City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	April 13, 2016
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6600-10-02/2016-Vol 01
Re:	**Alexandra District Energy Utility Bylaw No 8641 Amendment Bylaw No 9555**		

Staff Recommendation

That the Alexandra District Energy Utility Bylaw No. 8641, Amendment Bylaw No. 9555 be introduced and given first, second and third reading.

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Director, Engineering
(604-276-4140)

Att. 4

REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Finance	☑	
Law	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** DW	**APPROVED BY CAO**

Staff Report

Origin

In 2010, Council adopted the Alexandra District Energy Utility Bylaw No. 8641, establishing the charges that constitute the rate for the service of delivering energy for space heating and cooling and domestic hot water heating within the Alexandra District Energy Utility (ADEU) service area. Further, in 2014, Council adopted a separate ADEU rate for services applicable to large format retail customers within the service area. This rate was defined for a specific portion of the ADEU service area, denoted as Area A.

The purpose of this report is to:

- Recommend an amendment to the 2016 rate and rate structure for large format retail customers within Area A of the ADEU service area; and

- Recommend an amendment to the capacity charge calculation for the residential buildings with mechanical systems which include gas-fired make-up air units

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.*
>
> *4.1. Continued implementation of the sustainability framework.*
>
> *4.2. Innovative projects and initiatives to advance sustainability.*

Background

ADEU is a sustainable energy system that centralizes energy production for heating, cooling and domestic hot water heating for residential and commercial customers located in the Alexandra/West Cambie neighbourhood. The project is assisting in meeting the community-wide greenhouse gas emission reduction targets adopted as part of Richmond's Sustainability Framework by providing buildings with renewable, low carbon energy through geo-exchange technology.

The system started operation in 2012. In November 2015, the construction and commissioning of the Phase 3 expansion of the ADEU system was completed. This expansion more than doubled the capacity of ADEU's renewable energy generation by adding a second geo-exchange field. Additionally, it increased the size of the energy centre building while adding two 2,550 kW evaporative fluid coolers and three 1,500 kW condensing boilers. This will allow ADEU system to meet the energy demands of the rapidly growing West Cambie neighbourhood.

The system currently provides energy to six developments (Mayfair Place, Remy, Omega, Alexandra Court, Richmond Jamatkhana and Townline Oxford Lane) connecting over 1100

residential units and over 1 million square feet of floor area. See Attachment 1 for informational map with statistical summary.

As of March 30, 2016 (end of first billing quarter), the ADEU system has delivered 6751 MWh of energy to customers for space heating, cooling and domestic hot water heating. While some electricity is consumed for pumping and equipment operations, almost 100% of this energy was produced locally from the geo-exchange fields in the greenway corridor and the park. The backup and peaking natural gas boilers and cooling towers in the energy centre have operated only for a few days throughout the system's operation to date. Staff estimate that this has eliminated 1250 tonnes of GHG emissions[1] in the community (see Attachment 2) and are considering these reductions as GHG offsets for neutralizing corporate GHG emissions.

The system operation has been smooth and constant with only a few minor service interruptions scheduled as a part of the Phase 3 expansion. Incoming revenues and expenses have been increasing on pace with the gradual increase of serviced buildings and are meeting or exceeding the projected figures in the financial model.

Overall, the financial, operational and environmental results show outstanding performance of the ADEU system, as expected.

Analysis

Area A (SmartREIT) Rate Structure

Schedule C of the ADEU Bylaw No. 8641 defines the charges that constitute the rate for Area A. Total charges include a fixed capacity charge (tied to the building gross floor area) and a variable volumetric charge (tied to the energy consumed by the customer).

Phase 4 of construction is currently underway, which will see the addition of ADEU's first commercial customer – SmartREIT (previously Smart Centres). SmartREIT customers are within Area A and are subject to a rate that was developed specifically for this type of large format retail energy user. Large format retail buildings have a very different energy use profile when compared to residential buildings (one third the annual heat usage and four times more cooling loads). These differences are largely due to on-site waste heat recovery from refrigeration systems, heat that is gained from lighting systems and negligible hot water needs. The resulting large format retail rate calculations are not directly comparable to the residential rate calculations. As the detailed design of the Air Source Heat Pump (ASHP) system is complete and the construction is underway, staff is bringing forward recommendations to Council on how this rate should be structured to best serve ADEU and its new commercial customers.

