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ESQUIMALT RECREATION CENTRE CALIBRATION REPORT

2025-12-05





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WSP

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1 INTRODUCTION

1.1 CONTEXT

WSP energy performance team was mandated by Township of Esquimalt to assess energy benefits of a list of energy conservation measures options that they will develop for the Esquimalt Recreation Centre located in Esquimalt, British Columbia. The objective is to create a calibrated energy model in IESVE based on building documents, utilities, and monitored data. Afterwards this model will be used to analyze energy conservation measures.

1.2 REFERENCE DOCUMENTS

This energy modeling was prepared based on the following reference documents:

- Site Visit information
 - Utility bills
 - Building Automation System
-

1.1 DISCLAIMER

Plant loads estimates presented in this report are preliminary values. They will be refined during the energy model calibration process. If WSP energy performance team can have access to monitored data from the BAS, theoretical results from the energy model can be compared to actual data.

2 INPUT PARAMETERS

2.1 BUILDING

In this section are listed the main parameters specified in IESVE to estimate the plant peak heating and cooling loads. Please note that the IESVE energy model does not include the snowmelt system.

- **Building envelope areas**

	TOTAL AREA		GLAZING AREA		WINDOW TO WALL & SKYLIGHT TO ROOF RATIOS
	(m ²)	(ft ²)	(m ²)	(ft ²)	
North Walls	440.2	4738.3	21.1	227.1	4.8%
East Walls	806.1	8676.8	154.5	1663.0	19.2%
South Walls	507.8	5465.9	70.9	763.2	14.0%
West Walls	751.7	8091.2	192.0	2066.7	25.5%
Roof	3890.3	41874.8	0.0	0.0	0.0%

- **Building envelope opaque surfaces effective thermal resistances**

	RSI (M ² -K/W)	U-VALUE (W/M ² .K)
Walls	0.47	2.11
Roof	1.63	0.61

- **Building envelope glazing thermal conduction and shading coefficient**

	U (W/M ² -K)	SHGC
Windows	3.81	0.4

- **Internal gains**

Equipment and people gains are set at ASHRAE 90.1-2010 values. Please refer to the following table for more details.

SPACE FUNCTION (NECB 2011)	EQUIPMENT (W/M2)	PEOPLE (M2/P)
Atrium	5.382	0.62
Conference/ Meeting/ Multipurpose	10.764	1.858
Corridor/ Transition	2.153	0
Electrical/ Mechanical	2.153	0
Food Preparation	16.146	1.328
Gymnasium/ Fitness Center – Exercise Area	5.382	9.290
Gymnasium/ Fitness Center – Playing Area	5.382	3.096
Healthcare Facility – Exam Treatment	16.146	9.290
Healthcare Facility – Physical Therapy	16.146	4.645
Loading Dock	0	4.645
Lobby	5.382	0.620
Office	10.764	18.581
Restrooms	0	0
Sales area	5.382	6.194
Stairs	0	0
Storage	0	0
TOTAL	23.8kW	1677

- **Interior lighting:** The interior lighting is based on spec sheets, drawings and observation on site. The total interior lighting power is 19.785kW with average lighting power density of 3.61W/m2.

- **Building's occupancy:** Operation from 5:30-22:30 Monday to Sunday.
- **Weather file:** 2020 CWEC of Esquimalt Harbour (ASHRAE Climate Zone 5C)
- **Heating and cooling setpoint:** Heating: 21°C, Cooling: 24°C. Heating setback: 15°C, Cooling setback: 27°C
- **Infiltration:** 1.529 L/s-m² at 75Pa of exterior walls and roofs
- **Building envelope heating loads:** It is assumed that these loads are served by the radiant panels, radiators and convectors. However, from October to April, the fans will also cycle during the night when needed, to meet the heating setpoint.
- **Heating plant:** The heating plant is composed of two main gas condensing boilers (879.2kW) supplies hot water for AHU coils, reheat coils for AHU-2 and AHU-3, pool heating as well as DHW. The hot water loop supplies water at 71°C.
- **Hot water pumps:**

