PARTNER ENGINEERS
MEP.DESIGN

ENERGY ANALYSIS REPORT

11788 Tecumseh Rd E – Residential/Commercial
Windsor, ON

Rev	Submission	Date
1	ISSUED FOR REVIEW	8/4/2023
2	ISSUED FOR REVIEW – R1	3/27/2024

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1. DISCLAIMER

The intent of this report is to compare the relative performance of the new residential/commercial building located at 11788 Tecumseh Rd E, Windsor, ON. Documentation of this analysis is included in the following sections of this report. However, this report is not intended to serve as a detailed engineering design document. While the results in this report are believed to be reasonably accurate, the findings are estimates and actual results may vary.

There are many assumptions required to be made in energy modeling. The proposed model cannot necessarily be predictive of future energy consumption and should not be used for budgeting or utility service sizing. All relevant information provided by the client has been included in the analysis as much as possible. All weather data used in the simulation is averaged data provided by ASHRAE Climatic Design Condition 2017. Modeling assumptions are made per Ontario Building Code - Energy Efficiency Supplement (SB) and as a result Partner Engineers Inc. is not liable if projected estimated savings or economics are not actually achieved. All savings and cost estimates in the report are for informational purposes and are not to be construed as a design document or as guarantees.

2. EXECUTIVE SUMMARY

This project includes a 5-floor residential building construction with 50 apartment units in addition to amenity space on the second floor with approximately the total of 6,225 square meter (67,000 square foot).

The intent of this energy strategy report is to identify and evaluate the whole building energy efficiency. Several energy efficiency options were considered to improve the building efficiency including the option of rotating the building. The energy modeling results is showing a very minor changes in energy consumption that is not exceed 1% savings with each orientation. See appendix C for energy report results. Building orientation will remain as proposed at the city permit documents.

Additionally, the efficiency of the mechanical and electrical systems are examined to improve the whole building energy efficiency where possible. A high effeciecny LED lighting and mechanical systems are selected.

The final energy modeling results is outlined below:
Alternative #1: is the proposed building with the total energy consumption of 1,863.4x10^6 Btu/year
Comparing to
Alternative #2: is the baseline building (using minimum code requirements) with total energy consumption of 2,307.5x10^6 Btu/year.

The conclusion is that the total reduction in the proposed building energy consumption is approximately 444x10^6 Btu/year. This represents approximately 19.25% savings on energy consumption and 26 tCO2e/year (tonnes of equivalent CO2 emissions per year of operation).

The following report details the information of the inputs and analysis completed. A print out of the energy simulation results is included in Appendix C of this report.

Please do not hesitate to contact us with any questions or concerns.

3. PROJECT SUMMARY

A schematic design (SD) level energy analysis for the subject building was undertaken to examine the energy performance of the project and identify opportunities for improvement. The building modeled is composed of five-stories residential units, total of 50 residential units, in addition to amenity space on the second floor.

3.1 MODELING ASSUMPTIONS

The energy model created for this study was based upon schematic design (SD) data for space layouts, envelope performance, system performance, and internal loads. A brief overview of the model created are outlined below:

- Wall areas and Window areas are taken from the site plan package
- Windsor airport weather station data is used.
- Mechanical systems are modeled as water source heat pumps with central cooling tower for heat rejection and gas fired boiler for heat source. A dedicated water source heat pump indoor cabinet type unit with a dedicated outside air energy recovery unit will be serving each residential unit.
- Lighting power intensities are modeled as LED.
- Envelope values are modeled as current Ontario Building Code as shown in SB-10, table SB 5.5-5 2017.

The primary objective of this study was to identify elements which had the greatest impact on the project's energy performance. The areas of focus in this study were the performance of the envelope components and interior loads. The impact of these elements was based on the energy use intensity (EUI), energy cost comparison, and peak cooling load. The EUI is a metric of energy per unit of area of the building, akin to fuel economy in automobiles. The comparative energy costs are based on flat, blended rates, which account for both demand and usage costs. The peak cooling load is critical for proper equipment capacity selection as well as energy consumption for the life of the building.

