CITY OF NANAIMO
THE HARBOUR CITY

Staff Report for Decision

File Number: A4-1-2 / D1-8-44

DATE OF MEETING MARCH 17, 2021

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SUBJECT **PORT THEATRE – CHILLER EQUIPMENT RENEWAL AND LOW CARBON ELECTRIFICATION OPTIONS**

OVERVIEW

Purpose of Report

To provide information to Council on equipment renewal options for the Port Theatre, and request additional funding to support replacing the existing chiller with one of the heat pump systems recommended.

Recommendation

That the Finance and Audit Committee recommend that Council direct Staff to:

1) Proceed with installing the recommended Option A – Air Source Heat Recovery Heat Pump system to replace the existing chiller; and,
2) Increase the budget for the Port Theatre Chiller Replacement project by $500,799 in 2021 funded by $150,000 from the Emission Reduction Reserve and $350,799 from the General Asset Management Reserve.

BACKGROUND

The Port Theatre, which opened in 1998, has separate cooling and heating systems comprised of a refrigeration-based chiller and natural gas fired hot water boilers. Through the Asset Management Program and completed condition assessments, it has been determined that the chiller needs replacing.

To determine equipment renewal options, which take into consideration Council's Energy Conservation and Management Policy and the Climate Emergency declaration, a Low Carbon Electrification Study of the building's overall cooling and heating system was conducted in 2020. This study was 50% funded through the Provincial government's CleanBC Program. Results of the study recommended replacing the chiller with a heat pump system.

A budget of $211,400 was allocated in 2020 for replacement of the chiller and was carried forward to 2021.

DISCUSSION

Three chiller renewal options were presented in this study, including a business as usual "like-for-like" replacement, and two other concepts that use electric heat pumps. Both heat pump systems proposed provide both heating and cooling, however, one of the proposed systems is also able

to recover heat from the theatre during events and eliminate the existing natural gas boiler heating under normal operating requirements.

This building currently consumes approximately 2,100 gigajoules per year of natural gas, contributing to Greenhouse Gas (GHG) emission of approximately 110 tonnes of carbon dioxide (equivalent) per year (tCO2e per year).

Heat Pump Systems do come at a higher initial capital cost but provide annual energy cost-savings, reduce emissions, and may be eligible for a CleanBC financial incentive of up to $159,000 for this project.

Staff have applied for CleanBC incentives for the options presented in the study, and expect to be notified within the next two weeks regarding results.

OPTION A – Air Source Heat Recovery Heat Pump

This option involves the replacement of the existing chiller with an electric heat recovery Direct Expansion (DX) heat pump system. This system utilizes distributed "Hydro Kits" to transfer heat from refrigerant pipe to the existing chilled and hot water loops.

This system capitalizes on the load diversity within the building with potential to recover heat from the theatre into the perimeter zones, thus eliminating use of the natural gas boilers except as a backup source of heating.

- Provides highest GHG reduction of 106 tCO2e annually; 92% reduction of building heating using natural gas, unless backup heating is required.
- Highest estimated annual energy cost savings of $19,154.
- 25 year net incremental cost per tCO2e = $108.

Disadvantages of this option:

- Highest capital cost of $712,199 (includes PST and 10% contingency).
- Additional funding of $500,799 would be required, unless CleanBC incentive funding is successfully obtained.

OPTION B – Air to Water Chiller / Heat Pump

In this option, the existing chiller is replaced with a similar air-to-water chiller / heat pump. When in heating mode, free cooling would be utilized for the theatre. During shoulder seasons, when mechanical cooling is required, heating would be provided by the boilers.

- The majority of natural gas use would be avoided but not eliminated entirely.
- Provides significant GHG reduction of 78 tCO2e annually; a 62% reduction of building heating using natural gas.
- Requires rehabilitation of the existing chilled water lines, estimated cost of $30,000.
- Estimated annual energy cost savings of $13,902.
- 25 year net incremental cost per tCO2e = $87.

Disadvantages of this option:

- Capital cost of $550,514 (includes rehabilitation of chilled water pipe couplings, PST and 10% contingency).
- Additional funding of $339,114 would be required, unless CleanBC incentive funding is successfully obtained.

OPTION C – Like for Like Chiller

With this option, the existing chiller would be replaced with a new unit and would require rehabilitation of the chilled water pipe couplings.

- Lowest cost of $203,110 (includes rehabilitation of chilled water pipe couplings, PST and 10% contingency); and falls within the current budget.

Disadvantages of this option:

- Project is not eligible for financial incentives from CleanBC.
- No savings in energy consumption or GHG emissions would be expected.

OPTIONS

1. That the Finance and Audit Committee recommend that Council direct Staff to:
   1) Proceed installing the recommended Option A – Air Source Heat Recovery Heat Pump system to replace the existing chiller; and,
   2) Increase the budget for the Port Theatre Chiller Replacement project by $500,799 in 2021 funded by $150,000 from the Emission Reduction Reserve and $350,799 from the General Asset Management Reserve.

   - The advantages of this option: This option has the highest GHG reduction of 92% and the highest estimated annual energy cost savings. No need for new heating water pipes to be installed through the theatre. The only option with a heat recovery system.
   - The disadvantages of this option: This option has the highest capital cost.
   - Financial Implications: The Final 2021 – 2025 Financial Plan would be amended to include the additional funding. Any successful incentive funding will be used to reduce the funding from the Emission Reductions Reserve and the General Asset Management Reserve. The Port Theatre Society is responsible for the theatre's utility bills and this option has the potential to provide cost savings.

2. That the Finance and Audit Committee recommend that Council direct Staff to:
   1) Proceed with installing Option B – Air to Water Chiller / Heat Pump; and,
   2) Increase the budget for the Port Theatre Chiller Replacement project by $339,114 in 2021 funded by $150,000 from the Emission Reduction Reserve and $189,114 from the General Asset Management Reserve.

   - The advantages of this option: The majority of natural gas use would be avoided. This option has a significant reduction in GHG emissions and also includes energy cost savings.

- The disadvantages of this option: Increased capital cost that exceeds the current budget.
- Financial Implications: The Final 2021 – 2025 Financial Plan would be amended to include the additional funding. Any successful incentive funding will be used to reduce the funding from the Emission Reductions Reserve and the General Asset Management Reserve. The Port Theatre Society is responsible for the theatre's utility bills and this option has the potential to provide cost savings.

3. That the Finance and Audit Committee recommend that Council replace the existing chiller with Option C – a like-for-like chiller unit.

- The advantages of this option: This option is within the existing budget.
- The disadvantages of this option: No savings in energy consumption or GHG emissions would be expected.
- Financial Implications: No additional funding is required and this option falls within the existing budget.

SUMMARY POINTS

- The existing chiller used for cooling at the Port Theatre has reached end of operational expectations and is scheduled for replacement in 2021 with a project budget of $211,400.
- An electrification study has been completed which outlines three options, two which use heat pump systems which would reduce GHG emissions and energy costs.
- Both heat pump systems have higher initial capital costs compared to the like-for-like replacement of the existing chiller.
- CleanBC Incentives of up to $159,000 are potentially available for the proposed new heat pump systems.

ATTACHMENTS:

ATTACHMENT A: Excerpt from the Port Theatre Low Carbon Electrification Report

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