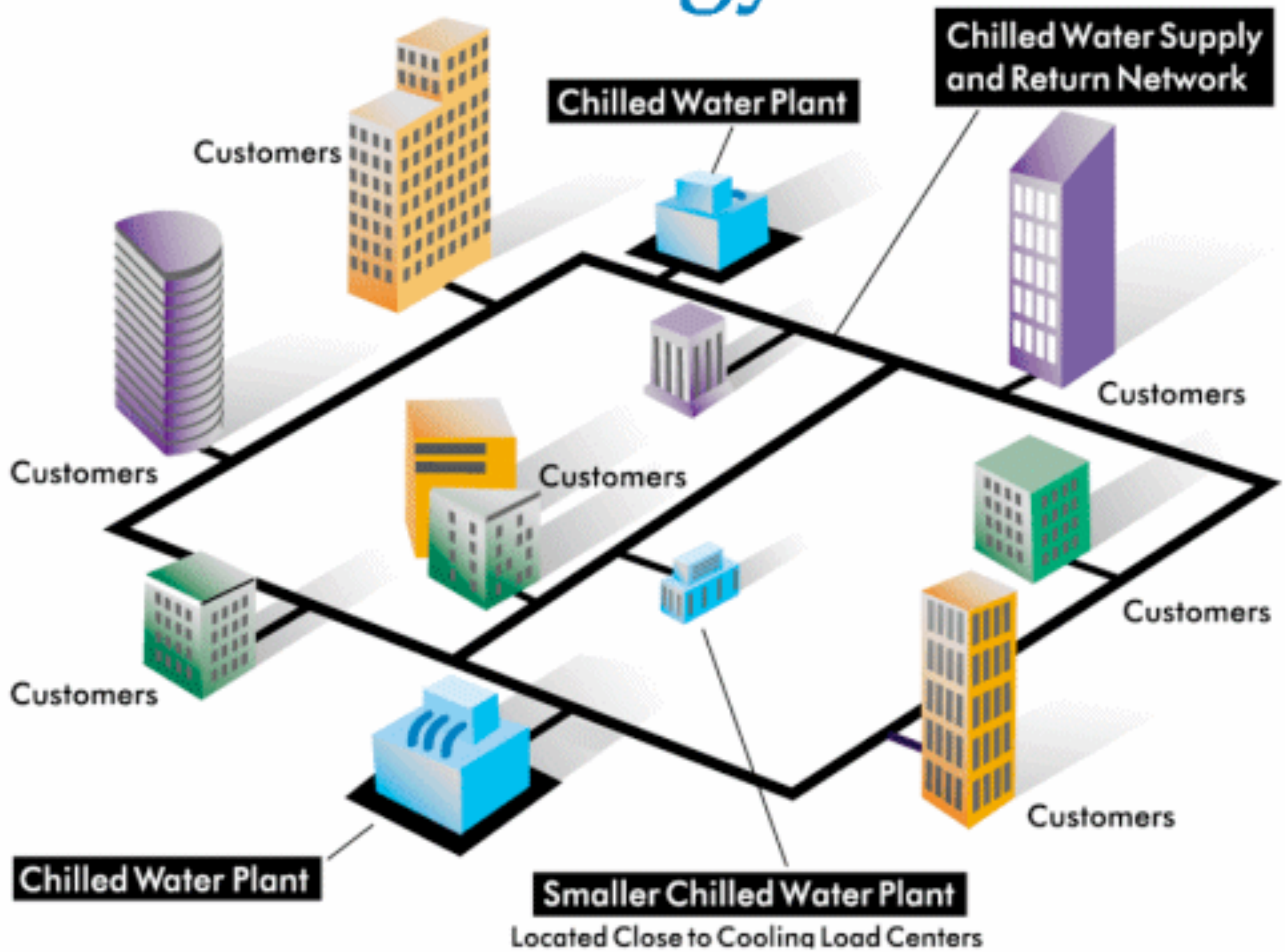
District Energy



What could 80% GHG reductions look like?

