



A City's Climate Toolbox: Exploring Water-Based District Heating and Cooling for Metro Boston

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Metropolitan Area Planning Council

June 26, 2019

Clean Energy in Metro Boston



Regional Energy
Projects



Climate and Energy
Planning



Energy Technical
Assistance



Cities and Towns as Climate Leaders

Cities adopt the Paris Climate Agreement goals

369 Climate Mayors, representing 67.5 million Americans, commit to uphold the Paris goals

Politics & Government

Somerville Pledges Support Of Paris Accord After Trump Withdrawal

Despite the president withdrawing from the international agreement, "Somerville is still in."

By Alex Newman (Patch Staff) - Updated June 2, 2017 3:03 pm ET



Metro Mayors reaffirm commitment to Paris Climate Accord

Updated Jun 27, 2017 at 4:39 PM

WICKED LOCAL MALDEN

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Cities and Towns as Climate Leaders

SANTA BARBARA BECOMES 30TH U.S. CITY TO COMMIT TO 100% RENEWABLE ENERGY

First City On California's Central Coast To Commit To 100% Clean Energy

Abita Springs aims to run on 100% renewable energy by 2030

BY SARA PAGONES | SPAGONES@THEADVOCATE.COM MAY 6, 2017 - 4:00 PM (1)

THE NEW ORLEANS
ADVOCATE

Tuesday, June 6, 2017

Orlando Becomes 40th City to Commit to 100% Renewable Energy

By **Sierra Club**
Aug. 09, 2017 08:39AM EST

Getting to Net Zero: Cambridge, MA

Thursday Mar 26, 2015 - 4:20 PM EDT

DAILY KOS

Madison approves 100 percent clean energy goals, up to \$250,000 for consultant

ABIGAIL BECKER | The Capital Times | abecker@madison.com | @abecker_4 Mar 22, 2017

Lexington Town Meeting votes to adopt a net zero carbon emissions policy

Posted Apr 21, 2016 at 8:48 PM

WICKED LOCAL LEXINGTON
Includes content from the Lexington Minuteman

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Local Tools

Clean heating and cooling

Peak Demand Management

Energy Efficiency

Clean Transportation

Green Municipal Aggregation

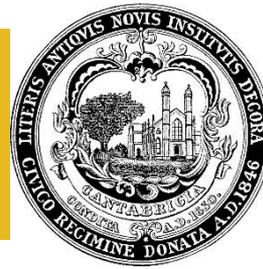
Renewables Procurement & Outreach Programs

Net Zero Planning

Building Codes, Zoning & Permitting



Researching WBDE



- Understand the **policy landscape** for water-based district energy in Massachusetts and locally.
- **Learn from other regions** around the U.S. and abroad on best practices for governance and potential roles for municipalities.
- Develop a set of recommendations in regards to a **governance framework** to enable water-based district-energy systems at the local level.

Governance

The laws, policies, regulations and decision-making processes that are used to manage and oversee district energy

