

Project Phases for a Thermal Energy Network

Steps and Services to Coordinate and Oversee TENs Development

See [What Does a TEN Project Look Like?](#) for an introduction to project phases and charts summarizing the Thermal Energy Network (TEN) development steps and services detailed below.

1. Exploration

Collect ideas for how a TEN could be built, owned, and operated in your community.

ACTIONS

- Form a working group or owner team to develop a project concept.
- Identify potential thermal energy resources and large anchor customers.
- Assess budget and personnel capacity to support a TEN project.
- Consider how a TEN fits within existing town and regional plans and/or other infrastructure plans that intersect with potential TENs development, such as:
 - Capital improvement plans,
 - Plans for growth and development, and/or
 - Bylaws/zoning/land use re: specific strategic sites, affordable housing plans, etc.
- Evaluate political support for a TEN project, including for authorizing an entity to develop a TEN. Does a municipal corporation already exist that could develop or own a TEN?

PROCUREMENT

Procurement for services needed to develop a TEN is done in stages across a project from pre-design through construction. Assembling the most qualified and cost-effective team requires effective contract management.

Request for Information (RFI)

Find out who has ideas to help solve project problems.

Request for Qualification (RFQ)

Find out what expertise and resources companies have to offer to the project team.

Requests for Proposals (RFPs)

Find out how much it will cost to engage project team members to satisfy timelines.

- Construction consultants: related to permitting, environmental permitting, energy modeling
- Construction contractors: electrical, mechanical, plumbing, construction project manager
- Engineering, Architecture, and Construction providers

STAKEHOLDER & COMMUNITY ENGAGEMENT

- Identify stakeholders and local champions, including technical experts, community experts, interested and impacted community members, and developers.
- Engage key project partners and expertise needed to help develop the TEN plan.

BEST PRACTICES

- Map out thermal energy resources within a geographically focused area to understand opportunities.
- Site visits: Invite local champions and potential project partners to tour buildings with an engineer or energy expert and learn how the facilities might function as thermal energy resources and/or customers.
- Evaluate [potential ownership models](#) for financing implications, cost-effectiveness, and stakeholder impact.
- Identify other parties that may be interested in collaborating on TEN development.

2. Planning

Flesh out ideas and build a business case for the project.

ACTIONS

- Define TEN scope and prioritize potential sites:
 - Catalog numbers, types, and sizes of buildings and thermal loads.
 - Identify waste heat sources and thermal supply.
 - Create a conceptual system design as the basis for a feasibility study in the next phase by pairing viable thermal energy resources with potential customers.
 - Map possible project stages.
- Articulate non-energy and non-financial benefits that apply to your project to help identify funding opportunities and stakeholders. See [The Benefits of Thermal Energy Networks](#) and [How Thermal Energy Networks Are Key To Successful Electrification](#).
- Consult legal expertise.
 - Municipal: What do the town charter or bylaws allow re: creating a TEN utility?
 - Private developers: What are the rights of way?
- Conduct a high-level economic assessment.
 - Engage a tax accountant to identify [IRA incentives](#) that match the project plan.
 - Consider incorporating adjustments to the project plan to maximize tax incentives and leverage IRA benefits.
- Secure seed capital for project development.

PROCUREMENT

- Assemble the core project team or hire a third-party TEN developer to include:
 - Project development: finance and project management, design engineers, architect as necessary,
 - Technical analysis, and
 - Construction management.
- Consult with environmental permitting and energy modeling experts.

STAKEHOLDER & COMMUNITY ENGAGEMENT

- Engage and educate owners of buildings.
- Consider how to engage building occupants or renters.
- Share the project concept with the community.

BEST PRACTICES

- Engage a procurement and contract manager for all of the design and construction.
- Ensure that RFPs or contracts include project team member involvement in the Operations phase to guarantee their availability as needed. Reiterate in project specifications document. Reserve time and money.
- Clarify how the project concept will provide adequate and timely financial returns and/or fit private developers' and investors' expectations.
- Consult State and municipal permitting laws and assess how permitting will impact the project timeline.
- For municipal projects:
 - Understand which boards should be consulted, when they meet, and how to get on their agenda. Boards often meet monthly and are volunteer-based. Ask to be added to their agenda and provide materials well in advance.
 - Convene a design review board (can be part of selectboard work/meetings).
 - Consult town plan and local land use bylaws, zoning, and environmental regulations.

3. Design

Confirm that a TEN project can happen—get to a “go” or “no go” decision.

ACTIONS

- Perform feasibility study to include an analysis of the technical and economic viability of extracting heat from a particular thermal energy resource and serving a particular customer(s). The level of detail required depends on whether or not investment decisions are being made based on the outcome of the feasibility study (e.g. investment grade analysis).
- Integrate stakeholder feedback to maximize co-benefits.
- Confirm the buildings and facilities involved, size the system, and plan construction phases.

