



# 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**

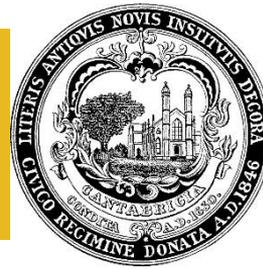
**Renewables Procurement & Outreach Programs**

**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

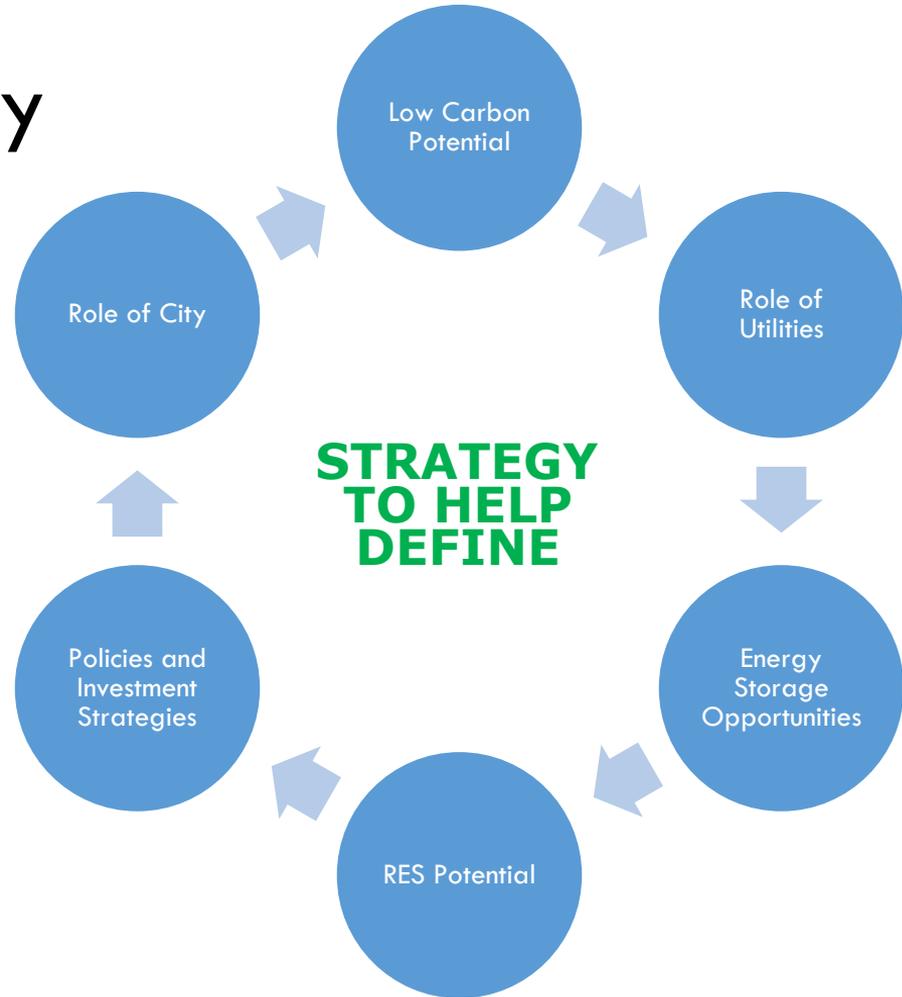
# Current Municipal Efforts

- 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

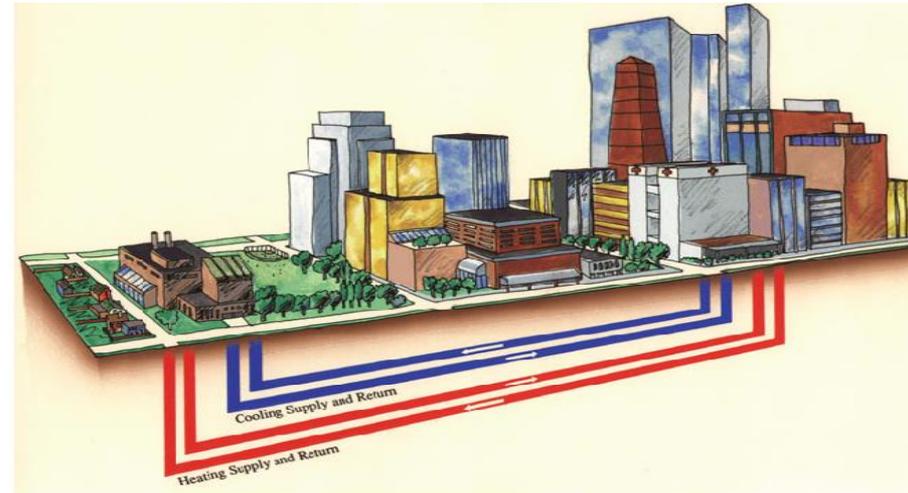


Image: IDEA 2012

# 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.

<sup>[1]</sup> 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](https://www.coolheating.eu/images/downloads/D24_Framework_conditions_DE_AT_DK.pdf)

