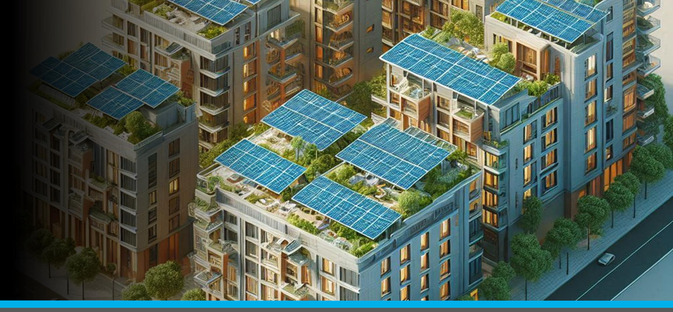
Multi-Residential Buildings in Alberta Microgeneration Regulations



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Abstract

This research project investigates the complexities of deploying microgeneration technologies in Alberta's Multi-Unit Residential Buildings (MURBs). The residential sector accounts for up to 75% of global building energy use and 28% of global electricity consumption. The research objectives include the analysis of the challenges in deploying solar photovoltaic technology, estimation of potential clean energy capacity, GHG emissions offset, and financial incentives that could benefit apartment owners in MURBs within the scope of the broader policy framework. The qualitative and quantitative analysis shows that stakeholders generally possess a positive attitude toward microgeneration technologies, and considerable potential exists for solar energy generation and GHG reductions. Leveraging sustainable design principles, MURBs have the potential to utilize their extensive infrastructure to actively participate in the electricity value chain and expedite Alberta's grid decarbonization efforts in line with its 2030 target.

Research Questions

- *What suitable microgeneration projects can be implemented in MURBs with current regulations?*
- *What factors would policymakers consider as the main motivations and opportunities available in amending the regulations to allow MURBs to deploy microgeneration projects?*

Introduction

- Apartments in multi-residential buildings are one-fifth of all residence types in Alberta and one-third across Canada.
- Rapid urbanization and population growth in Alberta municipalities have positioned multi-residential buildings as a crucial factor in addressing the housing challenges.
- The *Alberta Renewable Electricity Act* aims for 30% of the province's energy generation to come from renewable sources by 2030.
- Alberta Microgeneration Regulations provides the framework catering to residential and small commercial enterprises, allowing them to fulfill some energy requirements through micro-generation technology

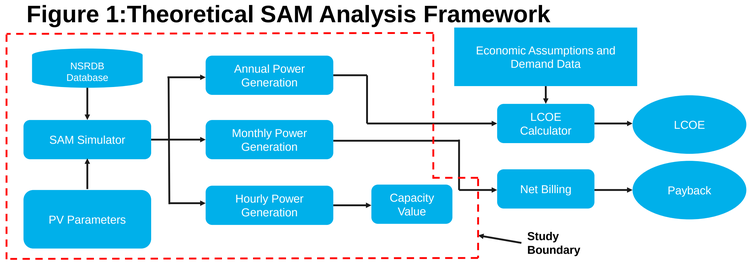
- The *Alberta Condo Act* stipulates the governance framework of multi-residential buildings, inadvertently promoting anti-common behaviour in maximizing shared infrastructure.
- With more than 20% of residential buildings classified as multi-residential [1], a significant amount of clean energy potential exists, but many residents are excluded from the clean energy transition.
- The concept of common property adds a layer of complexity for apartment owners who seek to deploy renewable energy projects to offset their grid-supplied electricity.

Method

The initial phase entails conducting surveys among apartment owners in multi-residential buildings to gauge their practical knowledge and support for implementing microgeneration projects. This involves using surveys, semi-structured interviews, and literature reviews to identify practical barriers to deploying microgeneration projects. The subsequent phase will involve simulating the technical performance of a sample-sized PV system in eight different municipalities within Alberta's distinct economic regions, utilizing renewable energy modelling software.

The System Advisor Model (SAM) software was used to estimate the technical performance of the PV system.

