DISTRICT ENERGY 101

Richard Damecour, P.Eng., MBA

FVB Energy Inc.

February 16, 2017

FVB ENERGY INC

DISTRICT ENERGY 101: PRESENTATION OUTLINE

1. About FVB Energy Inc.
2. What is District Energy: An Overview
3. History of District Energy
4. Why communities are interested in District Energy
5. District energy in Canada and around the world
6. Historical Barriers to District Energy
7. Questions & follow up

FVB ENERGY INC

FVB ENERGY INC

ABOUT FVB ENERGY INC.

- **Consulting firm specializing in District Energy and Combined Heat & Power (CHP).**

- **A global district energy firm with offices in Sweden, the U.S. and Canada: Edmonton, Toronto, Vancouver.**

- **Fjärrvärmebyrån**

FVB ENERGY INC

What is District Energy?

Green, Responsible, Effective

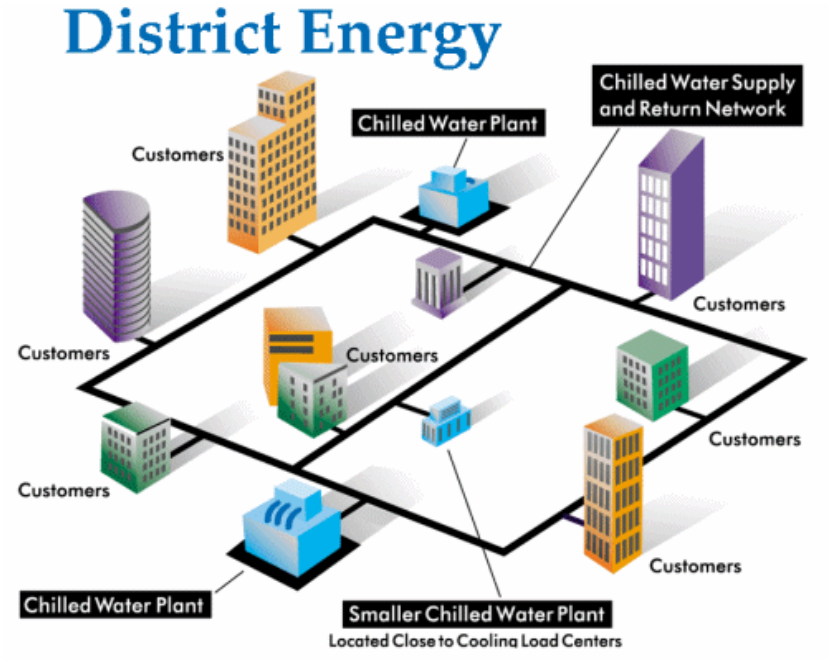
“Community” scale heating, cooling, and power generation, undertaken to make use of local resources and surplus heat to meet local needs in a manner that is more effective than individual production.

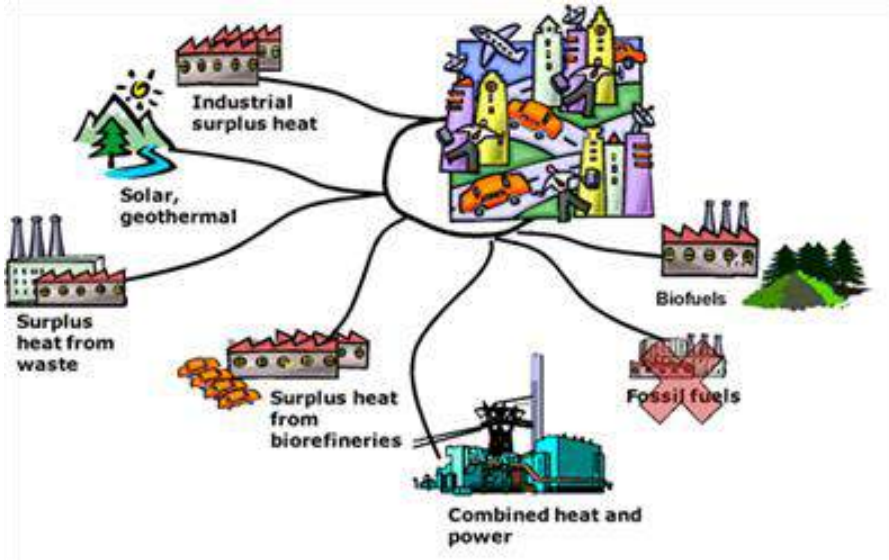
What is District Energy?