<sup>[2]</sup> 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](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**

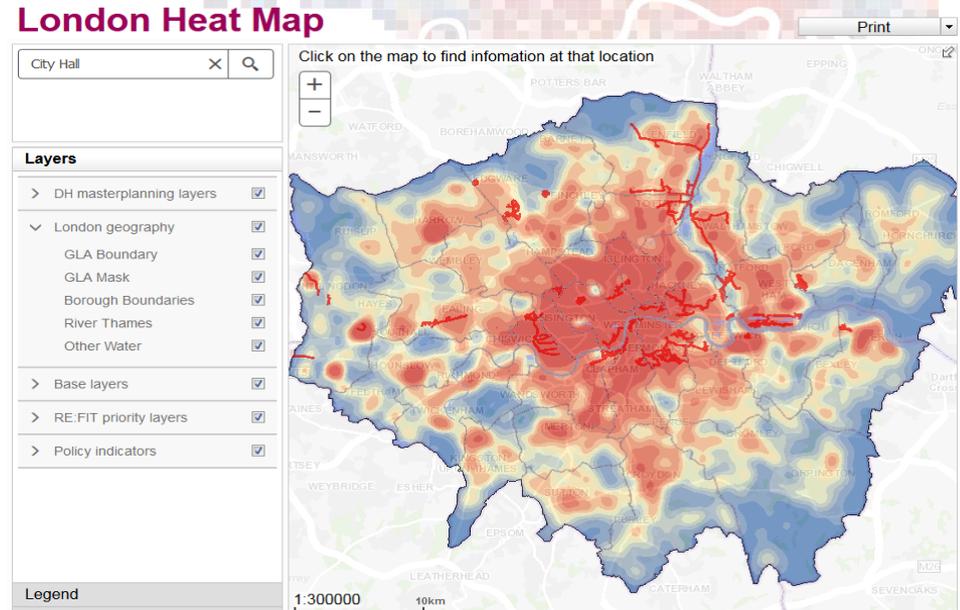


Image: London.gov London Heat Map

# Cambridge Heat Demand

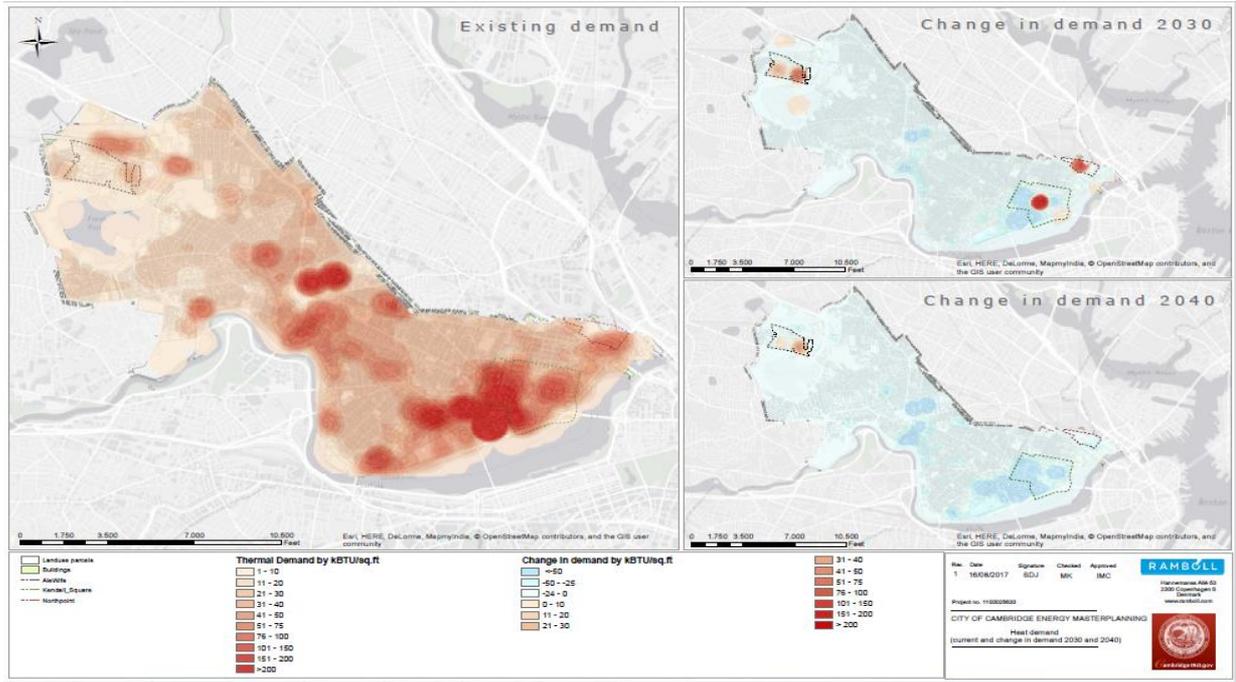


