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# Strategies for Making New Zealand's Existing Buildings Energy Efficient in the Warmer Climate

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## ABSTRACT

As construction industry and buildings are consuming large amounts of energy and resource, green building has become a focus in the built environment. However, the performances of buildings' energy efficiency can be influenced by the changing climate because global warming is a universal phenomenon. This paper aims to propose the effective strategies for improving NZ's existing buildings' energy efficiency through envelope retrofit. The method of this research is using eQUEST, a simulation tool, to examine different building energy retrofit packages and evaluate their effectiveness under the predicted weather changing pattern, such as warmer winter and hotter summer.

**Keywords:** Green Building; Energy Efficiency; Retrofit Simulation; Climate Change; Envelope

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# STRATEGIES FOR MAKING NEW ZEALAND'S EXISTING BUILDINGS ENERGY EFFICIENT IN THE WARMER CLIMATE

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## Abstract

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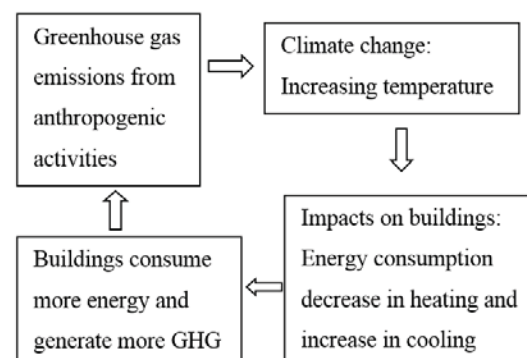
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## 1. Introduction

With the improvement of living standard and the increase in population, the past decades have seen dramatic surging energy demand and consumption in construction industry all over the world. It is estimated that the energy consumed by construction activity and buildings' operation accounts for almost 40 percent of the total energy use. Meanwhile, about 40% of the total CO<sub>2</sub> emissions is generated by buildings [1].

Thanks to the increasing awareness of sustainability, green building has emerged as a concept that can provide sustainable approaches for built environment. On the other hand, making the existing buildings more sustainable is believed as effective approach to green the construction industry. Retrofitting of the existing buildings is critical for reducing the resource and energy consumption and mitigating the greenhouse gas emissions. However, the climate change is a crucial factor in the buildings' sustainability, because a large part of energy consumed by a building is caused by the temperature adjustment, like cooling in the summer and heating in the winter.

However, few research has been done to evaluate the effectiveness of energy retrofitting in New Zealand, especially regarding to the life cycle performance under the scenario of climate change.



**Fig 1. The interactive impact between buildings & climate**

As shown in Fig.1, while the construction industry have impact on climate change, the changed climate is going to influence the buildings, such as its thermal performance and energy consumption pattern. The retrofitting package for existing buildings need to be designed to work effectively not only in the current climate but also in the future climate. Thus, this paper aims at evaluating

different envelope retrofitting package under the warmer climate.

## 2. Literature Review

Some literatures have highlighted the green buildings' performance. Byrd and Leardini [2] argued that some of the design feature of NZ's green buildings failed to keep them sustainable when the climate change was taken into account. Some are focusing on retrofitting strategies, like the researches of Gong, Akashi [3], Nik, Mata [4], [5]

## 3. Research Methods

**Step 1.** The energy demand of each building is largely dominated by the temperature. This paper will first analyse the future temperature change of several main cities in New Zealand. Weather data will be collected through historic information and the newest literature.

**Step 2.** In order to assess the performance of retrofit packages in terms of their ability to make buildings more adaptive to the climate change, data will be collected through the result of simulation run by eQUEST (3.65), a simulation software that can analyse the energy performance of a given building in certain location during certain period of time. Energy simulation of different envelope retrofitting package will be done, both in the current climate and in the predicted future climate and the result will be evaluated.

## 4. Discussion and Conclusion

A baseline model was created and the energy simulation was run by the software. Retrofit packages are:

- Building fabric insulation
- Glazing retrofit (i.e. low-E glass, shading, multiple glazing, etc.)
- Glazing proportion
- Window shading

Each package will be examined to show their effectiveness in reducing energy use. One of the results of an office building simulation are shown in figure 2.

Conclusions:

1. The reduction of glazing proportion made a most significant difference in saving electricity used by summer cooling.
2. For the office building, winter heating energy can be effectively reduced by upgrading the wall insulation.

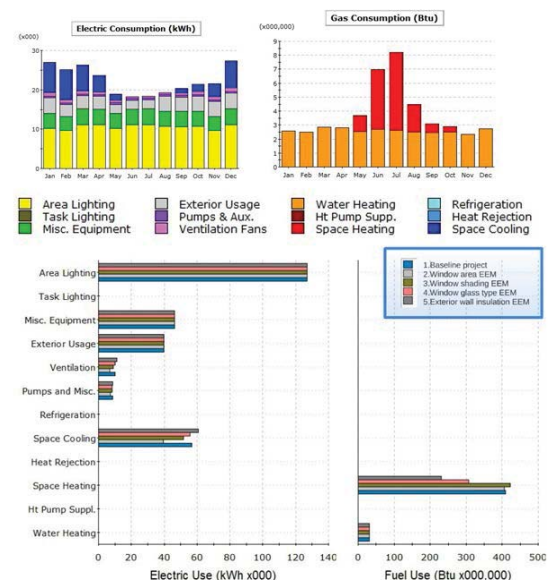


Fig 2. Example charts of data

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