4. MODEL DESCRIPTION

4.1. MODELING SOFTWARE INFORMATION

All energy modeling was completed using the building energy simulation tool Trane Trace 700 Version 6.3.5 that is capable of the annual hourly analysis for the entire year as required by ASHRAE Standard 140.

The weather data used in the simulation is from a typical meteorological year (TMY3) file. TMY3 files have monthly averaged weather data from a period of time and from a local weather station to the project. The simulations for all design iterations below utilized the TMY3 file from Windsor airport weather station.

4.2. OVERALL MODELING SETUP

The energy analysis was completed by constructing an energy model representing the performance of the base building with the code mandatory minimum values and the proposed building with actual building materials and systems inputs. These building alternatives were developed based on floor plans and other supplemental information provided by the Architect and the owner representatives. Any missing information was based upon industry acceptable guidelines, using National Energy Code of Canada for Buildings (NECB) as the applicable energy code. Any unknowns within the analysis were held constant between the two alternatives.

4.3. INTERNAL LOADS

Densities for occupancies and power are based on a building area method as outlined by ASHRAE Fundamentals Handbook and other industry standards.

4.4. ENVELOPE

Envelope performance values for the model have been based on information available to the design team at the time of modeling. This information was based on supplied design documents as well information from the Architect. All U-value calculations were completed using building envelope requirements for zone 5-A per ASHRAE 90.1-2013 and Ontario Building Code – table SB 5.5-5-2017, APPENDIX B – TABLE SB 5.5-5-2017 Building Envelope.

4.5. LIGHTING

Building lighting systems were based upon Interior Lighting Power Allowance (ILPA) by building type specified by ASHRAE 90.1-2017 lighting power densities listed in Table 9.5.1.

4.6. HVAC

The building design team had an early stage dialogue to discuss several HVAC systems that were carefully considered to suit the space use, unit metering, and occupancy comfortability. The design team has decided to proceed with:

- Water source heat pumps with central cooling tower for heat rejection and gas fired boiler for heat source. A dedicated water source heat pump indoor cabinet type unit with a dedicated outside air energy recovery unit will be serving each residential unit.

Space design set-point conditions were assumed to be 75F cooling and 70F heating. Setbacks were assumed to be 80F cooling and 65F heating.

5. ENERGY RATES

Energy costs were based upon average rates as determined by the Department of Energy. These rates include the impact of demand and consumption as a single rate based on total consumption. These rates were directly input into the model and used for the analysis of all three alternatives. The energy rates are as follows:

Electricity

- $0.16 / kWh

Natural Gas

- $0.45 / M3
- $1.27/therm

6. TOWARDS ZERO EMISSIONS

The ultimate goal of the Canada Green Buildings Strategy is a net-zero emissions and climate-resilient buildings sector by 2050, with an interim goal of 37% emissions reduction from 2005 levels by 2030. The team evaluated several design options to assess the feasibility and constructability of Energy Conservation Measures (i.e. ECM's) that puts this building on a path towards Zero Emissions operation. Several priorities and objectives were balanced in the decision making process, including:

1. Energy consumption & efficiency
2. Operation schedules suitable for residential and commercial use
3. GHG emissions measured in CO_2e
4. Energy resilience suitable for residential use
5. Feasibility and constructability

APPENDIX A – UNITS OF MEASURE, ABBREVIATIONS AND DEFINITIONS

Please note the definitions below shall be used as a guide for this energy study. These definitions may have different meanings in other applications:

- U-Value: A measure of the heat transmission through a building part or a given thickness of a material. A construction with a lower U-value indicates better insulating properties
- R-Value: A measure of resistance to the flow of heat through a given thickness of a material or construction. A construction with a higher R-value indicates better insulating properties
- Shading Coefficient: The ratio of radiant heat gained through a given type of glass relative to 1/8-in.-thick single clear glass. Value can range from 0 to 1 with lower values indicating better performing windows in terms of heat gain.
- Packaged DX: A type of HVAC technology that utilizes direct expansion and holds the components for heating and cooling within a single enclosure.
- Trane Trace: a widely used, time-proven whole building energy performance design tool.
- EUI: Energy Use Intensity in kBtu/square foot/year – a measure of how much energy per square foot a building uses per year.
- kWh : kilowatt hours; a unit of measure for energy use, typically for electricity.
- kW: kilowatt; a unit of measure for energy demand, typically for electricity.
- Building Area Method: A method of using the common building use type and building area to determine building power allowances.
- MBH: 1,000 Btu's per hour; a measure of energy demand.
- MMBtu: 1,000,000 Btu's; a measure of energy use.
- Therm: A unit of heat equivalent to 100,000 Btu or 1.055 x 10^8 joules. Commonly used measurement of gas.

