April 12, 2024

Angela Enman
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Dear Angela Enman,

RE: ECM Comparison for Building Envelope Components (R2) **RJC No. VAN.118538.0003**
Prince George Aquatic Centre
1170 George Paul Lane Prince George BC V2N 0E1

Read Jones Christoffersen Ltd. (RJC) has been asked to discuss the impact of various energy conservation measures (ECMs) related to building envelope component upgrades at the Prince George Aquatic Centre (PGAC). The Aquatic Centre is an enclosed natatorium located in Prince George in Northern BC. This high-level energy analysis is based on relative energy savings and excel-based calculations, providing a list of ECMs that pertain to the exterior building renovation components in comparison to the existing building. These calculations can be considered high level as they isolate the effects of each measure from other systems, as opposed to a whole building energy model which includes an evaluation of the buildings energy systems as a whole.

1.0 Energy Conservation Measures

In addition to the baseline building, five different energy conservation measure bundles were considered for comparative purposes. These ECM bundles relate to the various scopes of work developed by FBA and priced out in the Class D cost estimate as part of the first phase of the PGAC Renewal Project.

Equation 1 below was used to calculate the approximate energy use through the building envelope components over one hour. The heating degree days for Prince George are per the 2018 BCBC. The areas used in the following calculations were provided to RJC by Faulknerbrown Architects.

Eq. 1: $$Energy\ use\ [kWh] = Area\ [m2] * U - value \left[\frac{W}{m2K}\right] * Heating\ Degree\ Days\ for\ PG\ [K * day] * 24[\frac{hr}{day}]/1000$$

The assumptions pertaining to the various ECM scenarios are outlined in Table 1 below.

TABLE 1 – SUMMARY OF R-VALUES AND U-VALUES FOR EACH ECM SCENARIO

No.	Scenarios	EIFS Walls and Split Faced Block Veneer Walls [ft2·°F·h/BTU]	Curtainwall [BTU/ft2·°F·h]	Glazed Windows and Doors [BTU/ft2·°F·h]	Roof Areas [ft2·°F·h/BTU]
1	Existing Building (Baseline)	R-20	U-0.35	U-0.35	R-20
2	Scope 1A: Increased R-values of walls & roofs. Replacement of punched windows & metal doors (Lower U-values). Renewal of curtainwall (replacement of IGUs and gaskets, retaining existing frames).	R-40	U-0.33	U-0.21	R-50
3	Scope 1B: Scope 1A + full replacement of curtainwall + soffit upgrades + replacement of vestibule doors	R-40	U-0.21	U-0.21	R-50
4	Scope 3: Scope 1B + addition of windows at the east façade	R-40	U-0.21	U-0.21	R-50
5	High performance Option 1 (*Upgrade to Scope 1B*): Increased R-values at Wall & Roof Assemblies; Triple Glazed Windows with Lower U-values at Punched Windows and Curtainwall Systems	R-60	U-0.14	U-0.14	R-70
6	High performance Option 2: (*Upgrade to Scope 3, Addition of Glazing at East Façade*): Increased R-values at Wall & Roof Assemblies; Triple Glazed Windows with Lower U-values at Punched Windows and Curtainwall Systems	R-60	U-0.14	U-0.14	R-70

Note: Certain scope items have minimal impact on the overall energy use at the building and therefore have been excluded from the table above, such as metal and glazed doors, as well as 'Scope 2' which is the addition of canopies over the doors.

Figures 1 and 2 below compare the relative overall predicted energy savings for the five scenarios when compared to the existing building envelope, as well as show a breakdown of relative energy savings by energy conservation measure at each building envelope component.