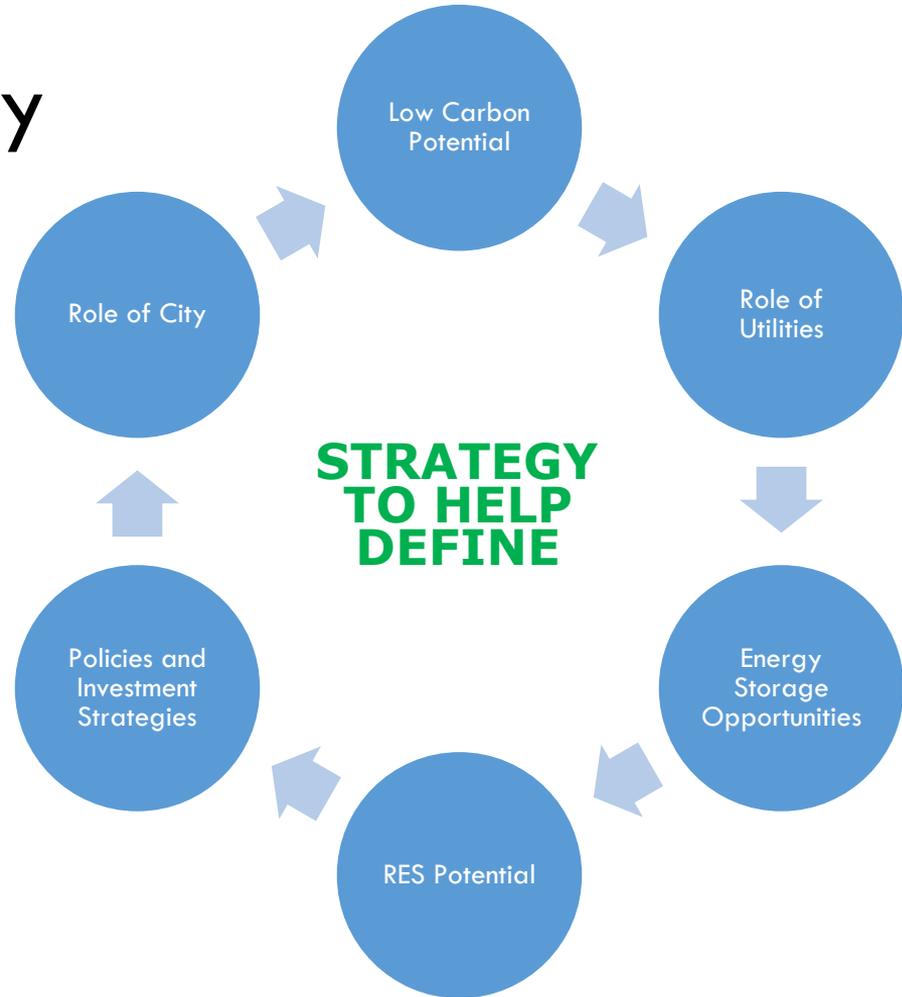
Current Municipal Efforts

- Cambridge, Boston and Somerville have developed climate action plans and committed to reducing GHG emissions
- Boston's 2016 Community Energy Study and City of Cambridge's Low Carbon Energy Supply Strategy Study identify potential areas appropriate for district energy
- Cambridge's Planning Unit Development 5 District in Kendall Square and DE Assessment required for Volpe development
- Boston's Smart Utilities Policy
- MAPC's Fix Our Pipes and E-Permitting work to coordinate street openings between utilities and municipalities

Cambridge Low Carbon Energy Supply Strategy

Project Scope

Develop an energy supply strategy for the City of Cambridge that achieves a system-level transformation in order to support the goals of the Net Zero Action Plan



BOSTON SMART UTILITIES POLICY FOR ARTICLE 80

	Article 80 Size Threshold	Specifications
District Energy Microgrid	>1.5 million SF	Feasibility Assessment; if feasible, then Master Plan & District Energy Microgrid Ready design
Green Infrastructure	>100,000 SF	Install to retain 1.25" rainfall on impervious areas (Increase from 1" currently required by BWSC)
Adaptive Signal Tech.	All projects requiring signal installation or improvements	Install AST & related components into the traffic signal system network
Smart Street Lights	All Projects requiring street light installation or improvements	Install additional electrical connection & fiber optics at pole
Telecom Utilidor	>1.5M SF of Development, or >0.5 Miles of Roadway	Install Telecom Utilidor

<http://www.bostonplans.org/planning/planning-initiatives/boston-smart-utilities-project>

Existing Steam-Based District Energy Systems

- Harvard University (Also in the process of installing a low-temperature hot water system on the Allston Campus)
- Massachusetts Institute of Technology
- Veolia – serves Kendall Square and Downtown Boston
- Medical Area Total Energy Plant (MATEP) in Boston Longwood

Medical area

Benefits of Water-Based District Energy for Metro Boston

- Energy efficiency
- Resilience and energy independence
- Flexibility in generating technology, including low-carbon options
- Individual buildings no longer need their own boilers and chillers
- Long-term cost savings
- May be paired with a microgrid for electricity

