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Green buildings: issues for New Zealand

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Abstract

If the mission of 'green' rating tools is to accelerate the transformation of the global built environment towards sustainability then a high priority must be placed on the energy consumed by buildings since energy supplies from various sources are depleting. This paper examines the apparent anomaly that almost all designs of 'green' office developments in New Zealand have high proportions of unshaded glazing. They are sealed, lightweight, air-conditioned buildings that are dependent on an uninterrupted supply of electricity in order to remain habitable. From an architectural science point of view, these characteristics are not normally associated with sustainability. The paper will investigate the drivers behind the highly glazed buildings recently realized in New Zealand, including those components of 'green' rating tools that favour this building type.

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Keywords: green building; energy; building rating tool; environmental performance

1. Introduction

As the number of 'green' rated office buildings in New Zealand increases there is a distinct pattern in their appearance and method of environmental control. Of those featured on the web site of the New Zealand Green Building Council (NZGBC) [1] the majority are highly glazed, thermally lightweight, sealed and air-conditioned buildings. These are characteristics that are not normally associated with 'low-energy' or 'sustainable' design. There appears to be a difference between a 'green' building and one that adheres to good architectural science principles.

Although 'green' accreditation considers many issues that are beyond the scope of architectural science, such as management, land use and transport, it would appear that energy, one of the central issues of both architectural science and sustainability, is inadequately addressed.

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This paper will put forward the case for reviewing the weighting that energy should have within the New Zealand accreditation process and for altering those key aspects of the rating criteria where there is an apparent conflict between 'green' accreditation and architectural science.

The paper will first review the issue of future energy supplies in New Zealand and will conclude that there is likely to be a seasonally inadequate supply of electricity that may result in energy rationing. Under these circumstances it will be argued that sealed, air-conditioned buildings become a high risk as an inadequate or interrupted supply of electricity will result in overheating and render them uninhabitable, unproductive and unsustainable.

The paper will then address some of the key criteria of rating tools involving architectural science including daylighting, views, internal noise levels, thermal comfort and energy. It will be argued that aspects of these 'green' criteria distort fundamental principles of architectural science and are incongruous with current research and trends in environmental control systems for sustainable buildings.

Lastly, there is a brief discussion concerning the motivation for 'green' accreditation and the conflict in architectural design between, on the one hand, the brand image of a building and, on the other, characteristics of the building envelope that are associated with good environmentally sustainable design.

1.1. The relationship of energy and sustainability in New Zealand buildings

To be sustainable, buildings should usefully last for many generations. This requires building designers to have some knowledge of the future climate and the resources available to maintain the operations, in particular the energy consumption, of buildings. The New Zealand climate is predicted to get hotter and an energy gap to emerge as fossil fuels deplete and seasonal hydroelectricity production declines due to the retreat of glaciers. The historical peak demand of electricity for buildings has been for winter heating. This is now shifting to a summer cooling demand which does not favour highly glazed buildings. Indeed, despite the complex New Zealand climate, varying from warm subtropical in the far north to cool temperate in the far south, due to its extent in latitude (between 34 and 48 degrees south), the majority of the population is concentrated in the northern island, where the climate is milder and the construction industry more active.

In a changing climate with predicted increases in average temperatures [2], 'green' buildings in New Zealand are still being designed with a dependence on air-conditioning. There appears to be an assumption that there will be an adequate supply of energy for the whole lifetime of the building that can maintain current comfort standards. This may be the case for buildings that can be certain of a secure an enduring supply of renewable energy. However, for the overwhelming majority of buildings, there is no unconditional security of an uninterrupted energy supply in the future and increasing evidence of the need for energy rationing.

1.2. Climate change, peak hydro and the availability of electricity in New Zealand

Apart from 'peak oil' and 'peak gas', New Zealand also faces 'peak hydro'. The hydro industry has long formed the backbone of New Zealand's successful power sector. It has provided a relatively constant 60% of total electricity production since the 1930s and enabled the country to enjoy some of the lowest power tariffs in the world.

The fear remains that a severe drought will trigger power rationing and the vulnerability of the power sector to dry years is becoming increasingly apparent with the decline of the Maui gas reserves, the New Zealand's largest gas and oil field, which has provided the majority of the country's hydrocarbons since his discovery in 1969.

One of the biggest problems with New Zealand's existing hydro schemes is the lack of water storage