APPENDIX B – TABLE SB 5.5-5-2017 BUILDING ENVELOPE

11788 Tecumseh Rd E

TABLE SB 5.5-5 (See Appendix A.)
(Supersedes Table 5.5-5 in 2010 ANSI/ASHRAE/IES 90.1)
Building Envelope Requirements for Climate Zone 5 (A, B, C) (SI)

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Max. U	Insulation [d] Min. RSI-Value	Assembly Max. U	Insulation [d] Min. RSI-Value	Assembly Max. U	Insulation [d] Min. RSI-Value
Roofs						
Insulation Entirely above Deck	U-0.22	4.4 ci	U-0.22	4.4 ci	U-0.53	1.8 ci
Metal Building	U-0.20	3.3 + 1.9 Ls	U-0.20	3.3 + 1.9 Ls	U-0.39	2.3 + 3.3
Attic and Other	U-0.12	8.6	U-0.12	8.6	U-0.19	5.3
Walls, Above Grade						
Mass	U-0.45	2.3 ci	U-0.40	2.7 ci	U-0.70	1.3 ci
Metal Building	U-0.30	2.3 + 2.3 ci	U-0.30	2.3 + 2.3 ci	U-0.45	2.3 + 1.1 ci
Steel Framed	U-0.31	2.3 + 1.8 ci	U-0.31	2.3 + 1.8 ci	U-0.48	2.3 + 0.7 ci
Wood Framed and Other	U-0.29	2.3 + 1.3 ci	U-0.26	2.3 + 1.8 ci	U-0.36	2.3 + 0.7 ci
Wall, Below Grade						
Below Grade Wall	C-0.52	1.8 ci	C-0.52	1.8 ci	C-0.68	1.3 ci
Floors						
Mass	U-0.36	2.2 ci	U-0.32	2.6 ci	U-0.61	1.1 ci
Steel Joist [c]	U-0.18	6.7	U-0.18	6.7	U-0.21	5.3
Wood Framed and Other [c]	U-0.15	5.3 + 1.3 ci	U-0.15	5.3 + 1.3 ci	U-0.19	5.3
Slab-On-Grade Floors						
Unheated	F-0.93	1.8 for 600 mm	F-0.90	2.6 for 600 mm	F-0.93	1.8 for 600 mm
Heated	F-0.76	2.6 for 900 mm + 0.9 ci below	F-0.76	2.6 for 900 mm + 0.9 ci below	F-1.56	1.8 for 600 mm
Opaque Doors						
Swinging	U-2.27		U-2.27		U-3.41	
Non-Swinging	U-2.27		U-2.27		U-2.84	
Fenestration	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Max. U	Assembly Max. SHGC
Vertical Fenestration, 0% - 40% of Wall						
Nonmetal framing: all [a]	U-1.42	0.35	U-1.42	0.40	U-3.12	NR
Metal framing: curtainwall / storefront [b]	U-1.99		U-1.99		U-3.41	
Metal framing: entrance door [b]	U-3.97		U-3.97		U-4.54	
Metal framing: all other [b]	U-2.56		U-2.56		U-3.69	
Skylight with Curb, Glass, % of Roof						
0% - 5.0%	U-3.80	0.36	U-3.80	0.36	U-11.24	NR
Skylight with Curb, Plastic, % of Roof						
0% - 5.0%	U-3.92	0.34	U-3.92	0.34	U-10.79	NR
Skylight without Curb, All, % of Roof						
0% - 5.0%	U-2.56	0.36	U-2.56	0.36	U-7.72	NR