Pump ID	Area Served	Schedule	Power (HP)	Description
P-M1	Boiler Supply Pump	Space, pool and DHW heating	2	- Model Armstrong
P-M2	Boiler Supply Pump	Space, pool and DHW heating	2	- Model Armstrong
P-M3	Pool Heating Supply Pump	Pool heating	3	- Model Armstrong
P-M4	DWH Supply Pump	DHW heating	0.75	- Model Armstrong
P-M5	AHU-1 Hot water supply pump	Space heating	0.75	- Model Armstrong
P-M6	AHU-2,3 HW supply pump	Space heating	1	- Model Armstrong
P-M7	DHW Tank Circulation Pump	DHW heating	0.25	- Model Bell & Gossett
P-M8	DHW Re-Circulation Pump	DHW heating	0.17	- Model Bell & Gossett
PP-1	Main Pool Vacuum Pump/Motor	Pool heating	1	- Model Sta-rite
PP-2	Whirlpool Circulation Pump/Motor	Pool heating	15	- Model Techtop
PP-3	Whirlpool Water Features Pump/Motor	Pool heating	15	- Model WEG

Pump ID	Area Served	Schedule	Power (HP)	Description
PP-4	Lifestyle Pool Water Features Pump/Motor	Pool heating	3	- Model Techtop
PP-6	Tots Pool Circulation Pump/Motor	Pool heating	10	- Model Osborne
PP-9	Tots Pool Water Features Pump/Motor	Pool heating	5	- Model AP Aurora
PP-11	Lazy River Jets Pump/Motor	Pool heating	25	- Model Osborne
PP-11A	Lazy River Vortex Pump/Motor	Pool heating	25	- Model Osborne
PP-12	Sheet Flow Pump/Motor	Pool heating	5	- Model Marathon
PP-14A	Popkorn Pump/Motor	Pool heating	2	- Model Techtop
PP-14B	Bubbler Pump/Motor	Pool heating	2.5	
PP-15	Lifestyle Pool Circulation Pump/Motor	Pool heating	3	- Model Osborne
PP-21/P15	Heat Recovery Pump/Motor	Pool heating	3	
PP-22	Lap Pool Circulation Pump/Motor	Pool heating	25	- Model Osborne
PP-31	Tots Pool Water Features Pump/Motor	Pool heating	1	- Model Techtop
	Acid Feed Pumps	Pool heating		- Model Pulsafeeder
	Chlorine Feed Pumps	Pool heating		- Model Pulsafeeder
P1	Support heat exchanger loop for Tot, Lifestyle, and Main Pools via heat recovery.	Pool heating		
P2	Support heat exchanger loop for Tot, Lifestyle, and Main Pools via heat recovery.	Pool heating		
P3	Small Circulator Pumps - Tot pool Loop Side Return	Pool heating	0.20	
P4	Small Circulator Pumps - Loop Side return	Pool heating	0.50	

Pump ID	Area Served	Schedule	Power (HP)	Description
P5	Small Circulator Pumps - Lap Pool Loop side supply	Pool heating	0.82	
P6	Small Circulator Pumps - Lifestyle Pool Supply	Pool heating	0.36	
P8	Small Circulator Pumps - Tot pool Return	Pool heating	0.36	
P11	Small Circ Pump - Lap Pool Loop side supply	Pool heating	0.82	

- **Heat pumps:**
 - Water to water heat pumps HP-1 and HP-2 are connected to AHU-1 through a glycol loop to recover heat from return air of the natatorium for pool heating through 3 heat exchangers
- **Pool temperature:** Lifestyle pool: 31.1°C, Tots pool: 32.2°C, Whirlpool: 39.4°C
- **Pool evaporation:** Derived from the water audit calculation and annual water use: 6046m³
- **Domestic water use:** 4219m³ from water audit calculation

- HVAC:

SYSTEM	TYPE OF SYSTEM	SUPPLY FLOW RATE		OUTSIDE AIR FLOW RATE		FANS POWER
		L/s	cfm	L/s	cfm	kW
AHU-1	VAV System	15,102	32,000	3,540	7,500	18.64
AHU-2	CAV System					
AHU-3	CAV System					
AHU-4	CAV System	1,357	2,876			
AHU-5	CAV System	1,448	3,068			
AHU-6	CAV System			0	0	

3 CALIBRATION ADJUSTMENTS

3.1 WATER TO WATER HEAT PUMP HP-1 AND HP-2

Cooling coil and dummy chiller loop is included in AHU-1 to mimic the heat recovery by HP-1 and HP-2.