At the time this rate structure was developed, information about the peak energy demand and annual energy consumption for the commercial buildings to be connected within Area A was limited. The only certain information was the gross floor area of the buildings. In order to provide certainty to the developers and their customers with respect to the cost of energy and assurance to the City that the revenue collected would support the utility business case, the rate was set with 100% weight on

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

the charge tied to the floor area of the building. The current 2016 rate for Area A is $0.047 per square foot per month of the gross floor area, with the volumetric charge left at $0.00 per kilowatt hour as adopted by Council.

Since then, the City has received detailed energy modeling reports summarizing the expected heating and cooling loads for the developments in the area, providing a better understanding of the expected energy loads and consumption. This has allowed staff to change the rate to include a variable component, which in turn supports energy conservation.

ADEU was established on the basis that all capital and operating costs would ultimately be recovered through revenues from user fees, making ADEU financially self-sustaining over the long term. The intent of amending the rate structure is to ensure guaranteed revenue necessary to recover the capital and operating costs, and at the same time, to encourage energy conservation and high energy efficiency within the buildings.

The rate for Area A of $55/MWh was approved by Council in 2014, and agreed upon by SmartREIT as approximately equivalent to business as usual operating costs. Once included in the Bylaw, this rate was subject to the annual rate review adjustments of 4% year over year along with the other ADEU rate. Since the preliminary development of this rate structure, there have been several changes to the design of the SmartREIT development. Most critically, SmartREIT increased the peak cooling demands of the development. This and other smaller changes have increased ADEU's capital infrastructure costs that are required to service the development. Staff have calculated that this additional energy capacity provision results in a 2016 energy rate increase from $59.49/MWh to $66.92/MWh.

Three options of the rate structure are presented for consideration as follows:

1. Leave the rate structure as is (with an overall rate increase to reflect additional energy capacity provided).
2. Maintain a portion of the charge tied to the gross floor area, and introduce charge tied to annual energy demand (with an overall rate increase to reflect additional energy capacity provided).
3. Introduce charge tied solely to annual energy demand (with an overall rate increase to reflect additional energy capacity provided).

Option 1 – Leave the rate structure as is [2] (not recommended).

This rate would be comprised of:

1. Capacity Charge - monthly charge of $0.087 per square foot of the building gross floor area.

The rate structure under this option is strictly based on the cost per gross floor area serviced and it does not take in to account the energy consumption of the customer buildings. It would not encourage customers to conserve energy as there is no financial incentive to use less energy. Also,

[2] With an overall rate increase to reflect additional energy capacity provided

higher customer energy use will result in higher costs in the electricity and gas required to generate the energy delivered to customers. This would have a negative impact on the variable operating costs of ADEU.

Option 2 – Maintain a portion of the charge tied to the gross floor area, and introduce charge tied to annual energy demand[3] (not recommended).

This rate would be comprised of:

1. Capacity Charge - monthly charge of $0.0693 per square foot of the building gross floor area; and

2. Volumetric Charge - charge of $13.4 per megawatt hour of energy consumed by the building.

With this rate structure, the Capacity Charge aims to recover the capital investment and fixed operating costs, while the Volumetric Charge aims to recover the cost of consumed electricity and gas required to generate the energy delivered to a customer (variable operating costs). This rate structure is still largely (80%) based on the gross floor area of serviced buildings due to uncertainty of actual energy use of the buildings. This provides billing certainty for both the customer and ADEU, but it limits the value of reduced energy use for the customer - the charge tied to the annual energy demand will provide limited incentive to the customers to conserve energy. Also, in the case of high energy use by the customer, ADEU will incur high electricity and gas costs, which this rate structure will not be able to recover.

Option 3 –Introduce charge tied solely to annual energy demand[3] (recommended).

This rate would be comprised of:

1. Volumetric Charge -a basic supply charge of $66.92/MWh based on energy use of 2644 MWh per annum (60% of modelled energy use) plus $66.92/MWh for each megawatt hour used in excess of the basic supply charge amount.

The rate structure under this option solely takes into account the energy consumption of the customer buildings. This rate will strongly encourage customers to conserve energy by providing a financial incentive to use less energy. It provides a simple and consistent rate to customers that is linear based on their energy consumption. The basic supply charge will be set at 60% of the designed energy use of the buildings. This would allow customers to save up to 40% based on their energy conservation efforts and incentivize them to not excessively use energy that could lead to exceeding projected energy demand. Due to the linear nature of this structure, in the case of high customer energy use, ADEU is able to recover variable operating costs (gas and electricity) while maintaining a constant rate for the customers. Conversely, in the case of low energy use, the basic supply charge will ensure the guaranteed revenue necessary to recover the capital investment and operating costs while still providing the customers with an incentive to use less energy.

