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REPORT TO REGIONAL WATER SUPPLY COMMISSION
MEETING OF WEDNESDAY 02 MAY 2012

SUBJECT **THERMAL ENERGY RECOVERY FROM GREATER VICTORIA WATER SUPPLY SYSTEM TRANSMISSION MAINS – PILOT PROJECT**

ISSUE

To provide information about a pilot project to determine the potential of recovering heat from potable water transmission mains in the Greater Victoria Water Supply System for use by public education and health facilities.

BACKGROUND

Under the Core Area Liquid Waste Management Plan, a resource recovery and use plan (the Plan) was required by the Ministry of Environment (MOE). The Plan was approved by the Board and submitted to the MOE in December 2010.

The Plan outlined various resource recovery initiatives related to liquid waste including heat from treated effluent and raw sewage. A feasibility study and two business cases have been completed for two different locations in the core area sewer system, concluding that heat recovery from raw sewage as an alternative to fossil fuels could be both environmentally and economically sustainable.

During the investigation and business case analysis, a new resource recovery concept was identified: the recovery of thermal energy from potable water systems. It was also found that this concept appears to be gaining interest in Europe.

The Greater Victoria Water Supply System contains two important aspects that improve the potential for successfully recovering heat from the potable water system.

- A relatively warm supply of water from Sooke Lake Reservoir (median temperature of 10°C and ranging up to 18°C).
- A number of large diameter transmission mains passing near public buildings and large facilities.

It should be noted that many water systems would not be particularly well suited for this type of project because the water in those systems is much colder having come from either deep wells or summer snow melt.

Initial investigations identified numerous suitable application sites including schools, hospitals, colleges and other provincial and federal facilities along the transmission routes. Three sites with high potential were shortlisted for further consideration, including Victoria General Hospital, Camosun College/Interurban area and Saanich Peninsula Hospital (SPH). Sooke School District also expressed interest in this green sustainable heating concept for its proposed new Belmont High School.

An assessment of energy demand at the three study sites in comparison with the capacities for heat recovery from nearby transmission mains showed that this concept is feasible at all three sites.

To explore this emerging heat recovery concept further, a feasibility study has been completed by Opus DaytonKnight Consultants Ltd. and DEC Design Mechanical Consultants Ltd. An executive summary of

their report titled *CRD Transmission Main Heat Recovery Feasibility Study* is attached as Appendix A. Copies of the full report are available on request.

An initial screening evaluation was carried out on the three shortlisted sites to determine the most promising opportunity based on ease of implementation, scalability and project timing. The screening concluded that the most promising opportunity at the time was to recover heat from the Greater Victoria Water Supply System #4 transmission main for use at the Saanich Peninsula Hospital, as shown in Appendix B.

The following four conceptual designs were developed and evaluated for the Saanich Peninsula Hospital opportunity:

Option 1 Electrical heat pump with transmission main heat recovery

Option 2 Natural gas absorption heat pump with transmission main heat recovery

Option 3 Electrical heat pump with transmission main heat recovery with a combined heat and power natural gas engine to supply electricity for the heat pump and pumping

Option 4 Combined heat and power natural gas engine to meet the alternative energy thermal output (option included for comparison only and does not include a heat recovery component)

ALTERNATIVES

Not applicable.

FINANCIAL IMPLICATIONS

The estimated capital cost, annual revenue (using 2012 utility rates) and carbon emission reductions for each option is shown in the following table.

SUMMARY OF ESTIMATED CAPITAL COSTS AND PROJECTED NET ANNUAL REVENUE FOR SPH OPTIONS

	Option 1	Option 2	Option 3	Option 4
Capital Costs Total	$1,344,000	$1,758,000	$1,443,000	$1,167,000
Utility Net Annual Revenue (not including debt payments)	$52,200	$13,000	$24,100	$25,300
Carbon Emission Reduction (tonnes CO_2e/yr)	522	252	191	(-) 327

Further detailed analysis by the Consultant confirmed that Option 1 was the most attractive financially based on highest Net Present Value and largest reduction in greenhouse gas emissions.

The business case analysis shows that for this pilot project to be economically viable, Option 1 will require a minimum of 53% grant funding.

The cost of the thermal energy rate has been calculated as follows:

(Natural Gas Rate + Carbon Tax) / Boiler Efficiency = Useful Heat Rate

When compared to the business-as-usual cost, the rate structure for the Saanich Peninsula Hospital would save approximately $13,600 per year as a result of reduction in carbon offsets.

Several potential sources of grant funding or other financial incentives have been identified, including the Gas Tax Fund, the Federation of Canadian Municipalities' Green Municipal Fund, the ecoENERGY Innovation Initiative and the Pacific Carbon Trust. The environmental outcomes of a project (e.g., greenhouse gas reductions) are a key parameter in assessing funding eligibility and priority for most of the organizations listed.

ENVIRONMENTAL IMPLICATIONS

There is a significant amount of thermal energy in potable water that can be recovered and utilized to replace natural gas heating for buildings and facilities.

As long as all water quality risks are eliminated, as indicated in the feasibility study, there are several distinct water quality benefits to having cooler water in the Greater Victoria Water Supply System. Cooler water provides:

- better carriage of chlorine residuals from the treatment plant to the extremities of the system.
- less potential for the regrowth of total coliform bacteria in the distribution system.
- less potential for nitrification to occur in the distribution system (i.e., growth of bacteria that use ammonia as food and resulting in dramatic reductions of the chlorine residual).
- less perception of odours that may be present in Greater Victoria's drinking water including chlorine and any odours associated with algal blooms that may occur from time to time in Sooke Lake Reservoir.

Option 1 also provides the largest estimated greenhouse gas emissions reduction of 522 tonnes CO_2e/year compared with current business-as-usual heating from natural gas boilers.

The Saanich Peninsula Hospital district energy system pilot project would contribute towards the reduction of the carbon footprint of the Capital Region and could encourage similar carbon reduction projects in the region and elsewhere.

SOCIAL IMPLICATIONS

Innovative projects such as this can demonstrate CRD leadership in providing an example to the community of the feasibility of using heat recovered from potable water as an alternative to heat from fossil fuels. In addition, the heat recovery and district energy system could provide teaching/training opportunities for students at schools, colleges and universities. Similar to other capital projects investments, moving forward with regional heat recovery system projects will also stimulate the local economy, creating a number of positive secondary community benefits.

CONCLUSION

There is a significant amount of thermal energy in potable water that can be recovered and utilized to replace natural gas heating for buildings and facilities.

The attached executive summary outlines the work completed by the consultants in assessing the feasibility of recovering heat from potable water and distributing it through a district energy system to buildings. This is an innovative project in utilizing green sustainable energy for heating public education and health facilities.

The business case analysis for the Saanich Peninsula Hospital opportunity has demonstrated that using heat recovered from potable water as an alternative to fossil fuels is technically and environmentally viable. It will, however, require some infrastructure capital funding grant support to be economically viable and sustainable in the long term. Infrastructure grants are available for such innovative projects.

This pilot project has been briefly discussed with Dr. Richard Stanwick, Chief Medical Health Officer, Vancouver Island Health Authority (VIHA) and he has expressed an interest in following it. Nevertheless, prior to any actual implementation, CRD staff will work closely with VIHA officials and all design drawings will require the approval of the Public Health Engineer.

If implemented, the Saanich Peninsula Hospital district energy system pilot project would be the first full scale potable water thermal energy recovery system in Canada.

This report will be presented to the Environmental Sustainability Committee for consideration on 23 May 2012.

RECOMMENDATION

That the Regional Water Supply Commission receive this report for information.

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