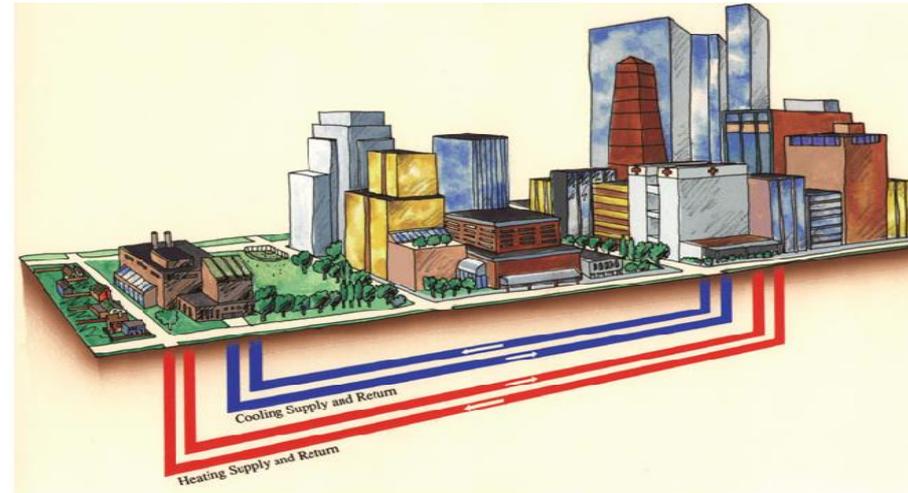


Image: IDEA 2012

Findings: Common Barriers

- **Physical Constraints:** Retrofitting existing buildings and space underground for additional pipes
- **Business Model Inertia:** High upfront costs and longer-payback periods may be difficult to compete with status quo of natural gas and traditional HVAC systems.
- **Customer Acquisition:** “Chicken and egg” challenge of confirming customers and financials.
- **Policies and Regulations:** Policy uncertainty may lead to investors not willing to invest due to perceived risk.

Findings: Role of the State

- H. 3394 An Act Relative to the Authority of Department of Public Utilities to Regulate Steam (2007)
 - Massachusetts DPU's Pipeline Safety Division regulates steam distribution companies for safety and operation
 - Safety requirements during design, installation, operation, and maintenance
 - Annual testing and audits
- Electrical Restructuring Act, M.G.L 164 (1997)
 - Primarily responsible for the regulation of the provision and distribution of electrical energy and protecting consumers. While it applies to microgrids, it does not apply to thermal district energy systems.
 - Franchise clause (M.G.L c. 164, § 1B(a)) applies to the electrical distribution grid, not thermal energy.

Findings: Role of the State

- Alternative Renewable Energy Portfolio Standards
 - An alternative to the Commonwealth's Renewable Portfolio Standard (RPS)
 - The technologies identified as applicable for the Alternative Portfolio Standards (APS) for retail energy are defined as “a source which generates energy using any of the following: (i) combined heat and power; (ii) flywheel energy storage; (iii) energy efficient steam technology; [and] (iv) any facility that generates useful thermal energy using sunlight, biomass, biogas, liquid biofuel or naturally occurring temperature differences in ground, air or water.”
 - Incentives may be applied to district energy systems depending on which technology is used.
- Federal and State Air Quality Permits

Sampling of District Energy Policies in Europe and Canada

Location	Level of Government	Policy	Description
Denmark	Federal	Heat Supply Act (1979)	Enabled municipalities to designate district heating areas and allows mandatory connection.
Austria	Federal	Heat and Cold Line Expansion Act (2008)	Supports development of district heating and cooling, including subsidies with the goal of energy efficiency and reducing emissions.
Germany	Federal	Renewable Energies Heating Act (2009)	To increase renewable heating and cooling to 14% by 2020 and requires new construction to have a certain percentage of their heating/cooling come from renewable sources.
British Columbia, Canada	Provincial	Utilities Commission Act	District Energy is regulated as a public utility by the BC Utilities Commissions (BCUC) unless a local government provides the services.

