Valuing Thermal Energy Networks as Non-Transmission Alternatives

Vermont System Planning Committee
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EMERGENT URBAN CONCEPTS

VERMONT COMMUNITY THERMAL NETWORKS

Presenters

Debbie New, Vermont Community Thermal Networks, EAN Network Action Team

Jared Rodriguez, Emergent Urban Concepts

Samantha Lash, Central Vermont Regional Planning Commission, EAN Network Action Team

with
Mark Kleinginna, Emergent Urban Concepts
Maddison Shropshire, Vermont Community Thermal Networks, EAN Network Action Team
Keara O'Laughlin, Building Electrification Institute

Thermal Energy Networks are a significant capacity resource that many Vermont communities are actively pursuing.

Context

- What we mean by “Thermal Energy Networks” (TENs)
- How they’re developing in Vermont
- How they can support many Vermont priorities

Question

How can TENs help avoid peaking load growth and alleviate regional grid constraints?

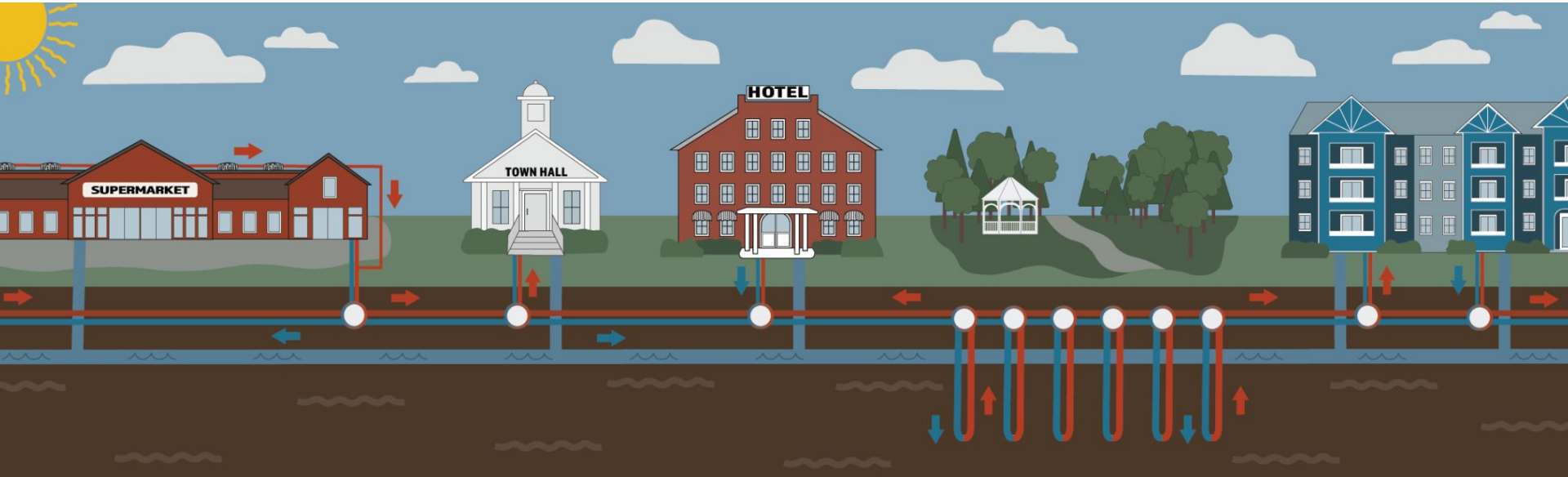
How to Develop A Thermal Energy Network: vctn.org/toolkit

Thermal Energy Networks

TENs = Ground Source Heat Pumps + Loop (water/non combustion fluid in pipes)