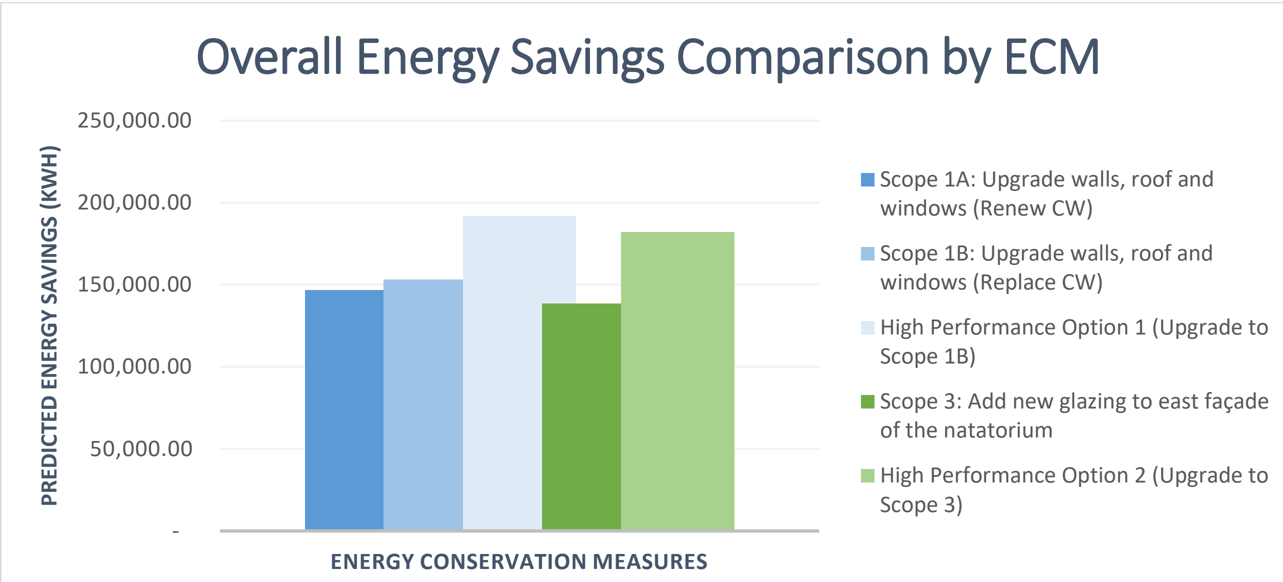

Figure 1: Overall predicted energy savings in kWh at the PGAC, for each ECM scenario

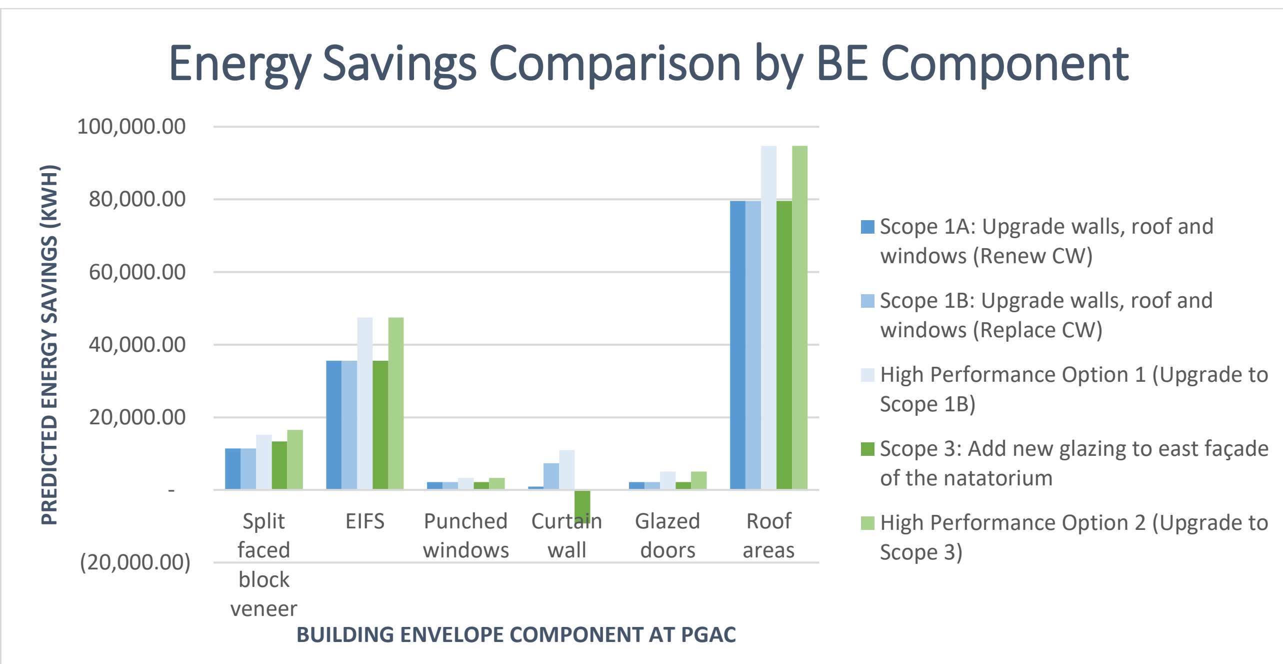

Figure 2: Graph comparing predicted energy savings in kWh across improved building envelope components at the PGAC

As noted at the beginning of this discussion, these calculations can be considered high level as they isolate the effects of each measure from other systems as opposed to a calibrated energy model that evaluates the building as a whole. RJC understands the intent of this letter is to guide a high-level discussion about potential estimated energy use reductions. It should be noted that this is a comparative analysis based on linear equations and does not consider industry accepted understanding of diminishing returns of insulation effectiveness at very thick applications. **Prior to committing to an ECM based on this letter, RJC recommends commissioning a whole building energy model using IES VE or similar that can be calibrated based on past utility data provided by The City of Prince George.** At the same time, consideration should be given to completing a pre-renovation airtightness test to verify the as-built construction airtightness infiltration rate for input into the model for better accuracy, instead of estimating the infiltration rate based on previous experience with buildings of this vintage and construction.