^[1] Plan Energi. 2016. "Framework conditions and policies on small district heating and cooling grids in Denmark, Austria and Germany". Oct. 4, 2016.

https://www.coolheating.eu/images/downloads/D24_Framework_conditions_DE_AT_DK.pdf

^[2] Pacific Institute for Climate Solutions. 2012. "The Regulation of District Energy Systems". https://pics.uvic.ca/sites/default/files/uploads/publications/WP_District_Energy_May2012.pdf

Findings: Potential Role of Municipalities

- **Planner and Coordinator**
 - Energy Mapping and Planning
 - Zoning Ordinance, Design Guidelines and Other Policies
 - Coordination of Customers
 - Coordination of Utilities
 - Provision of Financial Modeling Guidance
- **Governance and Oversight**
- **System Owner**
- **System Customer/Anchor Load**

Energy Mapping and Planning

- Energy Mapping: Better understand the use profiles and energy demand of potential off-takers
- Identify potential sources of energy
- Identify anchor tenants
- Creation of district energy zones

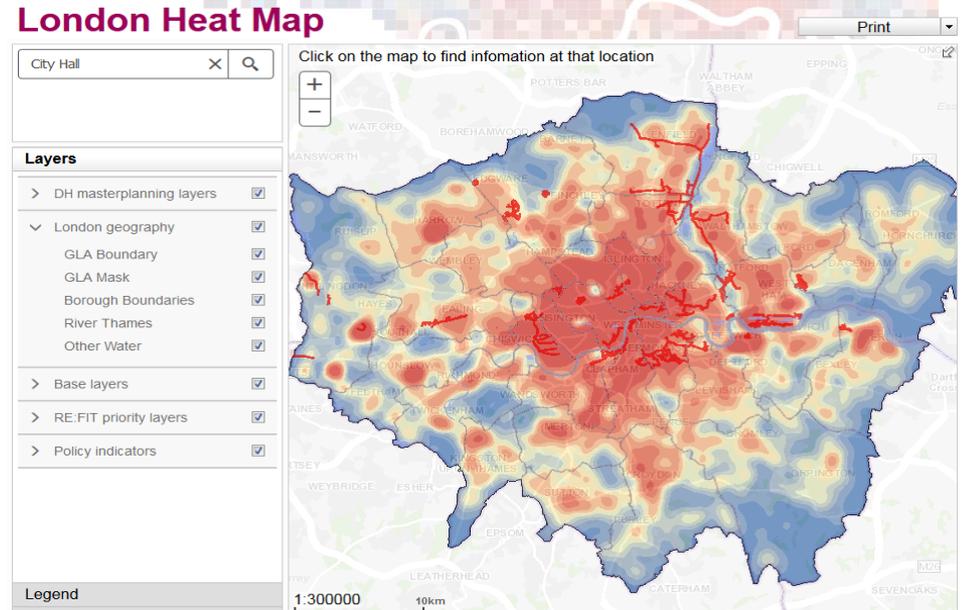


Image: London.gov London Heat Map

Cambridge Heat Demand

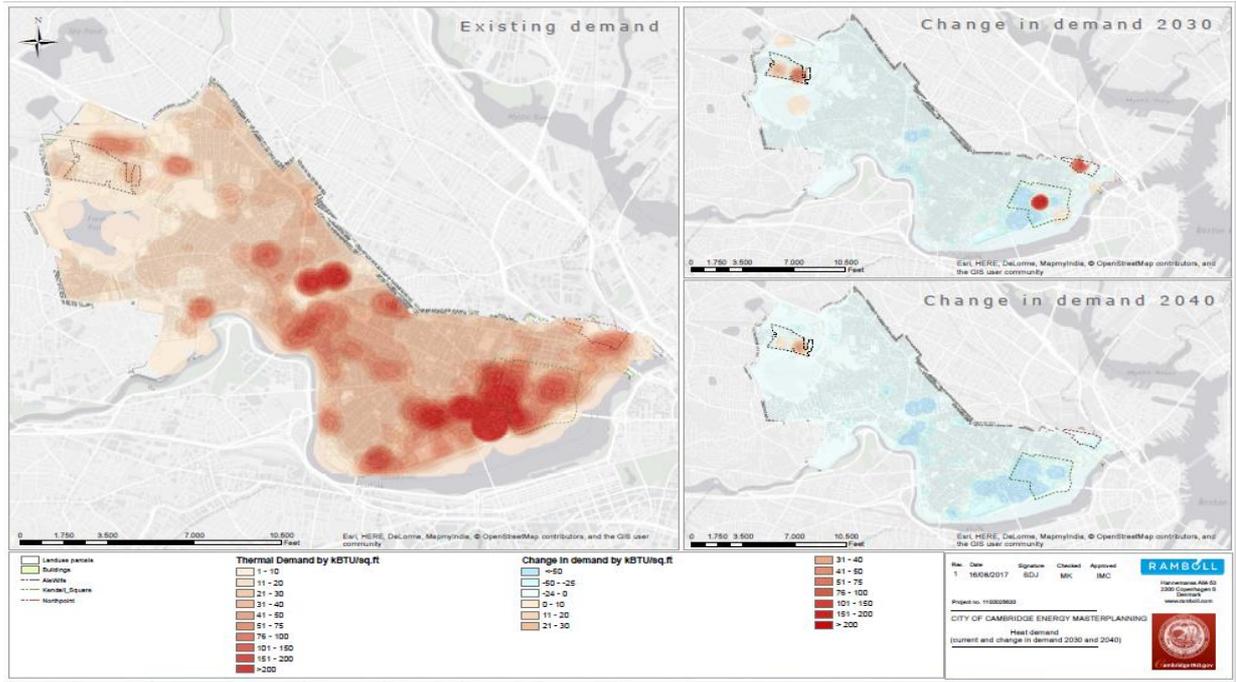


Image: City of Cambridge, Low Carbon Energy Supply Strategy Study

Zoning, Design and Other Policies

- Encourage dense, mixed-use development to better support district energy
- Establish zones that allow energy generation sites
- Require buildings to be “water-based district energy” ready
- Require that large developments do a district energy feasibility study or low-carbon energy study

