



## REPORT | INFORMATION REPORT TO COUNCIL

**PRESENTED:** October 18, 2016

**REPORT:** 16-115

**FROM:** Infrastructure Services

**FILE:** 420.2

**SUBJECT:** 2016 DISTRICT ENERGY SYSTEM ANNUAL REPORT

### COMMENT/RECOMMENDATION FROM THE CHIEF ADMINISTRATIVE OFFICER

That the recommendation of the General Manager of Infrastructure Services be endorsed.

### RECOMMENDATION

**That** Council receive Information Report No.16-115 regarding the Cheakamus Crossing District Energy System Annual Report.

### REFERENCES

Appendix A - Cheakamus Crossing District Energy System Overview and Ownership

### PURPOSE

Council last received an overall update on financial and operating performance of the municipal portions of the Cheakamus Crossing District Energy System ("DES") in October 2014. This report provides an update for the subsequent period.

### DISCUSSION

#### Operating Fees and Costs

The operation of the DES is a shared responsibility:

- Development Services staff (part of Infrastructure Services) manage the governance, oversight, and user communications associated with the DES.
- Wastewater Treatment Plant (WWTP) staff operate and maintain the DES plant. WWTP staff are responsible for ensuring that sewage heat is properly diverted to the DES pipe system, and that the DES equipment within the WWTP is operating smoothly.
- Utilities staff are responsible for maintenance and repair of the DES supply and return piping system which delivers DES heat to the Cheakamus Crossing neighborhood.
- Property owners are responsible for maintaining their private service connections and heat pump systems

Fees were established by By-Law 1951, 2010 based on a 2010 forecast of DES annual costs of \$195,000, of which \$125,000 was forecast to be operating costs, and \$70,000 was to be transferred to a capital Replacement Reserve Fund.

The Replacement Reserve Fund was anticipated to provide 50% of the full-system cost over the design life of the plant equipment (30 years) and distribution system (50 years).

Unit fees were established at \$4.58 per square metre interior space per year based on Phase I build-out area of 42,600 m<sup>2</sup>.

The 2010 plan was approved by Council and became the inaugural 2011 budget. Since 2011, unit fees levied on Cheakamus Crossing properties have remained unchanged, while revenues have increased due to on-going property development.

Since 2010, electricity costs in Whistler have increased significantly, while natural gas costs have held fairly steady. Had the municipality not chosen to pursue the DES system for Cheakamus Crossing, the residents of the neighbourhood using electric heat would have seen substantially increased utility costs.

The following table shows the Budgeted and Actual revenues and expenses for the DES operation:

Year	Revenue	Operating Expense	Capital Expense	Reserve Contribution	Reserve Contribution - Running Total
2010	\$ (154,839)	\$ 123,889		\$ (30,950)	\$ (30,950)
2011	\$ (184,340)	\$ 124,387		\$ (59,953)	\$ (90,903)
2012	\$ (192,176)	\$ 107,978		\$ (84,198)	\$ (175,101)
2013	\$ (201,386)	\$ 33,318		\$ (168,068)	\$ (343,169)
2014	\$ (200,085)	\$ 90,880		\$ (109,205)	\$ (452,374)
2015	\$ (200,337)	\$ 48,040	\$ 235,112	\$ (152,297)	\$ (369,559)

As the table shows, annual operating expenses for the first three years of plant operation closely matched the originally forecast of \$125,000. Since then expenses have been greatly reduced, largely due to plant equipment and operating improvements. As a result, total reserve contributions are greater than originally foreseen. It is anticipated that operating costs will remain stable and approximately at the 2015 level in the future.

Despite staff's significant improvements on reducing operating costs, three factors suggest that a reduction in reserve contributions would be premature at this time, specifically:

1. RMOW-wide reserve contribution policy is currently under review. The long-term 50% contribution target for the DES system is subject to change: it was based on an assumption that senior government funding would be available to half-fund replacement of in-ground infrastructure in 50 years' time.
2. Reserve contributions to end of 2015 are distinctly ahead of target, but they still may be deficient if replacement costs prove higher than anticipated or if replacement must occur earlier than forecast. Both of these scenarios are possible.