- Waste heat: refrigeration, ventilation
- Wastewater heat recovery
- Geothermal

\+ Solar thermal
\+ Thermal storage
\+ New technologies



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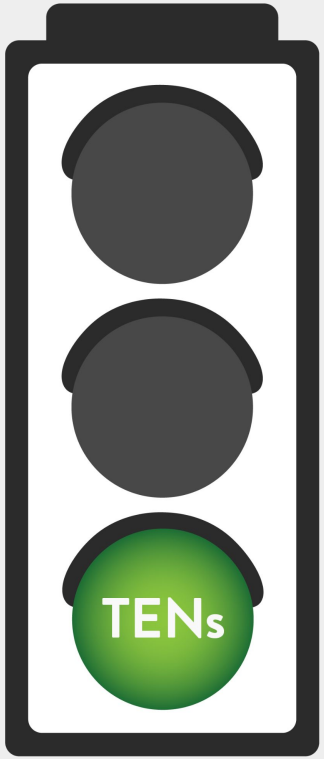
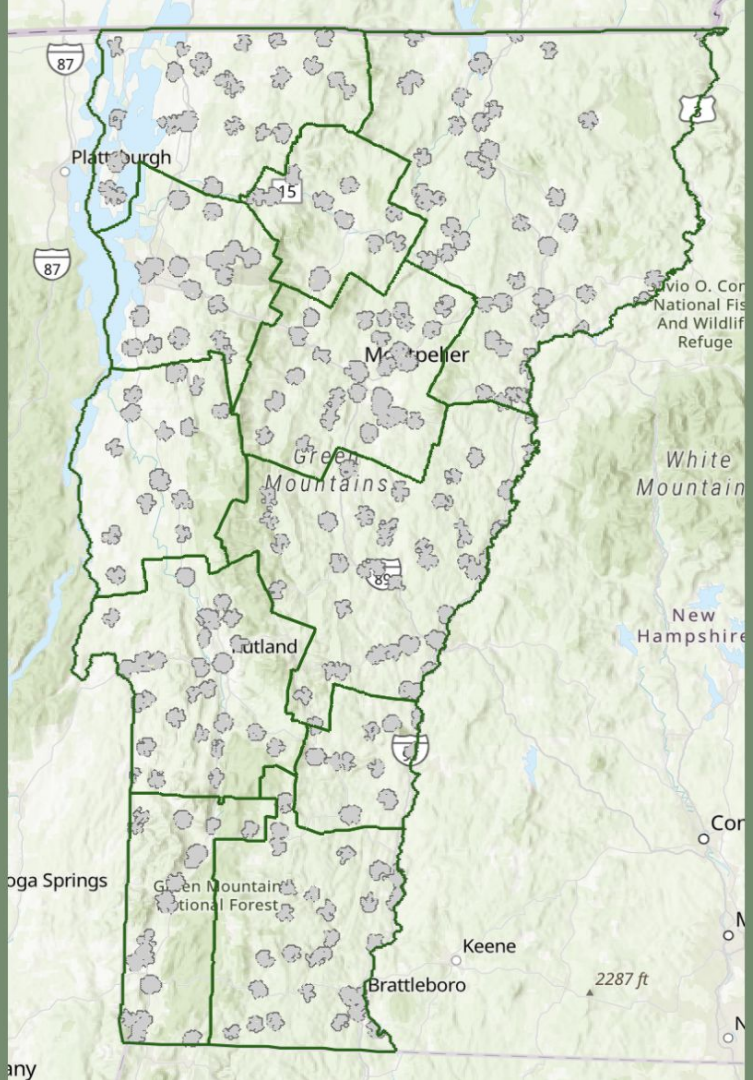


Act 142: Thermal Energy Networks

A green light for local heating & cooling solutions

- **All municipalities** can build Thermal Energy Networks and establish thermal energy utilities without Public Utility Commission approval or regulation, just as municipal water and sewer utilities operate under local control.
- **Cooperatives** are exempt from PUC oversight.
- **Campuses, condominiums, and landlords** can already provide a Thermal Energy Network on their properties.



Thermal Energy Network Potential in Vermont

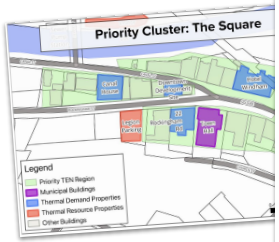
- Designated Centers
- Intentional Growth Areas
- Industrial Parks