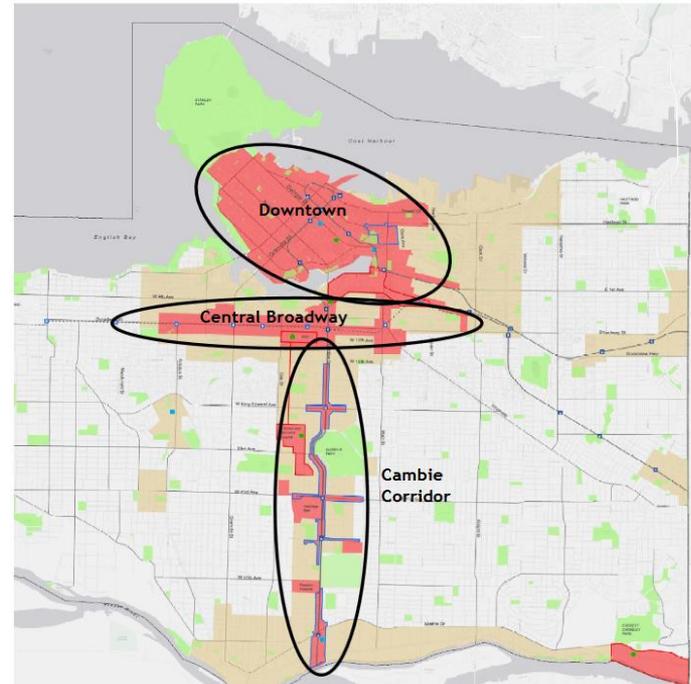


Image: City of Vancouver Map of Target Areas

Cambridge Potential DE Areas

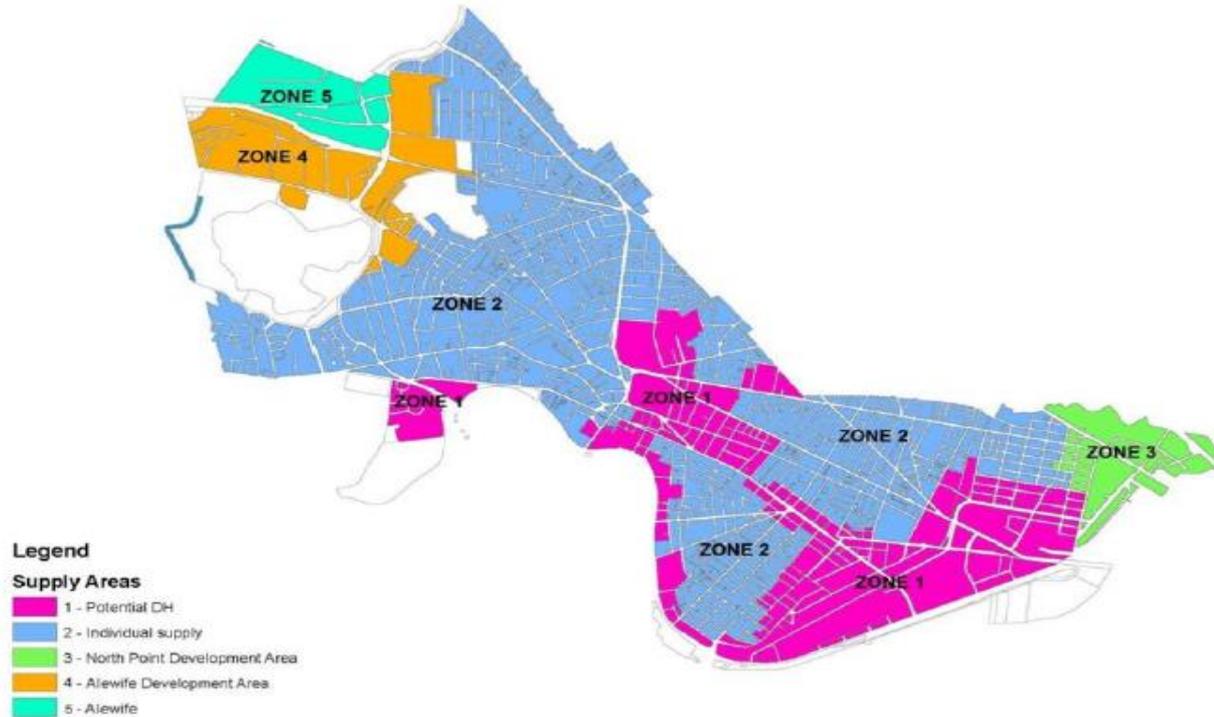


Image: City of Cambridge, Low Carbon Energy Supply Strategy Study

Coordination of Customers

Diagram: (not to scale)

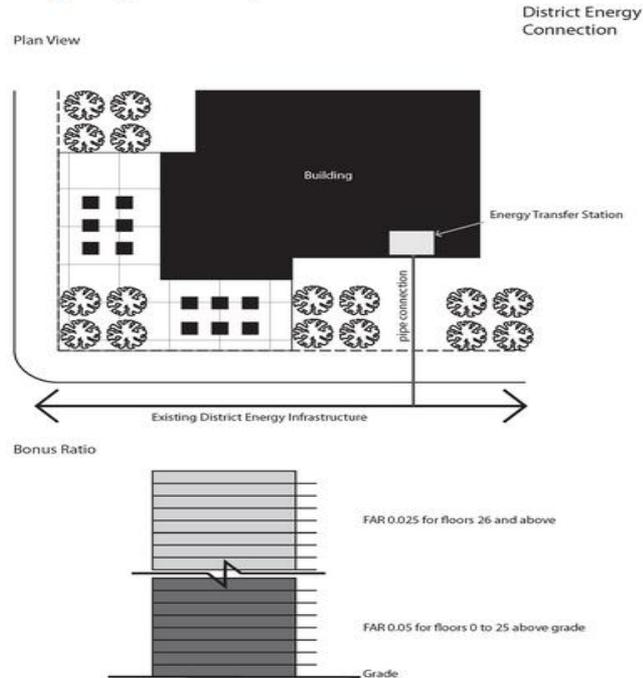


Image: City of Calgary, Alberta Bylaw

Incentives:

- FAR bonuses, fee waivers, streamlined permitting, financial assistance

Mandates:

- Require district-ready buildings or mandatory connection
- Encourage customers by requiring new large developments consider district energy.

Coordination of Utilities



Image: Installing pipes as part of downtown Guelph, Ontario's heating and cooling system. Credit: Mike1024.