- Present feasibility study results to the full project team and stakeholders and make a “go” or “no go” decision.
- After a “go” decision is made, pursue project financing.
- Engineer preliminary system design, including:
 - Piping, equipment, and installation cost estimate (based on user loads, heat sources, and equipment capacities),
 - Preliminary energy analysis and system sizing, and
 - Economic analysis including financing models and grants/incentives.
- Review preliminary design with the full project team, stakeholders, and community.
- Begin seeking local approval of the project including filing state and local environmental and construction permits.
 - Speak with the local building department to better understand the specific permits needed for your particular project.
 - Consider consulting the Permit Navigator (tiny.cc/vtpermit-nav) and contacting a Community Assistant Specialist (dec.vermont.gov/assistance/permits/specialists).
- Incorporate feedback and finalize detailed system design, including:
 - Plans and specifications,
 - Detailed energy analysis and HVAC design sizing, and
 - Project budget and financing.

PROCUREMENT

- Finalize contracts with the core project team members: Architecture / Engineering / Construction / Environmental & Permitting Consultant.
- Bid contracts for additional project team members:
 - Project management,
 - Design engineering,
 - Project estimators,
 - Project permit expeditors, and
 - Construction management and contracting.

STAKEHOLDER & COMMUNITY ENGAGEMENT

- Seek stakeholder and community responses to feasibility study results.
- Demonstrate how feedback has been included in project design.

BEST PRACTICES

- Conduct feasibility studies only after key TEN participants are on board and seed capital is secured.
- Check that designs and plans provide full details so all contractors can follow plans exactly. As construction contractors focus on delivering what’s in design documents, if designs are vague, contractors rather than TEN designers/engineers will make decisions.

TEN Design and Engineering

Designing a TEN requires knowledge of ground thermal properties, ability to determine piping configurations for connecting multiple customers and waste heat producers, and understanding the pumping needed to move heat.

This work requires an HVAC mechanical engineer with experience in district heating systems, the predecessors to TENs. This engineer will develop energy models and sizing calculations for individual customers, thermal energy resources, and the system as a whole.

Drilling contractors are another integral part of the engineering process. They work with a mechanical engineer to calculate and size the system's ground loop heat exchangers. During the drilling process, with adequate measurements, the depth of wells can be adjusted based on actual conditions.

4. Construction

Concept becomes reality. Ensure the project meets design goals.

ACTIONS

- Work with construction management to oversee the project and coordinate subcontractors.
- Engage an environmental specialist as an active member of the team to identify potential impacts on wildlife and community well-being, as well as seasonal issues depending on construction season.
- Bring in a commissioning agent or owner's representative to make sure the project achieves its goals and to identify ways to save money.
- Schedule construction activities in accordance with permitting timelines, and engage contractors once phases are permitted.

PROCUREMENT

- Identify and acquire a project or construction manager who can bring in the various trades and contractors needed to build the TEN.
- If a general contractor, construction manager, or project manager is not managing the full project construction procurement, identify and acquire additional trades and contractors as needed.
- Plan for equipment and materials procurement if these items are not included in the scope of the general contractor, construction manager, or project manager.
- Schedule materials purchases in alignment with the start of construction.
- Stage construction equipment and materials to align with construction permits. Procurement is an iterative process, and some equipment has long lead times.
- Track payments to contractors to ensure smooth project schedules.

STAKEHOLDER & COMMUNITY ENGAGEMENT

- Create on-site opportunities to educate the public: Install didactic signs and/or construction “peepholes” to invite the community into the process. Include how the system works, where money goes, and shared benefits.
- Share information frequently through various channels, including with the local energy committee and, for example, in school presentations, library forums, and site visits.

BEST PRACTICES

- Meet frequently with partners: Communicate early and often on key workflow stages.
- Use a design-build project delivery model which keeps the same people involved throughout the process; this is best for coordination and communication and minimizes contracting level of effort.
- Keep the community and neighbors aware of potential disruptions caused by construction including street openings and traffic routing.
- Provide regular briefings to local government and other stakeholders who might assist with disseminating information to community members.

5. Operations

Foster positive customer experience. Track and share project outcomes and data.

ACTIONS

- Implement a sustainable business model in which revenues from the TEN minus expenses can cover remaining debt with some cushion. Depending on the ownership model, the plan for revenue generation and recovering upfront costs will vary.
- Implement billing and customer services, including new customer onboarding.
- Contract and/or train maintenance and emergency repairs personnel.
- Create plans for training and maintenance.
 - Make sure facility managers are trained to do this work.
 - Include in the preventative maintenance contract who will conduct needed trainings and maintenance, as well as who will cover costs.
- Commission TEN system: Test and validate system performance.
- Track data on costs, energy use, and emissions reductions. Share results publicly.

PROCUREMENT

- Identify and hire operations and maintenance staff needed to manage a reliable system.
- Acquire a meter reading and billing agent to assist with billing for the thermal energy provided by the TEN, unless this function is already provided by an existing participating utility.

STAKEHOLDER & COMMUNITY ENGAGEMENT

- Install permanent signage to educate occupants and visitors about the project and its benefits.
- Celebrate successes and explore future possibilities with TEN participants and the community. Interview TEN participants and create opportunities to share stories and information about the project, performance, benefits, and potential to expand the system.

BEST PRACTICES

- Keep project team members involved in the Operations phase (e.g. construction contractor site visits):
 - Save scope, reserve time and money, and
 - Reiterate in project specifications document.
- Validate system performance through off season testing and post occupancy testing (12-18 months) to ensure energy savings persist and equipment is maintained.
- Share project data to demonstrate transparency and build knowledge within the community and across the industry.