residential

retail

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The following definitions apply: ci = continuous insulation, Ls = liner system, NR = no (insulation) requirement.
a Nonmetal framing includes framing materials other than metal with or without metal reinforcing or cladding.
b Metal framing includes metal framing with or without thermal break. The all other subcategory includes operable windows, fixed windows, and non-entrance doors.
c See Section 5.5.1.(7) under Sentence 1.1.1.3.(2) of Chapter 2 of this Division.
d Alternative combinations of insulation RSI-values are permitted provided the combinations are designed in accordance with "Normative Appendix A" of 2010 ANSI/ASHRAE/IES 90.1.

APPENDIX C – ENERGY MODELING REPORTS

Energy Cost Budget / PRM Summary

By HED

Project Name:	Date: March 26, 2024
City:	Weather Data: Detroit, Michigan

Note: The percentage displayed for the "Proposed/ Base %" column of the base case is actually the percentage of the total energy consumption.

* Denotes the base alternative for the ECB study.

		* Alt-2 OBC SB-10, Climate Zon			Alt-1 Proposed Building		
		Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh
Lighting - Conditioned	Electricity	285.2	12	144	190.1	67	96
Space Heating	Electricity	0.0	0	0	352.0	0	128
	Gas	1,915.8	83	729	1,174.7	61	434
Space Cooling	Electricity	98.6	4	131	95.0	96	126
Pumps	Electricity	0.0	0	0	36.0	0	13
Heat Rejection	Electricity	7.9	0	10	4.0	51	4
Fans - Conditioned	Electricity	0.0	0	0	12.0	0	1
Total Building Consumption		**2,307.5**			**1,863.8**		

		* Alt-2 OBC SB-10, Climate Zon	Alt-1 Proposed Building
Total	**Number of hours heating load not met**	0	0
	Number of hours cooling load not met	0	0

	* Alt-2 OBC SB-10, Climate Zon		Alt-1 Proposed Building	
	Energy 10^6 Btu/yr	Cost/yr $/yr	Energy 10^6 Btu/yr	Cost/yr $/yr
Electricity	391.7	10,321	689.1	12,408
Gas	1,915.8	6,344	1,174.7	3,850
Total	**2,308**	**16,665**	**1,864**	**16,257**

Project Name: 11788 TECUMSEH RD E, ON
Dataset Name: TRACE00.TRC

TRACE® 700 v6.3.5 calculated at 02:45 PM on 03/26/2024
Energy Cost Budget Report Page 1 of 1

Performance Rating Details

By HED

Project Name:	Date: March 26, 2024
City:	Weather Data: Detroit, Michigan

Performance Rating Method Alternative: Alt-2 OBC SB-10, Climate Zone 5A

		0° Rotation		90° Rotation		180° Rotation		270° Rotation		Average	
		Energy 10^6 Btu/yr	Peak kBtuh	Energy 10^6 Btu/yr	Peak kBtuh	Energy 10^6 Btu/yr	Peak kBtuh	Energy 10^6 Btu/yr	Peak kBtuh	Energy 10^6 Btu/yr	Peak kBtuh
Lighting - Conditioned	Electricity	285.2	144	285.2	144	285.2	144	285.2	144	285.2	144
Space Heating	Gas	1,927.4	729	1,955.7	729	1,930.8	729	1,849.5	729	1,915.8	729
Space Cooling	Electricity	105.5	150	89.1	119	108.7	132	91.0	122	98.6	131
Heat Rejection	Electricity	8.5	12	7.1	9	8.7	10	7.3	10	7.9	10
Total Building Consumption		**2,326.5**	**1,034**	**2,337.2**	**1,001**	**2,333.5**	**1,015**	**2,233.0**	**1,004**	**2,307.5**	**1,014**

	0° Rotation	90° Rotation	180° Rotation	270° Rotation	Average
Electric ($)	$ 10,605	$ 10,102	$ 10,567	$ 10,009	$ 10,321
Gas ($)	$ 6,228	$ 6,605	$ 6,193	$ 6,350	$ 6,344
Total Building Cost ($)	**$ 16,833**	**$ 16,707**	**$ 16,760**	**$ 16,359**	**$ 16,665**

