



CANADIAN CONSULTING ENGINEERS AWARD APPLICATION

OVAL VILLAGE DISTRICT ENERGY SYSTEM

The City of Richmond
British Columbia



To the Award Committee,

FVB Energy Inc. (FVB) is pleased to submit this binder to the Canadian Consulting Engineers Award. FVB is particularly proud of the Oval Village District Energy System as it represents the future of a low cost, low pollution, and more secure energy supply.

Municipal leaders across the country are facing growing economic, social, and sustainable challenges and are increasingly concerned about the resilience of energy infrastructure in the face of extreme weather events. At the same time, technological improvements and emphasis on environmentally sound practices have opened up unprecedented opportunities to replace cut budgets and put assets to more productive use while meeting wider social and environmental objectives. One such opportunity is to develop a District Energy (DE) System within the local infrastructure. Using high-efficiency generation and exploiting locally available renewable resources, these DE systems are able to enhance the energy security of local communities, reduce greenhouse gas emissions, and are resilient in the face of extreme weather and other complications.

District Energy is a centralized approach to heating and/or cooling and consists of network of underground pipes carrying hot water, steam, or chilled water from a central plant to the buildings using its service. FVB is the most prominent and established firm in North America within the district energy field with over 45 years international and 25 years Canadian experience. Our unique combination of business and technical skills from feasibility to business planning to construction supervision and through to operations have been developed from substantial District Energy Systems installations.

The Oval Village District Energy System is perfect example of the efficiency and flexibility of this style of heating. Should you have any questions, please do not hesitate to contact me.

Sincerely,



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[DISTRICT ENERGY] RESULTS IN IMPROVED SOCIAL, ENVIRONMENTAL, AND ECONOMIC CONDITIONS LOCALLY

District Energy is cost-effective (through economies of scale) and results in improved social, environmental and economic conditions locally. DEU aggregates demand from dozens or even hundreds of buildings and uses a more efficient method of generating heat in a few larger plants rather than having hundreds of smaller boilers each heating one individual building.

Joanne Chow, E.I.T, PMP

ABOUT US

The City of Richmond created the Lulu Island Energy Company (LIEC) in 2013 to implement and manage District Energy projects. In 2014, LIEC entered into a 30-year Concession Agreement with Corix Utilities to design, construct, finance, operate, and maintain infrastructure in the OVDEU service area. FVB Energy Inc. was first contracted by The City of Richmond in 2008 to complete various feasibility studies when Oval Village was in the pre-planning phases. FVB Energy then designed and provided construction support services for the first District Energy node and Energy Centre and has continued to provide design and construction services for subsequent expansions.

FVB Energy Inc is a Mechanical Engineering Consulting Firm specializing in District Energy. FVB was initially contracted by the City of Richmond, then by LIEC and Corix to complete study - design - procure - construct aspects of the project

The Lulu Island Energy Company is a wholly-owned municipal corporation, established to operate district energy (DE) utility systems in the City of Richmond on the City's behalf.

Corix is in a public-private partnership with the LIEC. Corix is responsible for the design, construct, finance, operate, and maintenance of infrastructure in the Oval Village District Energy Utility service area.



Above and Right: the River Parkway Interim Energy Centre



Above: an Oval Village
Energy Transfer Station

PROJECT HIGHLIGHTS

THE OVAL VILLAGE DISTRICT ENERGY SYSTEM INCREASES THE CITY OF RICHMOND'S ENERGY RESILIENCY BY REDUCING RELIANCE ON EXTERNAL ENERGY SOURCES

The Oval Village District Energy Utility (OVDEU) is an innovative district energy system which currently uses two Central Heating Plants (11MW capacity) to provide heating and domestic hot water. The OVDEU currently reduces greenhouse gas emissions by an estimated 400 tons/year – equivalent to removing 85 cars off the road. This reduction will increase significantly in phase two, when the OVDEU will extract heat from the Gilbert Trunk sanitary force main sewer.