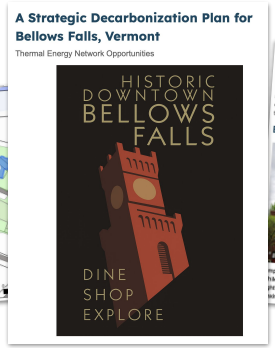
VT Thermal Energy Network Development

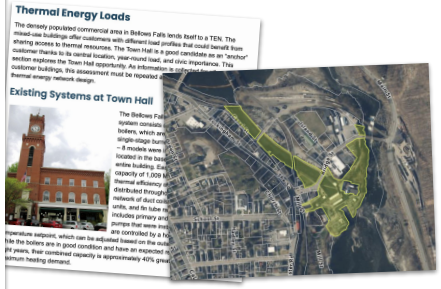
Thermal Energy Resource	Nearby Buildings	Future Phases
Commercial bakery	+ Housing	
Ice arena	+ Municipal buildings	+ Housing
Grocery store	+ Church	+ Housing + Businesses
Brewery	+ Health center	+ Pizzeria + Housing
Wastewater Treatment Plant	+ Local businesses	+ Food production + School
Geothermal borefield	+ Library and Town Hall	+ Housing

VT Thermal Energy Network Development

Community Workshops & Thermal Strategic Plans



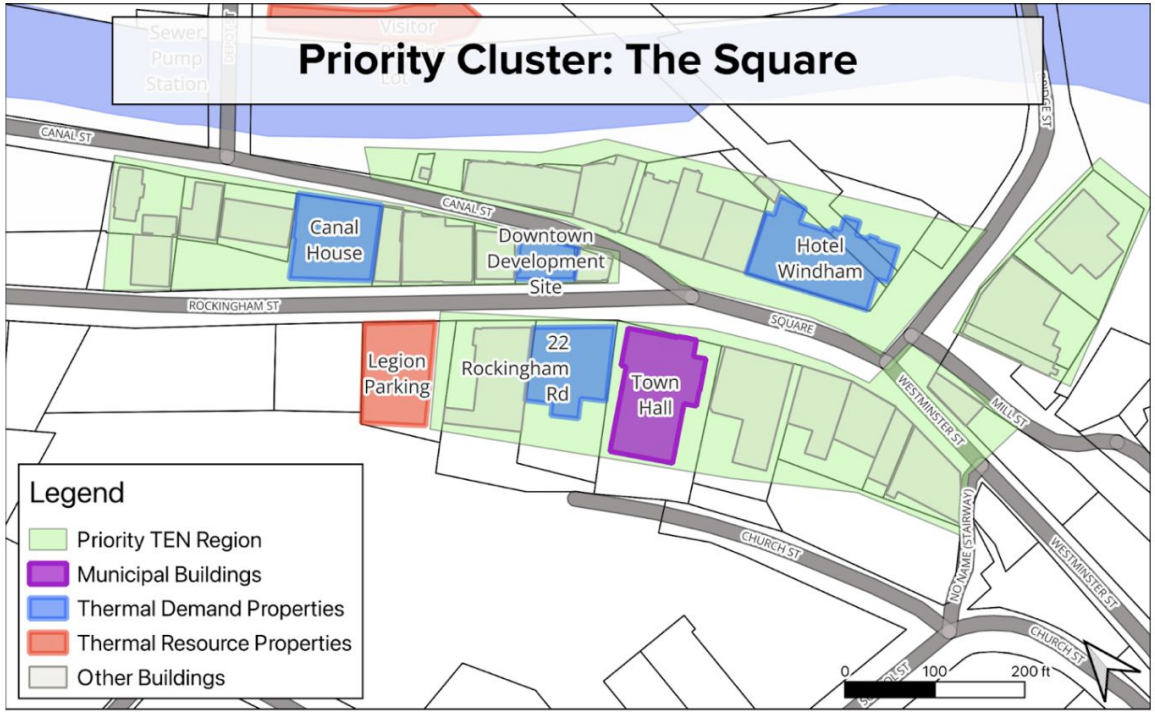




Cities & Towns

- Bellows Falls
- Manchester
- Morristown
- Middlebury
- Newport
- Northfield
- St. Albans
- St. Johnsbury
- Stowe
- South Royalton
- Williston
- Woodstock

VT Thermal Energy Network Development



- An anchor building with meaningful thermal load having a strategic or civic purpose
- A diversity of building types within reasonable proximity
- Access to thermal energy resources

1. Church
2. Church parsonage
3. Business/residential
4. Grocery/Co-op
5. Auto
6. VFW
7. River Arts building
8. Future housing
9. Church property
10. Business/residential

1. Wastewater Plant
2. Biodigester
3. Manufacturing
4. Construction
5. Beverage production
6. Manufacturing
7. Brewery
8. Tech center/school
9. Food production
10. Distillery

Thermal Energy Networks are actionable.

