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COMMUNITY ENERGY CASE STUDIES:

Alderney 5 Energy Project
Dartmouth, NS

Integrated Community Energy System Application

- District Heating and Cooling and Geothermal Storage

Context

- The Alderney 5 Energy Project is a $3.6 million energy-efficiency retrofit of municipal buildings on the Dartmouth, Nova Scotia waterfront.
- The Alderney 5 refers to the five buildings that will benefit from this project: the Alderney Landing Complex, the Alderney Gate Office, the library, the Dartmouth Ferry Terminal and the old Dartmouth City Hall building.
- The project has five major components, including a mini-district-energy system of heating and cooling pipes that will connect all buildings to one central energy centre in Alderney Gate, new gas conversion and high-efficiency boilers, new lighting, new seawater cooling and an advanced coaxial energy storage system.

Drivers and Rationale to do the Project

- Corporately, buildings and facilities in the Halifax Regional Municipality (HRM) consume approximately $6.9 million in utilities per year (oil, natural gas, propane and electricity). Upgrades to aging and inefficient mechanical and electrical infrastructure are the most cost effective strategy for reducing energy costs and reducing GHG emissions from this significant sector.
- HRM Council has made a commitment to reduce corporate greenhouse gas emissions 20% by 2012. HRM's building operations are responsible for 50% of corporate GHG emissions and increasing energy efficiency in building operations is the most cost effective method to meet GHG reduction goals.

Archetype Characterization

- ***Archetype:*** *District Heating, Cooling and Geothermal Storage*
- ***Density:*** *N/A*
- ***Size:*** *30,741 sq m*
- ***Mix:*** *Five municipal buildings on the Dartmouth, Nova Scotia waterfront*

Benefits

- It is expected the Alderney 5 Energy Project will save $350,000 per year in energy costs.
- Approximately $800,000 will be avoided in future replacement costs and maintenance of the new system will be reduced significantly.
- The Alderney 5 project has acted as a catalyst for future district energy developments on the Dartmouth waterfront. Excess renewable energy capacity will be sold to adjacent private properties. An interpretive centre and tourist attraction is also part of the project.

Project Description

- Five components of the project include:

    1. District Heating and Cooling Piping (creating an Energy Centre)
    2. Seawater Cooling System
    3. Borehole Cold Energy Storage System
    4. Lighting Retrofit
    5. New High Efficiency Gas Boilers

Borehole Cold Energy Storage

- This system is called underground thermal energy storage (UTES). The Dartmouth UTES system is **the first in the world to store cold energy.**
- Titanium heat exchangers will be used to extract cold energy from the Halifax Harbour in the wintertime. This cold energy is stored for seven months in a geothermal borehole field underneath the adjacent parking lot.
- The geothermal energy storage system uses a new design of borehole (100-120 in total, at a diameter of 4 ½ inches and 600 feet deep) that is 300% more efficient than traditional U-tube boreholes. This breakthrough borehole design is the key that enables cold energy to be stored in the rock mass, and then used directly for air conditioning without using heat pumps.
- Cold fresh water will be pumped down the holes in the winter, chill the rock mass which is equivalent to the volume of a 40-storey building, down to a useful temperature.
- In the peak summer months when the harbour temperature is too warm, the flow is reversed and fresh water is pumped down the holes to move the cold energy to the buildings. The geothermal borehole field acts as a large cold energy battery.

Timeline and Status

2005

The project was initiated

2005 - 2007

In collaboration with Environment Canada and International Energy Agency, the project team conducted preliminary site testing, a detailed feasibility study and secured federal funding

