City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	October 9, 2018
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6060-01/2018-Vol 01
Re:	**Sustainability Initiatives in Richmond's City Centre**		

Staff Recommendation

That the staff report titled, "Sustainability Initiatives in Richmond's City Centre", dated October 9, 2018 from the Director, Engineering, be received for information.

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Director, Engineering
(604-276-4140)

REPORT CONCURRENCE	
CONCURRENCE OF GENERAL MANAGER	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	INITIALS: CJ
APPROVED BY CAO	

Staff Report

Origin

This report is in response to a referral from the June 20, 2018 Public Works and Transportation Committee Meeting, which requested:

That staff: (1) provide an update on the District Energy program; (2) explore initiatives for a Solar District Energy in the city centre area; and (3) explore initiatives for rainwater harvesting; and report back.

This report supports Council's 2014-2018 Term Goal #4 Leadership in Sustainability:

> *Continue advancement of the City's sustainability framework and initiatives to improve the short and long term livability of our City, and that maintain Richmond's position as a leader in sustainable programs, practices and innovations.*

Background

The City incorporated the Lulu Island Energy Company Ltd. (LIEC) in 2013 for the purposes of managing district energy utilities on the City's behalf. LIEC currently owns and operates the Alexandra District Energy (ADEU) and Oval Village District Energy (OVDEU) Utilities.

The City adopted the Community Energy and Emissions Plan (CEEP) in 2014, outlining strategies and actions for the City to meet the OCP targets to reduce community greenhouse gas (GHG) emissions 33% below 2007 levels by 2020, and 80% below 2007 levels by 2050.

The City adopted the Integrated Rainwater Resource Strategy in 2018, introducing a number of initiatives and strategies to address the City's unique stormwater management needs.

Analysis

<u>District Energy</u>

The City Centre District Energy Utility (CCDEU) service area was recently approved by Council; the first customer buildings in this area are expected to be connected in 2021. The City Centre area, including the West Cambie and the Oval Village neighbourhoods, has experienced a rapid development pace. LIEC's energy utilities have been growing to meet this increased energy demand, and have played a key role in meeting the community-wide greenhouse gas emission reduction targets identified in the City's Official Community Plan (Table 1).

Table 1: Current District Energy Services Areas

	Connected		Committed		Lifetime GHGs
	No. Units	**Floor Space**	**No. Units**	**Floor Space**	**Avoided (tCO_2e)** [1]
ADEU	1,456 units	1.68 M sq.ft.	1,127 units	0.95 M sq.ft.	~20,000
OVDEU	1,681 units	1.89 M sq.ft.	1,611 units	2.04 M sq.ft.	~30,000
CCDEU	-	-	4,141 units	4.43 M sq.ft.	~100,000

LIEC is continuing to work with Corix on the City Centre DEU (CCDEU) due diligence process. This work includes the development and analysis of long term DEU servicing strategies for the City Centre area. The City has continued to secure commitments that new developments will be connected to LIEC's services through rezoning, development and building permit processes.

ADEU

Expansion and development in the West Cambie Neighbourhood continues. There are three developments scheduled to connect to the ADEU system in 2019 and two more in 2020. The design of two new geo-exchange fields is currently under way to ensure the ADEU's low carbon infrastructure is able to meet the needs of the multiple new developments which are scheduled for completion in 2019 and beyond.

	Anticipated Occupancy
Trafalgar Square	2019
Spark	2019
Westmark	2019
Berkeley House	2020
Ex-Jingon	2020

OVDEU

Development activity continues in the Oval Village within and adjacent to the OVDEU service area. LIEC continues monitoring development activity and is bringing forward to Council recommendations for a broader expansion of the service area to match development activity. A permanent energy centre is currently planned to be built 2024, which will produce low carbon energy, harnessed from the Gilbert Trunk sanitary force main sewer.

	Anticipated Occupancy
Intracorp (River Park Place 2)	2019
Landa Cascade City	2020
Aspac Lot 12	2020
Onni Riva Phase 3 Building 4	2020
ASPAC Lot 13	2020

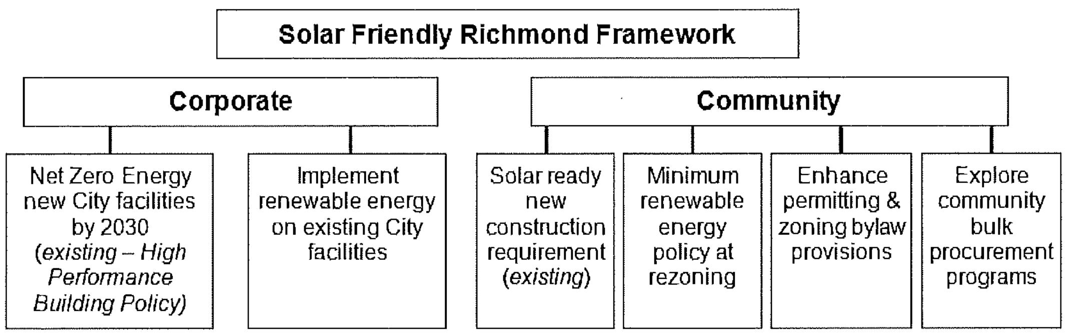
[1] Based on the estimated energy provided for heating. The business-as-usual (BAU) assumes that 40% of the building heating load would be provided from electricity and the remaining 60% would be from gas make-up air units.