Street openings:

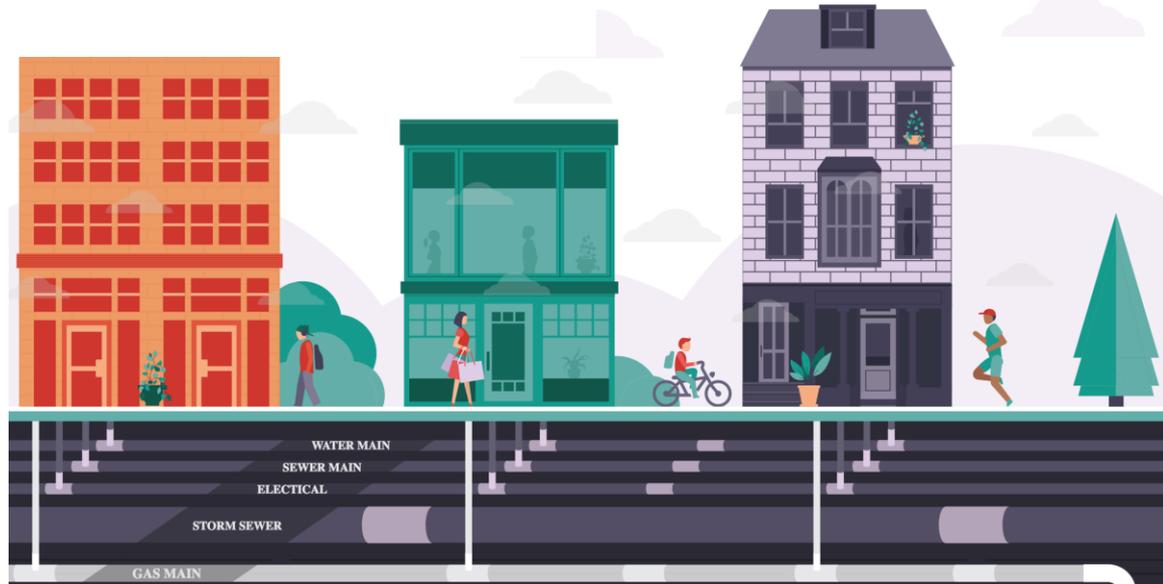
- Require city approval
- Create an opportunity to coordinate with other utilities

Fixing Our Pipes: Coordinating Natural Gas Main Replacement

Between Local Governments and Gas Companies



<http://fixourpipes.org/>



Provision of Financial Modeling Guidance

- Challenge of high upfront costs and longer payback periods
- Life-cycle costs assessment vs. cost-benefit analysis
- Carbon pricing and social costs of carbon

Carbon Pricing: The Metro Vancouver Regional District Board set a carbon pricing policy to dictate how Metro Vancouver systems should incorporate carbon into decision-making and lifecycle cost analyses for construction and vehicle procurements.⁴³ The policy is in line with British Columbia's carbon tax rate, which increases from \$35 per ton in 2018 to \$50 per ton of carbon dioxide in 2021.⁴⁴ While this does not set pricing for businesses, residents, or institutions, it does signal to the market that incorporating the true cost of carbon is critical for lifecycle cost analyses.

<https://vancouver.ca/files/cov/2017-06-21-carbon-pricing.pdf>



Neighborhood Energy Utility
Image Source: Christopher Porter. [Flickr](#).

Role of Municipalities: Governance and Oversight

- Ensure the health, safety and welfare of residents and businesses
- Protect consumers on issues of rate setting and transparency



Role of Municipalities: System Owner

Ownership Option	Governance	Level of Municipal Control and Risk
Publicly Owned	A board that is responsible for oversight of the system is often established. This board may be appointed by City Council or other elected officials, or the board members may be elected. A governing board can help ensure transparency in decision-making as well as accountability for decisions that impact customers, such as rate changes and investment plans.	Most control and risk
Public-Private Partnership (P3)	Similar to a publically owned system, a P3 could establish a Board that includes publically appointed and accountable representatives. The Board of Directors could include members that are publically appointed as well as private-sector members from local businesses, such as hospitals and large building managers that connect to the system. Representatives could also include those from the local Chamber of Commerce.	Moderate control and risk
Privately Owned	A private Board of Directors typically manages a privately owned system. Decisions on rates, fees, and investment plans are made based on the market via the return on investment and recovery of investment costs. Since most district energy systems compete with traditional heating and cooling systems, these rates are often cost competitive in order to appeal to customers. A city may choose to release guidelines on rate setting and pricing transparency to shape expectations for private sector district energy system owners.	Least control and risk