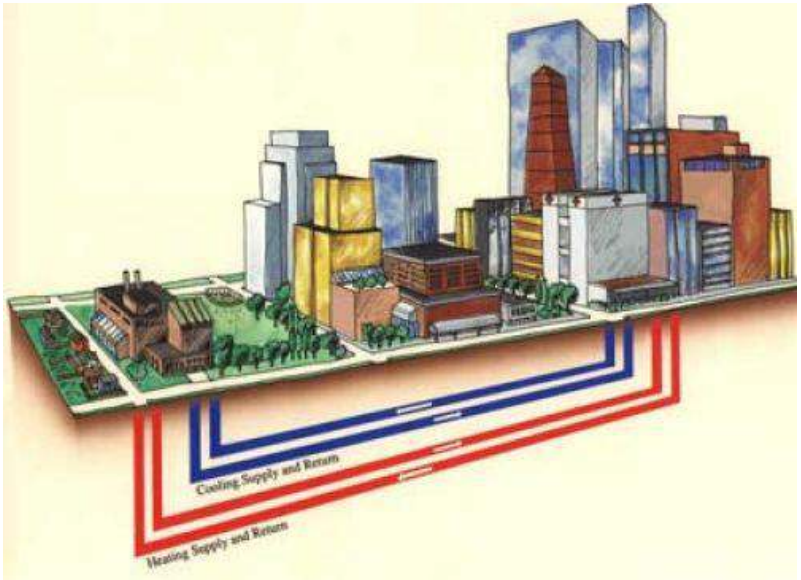
https://www.youtube.com/watch?v=7BznKyEb0bc

FVB ENERGY INC

What is District Energy?







FVB ENERGY INC

What is District Energy?