In a typical neighbourhood each building has a furnace or boiler which draws gas and electricity from the grid to heat the interior spaces and water. The OVDEU is a more efficient approach to heating where individual buildings use the central system for heating, eliminating the need for individual boilers. Domestic hot water is also provided by this system. Having a DE System directly connected to buildings increase the resiliency of the neighbourhood: as the distribution piping is buried it is safe from most extreme weather events.

Economies of scale allow the central plant to use technologies with higher efficiencies. The current plants are able to use state of the art, expertly maintained boilers to provide heating. Furthermore, this district energy system takes advantage of compact, mixed-use developments by energy-sharing opportunities between neighbouring facilities. The energy demand varies seasonally and from one type of a building to another (residential, commercial, industrial), and LIEC manages these changes and balances the supply between customers.

FVB has been involved with the Oval Village project since performing the initial concept screening study, right

through to design, construction support and operations support. As part of the initial studies, FVB investigated several sources of energy, including heat recovery from the Gilbert Trunk sewage line, from the Richmond Oval, from the Fraser River, CHP, and biomass. FVB developed the most promising concepts and used technical and financial analyses to assess the viability of each option.

In 2014, FVB updated the concept for the project, looking at the technical and financial feasibility of sewer heat recovery, and assisted Corix Utilities with completing their pro-forma by preparing AACE Class 4 cost estimates for several options for the Energy Centre, Energy Transfer Stations (ETS), Distribution Piping System (DPS), and Operation and Maintenance (O&M) costs.

FVB has performed the design and construction support for one 3.0 MW_t Interim Energy Centre and one 8.0 MW_t Interim Energy Centre. FVB has performed peer reviews on all buildings that reach the building permit stage in the service territory. FVB has also performed the design and construction support for 8 energy transfer stations and over 1,300 trench metres of piping (2,600m of piping).

At the full build-out OVDEU will service 5.5 million sq. ft. of mostly residential space with a 21-megawatt peak load. Once enough buildings are connected to the OVDEU, the next phase will be the construction of a major energy plant that will extract heat from the Gilbert Trunk sanitary force main sewer, further reducing greenhouse gas emissions by an estimated 80% or 5,500 tonnes of CO₂. The present natural gas boilers will remain for peaking and backup

COMPLEXITY

DISTRICT ENERGY PROVIDES WORRY-FREE, READY-TO-USE HEATING AND COOLING DIRECTLY TO A CUSTOMER'S BUILDING.

All construction projects have a tight timeline, but the deadline imposed by the first buildings to connect to the OVDEU meant there was no margin for error in scheduling, design, construction, or budgeting. FVB Energy was able to design and support construction for two separate interim plants (one containerized and one in a pre-engineered building), 200 trench metres of distribution piping, and two energy transfer stations in only six months. FVB worked closely with Corix and LIEC to integrate the design and construction of the district energy system with the design and construction of Polygon Carrera and Onni Riva Phase 1. This tight timeline meant that much of the equipment was procured while design was still being completed. Thus, as there was little opportunity for re-design, every aspect of the design had to be completed as efficiently and accurately as possible. Construction of the first phase was completed on time and on budget.

PROJECT MILESTONES

- Richmond Oval Heat Recovery and Potential Resource Screening Study (2008-2009)
- Due Diligence Study – Phases 1 & 2 (2011)
- Peer Reviews (2013 – Present)
- Concept Development Update (2014)
- Hydraulic Modeling (2015)
- Prime consultant and construction support of 3.0 MW_t Interim Energy Centre, 8.0 MW_t Interim Energy Centre
- Design and Construction Support for 8 Energy Transfer Stations (2014 – Present)
- Design and Construction Support for 1300 trench metres of piping (2014 – Present)



Above: Insulated steel piping installation

SOCIAL AND ECONOMIC BENEFITS

The Oval Village District Energy Utility has found the balance of competitive costs and protecting the environment. District Energy in Richmond is fully funded from service fee revenue and has no impact on Richmond property taxes. Customer energy rates are set in the City of Richmond Service Area Bylaws and are reviewed by Council on an annual basis, ensuring transparency and accountability. District Energy rates are set to be equal to or less than the same level of service from conventional system energy costs.