Efficient Buildings

- 30% or more beyond code
- No cooling service
- Waste heat recovery

Efficient Infrastructure

- Load diversification = lower peak
- More efficient equipment
- 20% improvement

Clean, renewable energy

- Sewer heat recovery = base load
- Solar thermal supplement
- Natural gas peak/back-up; potential to fuel switch

Utility service model

- Neighborhood scale focus
- Business planning process
- Positioned to engage new system development options

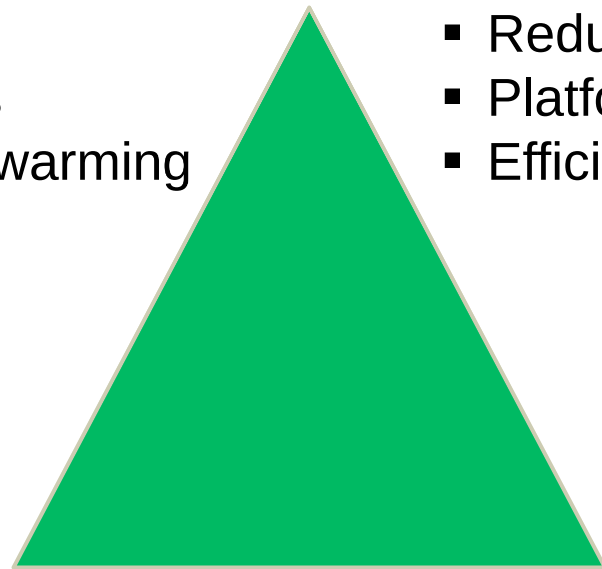
District Energy Benefits

Social

- Healthier buildings
- Enhanced awareness
- Connection to global warming
- Leadership

Environmental

- Reduced emissions
- Platform for future improvements
- Efficiency

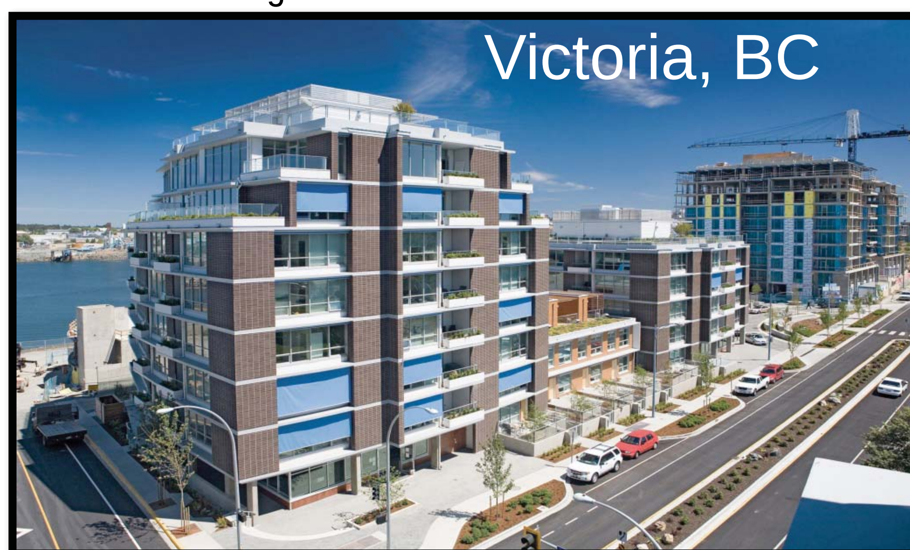


Economic

- Better long term investment
- Return on investment
- Stable and predictable energy costs

District Energy Systems

System	Energy Source(s)
Seattle Steam (Downtown Seattle)	Biomass (in 2009) and natural gas – heat only
District Energy St. Paul (Downtown St. Paul)	Biomass and natural gas – heating, cooling
Brewery Blocks (Downtown Portland)	Electricity – cooling only
SEFC NEU and Central Heat (Vancouver, BC)	Central sewer heat and natural gas
Lonsdale Energy Corporation (North Vancouver, BC)	Natural gas mini-plants – heat only
Dockside Green (Victoria)	Central biomass and natural gas – heat only
Revelstoke, BC	Central biomass plant
Sun Rivers (Kamloops,BC)	Distributed ground source heat pumps
Aalborg District Heating (Denmark)	CHP, municipal solid waste, biomass
Olympic Village (Whistler)	Waste heat - sewage plant w/ gas, ambient loop
Stockholm (Sweden)	Multiple energy sources
Nashville District Energy System	Natural gas



