

City of Nanaimo | Port Theatre Low Carbon Electrification

Prism Engineering supported [Port Theatre](#) to reduce its greenhouse gas (GHG) emissions through Low Carbon Electrification (LCE) measures.

Located in Nanaimo, BC, Port Theatre is a popular cultural centre on Vancouver Island. The building was constructed in 1998 and includes a theatre, offices, lobby, and backstage area totalling 38,875 square feet. It has five storeys above grade and one floor below grade.

Project background

Port Theatre required year-round cooling during events, while heating was provided for specific areas of the building throughout the shoulder and winter seasons. We observed that the boilers operated year-round, and a high volume of fresh air was used for free cooling in the winter.

The rooftop, air-cooled screw chiller had reached its end-of-life. Prism redesigned the heating system with a heat recovery, air-to-water variable refrigerant flow (VRF) system to provide primary heating for the building, recovering heat from the theatre during shows. This entailed dividing the chilled water distribution into four independent loops, each served by 2-3 VRF refrigerant-to-water heat exchangers.

Higher performance and lower emissions

The retrofitted VRF system is capable of heating and cooling simultaneously. During major winter events, it mechanically cools the interior audience chamber and the stage and heats the north perimeter and other zones, greatly increasing the coefficient of performance (COP) in extreme winter conditions.

One of the most innovative aspects of this project is that the new system capitalized on the load diversity within the building, with the potential to recover heat from the theatre into perimeter zones, eliminating the use of natural gas boilers.

In addition, the measures proved very cost-effective as they avoided the need for new heating water pipes. Under the new design, only a refrigerant pipe was required between the outdoor condensing unit through the theatre and the north mechanical room.

Finally, this project had a substantial, positive environmental impact. Replacing the existing chiller with a heat pump system eliminated natural gas consumption to heat the building, leading to GHG savings of 98 tonnes eCO₂, or 90% of the building's emissions.

Award-winning project

The results achieved by this project earned [Prism Engineering First Place in the ASHRAE BC Technology Awards for the 2023-24 year.](#)