooperatives, should be encouraged when advantageous. New York State municipal leaders should explore a

[53] N.Y. Gen. Mun. Law § 361.2.

standard set of default rules that municipalities can voluntarily adopt and modify as needed, ensuring fair terms for jointly developing, owning, and operating TENs.

- ***Inter-Municipal Cooperation*** – Municipalities can collaborate to plan, build, and operate district systems by forming joint municipal energy companies or cooperatives.
- ***Municipal Energy Companies*** – These entities should operate on a non-profit basis, focusing on cost recovery and reinvestment into the system. The PSC should exempt municipal TEN utilities from regulation, as it does with electric, gas, and water utilities.

Funding and Financing

- ***Low-Interest Loans*** – Municipalities need access to low-interest loans for TENs through programs like the New York State Green Bank, expanded borrowing authority, or similar initiatives.
- ***Heat Charges and Rate Design*** – A structured yet flexible heat rate system – including fixed and variable charges – should promote economic sustainability and equitable cost distribution. Further, the New York State Public Service Commission, together with electric utilities and other stakeholders, should develop tariffs for heat pump or thermal system customers to minimize electric bill increases.
- ***Carbon Pricing Revenues*** – Proceeds from New York's Regional Greenhouse Gas Initiative (RGGI) and the planned Cap-and-Invest program could be allocated to support and de-risk district thermal and TEN projects.

Integrated Energy Planning

- ***Comprehensive Planning*** – Local energy planning should assess geothermal potential, incorporate renewable energy sources, and coordinate with regional energy strategies. State support should encourage regional planning to facilitate resource sharing and system integration when beneficial.
- ***Infrastructure Integration*** – Ensure geothermal infrastructure aligns with existing energy, water, sewer, and road systems to minimize disruption and maximize efficiency. Municipalities should leverage and monetize such assets to support TENs development.

Community Engagement and Transparency

- ***Public Engagement*** – Municipalities must actively engage residents and property owners to ensure transparency and public buy-in for district energy projects.
- ***Cooperative Ownership Models*** – Cooperative ownership models can empower residents by granting them a direct stake in the infrastructure, building trust, and

ensuring long-term support. The economics of these arrangements should be explicit and transparent.

Workforce Development

- ***Training Programs*** – Investment and support for training municipal workers, including officials who review and approve proposed TEN-systems, building and other staff who inspect for code compliance, and personnel needed to operate any TENs the municipality chooses to own and manage directly.

Equity

- ***Equitable Access*** – Planning should enable low-income and disadvantaged communities to participate in district thermal and TENs, promoting affordable access and equitable cost-sharing mechanisms.

Pilot Projects and Demonstrations

- ***Pilot Projects*** – To build momentum, New York State should initiate pilot projects demonstrating the feasibility of municipally-owned TENs as it has with UTENs.
- ***Regional Collaborations*** – Pilot projects should promote municipal cooperation and showcase municipally-owned TENs developed by one or more municipalities.
- ***Cooperative Governance Support*** – New York State and relevant agencies should sustain support to municipalities through knowledge-sharing, technical assistance, and governance resources, especially for those seeking inter-municipal collaboration.