Image: City of Cambridge, Low Carbon Energy Supply Strategy Study

# 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

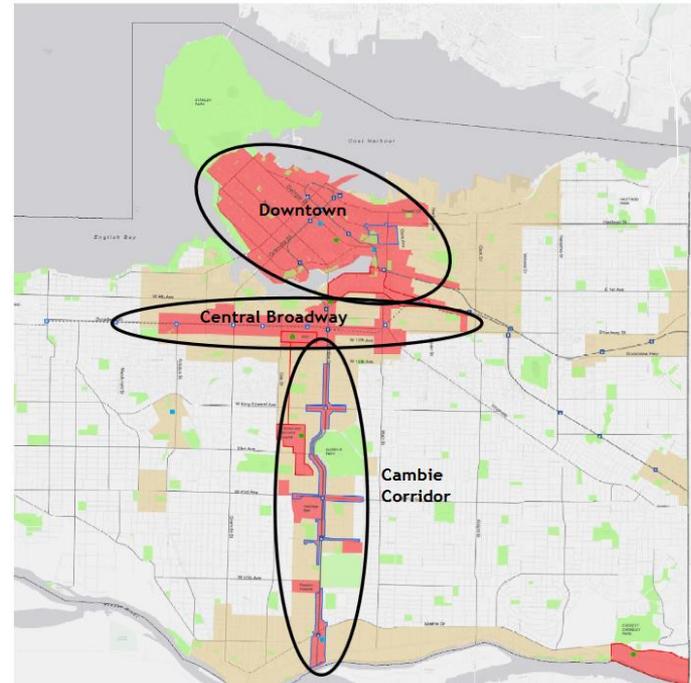
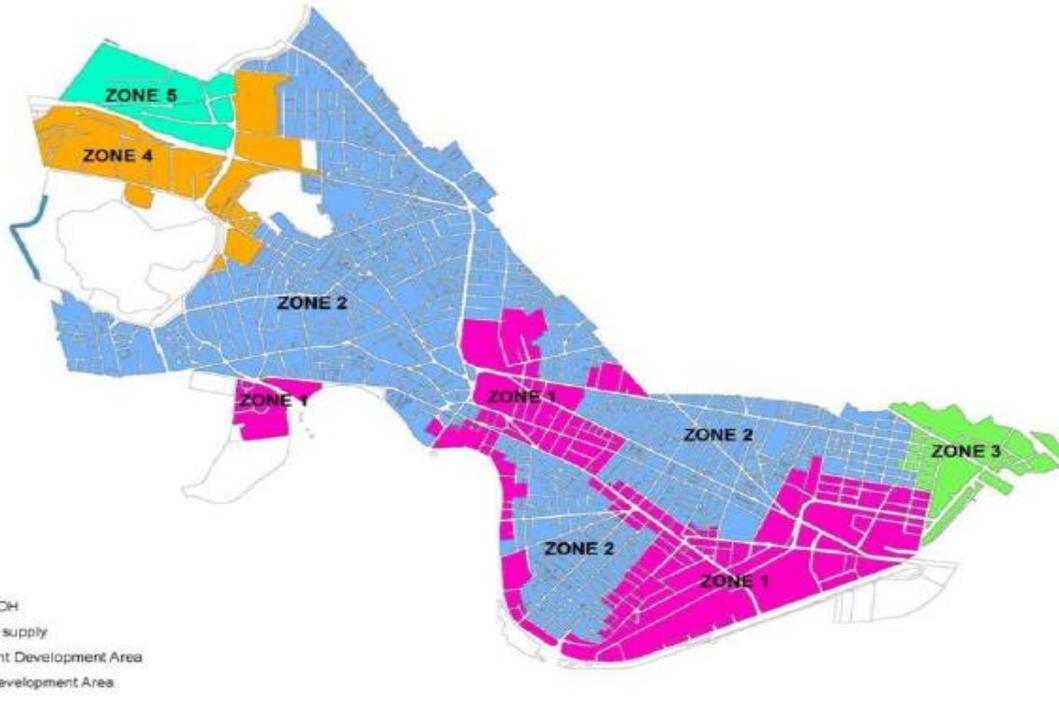