Technical Introduction

Major system components:

System responsibility

1. Energy Center(s) where energy is extracted, produced and rejected
2. Community Distribution System(s)
3. Energy Transfer Stations (ETS) energy transferred to customers and metered

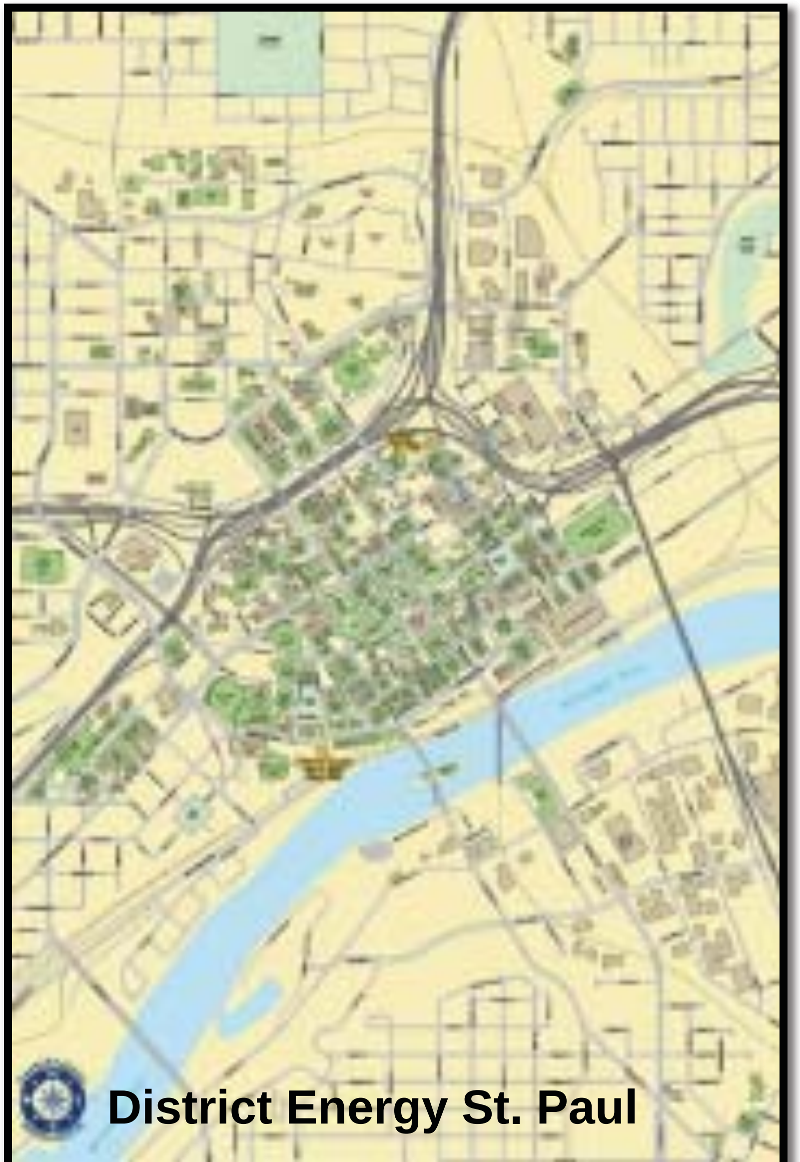
Building owner responsibility

4. Building HVAC Hydronics within the buildings beyond the ETS

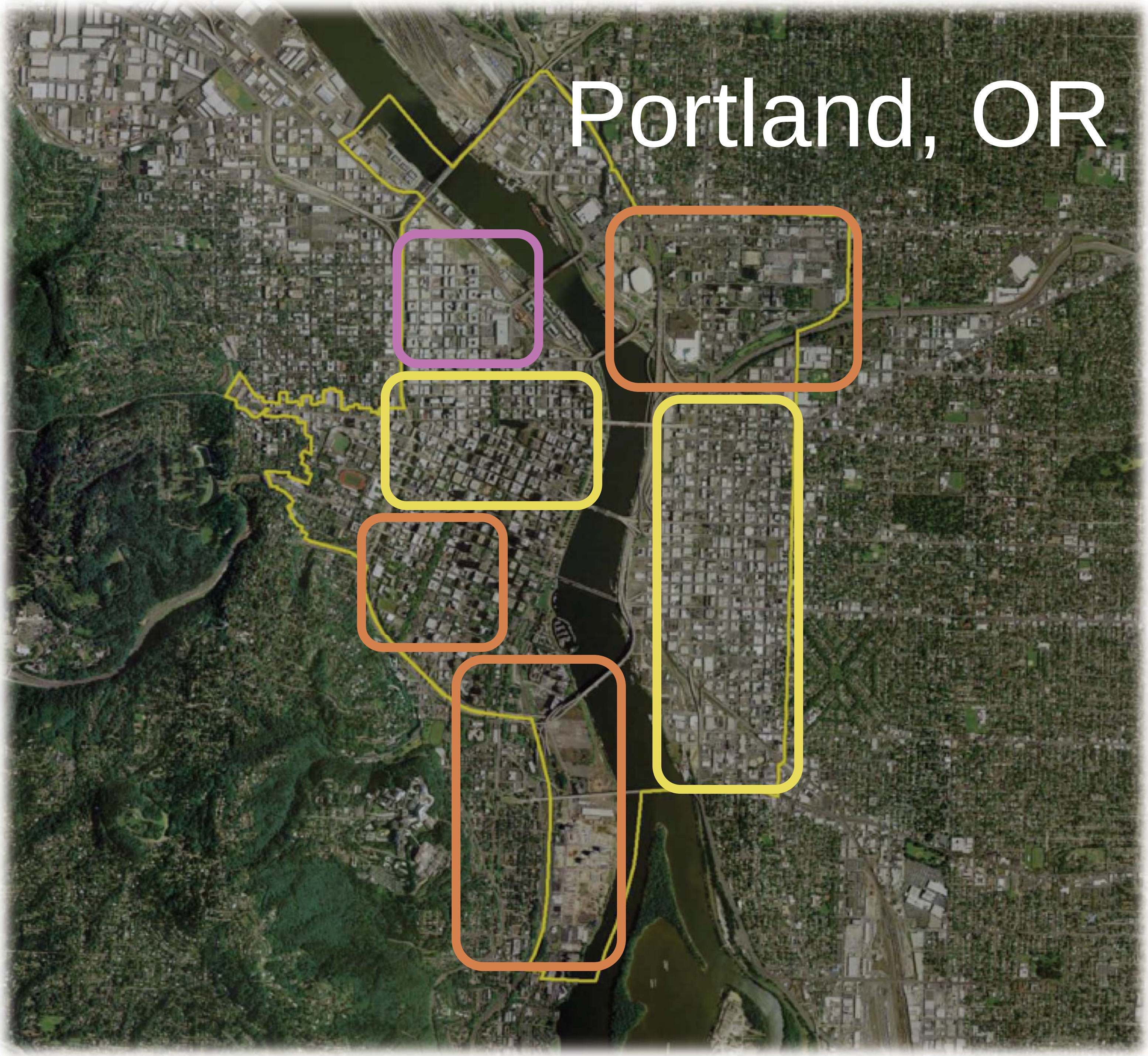
Start Small, Think Big

- The NEU provides a sound infrastructure and business model that can be expanded and replicated
- European cities such as Copenhagen and Stockholm started small, and expanded over time into large scale DE systems that are integrated with liquid and solid waste management programs

Evolution of Scale



Right Sizing (Vancouver)


Portland, OR

Technology Options

- Heat recovery - waste process heat
- Heat exchange - ground-source, water-source, sewer lines, waste-water plants
- Biomass - waste wood, pellets, 'hog' fuel
- Natural gas
- Bio-gas - digester methane, industrial process gas
- Municipal waste combustion

What's wrong with electric heat?