Figure 1:Theoretical SAM Analysis Framework



Results

Figure 2: Annual Solar PV Energy Generation

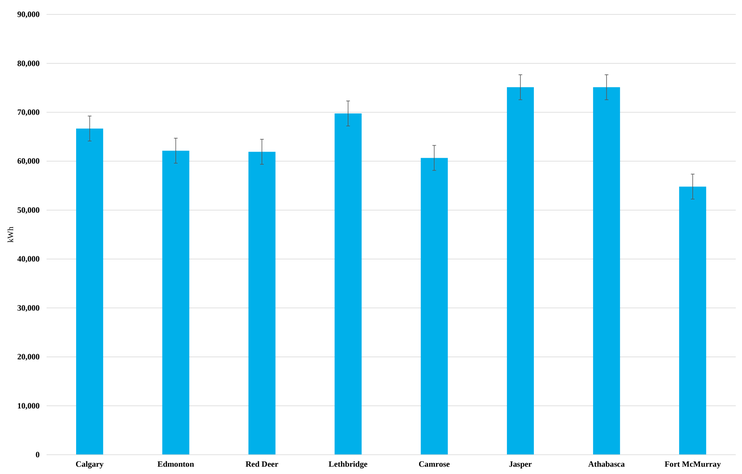
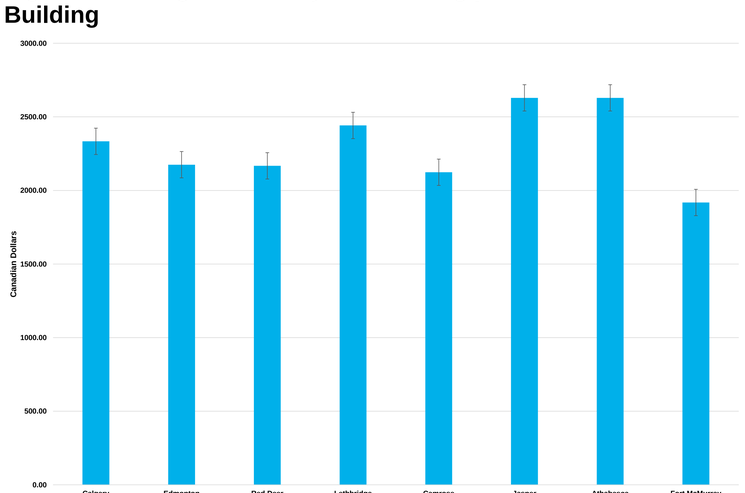


Figure 3: Average Electricity Cost Saving per Multi-Residential Building



***** Average Cost Saving = Solar Energy Generated × Self-Consumption Rate × Average VRRO Rate**

Figure 4: GHG Avoidance from Electricity Grid per Multi-Residential Building

Municipality	Annual AC energy generated (kWh)	GHG Offset from Electricity Grid(tCO$_2$e)					
		2024	2025	2026	2027	2028	2029
Calgary	66,678	32.7	30.7	28.7	26.7	24.7	22.7
Edmonton	62,145	30.5	28.6	26.7	24.9	23.0	21.2
Red Deer	61,922	30.3	28.5	26.6	24.8	22.9	21.1
Lethbridge	69,760	34.2	32.1	30.0	27.9	25.9	23.8
Camrose	60,672	29.7	27.9	26.1	24.3	22.5	20.7
Jasper	75,120	36.8	34.6	32.3	30.1	27.8	25.6
Athabasca	75,120	36.8	34.6	32.3	30.1	27.8	25.6
Fort McMurray	54,805	26.9	25.2	23.6	21.9	20.3	18.7

***** GHG Avoidance = Energy Output by Solar PV × Self Consumption Percentage × Emission Factor of Electricity**

Microgeneration Technologies Implementation Models in Multi-Residential Buildings

- Individual Installation from End Users
- Distributed Systems via an Embedded Network
- Distributed Systems" Behind the Meter"

Conclusion and Recommendations

- Apartment owners in multi-residential buildings possess sufficient knowledge, attitude, and positive perception towards microgeneration technologies to make adoption relatively smooth.
- Significant clean energy generation potential, GHG avoidance, and modest significant savings in electricity consumption that can be maximized by increasing self-consumption
- Simplifying microgeneration regulations can drive adoption and help Alberta accelerate its efforts to reach its renewable energy electricity goal by 2030.
- Policies mandating that new multi-residential buildings adopt BIPV technologies should be encouraged to reduce their GHG intensities.

Limitations and Future Research

- Lack of geographical mapping data for multi-residential buildings in Alberta.
- Survey responses from the surveyed sample size might not indicate the complete perception of this stakeholder category.
- Future research can investigate the potential to increase self-consumption through a combination of microgeneration technologies.
- Comparison of BAPV and BIPV technologies on multi-residential buildings from a cost-benefit perspective.

References

Han, S., & Wang, J. (2023). A Guide to Installing EV Infrastructure in Alberta's Multi-Unit Residential Buildings: How to prepare for an electric vehicle future. https://www.jstor.org/stable/resrep52427