[3] With an overall rate increase to reflect additional energy capacity provided

City staff have reviewed the amended rate and structure with SmartREIT. SmartREIT provided several comments, mostly with respect to the administration of this proposed rate. Staff have addressed their comments.

Capacity Charge Calculation for the Residential Buildings with Natural Gas Operated Make-Up Air Units

Currently, buildings connecting to ADEU are prohibited from installing gas make-up air units in their mechanical systems as per Bylaw 8641, Part 22.2 (c). In traditional applications, gas make-up air units are often used to heat common spaces within residential apartment buildings. The inclusion of this technology in a building connected to ADEU does not allow for the building system to fully utilize the energy received from ADEU. With ADEU not able to provide heating energy to the common areas, this energy must come from burning natural gas. As a result, customers within these buildings would experience additional heating costs due to the use of the natural gas to heat common spaces serviced by the make-up air units. Different studies completed in recent years also showed that some amount of the heat from the common spaces/corridors is transferred by make-up air units into the residential suites. Staff have analysed energy data for one building in the service area that has natural gas make-up air units and concluded that approximately 50% of the energy supplied to common spaces is "pushed" into the suites.

Considering the above, staff is proposing to amend the capacity charge calculation for the buildings that have natural gas make-up air units to service common space. In those situations, as per the amended Bylaw (Attachment 3), common space floor area multiplied by factor 1.5 will be deducted from the building gross floor area when calculating capacity charge. This will ensure that customer's holistic costs for space heating energy are fair.

Financial Impact

With respect to the rate structure for Area A outlined in the proposed Alexandra District Energy Utility Bylaw No. 8641, Amendment Bylaw No. 9555, ensures full cost recovery for the delivery of energy within the ADEU service Area A.

With respect to the proposed amendment to the capacity charge calculation will provide a way to ensure that customers in buildings with gas make up air units are charged fairly for the heating and cooling services that they are receiving. This change will reduce ADEU revenue by approximately $40,000 annually based on the 2016 rate, which will have minimal impact on the ADEU financial model (Attachment 4).

Conclusion

The amendment bylaw presented with this report supports Council's objective to provide end users within the ADEU service area with annual energy costs that are competitive with the conventional system energy costs based on the same level of service. Staff will continuously monitor energy costs and review the rate structures with the objective of ensuring that the

average annual energy costs for end users will not exceed the conventional system energy cost for the same level of service.

The proposed rate structure for Area A encourages energy conservation and efficiency, while at the same time ensuring recovery of the costs necessary to offset initial capital investment and ongoing operating costs.

FOR:

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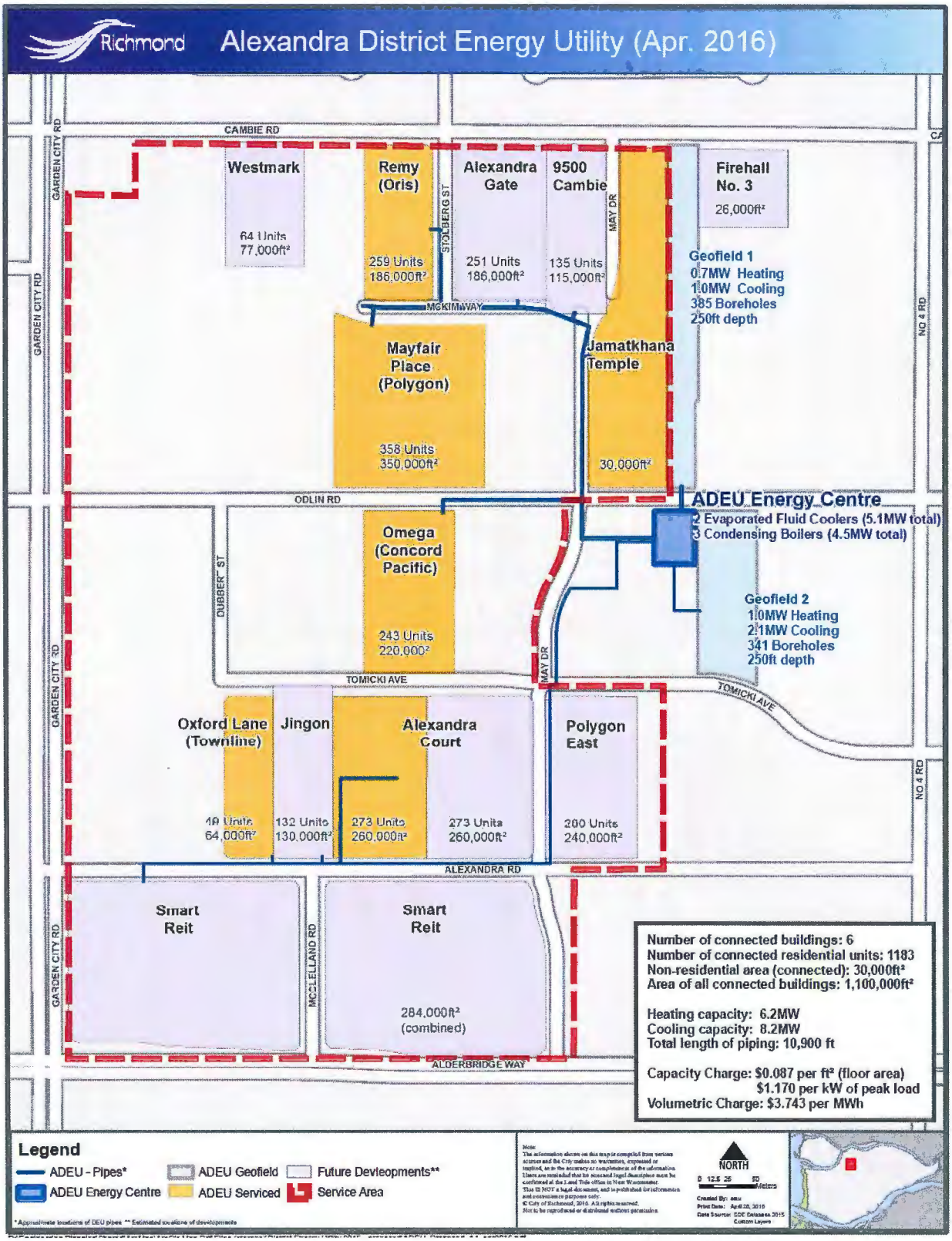
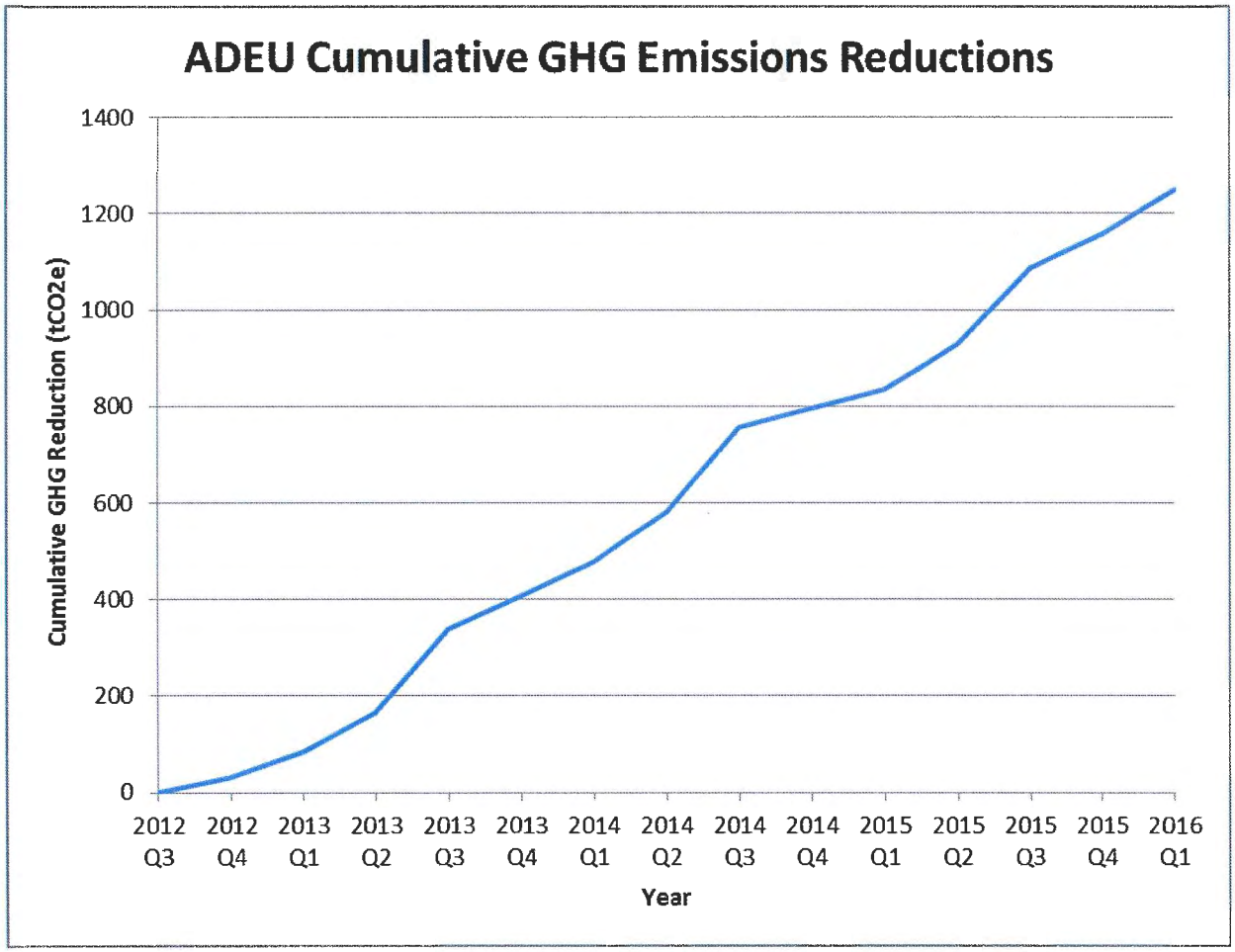
Att. 1: Alexandra Neighbourhood and ADEU Service Area Informational Map
2: ADEU GHG Emission Informational Graph
3: Alexandra District Energy Utility Bylaw No. 8641, Amendment Bylaw No. 9555
4: ADEU Financial Analysis Model