2007

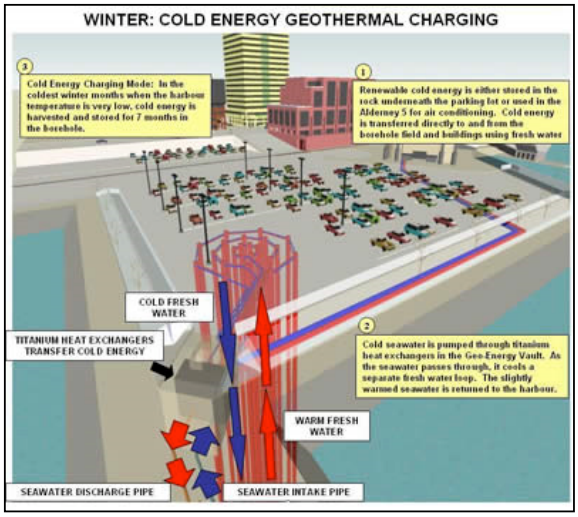
In August, HRM Council approved the project

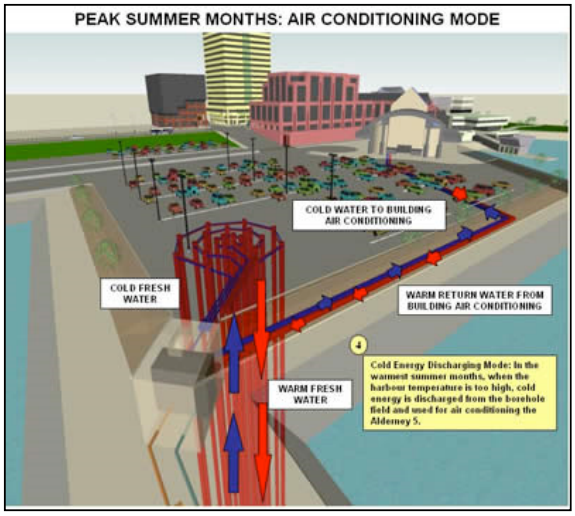
2008

In November, construction began

2009

It is expected that the project will be completed in April





Source: http://www.halifax.ca/facilities/Alderney5HowDoesitWork.html

Considerations for Implementation and Ownership

- It is important to recognize projects such as these involve risk – sometimes significant risk. The municipality should possess seasoned technical and financial staff in-house to be able to balance risks associated with such advanced technologies.
    - A well rounded team of highly qualified HRM staff were involved in the Alderney 5 project (technical/financial/legal).
    - Partnering and networking with Federal departments who have deeper technical resources is also a good idea. Municipalities will be exposed to greater contractual and operating risks without good in-house capabilities.
- The project is highly replicable. Cities with high air conditioning needs, expensive electricity and cold winters are ideally suited. Cold energy could be harvested in the winter from lakes, rivers, or even cooling towers and stored underground for summer air conditioning.
    - Alderney 5's proximity to Halifax Harbour was instrumental to this project as the sea water is the source for the cold energy. The harbour was a natural choice as it is capable of going down to very low temperatures which makes it a great source for cold energy.

Costs and Financing

- The total cost of the project is $3.6 million.
- Construction was funded through an innovative public private partnership between the Halifax Regional Municipality (HRM), the Federal government's Technology Early Action Measures (TEAM) program, and High Performance Energy Systems (HPES) – a local design build engineering firm specializing in geothermal energy applications.
- HRM contributed $1 million to the capital costs, TEAM $1 million, and HPES $1.6 million via an innovative 20- year capital lease agreement tied to the energy performance of the system.

Relationship to Other Best Practices

- The project encompasses goals and targets from a variety of existing policies and plans, specifically:
    - *Greenhouse Gas Reduction Plan*, approved by HRM Council in 2005;
    - *Community Energy Plan*, approved by HRM Council in 2007; and
    - HRM's Economic Strategy.

Lessons Learned

- The public-private partnership project used an innovative contract structure that combined a turn-key capital construction project and capital lease agreement that shared the construction and operating risks with the private partner. The contract structure is what enabled the municipality to participate in the project without excessive risk.
- No specific tools were developed to help partners work more effectively, other than an ftp site to share files. Very regular and intensive project meetings were held to communicate key information and joint understanding of issues. There were many unexpected changes in the course of developing the final project scope and financing. Basic communication skills were crucial in resolving issues (ie meeting agendas, minutes, regular email/telephone communications, open dialogue/information sharing, trust).

Additional Information

- Additional information may be obtained from the HRM's web site at http://www.halifax.ca/facilities/Alderney5.html