4 RESULTS

4.1 CALIBRATION RESULTS

Township of Esquimalt provided utility data for the electrical consumption from May 2024 to April 2025. May 2024 to April 2025 has been selected for the model's calibration. The Figure 1 present the modelled electrical consumption compared to 12 months of electric utility data.

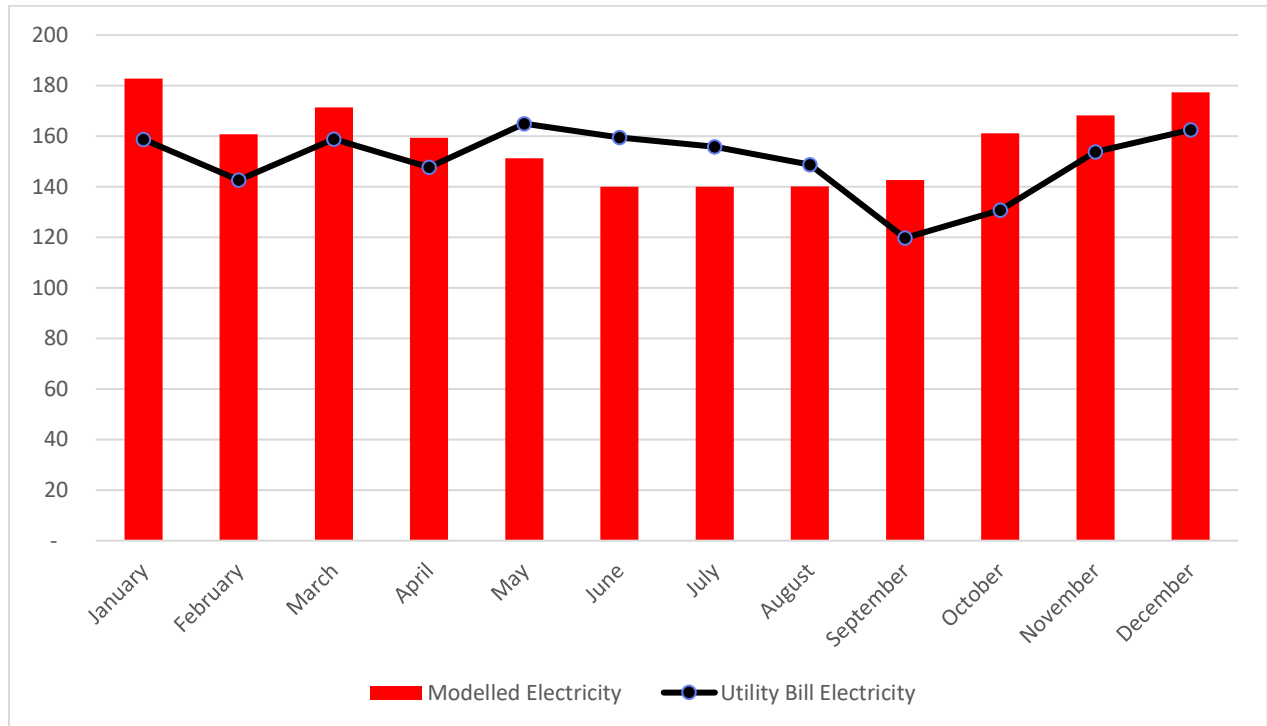


Figure 1 : Electricity Usage: Utility Bill vs Simulation Results

As shown in Table 41, the calibrated electricity results fall within an acceptable error. The modelled electricity consumption is well calibrated.

Table 4-1 : Electricity Calibration

	AVARAGED UTILITY BILL	MODEL	DIFFERENCE
Annual Electricity Consumption (kWh)	1,803,827	1,895,326	5%

Township of Esquimalt provided utility data for the natural gas consumption. May 2024 to April 2025 has been selected for the model’s calibration. This presents the modelled natural gas consumption compared to 12 months of the natural gas utility data.