It should be noted that the actual performance of the proposed design may differ from the modeled building due to several reasons such as: actual weather, building operation, actual schedules and internal gains as outlined in ASHRAE 90.1-2016 User Manual Section 11.2.

2.0 Expected Useful Service Life of New BE Components

As requested by the City of Prince George, RJC has provided the expected useful service life for the major building envelope components being replaced at the PGAC. These service life estimates assume that regular maintenance of the components will occur over their lifetime, as described in the column on the right in the table below. The lifespan of a component can vary greatly depending on the exact products installed, the method and quality of installation, and maintenance or lack thereof. Typically, sealants should be budgeted for replacement every five years. However, like all recommended maintenance, regular reviews should be undertaken to cater the maintenance and renewal plan to the rate of deterioration at this specific building. Lastly, with regular maintenance, the expected service life of the components listed below may be extended to align the replacement of multiple components at once to achieve construction cost savings.

Building Envelope Component	Approximate Remaining Service Life of Existing Components*	Expected Service Life (ESL) of New Components	Recommended Maintenance Plan for New BE Components Necessary to Achieve the ESL
EIFS Wall Assembly (Rainscreened)	1 Year	30 Years	Repair deficiencies in field of EIFS panels, and replace sealants between panels or install silicone strips at panel joints at regular intervals.
Single Skin Metal Panel Wall Assembly (Rainscreened, with mineral wool insulation, thermally broken clip system and self adhered air/vapour barrier membrane)	N/A	50 Years	There are many factors that will assist with achieving the 50 year life. Localized replacement of metal panels and fasteners may need to occur to achieve the full service life. Concealed vs. exposed fasteners also affect the service life of the metal panel wall assembly differently.
Split Faced Block Veneer Wall Assembly (Rainscreened)	1 Year	75 Years	Replace sealants at control joints and repoint mortar at regular intervals. There are many factors that will assist with achieving the 75 year life. Localized replacement of shelf angles or ties may need to occur to achieve the full service life.
Conventional Roof Assembly	0 Years	25 Years	Maintain functionality of drains by removing debris on a regular basis, repair roof leaks as soon as they occur.
Punched Aluminum Windows (Double or triple glazed)	5 Years	30 Years	Replace sealants at regular intervals. Review and repair any leaks that occur over the lifetime of the windows. Replace IGUs as needed.

Curtainwall System (Double or triple glazed)	25 Years	50 Years (Full replacement of system) 25 Years (Renewal of system, keeping existing frame)	Review and repair any leaks that occur over the lifetime of the windows. Budget for replacement of IGUs around the 25 to 30 year mark.

*The approximate remaining service life of existing building envelope components at the PGAC has been estimated based on typical expected service life, in addition to a visual condition assessment of the building, conducted by FBA and RJC in the Fall of 2023.

3.0 Limits of Commission

Our opinion cannot be extended to portions of the site that were not reviewed or situations reasonably beyond the control of RJC. If unexpected conditions are encountered at the site, RJC must be notified in order that we may determine if modifications to the conclusions presented here are necessary. Any conclusions or recommendations presented in this report were determined from the limited information available.

This report has been prepared in accordance with generally accepted engineering practices. No other warranties, expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report. A detailed review of the structural system, including seismic restraint, was not included in the scope of work.

The material in this report reflects the best judgment of RJC with the information made available to us at the time of preparation. Any use that a third party may make of this report or any reliance on or decisions made based upon the report, are the responsibility of such third parties.

The input summary table of this report should be reviewed by the Client and Consultant Design Team to confirm that the information and assumptions are reasonable and will be achieved through the design of architectural, enclosure, mechanical, and electrical systems.

The Client recognizes that special risks occur whenever engineering or related disciplines are applied to identify hidden elements or portions of a building. Even a comprehensive sampling and testing program, implemented with the appropriate equipment and experienced personnel, under the direction of a trained professional who functions in accordance with a professional standard of practice, may fail to detect certain conditions. This is because these conditions are hidden and therefore cannot be considered in the development recommendation. For similar reasons, actual conditions that the design professional properly inferred to exist between examined conditions may differ significantly from those that actually exist.

4.0 Closing

This report was prepared for FaulknerBrowns Architects and The City of Prince George. It is not for the use or benefit of, nor may it be relied upon, by any other person or entity, without written permission of RJC.

We trust the information contained within this report satisfies your current requirements. Should you have any comments, questions or concerns, please contact the undersigned. We remain available to review and discuss findings and future action.

Yours truly,

READ JONES CHRISTOFFERSEN LTD.
EGBC Permit to Practice No. 1002503

2024-04-12

Maddie Reid, BSc, P.Eng., CPHD
Project Engineer

MCR/jpy