"**This is meaningful work because it's a *multiplier*.** It's unusual for one project to impact multiple things, but this has the potential to help us achieve other town goals around housing, equity, and more. I tell my son, if things were easy, everyone would do them, but **this one is do-able, and now is the time to get to work.**"

— Williston

"The technology is straightforward and well-established. Small groups of people can actually do this. **It's achievable.**"

– St. Albans

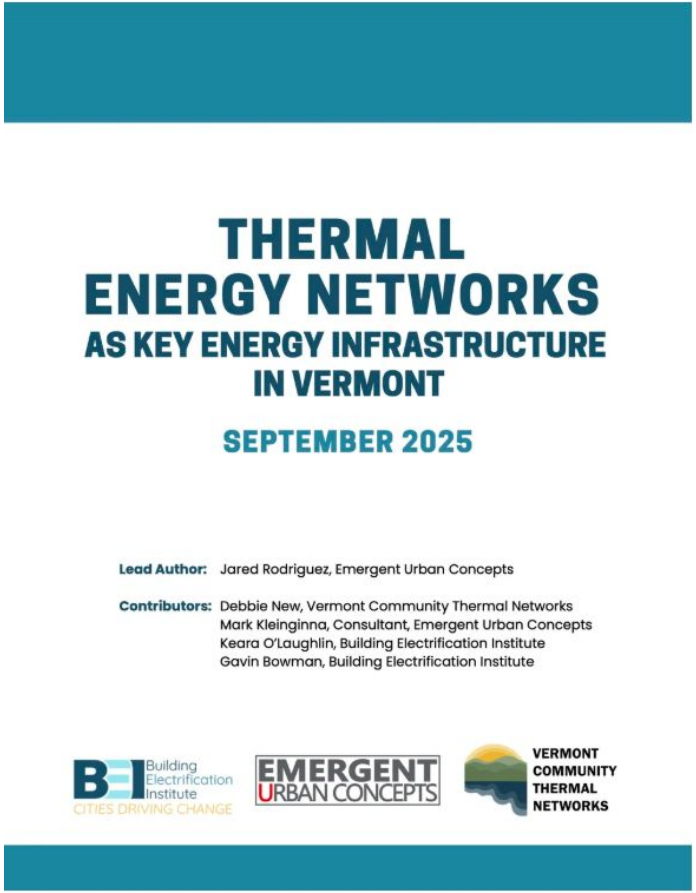
"I like that we're not just replicating something pre-packaged. We're asking questions, we're learning, and we're implementing it ourselves, so people are more willing, more receptive. **Our town has agency.**"

– St. Johnsbury

New Report

Using utility data to calculate the potential savings TENs could deliver, the analysis:

- Makes a case for the high efficiency, peak-shaving, cost-saving value of TENs as a capacity resource for Vermont's electric grid.
- Forecasts the impact of broad deployment of TENs in Vermont.
- Offers several recommendations to facilitate TEN development.



Key Takeaways

Prioritizing the development and deployment of TENs via policy and program design will help Vermont achieve state-level goals, including:

- Transitioning away from imported fuels.
- Avoiding peak demand resulting from buildings electrification.
- Mitigating electric grid constraints with affordable, resilient approaches.
- Reducing capacity limits, aiding economic development and related efforts such as housing production.

To reduce dependence on imported fossil fuels, Vermont must expand its electric grid's capacity to meet rising demand. Thermal Energy Networks (TENs) could help achieve this more affordably, **saving Vermonters up to $800 million in electric infrastructure costs.**

Broader Recommendations from the Report

Account for the full value of TENs and treat them like other energy solutions.
TENs provide measurable value to local distribution, regional transmission, and firm capacity. **Technology-agnostic compensation mechanisms** are needed so developers can monetize this value and unlock capacity.

Increase incentives for TEN deployment.
TENs can deliver grid operational and capital cost savings that individual building systems cannot—often competitive with batteries and, in some cases, a lower-cost alternative to traditional transmission upgrades.

Recognize waste heat as a valuable energy resource.
Waste heat and other thermal resources should be treated as **deployable commodities** that expand system diversity and improve reliability and affordability.