Attachment 1 – Alexandra Neighbourhood and ADEU Service Area Informational Map



Attachment 2 – ADEU GHG Emission Informational Graph



City of Richmond

Bylaw 9555

Alexandra District Energy Utility Bylaw No. 8641 Amendment Bylaw No. 9555

The Council of the City of Richmond enacts as follows:

1. The **Alexandra District Energy Utility Bylaw No. 8641**, as amended, is further amended:

   (a) by adding a new Section 1.2(f) to read as follows, and by re-numbering all sub-sections in Section 1.2 as necessary so that they maintain sequential alphabetical order:

   1.2(f) *"**Common Space Floor Area**" means the total area of all horizontal floor space within a building used as common space or for giving access, including corridors, hallways, landings, foyers, staircases, stairwells, amenity spaces, mechanical/electrical rooms, laundry facilities and common storage facilities;*

   (b) by adding a new Section 1.2(k) to read as follows, and by re-numbering all sub-sections in Section 1.2 as necessary so that they maintain sequential alphabetical order:

   1.2(k) *"**Designated (GMAU) Property**" means a Designated Property that is utilizing gas make-up air units as approved by the City;*

   (c) by deleting the definition of Gross Floor Area from Section 1.2 in its entirety and replacing it with the following new definition:

   1.2(r) *"**Gross Floor Area**" means:*

   (i) *for Designated Properties, the total area of all horizontal floors, measured to the outer building limits, including all uses and all Common Space Floor Area, and includes enclosed balconies and mezzanines, enclosed porches or verandas, elevator shafts and accessory buildings, except those used for parking; and*

   (ii) *for Designated (GMAU) Properties, the total area of all horizontal floors, measured to the outer building limits, including all uses and all Common Space Floor Area, and includes enclosed balconies*

and mezzanines, enclosed porches or verandas, elevator shafts and accessory buildings, except those used for parking, less the Common Space Floor Area multiplied by a factor of 1.5;

(d) by deleting Schedule C (Rates and Charges) in its entirety and replacing with a new Schedule C attached as Schedule A to this Amendment Bylaw.