Inefficient use of electricity for thermal uses (i.e., space heating & hot water)

Even simple heat pumps improve efficiency by 2-3 times that of electric resistance

Virtually impossible to retrofit buildings over time

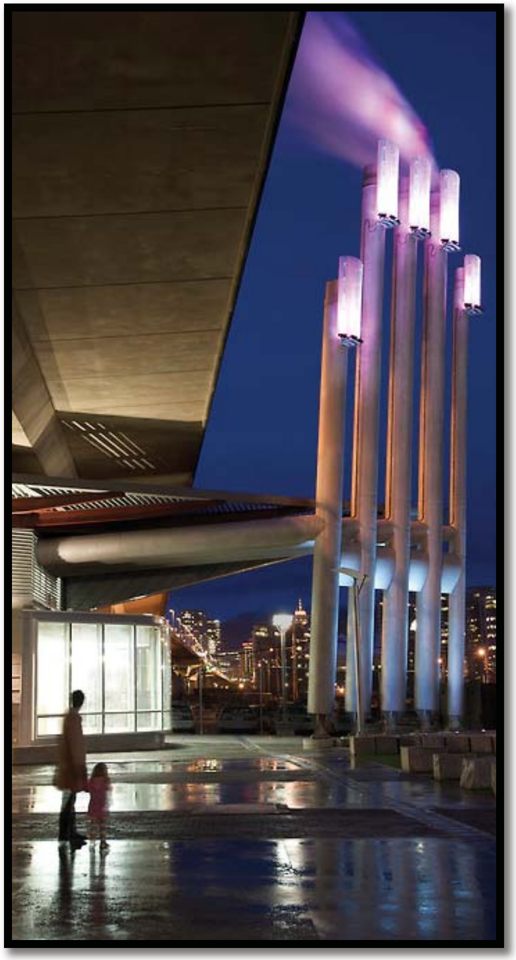
Prohibits use of innovative systems to use waste heat

Long-term burden of increasing energy prices will be on building occupants

Opportunity cost to Seattle City Light and electricity producers

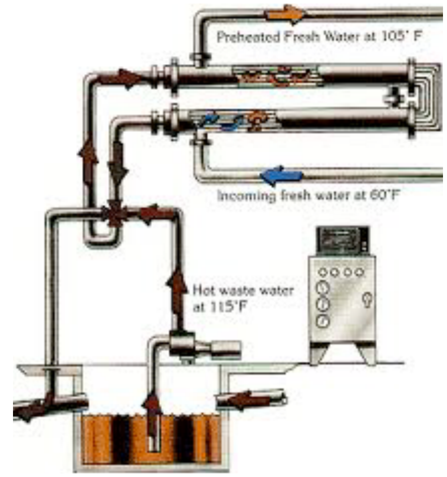
Vancouver 2010 Olympic Village Renewable Energy Supply Strategy

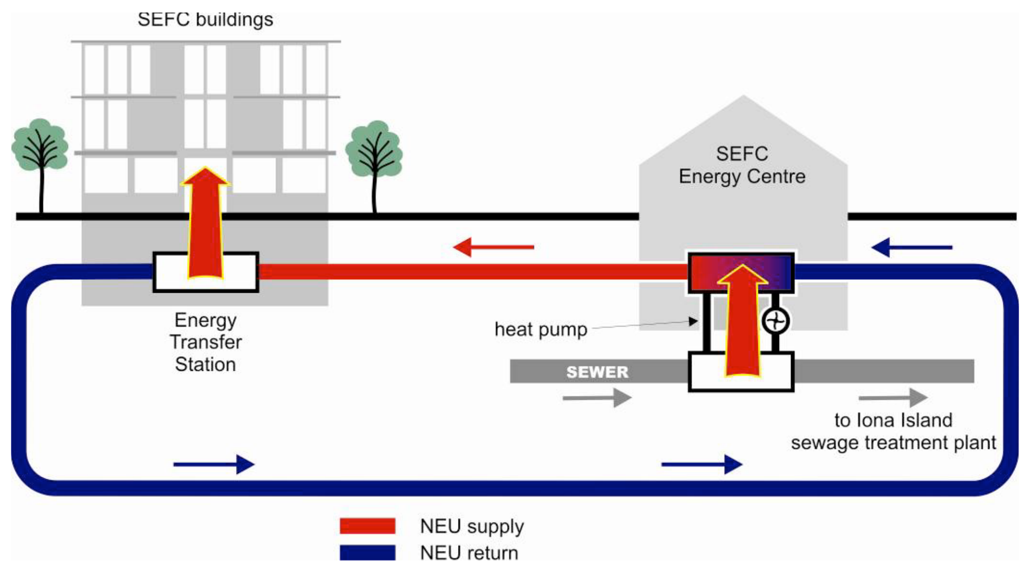
- Utilize renewable sources to provide "base load." In first phase, 70% of annual thermal energy supplied with raw sewage heat recovery.
- NEU to be supplemented by solar modules located on rooftops of 3 Olympic Village buildings
- Natural gas boilers used for back-up and peaking heat. This ensures reliability and affordable utility rates.