3. The original boilers lasted only six years, and had to be replaced at a cost of more than \$200,000 in 2015. It is possible that other portions of the mechanical equipment may not last the forecast 30 years and will require early replacement.

Five improvements have been implemented since the last DES Annual Report to Council in 2014. These are:

1. In 2015, the heavily corroded and failed/failing DES boilers were replaced with high-efficiency boilers better suited to the demands of the DES system.
2. Also in 2015, the DES control logic was reviewed in its entirety and many improvements made to provide for incremental reduction in boiler use.
3. As a result of the work completed in November 2015, a new plant operations manual was commissioned and provided to staff in 2016.
4. In the summer of 2016 a new system for cleaning the heat exchangers was suggested and tested by staff. This new approach reduced cleaning time from 35 hours to less than 10 hours per heat exchanger. This opens up the potential of changing the heat exchanger cleaning schedule to gain further efficiencies.
5. A “small” gas leak was detected and fixed in September 2016. It is unclear what gas flow was involved, and unknown how long this leak has existed.

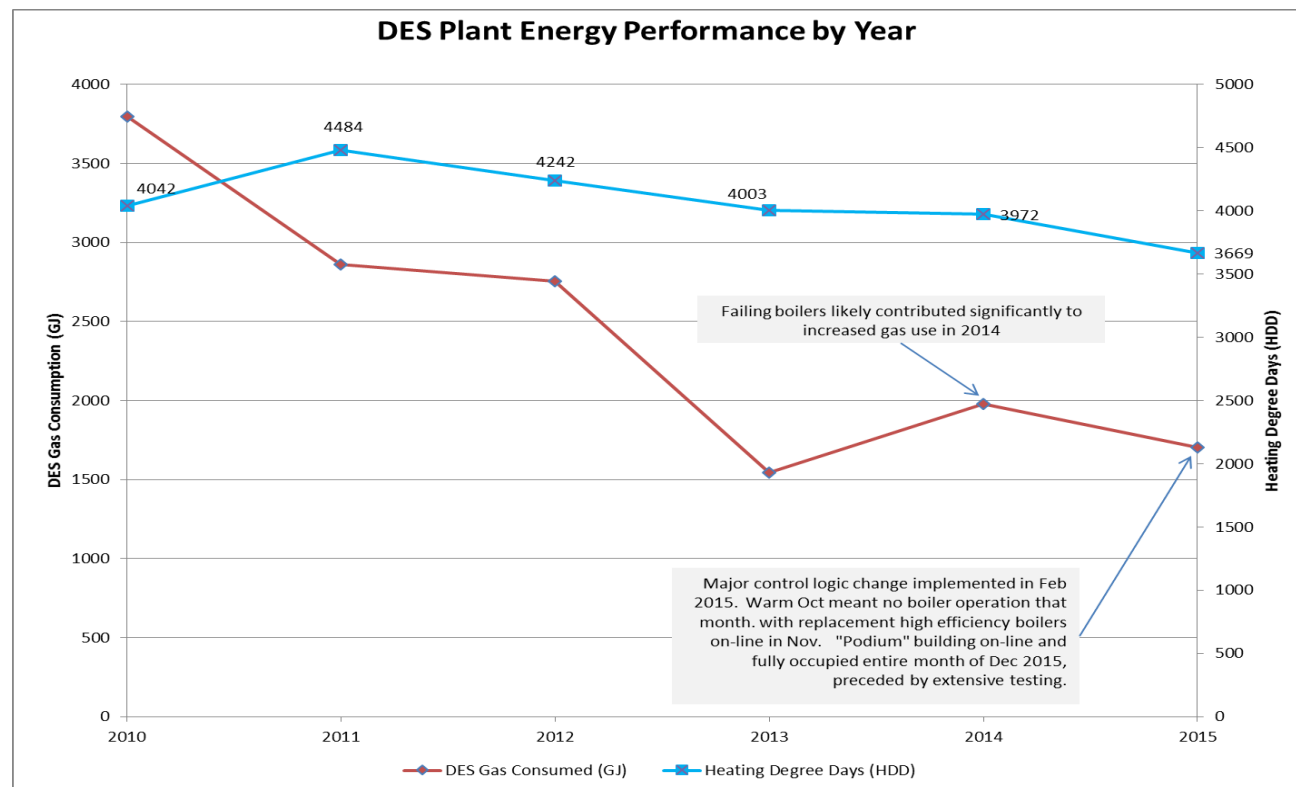


Figure 1 Energy Performance

Natural gas use by the DES plant has changed substantially in the years since 2010 (see figure 1). Major improvements in the first three years (over 50% reduction in gas use), and further reductions are possible, but not expected to be so significant.

