April 4, 2024

Engineers

Angela Enman
FaulknerBrowns Architects
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Vancouver BC V6B 2V2
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Dear Angela Enman,

RE: ECM Comparison for Building Envelope Components (R1) **RJC No. VAN.118538.0003**
Prince George Aquatic Centre
2187 Ospika Blvd South Prince George BC V2N 6Z1

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 CN Centre. The CN Centre is an enclosed arena multiplex 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 CN Centre 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.

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 scenarios are outlined in Table 1 below.

TABLE 1					
No.	**Scenarios**	**Stucco Walls and CMU Veneer Walls [ft2·°F·h/BTU]**	**Glazed Windows and Doors [BTU/ft2·°F·h]**	**Exposed Mass Concrete Walls [ft2·°F·h/BTU]**	**Standing Seam Metal Walls and [ft2·°F·h/BTU]**
1	Existing Building (Baseline)	R-11, R-7.5	U-0.35	R-1.6	R-15
2	Scope S1 – Increase R-values of stucco and CMU veneer walls; replacement of existing glazed windows and doors with improved U-values	R-40	U-0.21	R-1.6	R-15
3	Scope S2 – Scope S1 + replacement of metal doors; upgrade R-value of exposed mass concrete wall	R-40	U-0.21	R-40	R-15
4	Scope S4 – Scope S2 + replacement of standing seam metal roof and wall assemblies	R-40	U-0.21	R-40	R-50
5	High performance Scope S1	R-60	U-0.14	R-40	R-50
6	High performance Option 2: Higher performing version of Scope S4	R-60	U-0.14	R-40	R-70

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 predicted energy savings by energy conservation measure at each building envelope component.