Energy Centre

Distribution System

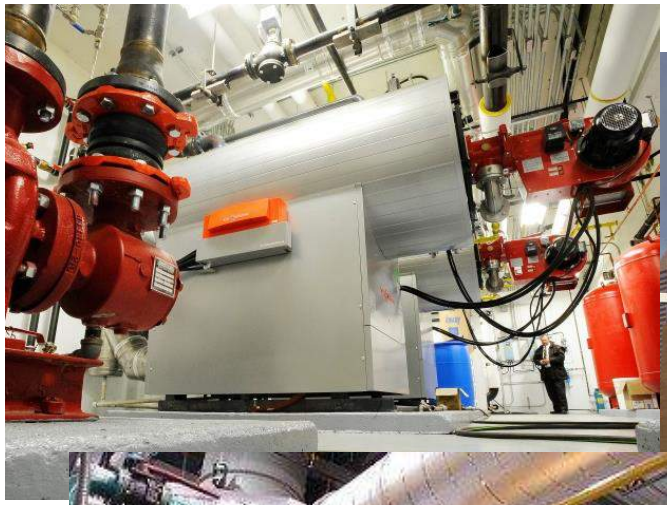
Energy Transfer Station

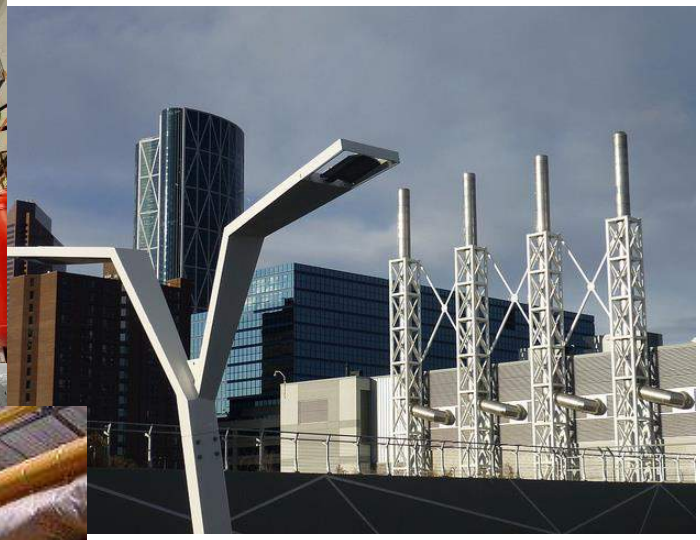
Customer Building Hydronic HVAC

Components of a District Energy System

FVB ENERGY INC

Energy Centers



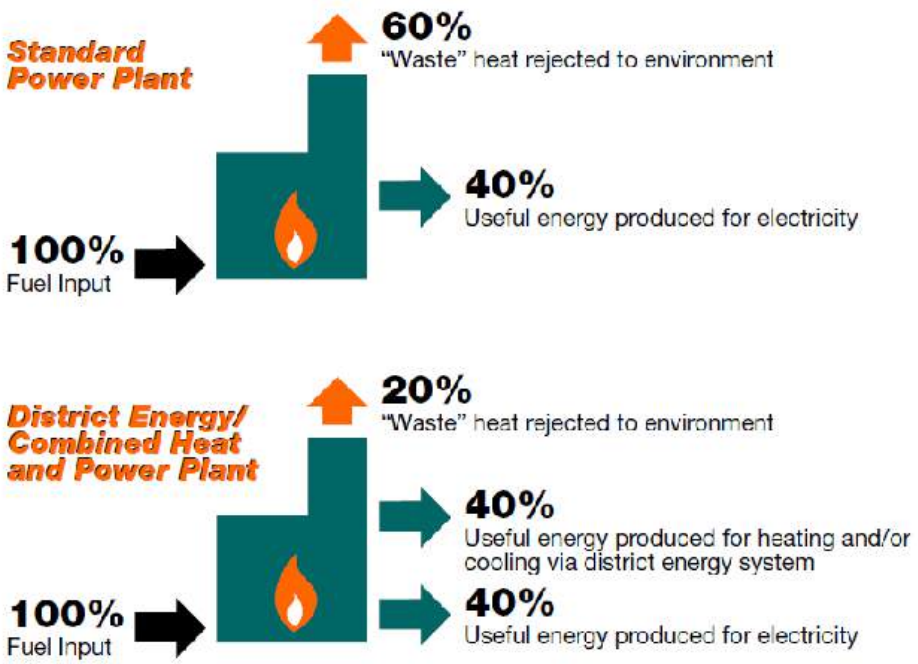


One or more centralized thermal production facilities using multiple technologies or fuels depending on location and application.

FVB ENERGY INC

Energy Centers: District Energy & Combined Heat and Power (CHP)

- Waste heat is captured from the power production plant and added to the District Energy distribution system
- Distributed heat is used to heat connected buildings
- Connected buildings no longer burn fuel for heat
- GHG reductions of up to 60%
- Single point of heating can accommodate alternate fuel types