2. This Bylaw is cited as "**Alexandra District Energy Utility Bylaw No. 8641, Amendment Bylaw No. 9555**".

FIRST READING _____

SECOND READING _____

THIRD READING _____

ADOPTED _____

CITY OF RICHMOND
APPROVED for content by originating Dept.
APPROVED for legality by Solicitor

_____ MAYOR

_____ CORPORATE OFFICER

Schedule A to Amendment Bylaw No. 9555

SCHEDULE C to BYLAW NO. 8641

Rates and Charges

PART 1 - RATES FOR SERVICES

The following charges will constitute the Rates for Services for the Service Area excluding shaded Area A as shown in Schedule A to this Bylaw:

(a) Capacity charge – a monthly charge of $0.087 per square foot of Gross Floor Area, and a monthly charge of $1.170 per kilowatt of the annual peak heating load supplied by DEU as shown in the energy modeling report required under Section 21.1(c); and

(b) Volumetric charge – a charge of $3.743 per megawatt hour of Energy returned from the Heat Exchanger and Meter Set at the Designated Property.

PART 2 - RATES FOR SERVICES APPLICABLE TO AREA A

The following charges will constitute the Rates for Services applicable only to the Designated Properties identified within the shaded area (Area A) shown in Schedule A to this bylaw:

(a) Volumetric charge – a charge of $66.92 per megawatt hour of Energy returned from the Heat Exchanger and Meter Set at the Designated Property calculated on each of (i) an energy use of 2644 MWh per annum ("Basic Supply Amount"), and (ii) any energy use in excess of the Basic Supply Amount.

Attachment 4– ADEU Financial Analysis Model (to build-out)

*Preliminary draft based on current assumptions. Financial Model is subject to change as these facts and assumptions change.

	(All dollar figures are in thousands of dollars)										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 10	Year 15	Year 20	Year 25	Year 30
	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
TOTAL REVENUE	$ -	$ 72	$ 479	$ 601	$ 912	$ 1,310	$ 4,237	$ 7,507	$ 9,134	$ 11,113	$ 13,520
TOTAL EXPENSES	$ -	$ 6	$ 181	$ 206	$ 251	$ 1,087	$ 1,390	$ 2,073	$ 2,515	$ 3,050	$ 3,701
DEBT INTEREST EXPENSE	$ -	$ -	$ -	$ -	$ -	$ -	$ 528	$ 1,466	$ 416	$ 109	$ -
PROJECTED OPERATION INCOME (LOSS) BEFORE AMORTIZATION	$ -	$ 65	$ 298	$ 394	$ 661	$ 224	$ 2,319	$ 3,968	$ 6,203	$ 7,954	$ 9,819
Principal Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ 651	$ 4,135	$ 1,245	$ 109	$ -
PROJECTED CASHFLOW	$ -	$ 65	$ 298	$ 394	$ 661	$ 224	$ 1,668	($ 168)	$ 4,958	$ 7,845	$ 9,819
Cumulative Project Cashflow	$ -	$ 65	$ 363	$ 757	$ 1,418	$ 1,641	$ 8,107	$ 8,203	$ 14,767	$ 48,958	$ 94,402
Internal Rate of Return (IRR) over 30 years:											
CAPITAL INVESTMENT*	($ 2,300)	($ 2,066)	$ -	($ 1,634)	($ 18,100)	$ -	$ -	$ -	$ -	$ -	$ -
Annual Cash Inflow from Operation	$ -	$ 65	$ 298	$ 394	$ 661	$ 224	$ 2,319	$ 3,968	$ 6,203	$ 7,954	$ 9,819
Net Annual Cashflow of Investment	($ 2,300)	($ 2,001)	$ 298	($ 1,240)	($ 17,439)	$ 224	$ 2,319	$ 3,968	$ 6,203	$ 7,954	$ 10,384
CUMULATIVE DEBT LOAD	$ 2,412	$ 4,566	$ 4,646	$ 6,405	$ 25,731	$ 27,017	$ 36,149	$ 23,084	$ 2,582	($ 0)	($ 0)
CUMULATIVE PROJECTED NET INCOME	($ 49)	($ 106)	$ 69	$ 341	$ 521	($ 79)	$ 3,516	$ 14,526	$ 35,401	$ 66,348	$ 109,066
IRR:	10.93%										
NPV:	$ 18,214										
Payback Period:	17 year	(time to recover original investment of $30.8M from operation income)									

The projections are based on prospective results based on assumptions about future conditions and courses of action.
The current model assumes internal borrowing for Phase 3 at an interest rate of 5% over 15 years.
*Includes an estimation of the remaining value of capital equipment.