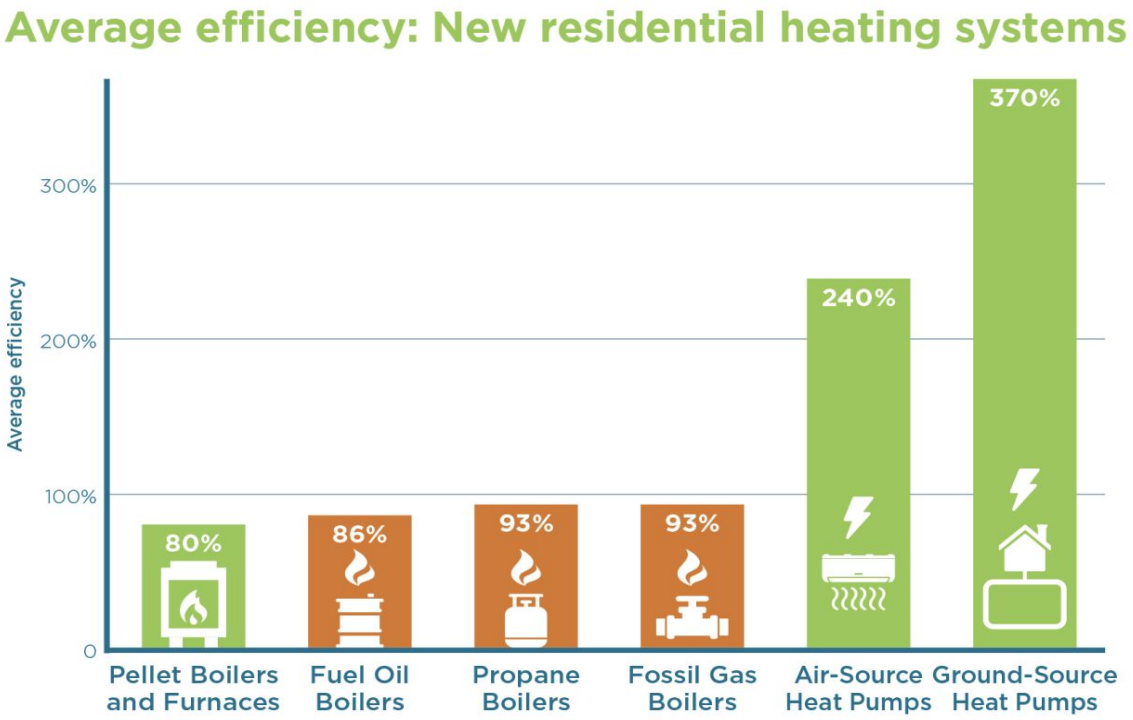
National Reports: U.S. & Canada

Ground source heat pumps dramatically lower peak load impacts & electricity costs, especially in colder climates.

Potential to:

- ➢ Decrease grid expansion by 38%
- ➢ Avoid 43,500 additional miles of transmission lines
- ➢ Create 12% reduction in wholesale price of electricity