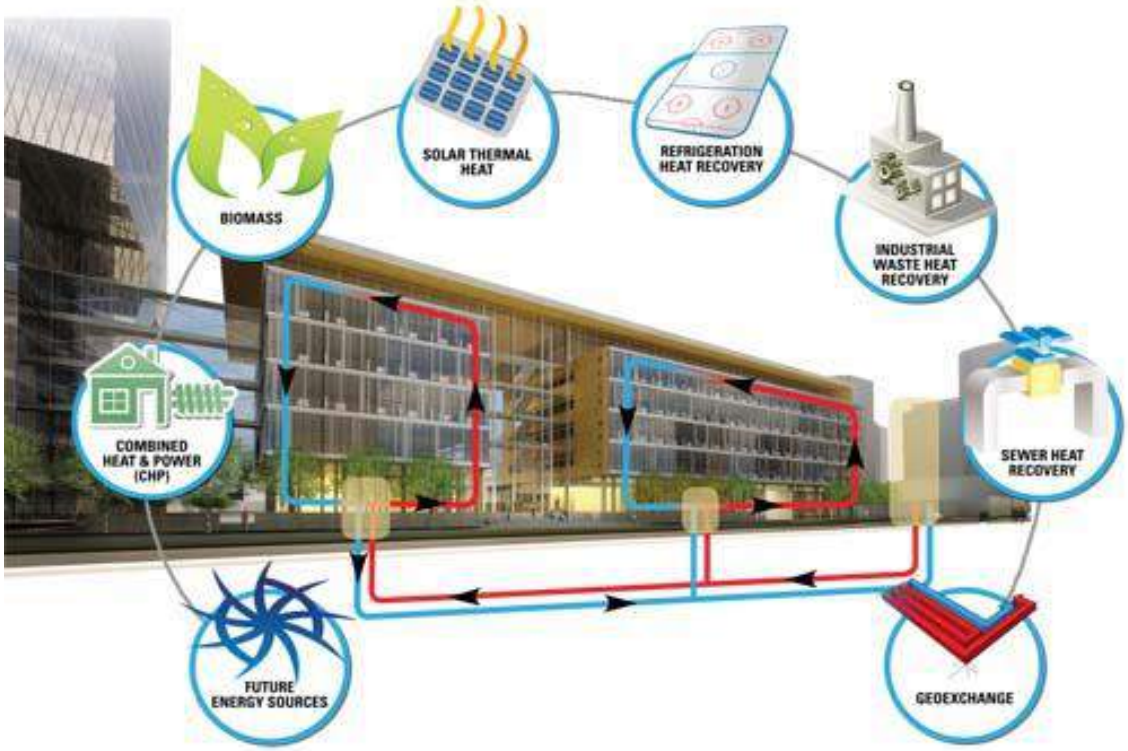
FVB ENERGY INC

Distribution Piping System: The THERMAL GRID

A thermal grid in a community connects the central plant location –where the thermal energy is produced –with users through-out the community.

DE grids are resilient, once grid is in place, communities can:

- Add community scale equipment to optimize energy efficiency (e.g. thermal storage, solar thermal, Combined Heat & Power (CHP)
- Deliver energy security & resiliency in communities
- Defer need for large scale transmission infrastructure
- Use local resources



DISTRICT ENERGY 101

FVB ENERGY INC

Distribution Piping System

A piping network or thermal energy grid that connects the energy producers to the end-users.

FVB ENERGY INC

Energy Transfer Stations or Customers Substations

The thermal and hydraulic interface at the building where energy is exchanged, is comprised of heat exchangers, thermal energy meters, & controls.

FVB ENERGY INC

History of District Energy

- 1300's district heating using geothermal hot springs in the French village of Chaudes-Aigues Cantal in France (it is still in operation today)
- 1877 first commercial district energy system in New York, USA
- 1880 first district energy system in London, Ontario, Canada
- 1903 first district heating power plant in Denmark
- 1912 University of Toronto - celebrating 100 years
- 1964 Enwave – Toronto District Heating Corporation
- Surge in district heating systems in Scandinavia in 1970's

District energy systems were historically primarily steam systems and used on campus type systems for hospitals, military bases, and universities. Hot water district energy systems are becoming more common.

FVB ENERGY INC

Why are Communities interested in District Energy?

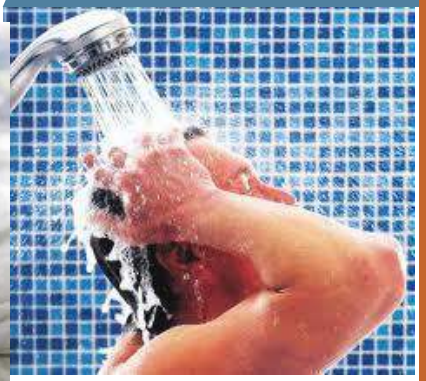
1. **Economic**
   - District energy systems are infrastructure projects that can create and enhance a local energy market and industry
   - Increase global competitiveness and encourage research and development

2. **Energy Stabili**
   - Use of loc
   - More stab
   - More opp renewabl
   - Enables a

3. **Environmenta**
   - Energy co efficiencie
   - Smart use of resources through
   - Reduce GHG emissions and poll
   - Opportunities to manage local v
   - Economy of scale enables more and controls to be implemented

FVB ENERGY INC

Why are Communities interested in District Energy?



1. **Economic**
   - District energy systems are
     and enhance a local energy
   - Increase global competitive
     development

2. **Energy Stability**
   - Use of local resources and increased energy security/resilience
   - Can provide more stable energy costs
   - More opportunities vs. individual users for incorporations of renewables and alternative technologies
   - Enables a highly flexible and adaptable fuel mix

3. **Env**
   -
   -
   -
   -
   -

DISTRICT ENERGY 101

FVB ENERGY INC

Why are Communities interested in District Energy?