Image: City of Vancouver Map of Target Areas

# Cambridge Potential DE Areas



## Legend

### Supply Areas

- 1 - Potential DH
- 2 - Individual supply
- 3 - North Point Development Area
- 4 - Alewife Development Area
- 5 - Alewife

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

# Coordination of Customers

Diagram: (not to scale)

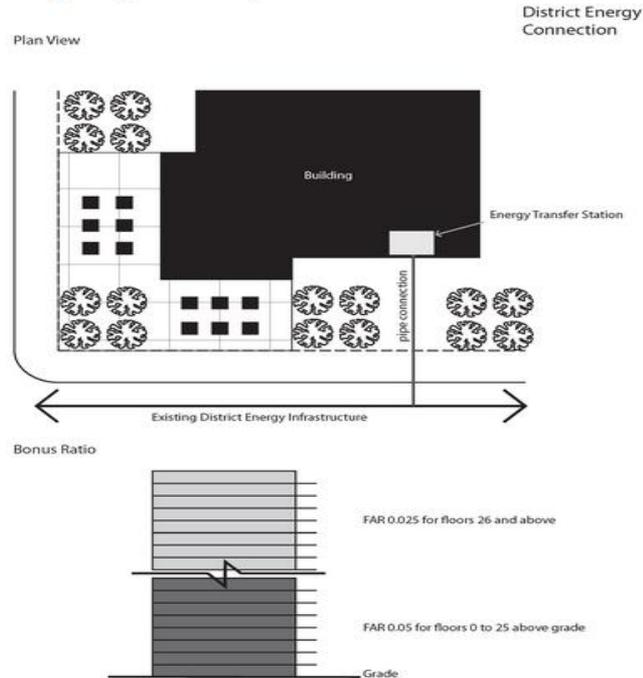


Image: City of Calgary, Alberta Bylaw

## 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:

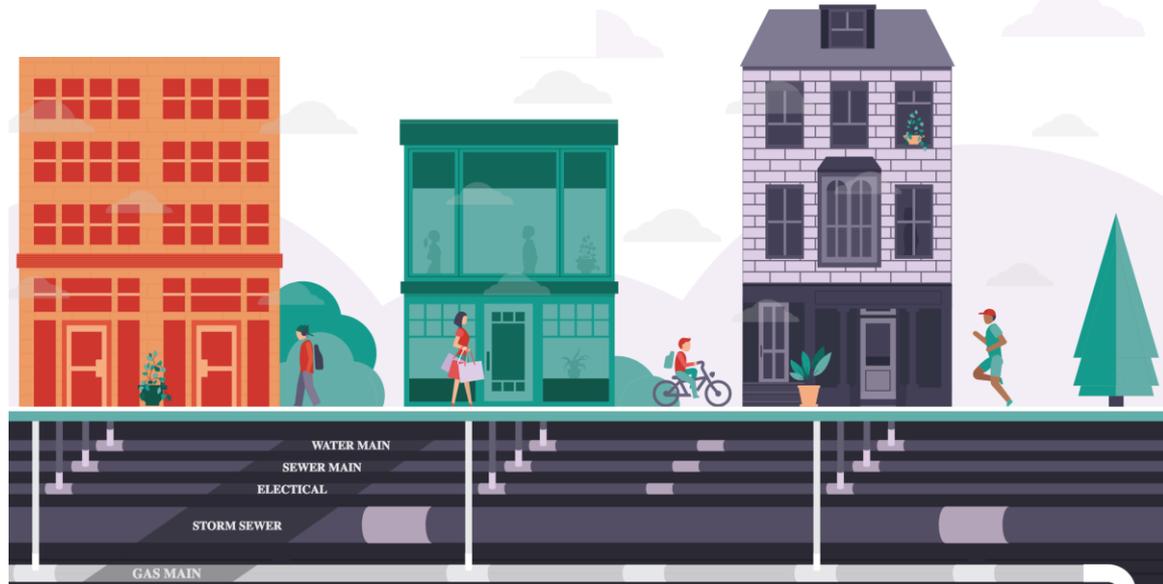
- Require city approval
- Create an opportunity to coordinate with other utilities