CCDEU

Through recent rezoning applications six developments, including Richmond Centre Mall development, have committed to construct and transfer low carbon energy plants to the City/LIEC. The recent adoption of the City Centre DEU Service Area Bylaw 9895 will allow for immediate provision of low carbon energy and in turn immediate avoidance of generating GHG emissions. At full build out, the City Centre DEU service area has the potential to service over 30M ft^2 of customers.

<u>Solar District Energy</u>

Staff previously brought to council the report titled "Solar Friendly Richmond Framework" in 2016, which identified the potential of solar PV technology and provided a framework for the City to support greater deployment of solar energy technologies both in its corporate operations and in the community.



The City of Richmond has taken a variety of leadership actions to integrate solar energy into a wide variety of corporate buildings and infrastructure, reducing electrical demand, GHG emissions, and building energy resiliency into its corporate operations. These projects are also intended to demonstrate the use of renewable energy technologies as an effective tool to achieve energy and emission reductions in the community. These projects include:

- Solar air heating on the South Arm Community Centre
- Solar hot water on Steveston Firehall No 2, South Arm Outdoor Pool, and Minoru Aquatic Centre
- The Hamilton Fire Hall's solar wall
- Planned solar PV installation with battery storage at Firehall No 1
- Planned solar PV installation and battery storage at the Works Yard and Graybar sanitary pump stations

The recently adopted BC Energy Step Code relies on building energy efficiency as the most cost effective means to achieve energy demand reductions in the community; due to BC's relatively low electricity prices and low annual levels of sunshine, energy efficiency continues to be more cost-effective than investing in solar energy systems.

Cost and Space Constraints

One of the main findings presented in the "Solar Friendly Richmond Framework" January 28, 2016 report to Council was that even though the costs of solar PV modules has decreased markedly in the last decade, solar energy would need to cost approximately $2.00/W to be competitive with the retail price of electricity in BC. Industry stakeholders estimate this will occur in 5 to 10 years. Some building owners/developers have chosen to install solar PV even when it is not competitive with retail electricity prices; this choice may reflect power resiliency or backup needs, environmental values, technological interest, leadership, and other reasons. Reaching "grid parity" is important to achieve a positive business case, in particular for utility scale projects.

A solar PV feasibility study conducted by staff in 2017 found the actual cost of solar PV in Richmond to be in the range of $2.5-3.0/W. Other low carbon thermal energy sources actively being considered for the City Centre DEU servicing strategy are in the $1.2-1.6/W range, while still providing the same environmental benefits. Selecting the most cost effective low carbon energy solution is important to ensure customer rates are competitive with conventional non-renewable energy sources.

One of the main benefits of district energy is the ability to centralize generating equipment to achieve higher efficiencies and reduce capital costs and space requirements. Covering the rooftop of a typical multi-unit residential building with solar PV panels would satisfy only about 10% to 20% of its total energy needs, and would require an installation at least five times that size to completely fulfill them. In the case of district energy, this area would have to be multiplied for each building connected to the system.

Other Opportunities

LIEC is currently looking at the possibility of using solar thermal or solar PV technology to supplement other on-site energy needs in buildings and to provide backup power to improve energy resiliency in the city centre area. Solar energy in some cases could be used to supply energy for onsite DEU equipment. This would provide customers with a larger share of renewable energy and could result in a more stable energy rate. Energy storage could also be used in combination with solar PV to provide backup power during energy outages. The adoption of the *City Centre District Energy Utility Bylaw* makes this possible by requiring a share of the energy used for heating, cooling and domestic hot water to come from on-site low carbon energy source.

As part of the City Centre DEU due diligence process, LIEC has been looking at different low carbon energy sources for thermal energy needs to service customers, and it will continue to consider solar as an alternative. The cost of solar and hydro rates may change in the future and could make solar a viable option to serve customers in the city centre area. One of the greatest benefits of district energy is the ability to add or switch energy sources using the same distribution network. Staff will also continue to look for opportunities such as economic incentives and grants that could make solar energy feasible.

Rainwater Harvesting

Rainwater harvesting for outdoor irrigation purposes is common in the Lower Mainland and Richmond has a rain barrel programs to support this form of rainwater harvesting. The City sold 153 rain barrels in 2017. Rain barrels can be purchased for $30 from the Richmond Recycling Depot.

Rainwater harvesting for use inside of buildings is not a common practice in BC. In the Lower Mainland due to long payback periods and onerous BC Building Code regulation. There are only a handful of projects that utilize harvested rainwater for toilet flushing. These include:

- The Richmond Olympic Oval;
- The UBC Centre for Interactive Research on Sustainability;
- Quayside Village in North Vancouver; and
- The Vancouver Convention Centre.