1. **Economic**
   - District ene
     and enhanc
   - Increase glo

es vs. individual tions of
lternative techn
lexible and adap

3. **Environmental**
   - Energy conservation, lower primary energy use and increased efficiencies
   - Smart use of resources through energy planning
   - Reduce GHG emissions and pollutants
   - Opportunities to manage local waste streams
   - Economy of scale enables more effective pollution prevention and controls to be implemented

FVB ENERGY INC

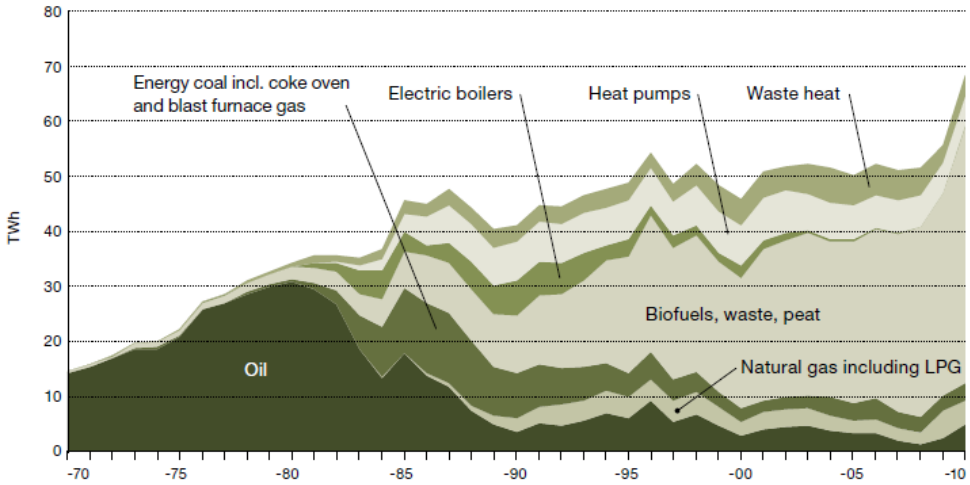
Benefits to Building Owners

- Demonstrates environmental and energy leadership.
- Simplified building operations, no building boilers and/or chillers and cooling towers.
- Deferral of capital dollars (conventional heating & cooling plants, structure, space, stack, cooling towers, natural gas service)
- Enhanced reliability of heating & cooling systems.
- Reduction in noise, vibration, and building emissions.
- Elimination of fuel onsite and reduction in building electrical load.
- Repurposing of rooftop space for greenroof and rainwater harvesting. Smaller mechanical room footprint.
- Risk transfer - capital and operating cost from boilers, chillers, and cooling towers.

District Energy around the World

Copenhagen, Denmark – 98% of the city's heating demand is met by district heating, primarily waste heat from CHP and from waste incineration plants – aims to be carbon neutral by 2025.

Figure 29 Energy supplied to district heating, 1970–2010, in TWh



Source: Swedish Energy Agency and Statistics Sweden.
Note: Peat and biofuel are presented together, even if peat is not considered to be renewable. It should be noted that the development in the last two years is primarily a result of unusually cold winters. This is especially the case for 2010.

In 2015, +70 % of the district heating systems in Sweden were supplied by renewable sources such as wood, municipal waste, and waste heat. District heating supplies ~56% of heating in Sweden. Reduced carbon emissions from 300 CO_2 g/kWh to 50 CO_2 g/kWh between 1980 to 2015.

District energy systems can be found in Italy, Iceland, Norway, Finland, Germany, Portugal, Switzerland, Russia, China, UAE,