Economic Summary

Project Information

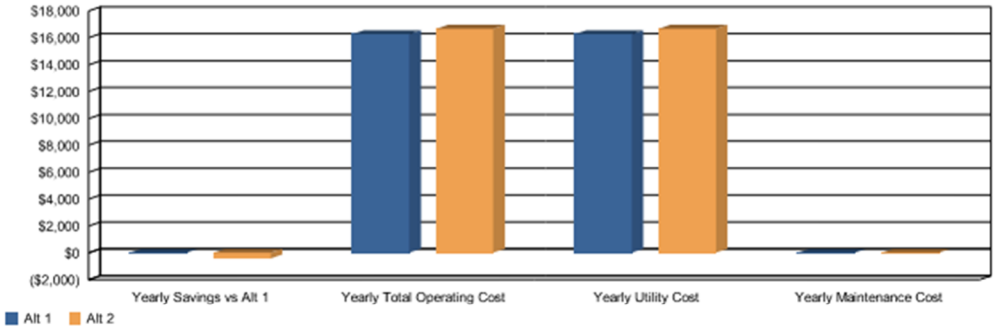
Location
Project Name
User
Company
Comments

Study Life: 20 years
Cost of Capital: 10 %
Alternative 1: Proposed Building
Alternative 2: OBC SB-10, Climate Zone 5A

Economic Comparison of Alternatives

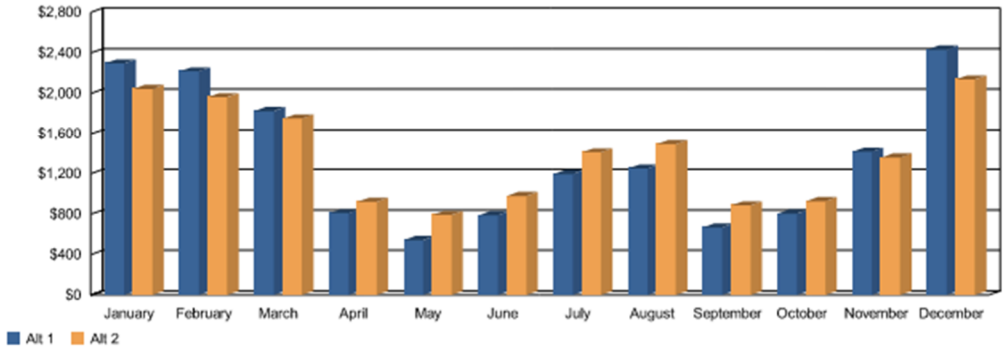
	Yearly Savings ($)	First Cost Difference ($)	Cumulative Cash Flow Difference ($)	Simple Payback (yrs.)	Net Present Value ($)	Life Cycle Payback (yrs.)	Internal Rate of Return (%)	Life Cycle Cost Difference
Alt 1 vs Alt 2	407	0	2,033	No Payback	866	No Payback	1,000.0	865.60

Annual Operating Costs



	Yearly Savings vs Alt 1	Yearly Total Operating Cost ($)	Yearly Utility Cost ($)	Yearly Maintenance Cost ($)	Plant kWh/ton-hr
Alt 1	0	16,257	16,257	0	1.003
Alt 2	-407	16,665	16,665	0	0.920

Monthly Utility Costs



Project Name: 11788 TECUMSEH RD E, ON
Dataset Name: TRACE00.TRC

TRACE 700 6.3.5
calculated at 02:45 PM on 03/26/2024

APPENDIX D – REFERENCES

- “Electricity Rates.” ENWIN Utilities, https://enwin.com/electric-rates-residential/.

- “Natural Gas Rates.” Enbridge Gas., Natural Gas Rates | Ontario Energy Board, https://www.oeb.ca/consumer-information-and-protection/natural-gas-rates.

- Feasibility - Residential - Apartment building/Multi-unit housing - Model National Energy Code for Buildings (MNECB) / Canada