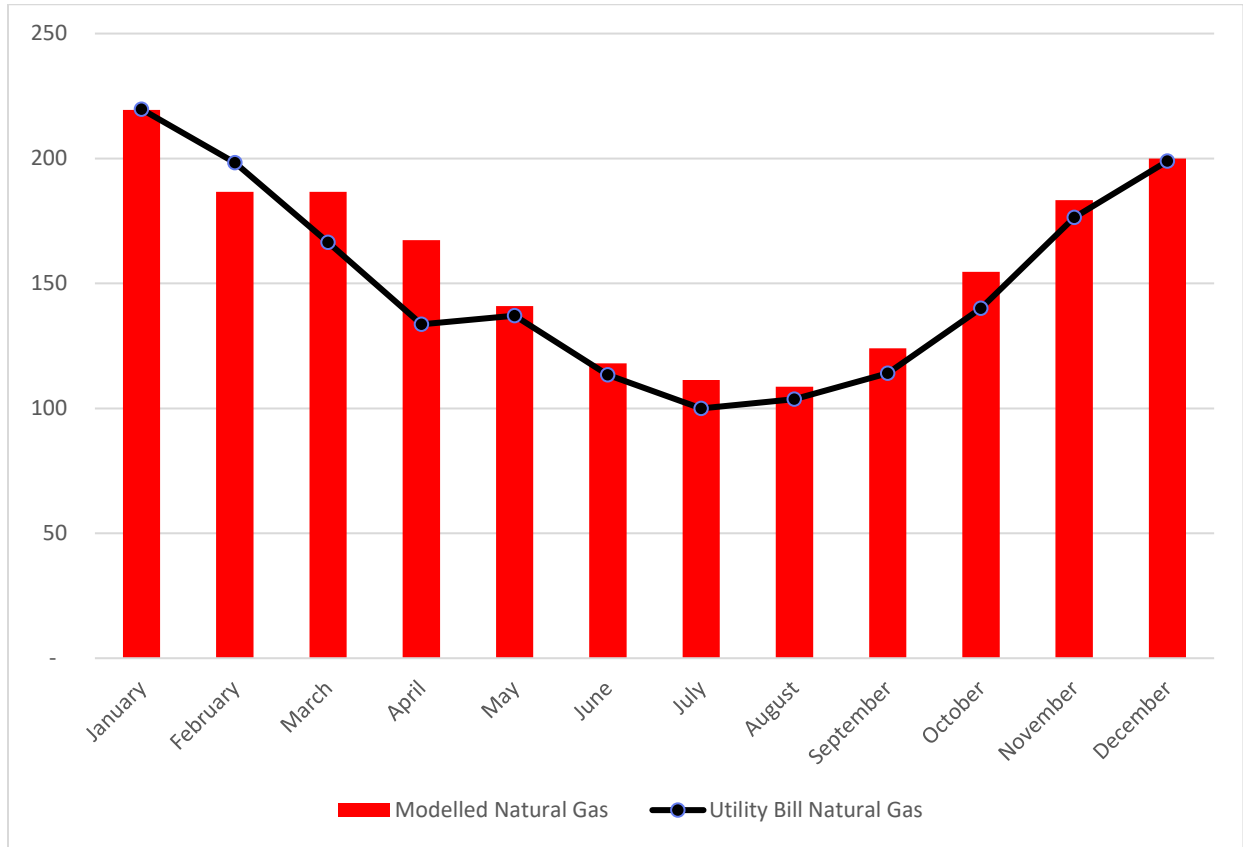


Figure 2 Natural Gas Usage: Natural Gas Utility Data vs Modeled Natural Gas

As shown in Table 4-2Error! Reference source not found., the calibrated natural gas results fall within an acceptable error. The modelled natural gas consumption is well calibrated.

Table 4-2 : Natural Gas Calibration

	AVARAGED UTILITY BILL	MODEL	DIFFERENCE
Annual Natural Gas Consumption (kWh)	1,801,591	1,901,219	6%

4.2 ENERGY END-USE BREAKDOWN

The energy end-use breakdown provided in Table 4-3 and Figure 3 are based on the modelled data.