Source:
https://eanvt.org/2024-annual-report/

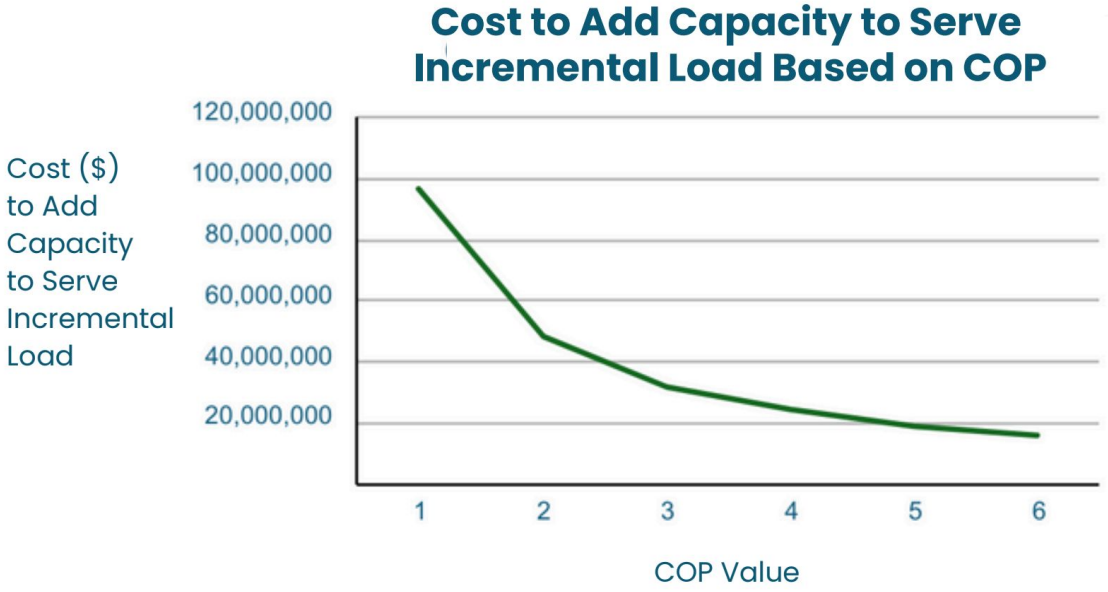


Sources: Pellet stoves, air-source heat pumps, and fuel oil, propane, and fossil gas boiler efficiencies: Vermont Public Utility Commission, TAG Tier III Annual Report, 2021. Ground-source heat pumps: US Energy Information Agency, "Updated Buildings Sector Appliance and Equipment Costs and Efficiencies," 2023. **Notes:** Heating efficiency refers to the average rate at which an appliance converts energy from fuel to heat output, expressed as a percentage. Heat pumps are capable of achieving efficiency rates greater than 100% because the energy input is used to transfer—rather than generate—heat. Because of this, heat pumps can transfer more energy than they consume. Efficiency rates for air-source heat pumps can vary considerably depending on outdoor air temperature. The efficiency presented here is an average over the course of the heating season.

TENs as a Grid Capacity Resource in Vermont

Unit Cost of Adding New Capacity to Serve Technologies Operating at Varying COPs

COP VALUE (kWout/KWin)	UNIT COST CAPACITY ($/kw-yr)
1	$482.76
2	$241.38
3	$160.92
4	$120.69
5	$96.55
6	$80.46



Read the full BEI report HERE

Each Megawatt of Avoided Peak Demand. . .

- Adding 1 MW of electric capacity costs approximately $483/kW-year in Vermont (generation + transmission + distribution).
- Over a 25-year equipment lifespan, each 1 MW of avoided peak demand is worth approximately $5 million in infrastructure savings.
- At COP 5.0 (TENs peak performance), the potential value delivered per MW is over $4 million in avoided infrastructure costs.
- Scaling TENs across Vermont's 200 MW of projected heating load growth avoids roughly $800 million in capital expenditure on grid expansion.

Example Policy + Market Mechanisms Incentivizing TENs

- **NY UTENJA BAU requirement:** Neighborhood-scale TENs show ~50% peak demand vs ASHP alternative (Link) (Link)
- **CA neighborhood-scale decarb:** Direct comparison of traditional upgrades vs TEN alternative (Link)
- **VDER (nodal value):** Technology-agnostic compensation for grid services (Link)
- **Non-Pipes / Non-Wires Alternatives:** Procure local capacity solutions (Link) (Link)
- **Vermont NTA process:** Procure regional non-transmission solutions (Link)
- **CHIP funding:** Housing investment enables capacity unlock + grid modernization overlay (Link)
- **C&I make-ready funding:** Accelerates adoption through economic development investment (Link) (Link)

Additional Considerations

- Thermal Energy Storage integration as a capacity resource
- Demand Response Opportunities: Controls, behavioral/market signals, etc.
- Emergency Back-Up, Grid Independence, Resilience and Adaptation
  - Less generation capacity needed for high COP at peak load
- Deep Integration with Intermittent Renewables
- Ratepayer Cost Stabilization
- Co-Benefits for Vermonters
  - High(er)-efficiency cooling
  - Improved affordability and accessibility of beneficial electrification
  - Economic benefits of thermal assets (breweries, dairies, grocery stores)

TENs and Vermont Priorities

Intact IRA incentives + Direct Pay

- Benefits construction of other projects: water, sewer, housing
- Reason to plan & coordinate, open door for partnering