# 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.<sup>43</sup> 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.<sup>44</sup> 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

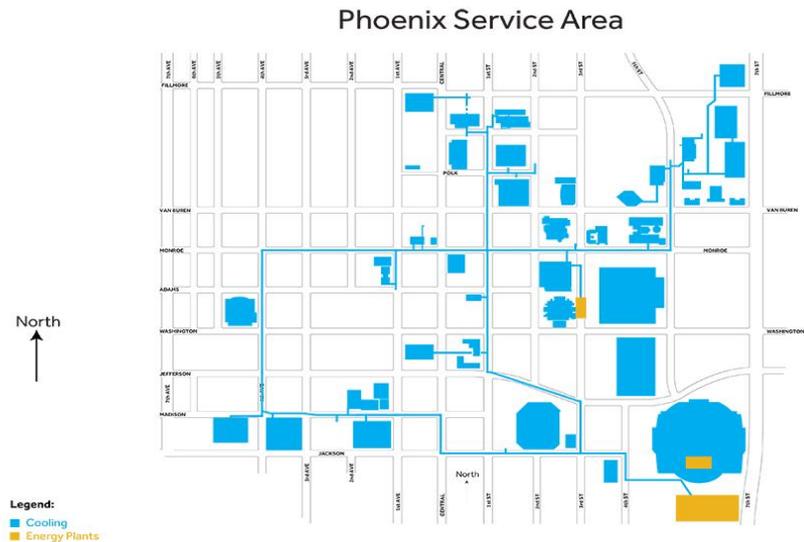
- **Customers:** Provides space heating and cooling to 200 buildings.
- **Owner:** Non-profit organization, but was first built as a public-private partnership in 1979.
- **Governance:** Rates are set by the Board of Directors, which includes members appointed by the St. Paul City Council and from local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



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

# Role of Municipalities: System Customer/Anchor Tenant

- Customers of district energy systems, providing thermal energy to municipally-owned buildings
- Energy cost price stability when using renewable energy sources



# 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)

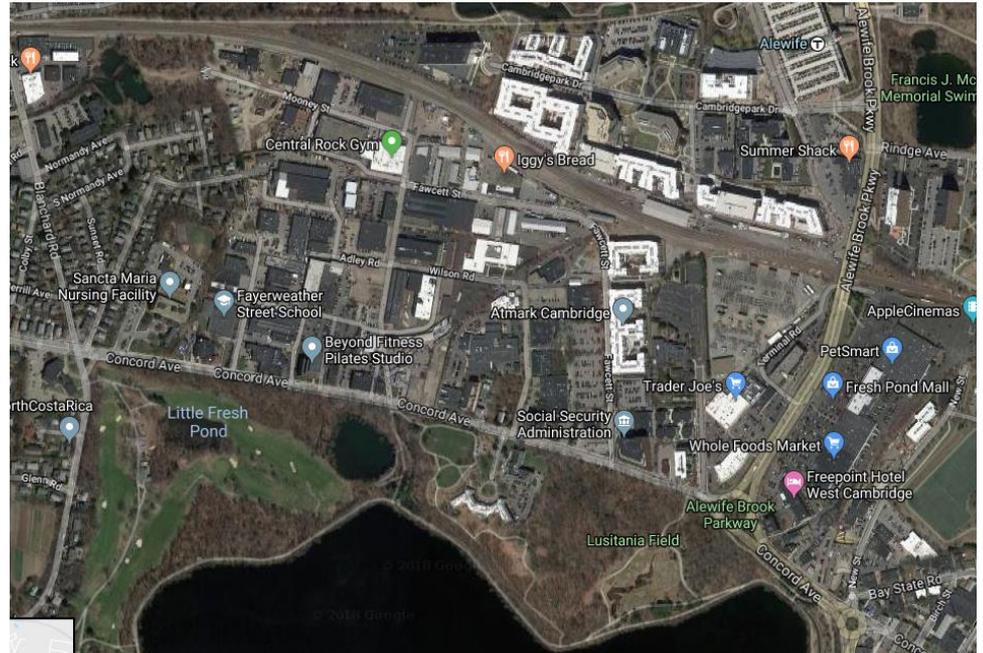
- **Additional Analysis and Mapping**
- **Consideration of ownership models**

## 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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