Table 4-3 Energy End-Use Breakdown

		CONSUMPTION (MWh)	% ENERGY
NATURAL GAS	DWH	204	5.38%
	Space Heating	955	25.17%
	Pool Heating	741	19.53%
	TOTAL	1,901	50.08%
ELECTRICITY	Lighting	123	3.23%
	Equipment	192	5.07%
	Space Heating	637	16.77%
	Space Cooling	25	0.67%
	Heat rejection	2	0.04%
	Pumps	520	13.71%
	Fans	396	10.43%
	TOTAL	1,895	49.92%
TOTAL MIXED ENERGY		3,797	

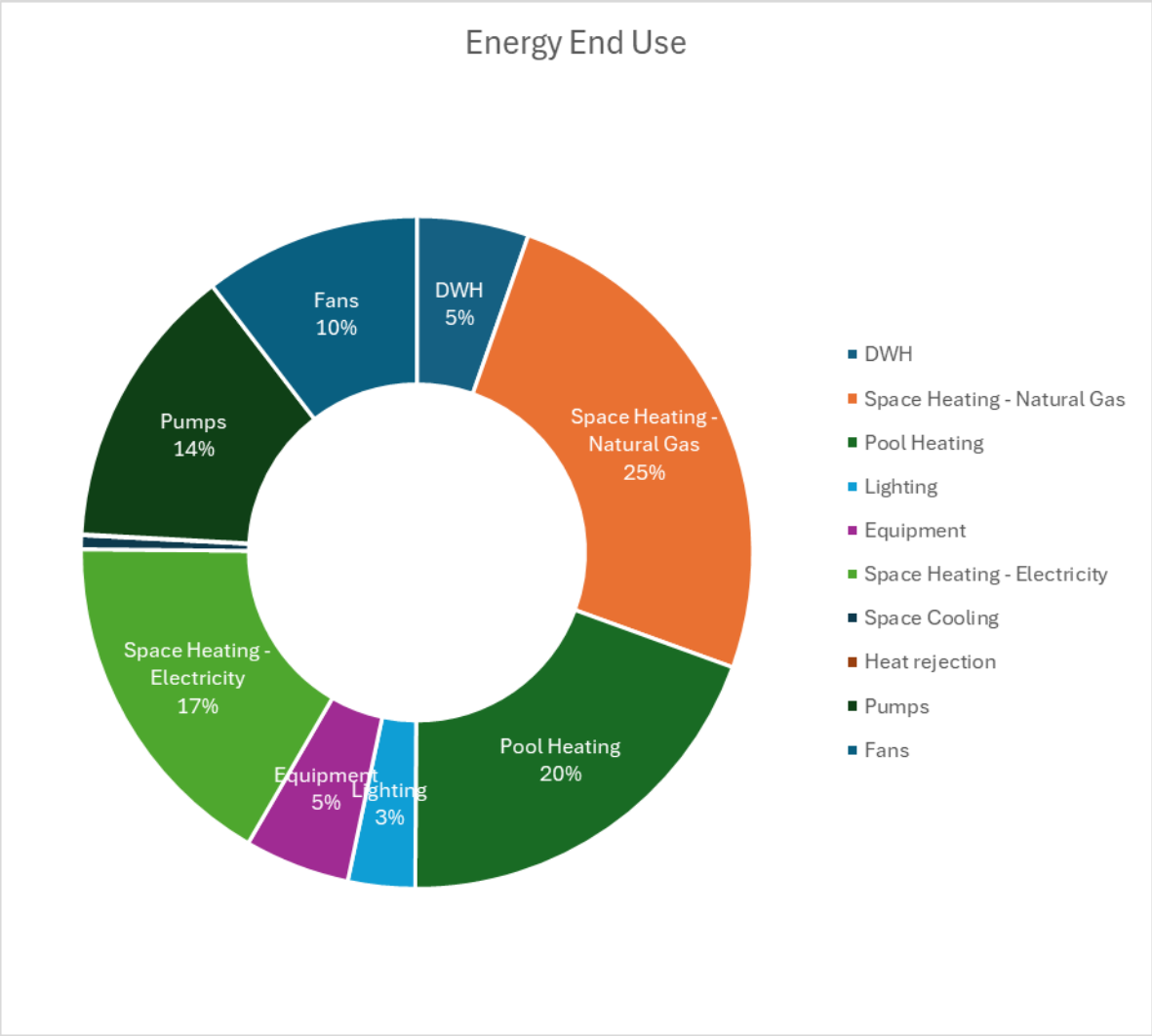


Figure 3 Energy End-Use Breakdown

APPENDIX