Utilization of harvested rainwater indoors is permitted by the BC Building Code, however harvested rainwater is included in the same category as recycled wastewater from sinks, toilets, dish washers and washing machines. The same level of water treatment is required for both sources. Rainwater is cleaner than these other sources and the required level of treatment is therefore excessive. The Canadian Standards Association has proposed guidelines that are specific to harvested rainwater for indoor use, however, there is no schedule for adoption and implementation of these guidelines. The design and implementation of rainwater harvesting systems for indoor use is reviewed on a case by case basis by local health authorities, however, there is no oversight or regulation for maintenance of these systems. Buildings that incorporate water re-use are eligible for LEED credits through the U.S. Green Building Council. Table 1 summarizes the advantages and disadvantages of rainwater harvesting.

Table 1 - Benefits and Disadvantages of Rainwater Harvesting

Benefits of Rainwater Harvesting	Disadvantages of Rainwater Harvesting

• Drinking water conservation
• Lower utility bills for property owners
• Reduced impact on Municipal infrastructure
   o Captured rainwater is diverted from stormwater infrastructure
   o Reduces demand on the Municipal drinking water distribution system
	• Cost to property owners for installation and maintenance of rainwater harvesting system
	• Long payback period

Single-Family Residential Rainwater Harvesting Components and Costs

Rainwater harvesting for use in toilets requires the following components: installations including a rainwater storage tank, filtration system, pump, chemical treatment system and a separate piping system for harvested rainwater. The estimated cost of retrofitting an existing home with a rain harvesting system is approximately $9,300 and the estimated cost for installation in a new home is $7,500.

Rainwater Harvesting Payback Period

The following analysis focuses on rainwater harvesting for toilet flushing in residential developments. Toilet flushing accounts for approximately 25% of indoor water use in a typical home and is the most common use for water that is not suitable for drinking, such as harvested rainwater. There are additional potential indoor uses for lower quality water in residential developments; however, toilet flushing is the most economic use.

a) Single Family Homes

Rainwater harvesting has a long payback period for single family homes and is not economic at current water rates. Using rainwater for toilet flushing in a typical single family home will reduce drinking water use by approximately 75 m^3/year. At Richmond's 2018 net water rates ($1.2757 per m^3), property owners would save approximately $88 per year in water costs. Using the estimated installation costs above, not including inflation, the simple payback period for retrofits and new construction in single family homes would be 105 and 86 years respectively. As water rates increase in the future through inflation, this payback period will decrease.

b) Multi-Family Homes

The payback period for multi-family residential development is dependent on the density of the development. High density developments have a shorter payback period than low density developments. As such, developments need to be reviewed on a case by case basis to determine the economic viability of rainwater harvesting for toilet flushing. At a very high level, high rise residential developments are estimated to have a payback period in excess of 30 years, low rise have a payback in excess of 40 years and townhouses have a payback in excess of 80 years.

c) Commercial and Industrial

The commercial and industrial sectors have a high degree of variability in land use. As such, staff cannot make a blanket statement regarding the viability of rainwater harvesting in these sectors. Each of the properties will require analysis for the suitability and economic viability of rainwater harvesting for each of their unique uses.

The payback period for rainwater harvesting for indoor use is in excess of 30 years for the densest Richmond developments and is not currently considered cost effective. This will change over time as water prices increase and the cost of rainwater harvesting systems go down through changes in regulation or technological improvements. At this point in time, investments in other water demand management tools, such as water metering, pressure management and toilet rebates are more cost effective than rainwater harvesting.

Other Considerations

While permanent signage is required where people come into contact with non-drinking water, it is possible that children that are not old enough to read or understand the warnings could ingest the harvested rainwater.

Harvested rainwater systems for indoor use require a separate pipe system to keep the harvested water separate from drinking water. Implementing rainwater harvesting systems will create opportunities for accidental connection of the drinking water system to the harvested water system during construction or renovation.

The City's metered sewer utility rates utilize water meter readings as a proxy for sewer use. Rainwater harvesting for indoor use would reduce drinking water use, but would not impact household discharge to sanitary sewers. Therefore the metered sewer rate structure may require an updated structure to maintain equity should rainwater harvesting systems become more common.

Financial Impact

None.

Conclusion

District energy continues to play a key role in meeting the community-wide greenhouse gas emission reduction targets. An opportunity also exists to incorporate solar energy into the City's low carbon district energy systems. LIEC is currently looking at the feasibility of different low carbon technologies as part of the CCDEU due diligence process, and will continue to look at solar as one of the available alternatives.

The City's rain barrel program for utilization of harvested rainwater for outdoor irrigation has been successful and rain barrels are available at the Richmond Recycling Depot for $30. High rise developments have the shortest payback period for indoor rainwater harvesting, however, the payback period for the densest Richmond developments is over 30 years at current drinking water prices. Indoor rainwater harvesting will become more economic as water rates increase, however, it will likely be a long time before indoor rainwater harvesting becomes economic. Investment in other demand management tools, such as water metering, pressure management and toilet rebates are more cost effective than rainwater harvesting at this time. Staff will continue to monitor changes to the BC Building Code and other technical advances that impact the cost of rainwater harvesting for indoor use and will report improvements as they become available.

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