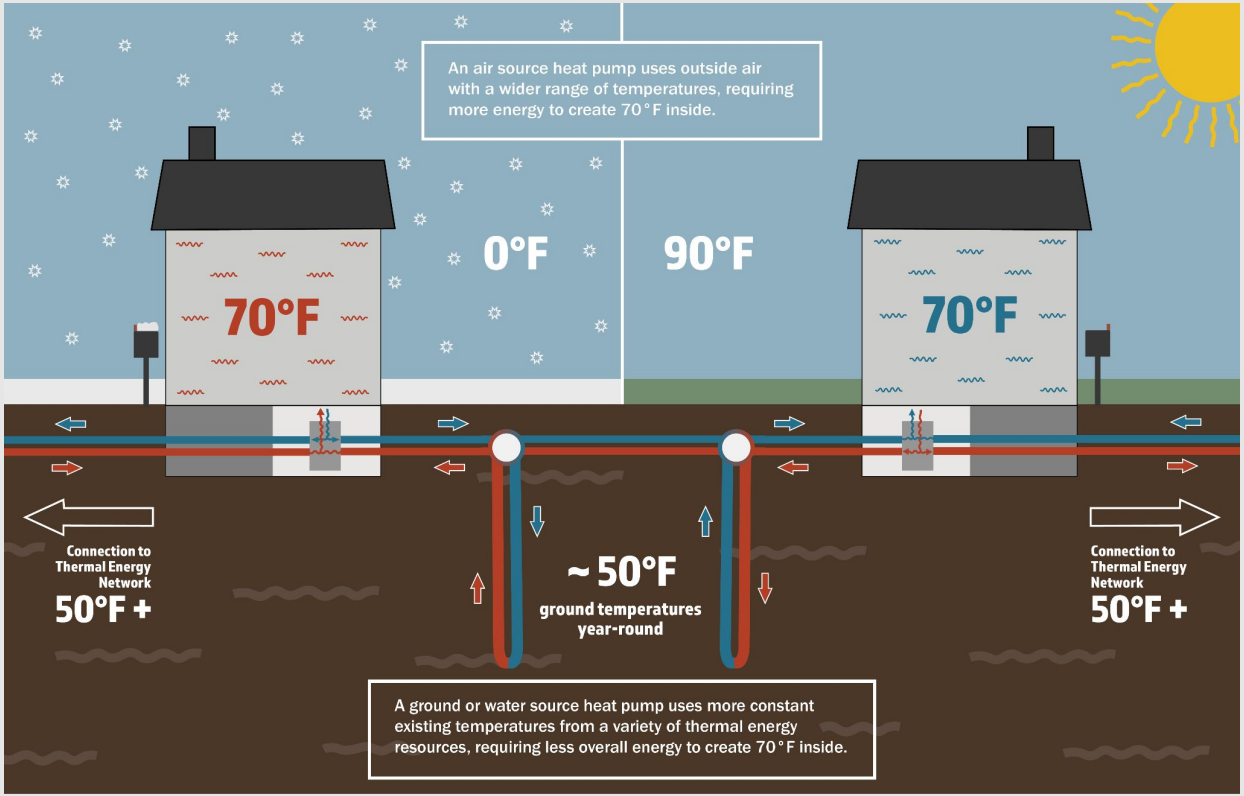
TENs can achieve grid reliability + resilience goals via other priorities

- Housing Preservation and Production
- Downtown Revitalization
- Flood Recovery and Adaptation
- Emissions Reduction Mandates

TENs are included in:

- Grid resilience proceeding
- Housing: Community Housing & Infrastructure Program (CHIP)
- Economic development: ACCD, CEDS, Northern Border Regional Commi
- Resilience hub planning
- Climate Action Plan (CAP) prioritization

Think outside the box (and beyond geothermal).



Serene Lea Dairy in BC (link)

Blasty Bough Brewery in NH (link)

Regional Perspective

- Housing and housing-ready Infrastructure
- Economic development: thermal assets, existing energy workforce, municipalities
- Challenging assumptions around load growth

Questions For VSPC

- Existing standards for how NTAs and targeted efficiency are evaluated and valued (e.g. Geographic Targeting Committee process)?
    - How do TENs stack up? How would they be valued? And who decides?
- We see a role TENs should play in changing load growth assumptions that underpin the 2024 Economic Study and the LTTP.
    - How are DU's and other stakeholders perceiving TENs in terms of load reduction?
- What avenues can we use to continue this conversation?
    - How do we better integrate community planning and system planning?

Thank you. We hope to connect with you.

Debbie New	debbie@vctn.org
Jared Rodriguez	jared@emergentgroup.com
Sam Lash	lash@cvregion.com