The OVDEU is city owned, creating revenue opportunities for the City of Richmond which will be reinvested back into the community. Furthermore, the need for trained staff to maintain the current system as well as professionals for continuous system expansion creates jobs in the community.

Removing boilers from buildings means there is no risk of a malfunction. Both residential and commercial owners benefit from not needing to worry about the scheduling and cost of regular maintenance or of replacing old technology. The boilers located in the Central Heating Plant are managed daily by experts and are upgraded as necessary to ensure the safest, most efficient and most reliable heating system possible.

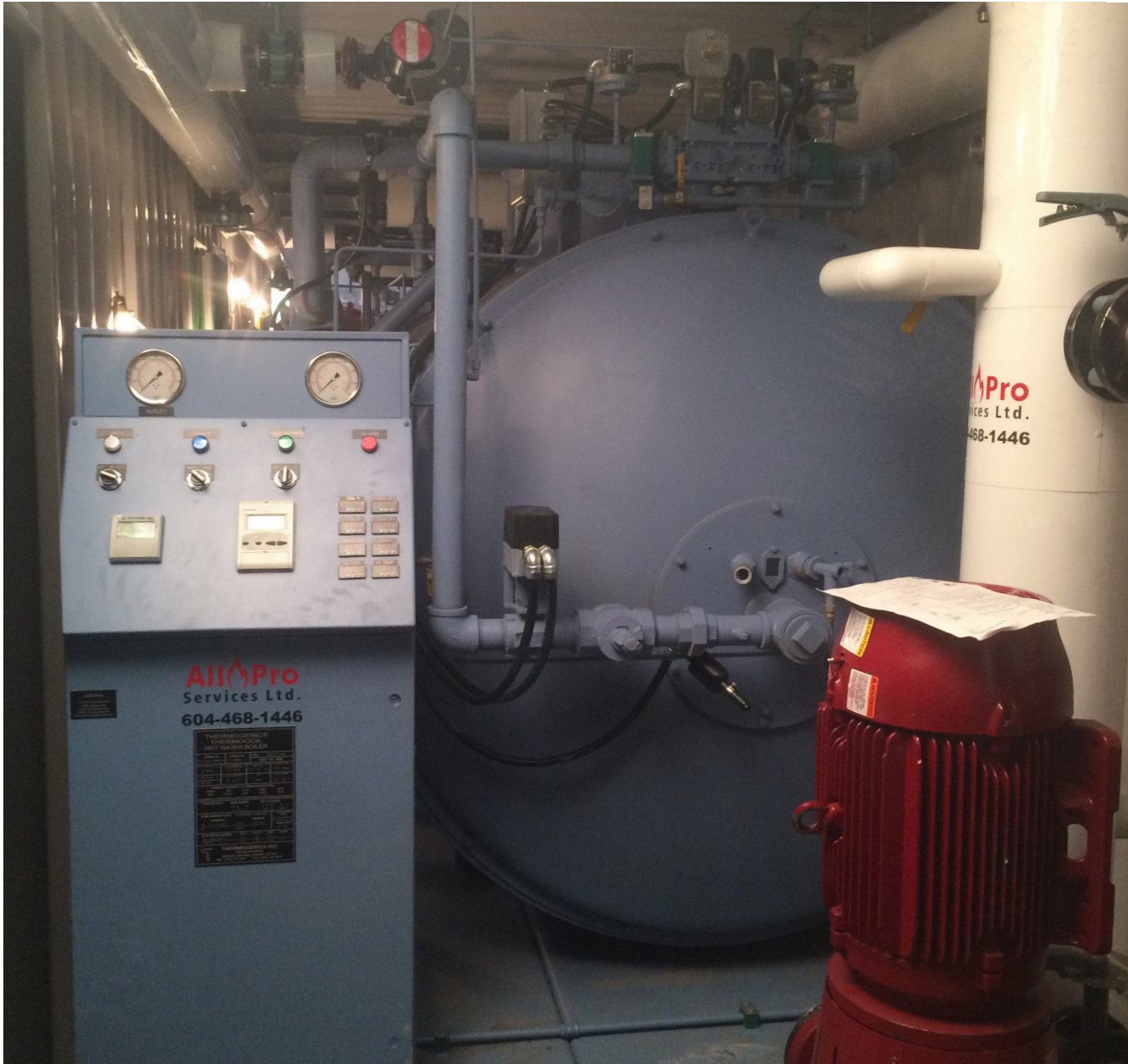
Finally, District Energy allows for more efficient land use. As most buildings are connected from new build they do not need to allot space for boiler rooms, providing value to developers and owners. The phase two sewage expansion will provide heating without taking up land that could be used for parks, service buildings, or other amenities.