FVB ENERGY INC

District Energy in Canada Today

Regent Park Revitalization – Toronto, Ontario

FVB ENERGY INC

District Energy in Canada Today

Markham Centre – Markham, Ontario

District Energy in Canada Today

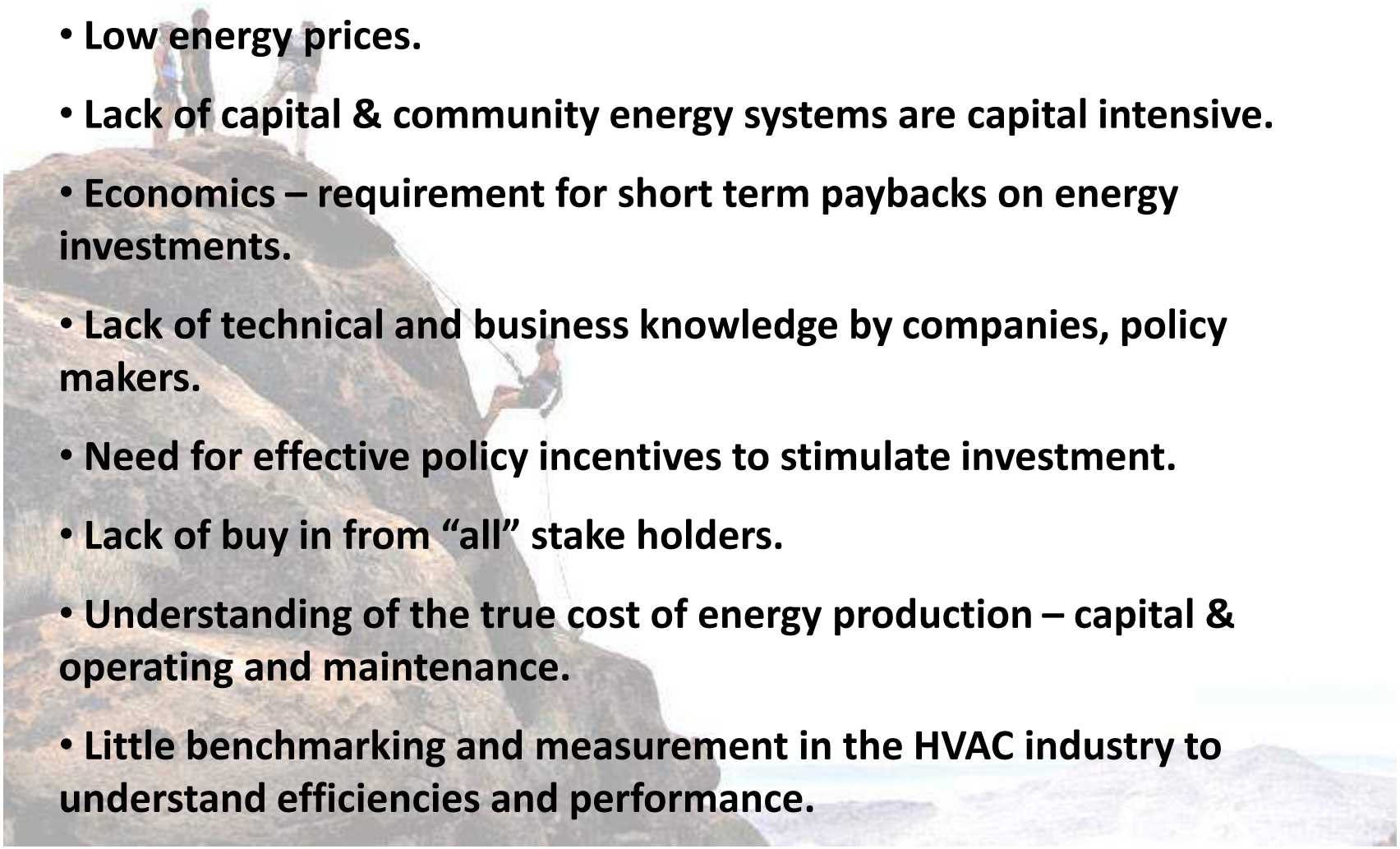
Southeast False Creek & Olympic Village -
Vancouver, British Columbia

FVB ENERGY INC

District Energy in Canada Today

East Village (Downtown) – Calgary, Alberta

Historical Barriers to District Energy



- Low energy prices.
- Lack of capital & community energy systems are capital intensive.
- Economics – requirement for short term paybacks on energy investments.
- Lack of technical and business knowledge by companies, policy makers.
- Need for effective policy incentives to stimulate investment.
- Lack of buy in from “all” stake holders.
- Understanding of the true cost of energy production – capital & operating and maintenance.
- Little benchmarking and measurement in the HVAC industry to understand efficiencies and performance.

Thank you for your time!

District energy connecting energy users to waste heat and alternative energy sources – bridging the path to renewables.

FVB ENERGY INC

DISTRICT ENERGY 101: QUESTIONS?