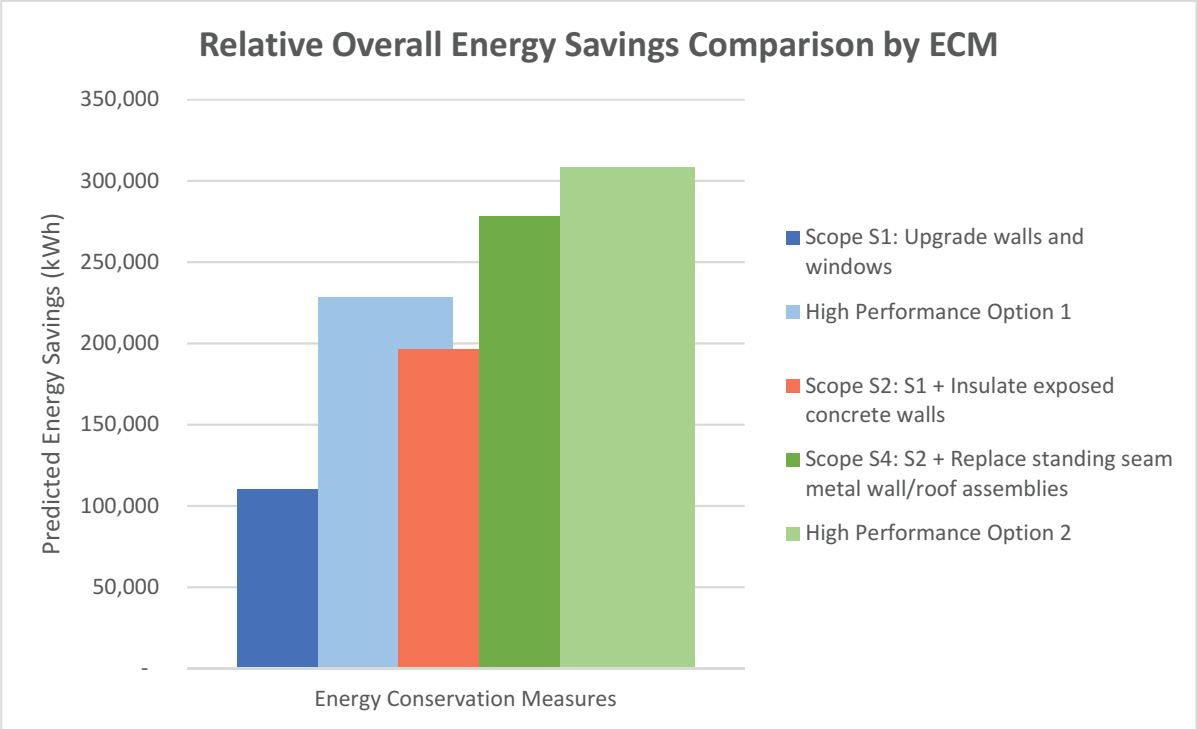

Figure 1: Relative Overall energy savings in kWh at the CN Centre, for each ECM scenario

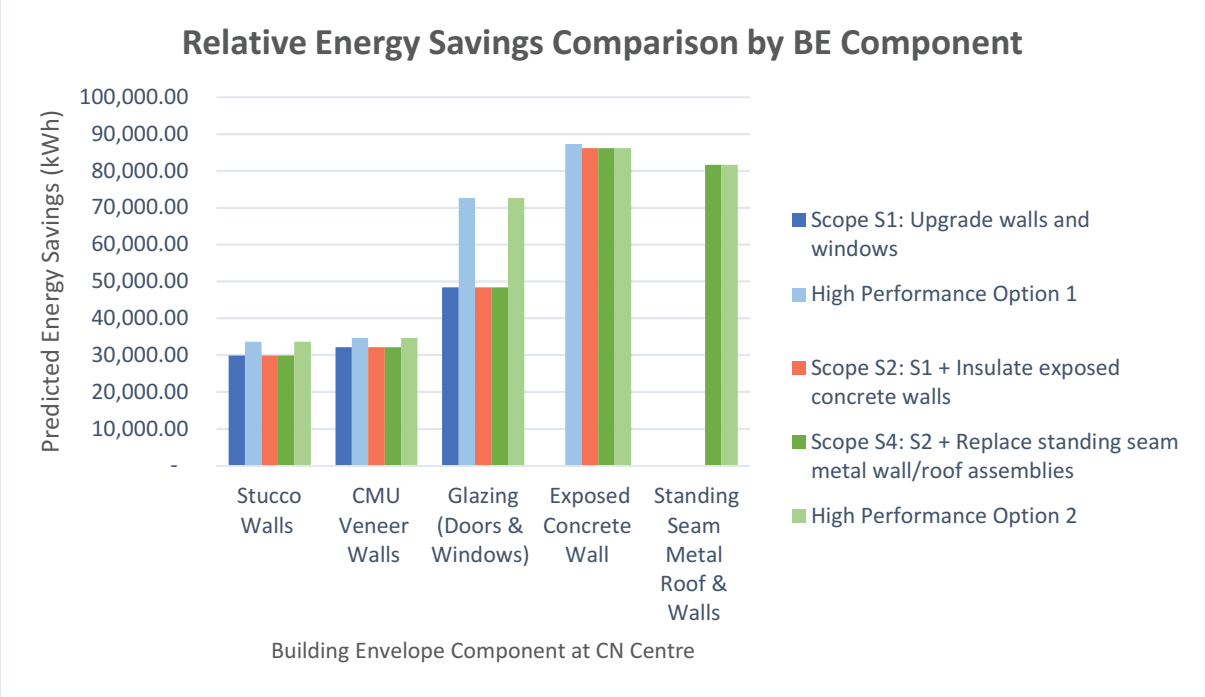

Figure 2: Graph comparing relative energy savings in kWh across improved building envelope components at the CN Centre

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 VE2019 or similar that can be calibrated based on past utility data provided by The City of Prince George.** At the same time, consideration to complete 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 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.

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.

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 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.

3.0 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

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

MCR/jpy