ENVIRONMENTAL BENEFITS

The driving forces behind the establishment of the OVDEU were to reduce Green House Gas (GHG) emissions that cause climate change, develop renewable energy, and support local green jobs. The OVDEU reduces GHG emissions by an estimated 400 tonnes/year – equivalent to removing 85 cars from the road. The LIEC continuously connects new buildings to renewable district energy systems and regularly conducts studies to identify future opportunities for the implementation of new district energy systems. By harvesting renewable energy through district energy systems, LIEC supports the City of Richmond's goal to lower GHG emissions and meet its community GHG targets of 33% below 2007 levels by 2020 and 80% by 2050.

In the OVDEU the buildings are heated by drawing hot water from a central system, rather than from individual boilers. DEU aggregates demand from dozens or even hundreds of buildings and uses a more efficient method of generating heat in a few larger plants rather than having hundreds of smaller boilers each heating one individual building. Once there is sufficient load, the OVDEU will construct an energy plant that will extract heat from the Gilbert Trunk sanitary sewer, further reducing greenhouse gas emissions to a total of 80% or 5,500 tonnes of CO₂ equivalent per year.

The infrastructure and energy plants provide tangible examples of local climate action that inspire community members to participate in preserving the environment, while enhancing the community's energy resilience.



LULU ISLAND ENERGY COMPANY REMAINS COMMITTED TO
EXCELLENCE IN SUSTAINABLE UTILITY MANAGEMENT AND
OPERATIONS AS RICHMOND'S SOLUTION TO PROVIDING
"CLEAN, EFFICIENT ENERGY FOR NOW AND THE FUTURE".

- ROBERT GONZALEZ, CHAIR OF THE LIEC BOARD

Below and Right: components
of the River Parkway IEC





PROJECT GOALS

01 ENVIRONMENTAL BENEFITS

By taking advantage of economies of scale the OVDEU currently reduces GHG emissions by approximately 400 tonnes/year. In future, heat will be extracted from the Gilbert Trunk sanitary force main sewer, which will reduce emissions by an estimated 5,500 tonnes/year.

02 FUEL FLEXIBILITY

The OVDEU is adaptable to sustainable energy sources such as ground source heat, river water heat, sewer heat, solar and renewable energy technologies as they are developed.

03 COST SAVINGS

Rates are based on the Richmond Council adopted objective to provide customers with annual energy costs that are equal to or less than conventional system energy costs based on the same level of service. At the same time, the rate is designed to recover the utility's costs related to infrastructure development, operation and maintenance, and fuel.

04 EASE OF OPERATION

Buildings connected to District Energy systems do not require boilers or furnaces. This results in reduced ongoing operating, maintenance, and labour costs and safer methods of heat generation for all involved

05 RELIABILITY

District energy technology is proven and reliable, has built-in backup systems, and performance is monitored continuously. District energy systems increase community energy resiliency by reducing reliance on external energy sources.

06 COMFORT AND CONVENIENCE

District Energy provides worry-free, ready-to-use heating and cooling directly to a customer's building. District Energy provides hydronic (water) heating and cooling which is generally considered more comfortable than other forms of space conditioning.