What is Sewage Heat Recovery?

- Will be integrated with a new municipal sewage pump station
- Heat Pump will capture waste heat from screened raw sewage.
- Similar to geo-exchange, but higher efficiency and lower cost.
- Low Emissions of GHG and other combustion sourced pollutants





The Role of District Energy in Greening Existing Neighborhoods

A PRIMER FOR POLICY MAKERS AND LOCAL GOVERNMENT OFFICIALS

Preservation Green Lab, National Trust for Historic Preservation
Center for Sustainable Business Practices, University of Oregon

EXECUTIVE SUMMARY | SEPTEMBER 2010

POLICY ROAD MAP FOR DISTRICT ENERGY DEVELOPMENT IN EXISTING NEIGHBORHOODS

Depending on a neighborhood's compactness and its mix of uses, a district-scale approach can improve the efficiency of heating and cooling its buildings by up to 20 percent...

Preservation Green Lab
NATIONAL TRUST FOR HISTORIC PRESERVATION

District Energy in Existing Neighborhoods

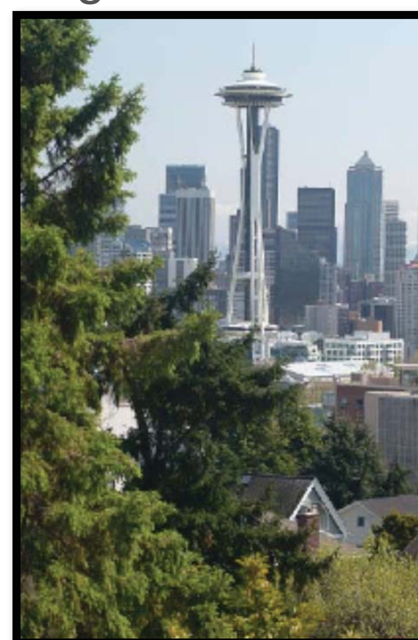
- End user perspective – cash flows, time & expertise
- Context – policies, target areas
- Identify catalysts & be ready
- Consider aggregate energy demand
- Building-by-building ‘business case’
- Evaluate energy sources
- Business analysis - investment decision, phasing plans, risk management, rates & governance
- Include property owners & community stakeholders

Making district energy happen

- Identify major developments & infrastructure projects
- Assess long-term, stable energy demand
- Identify core distribution system
- Evaluate energy sources - local, renewable, waste
- Business analysis - investment decision, phasing plans, risk management, rates & governance
- Include property owners & community stakeholders throughout the process

Strategic Issues

- Long-term GHG reduction strategies
  - 80% by 2050 (2030, if honest)
  - Emerging strategies for existing buildings & infrastructure
- Policy framework
  - District scale orientation for energy & emissions
- Aggregating demand from energy customers
  - Mechanisms for capturing energy loads – new & existing
  - Definition of energy utility service areas
- Energy pricing & new building construction
  - Culture of cheap energy, lowest first-cost options
- Integrated infrastructure development
  - Major projects – street/rail, water/sewer, grid
- Institutional model & business planning
  - Less risk, greater certainty
  - Business case development



Pathways – Strategic Directions

- Engage in a short, focused process to create a policy framework to support district energy system development
- Develop mechanisms & processes to capture energy demand from new construction (and existing buildings, where appropriate)
- Determine institutional approach & establish robust business planning process
- Pursue integrated infrastructure planning in key areas

Montpelier, VT received grant money to expand their district energy system which currently includes 17 buildings, after expansion over 100 existing and historic buildings will be connected.
Photo Credit: Vermont Perspectives, Linda Baird-White

Aerial view of Dubuque Millworks District which plans to lay piping for district energy when it rebuilds its streets.
Photo Credit: City of Dubuque

The original Seattle steam plant is still in use today providing district heating to many downtown buildings.
Photo Credit: Seattle Steam Co.

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