Southeast False Creek Neighbourhood Energy



Image: City of Vancouver

- **Customers:** Waste heat recovery from sewer provides space heating and hot water to 4,300,000 sq ft. of both residential and commercial buildings.
- **Owner:** Utility is owned and operated by the City of Vancouver and began operation in 2010.
- **Governance:** Regulated by the City and competitive rates are set annually by the City Council.

District Energy St. Paul

- **Customers:** Provides space heating and cooling to 200 buildings.
- **Owner:** Non-profit organization, but was first built as a public-private partnership in 1979.
- **Governance:** Rates are set by the Board of Directors, which includes members appointed by the St. Paul City Council and from local business community.



St. Paul, Minnesota
Image Source: Michael Hicks. [Flickr](#).

Key Takeaways

- Governance of district energy ranges from support of market-based dynamics to oversight of health, safety and welfare to rate setting, investment, and consumer protection.
- Water-based district energy is currently not regulated or governed in Massachusetts, while steam is regulated for health and safety purposes.
- Many States in the U.S. do not oversee thermal energy/district energy systems, in part because connection to district energy systems in the U.S. is typically not mandatory.
- Municipalities can play a significant role in enabling water-based district energy systems, helping overcome barriers, and build the market.

Recommendations



**Data-Driven Analysis
and Mapping**



Enabling Policies and Guidance



Considerations for System Ownership



Regulation and Oversight

Localized Case Study

Near term (1-2 years)

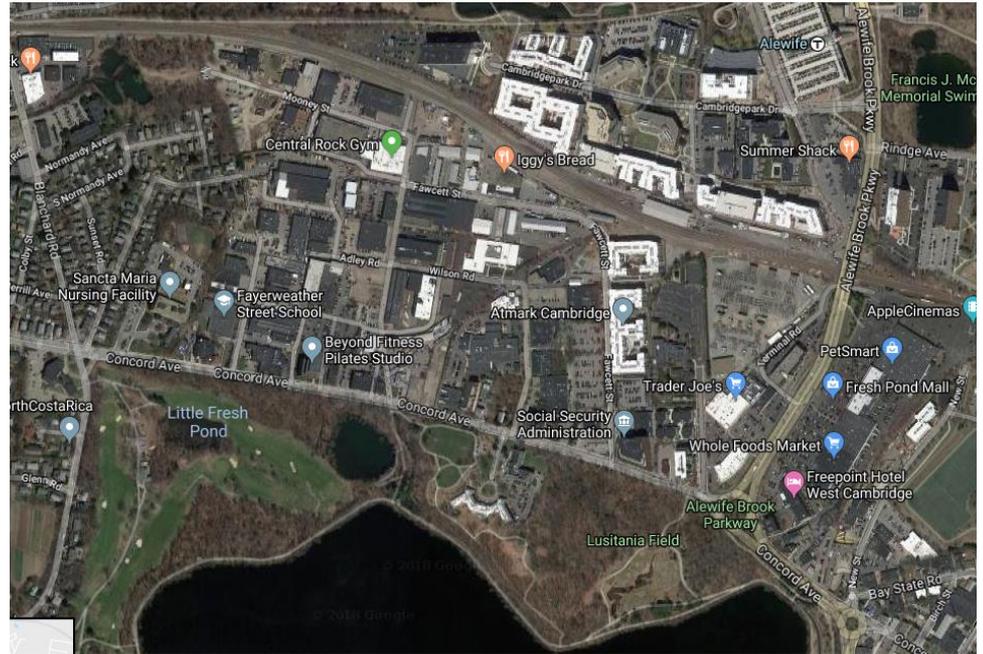
- **Additional Analysis and Mapping**
- **Consideration of ownership models**

Medium term (2-3 years)

- **Zoning**
- **District Energy Feasibility Policy**

Long term (3+ years)

- **Implementation Support and Oversight**



City of Cambridge: Alewife quadrangle concept

Thank You!

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