The system improvements made over the past few years allow staff to recommend that DES unit fees will not need to be increased in 2017.

### **Service Level**

As in the first four years of operation, the Cheakamus Crossing DES plant has provided reliable heat energy to the Cheakamus Crossing community in 2015 and 2016.

To ensure minimum disruption to residents, planned shutdowns and major maintenance work continue to be planned for the summer period whenever possible. Key operational outcomes for 2015 and 2016 to-date were as follows:

#### **2015**

2015 Operational Parameter	Goal	Outcome
Hours below minimum temperature during heating season	None	None
Heating season plant shutdowns	None	None
Loop pressure below minimum	None	Three
Loop chemistry outside standard	None	None

- There were only three instances in the summer of 2015 in which the supply system was not operating due to the plant circulation pumps being temporarily out of service. One instance was due to regular planned maintenance, the second was due to a failed electrical relay, and the last was a scheduled shutdown required by the boiler replacement project.
- There were two additional instances in 2015 where the RMOW notified residents to check their systems, because the supply system was temporarily operating at a pressure which was lower than normal but not below minimum. These notifications occurred on October 30, 2015 and November 23, 2015.
- The DES distribution piping infrastructure has been trouble-free since the DES went into operation in 2010, excepting on-going issues with failures of submerged temperature sensors.

#### **2016 (to date)**

2016 Operational Parameter	Goal	Outcome (to date)
Hours below minimum temperature during heating season	None	None
Heating season plant shutdowns	None	None
Loop pressure below minimum	None	None
Loop chemistry outside standard	None	None

- The circulation pumps and piping infrastructure have not had any problems in 2016 (to date), with no interruptions to the heat energy supply system.

### **Future Plans**

Staff are currently reviewing the performance of and potential improvements to the chemical dosing system and heat transfer fluid filtration systems.

Staff are considering possible approaches to adding more remotely monitored distribution system sensors, to ensure temperatures in the peripheral areas of the piping loop are easily and continually monitored.

If and when Phase II of the Cheakamus Crossing development occurs, it will potentially result in a doubling of the number of Cheakamus Crossing DES connections. If so, the cost per connection will likely drop substantially, while the expansion will add some new capital demands, those fixed capital costs and incremental operating costs will be spread over many more buildings than presently.

### **Energy Study Program (ESP)**

The RMOW had entered into an agreement with BC Hydro to complete a comprehensive DES data collection and analysis in 2013 as part of their province-wide DES benchmarking project. In 2014, BC Hydro cancelled this project, citing organizational changes and cutbacks. The RMOW has now turned this initiative into an approved capital project in 2016. The purpose of the ESP is to analyze and report on the operating and ownership costs of using the installed heat pump systems for domestic hot water and space heating needs. Then provide a comparison to the costs of providing the same heating energy with a hydronic heating system with an electric boiler, and with a conventional electric baseboard heating system.

A call for volunteers was advertised and six Cheakamus Crossing homes were selected for the six month long data collection period from January 2016 to June 2016. The data collected during the study period is currently being reviewed and analyzed by our consultant. The ESP final report is expected in December 2016 and will be available from the RMOW and WDC websites.

A preliminary version of the report indicates that the heat pumps in the six homes tested averaged a coefficient of performance (CoP) of approximately three, meaning that the heat pumps were three times more efficient than an electric boiler or electric baseboard heating system. This is good news and confirms that when these systems are working properly, they provide very cost effective heat energy to the Cheakamus Crossing residents

## WHISTLER 2020 ANALYSIS

W2020 Strategy	TOWARD Descriptions of success that resolution moves us toward	Comments
Resident Affordability	Income and innovative benefits help make it affordable to live in Whistler.	The DES provides annual energy savings to residents of Cheakamus Crossing. No increase in fees in six years of operation.
Water	Wastewater and bio-solids are readily assimilated in nature.	The use of waste heat from the Wastewater Treatment plant improves the health of the Cheakamus River.
Built Environment	The new and renovated built environment has transitioned towards sustainable management of energy and materials.	The DES uses a renewable energy resource which displaces conventional energy supply sources, and partially offsets the impact of the Wastewater Treatment Plant on the Cheakamus River. Some deficiencies became apparent in the new DES plant, including premature failure of some components. These were addressed with new components and systems designed to minimize additional energy use, prevent problem reoccurrence, and improve overall plant efficiency beyond original design levels.
Energy	Whistler's energy system is supplied by a mix of sources that are local and regional wherever possible.	The DES is an entirely local (neighborhood) energy source.
Energy	Whistler's energy system is transitioning to renewable energy sources.	The DES's primary energy source is renewable.

W2020 Strategy	AWAY FROM Descriptions of success that resolution moves away from	Mitigation Strategies and Comments
None.		

## OTHER POLICY CONSIDERATIONS

None.

## **BUDGET CONSIDERATIONS**

The Cheakamus Crossing DES has operated within its budget during 2015 and 2016. A capital reserve fund is building up ahead of schedule, and no unit fee increases are recommended.

Staff will continue to monitor the Cheakamus Crossing DES plant and distribution system performance, costs, and revenue and report to Council with rationale for any proposed fee change recommendations in the future.

## **COMMUNITY ENGAGEMENT AND CONSULTATION**

E-mail alerts regarding planned system shutdowns continue to be sent to Cheakamus Crossing residents.

Presentation to Council and associated publication of this report provides opportunity for interested community members to read about and understand the Cheakamus Crossing DES financial and operational performance.

## **SUMMARY**

The Cheakamus Crossing DES financial and operational performance has exceeded expectations in the past two years, and during the 2017 budget planning process staff anticipate recommending no increase to DES user fees. The Cheakamus Crossing DES has been a reliable source of primarily renewable heat energy for the Cheakamus Crossing neighbourhood in 2015 and 2016.

Respectfully submitted,

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Operations Manager

for

James Hallisey

GENERAL MANAGER, INFRASTRUCTURE SERVICES

## **APPENDIX A**

### **Cheakamus Crossing District Energy System Overview and Ownership**

The Cheakamus Crossing DES plant provides low temperature (11 to 20°C) heat, via about 1 million m<sup>3</sup> of heat transfer fluid, through a five kilometer loop of pipe with associated valves and controls, to approximately 166 service connections.

The Cheakamus Crossing DES plant is located on the grounds of the Whistler Waste Water Treatment Plant. It's function is to extract heat from treated effluent water and transfer it to the heat transfer fluid in the loop. The distribution piping and controls are partly on public land and partly on private land, however, both the plant and distribution system are entirely the property of the RMOW.

The Cheakamus Crossing DES service connections are associated with heat pumps in the various residential duplexes, row houses, hostel, high performance athlete centre, etc. The building heat pump, controls, valves and plumbing, etc. belong to the owner of the building they're in, not to the RMOW. The residential heat pumps only support heating, whereas some of the commercial heat pumps are believed to both heat and cool.

The residential heat pump system includes an electric heat backup circuit (for home heat) and a backup electric hot water heating circuit (for domestic hot water). In the event of any failure of loop flow or temperature, the heat pump will switch to backup electric heating automatically, then attempt to go back to heat pump mode. If it can't go back to heat pump, the heat pump will eventually shut down entirely, requiring the home owner to manually restart the heat pump once the DES loop is up and running again.

Controls and backup boilers at the Cheakamus Crossing DES Plant are setup to ensure that loop temperature is always maintained in the correct range, in order to prevent needless electric heating expense or damage to the various privately owned heat pumps.

The Cheakamus Crossing DES loop (or private connections to it) loses about 1 m<sup>3</sup> of heat transfer fluid per day into the ground. This loss isn't harmful to the environment: the loop fluid is, notionally, potable water. The loss is made up by chemically treating regular drinking water to ensure it doesn't cause corrosion to heat pumps or cause growth of bacteria in the Cheakamus Crossing DES loop piping, adding fluorescent food-grade dye to help distinguish transfer fluid from other drinking water, then adding the resulting mix into the loop at the Cheakamus Crossing DES plant.