Changing Architecture for a Changing Climate; Unsustainable Trends in New Zealand

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Fuel and electricity allows buildings to ignore the natural environment by creating an artificial internal environment through heating, cooling and lighting.

This allows designers to ignore the environmental performance of the building envelope since poor performance can be remedied by more heating, more cooling, more lighting....**more energy.**

“**If it can be designed, we can air-condition it**” is a license for designers to ignore the performance of a building envelope.
This has led to an architecture that is characterised by being highly-glazed, lightweight, air-conditioned and poorly insulated.

Also characterised by ‘sick building syndrome’, overheating, glare and excessive energy consumption.

“less is more”; a bad joke for energy
However, the powerful brand image that this building type portrays drives its continued production.

Energy consumption has little value when fuel and electricity is cheap and plentiful.
But what happens when energy supplies are scarce and insecure?

Glass-box buildings have no resilience to an interrupted or inadequate supply of energy.

“the power failures to the Eastern Seaboard of the USA in August 2003 when New Yorkers had to evacuate most of the buildings in the city because they had non-opening windows and air-conditioning systems in which the air for breathing ran out in under an hour and internal temperatures surged within minutes”
How much glazing is energy efficient?

On all orientations and all circumstances the optimum lies somewhere between 20 and 40%.

30%  50%  100%

Optimum % Glazing in Sub-tropical Climates

With climate change, Zone 1 (NZS 4218) is moving towards a sub tropical climate. The optimum area of glazing in sub-tropical climates is less than temperate climates.

‘Green’ rated buildings in NZ

• Air conditioned, ‘green’ office buildings average score for ‘energy’ is only 50% of the available.

• The majority are sealed buildings that are fully air-conditioned and have 80% glazing or more.

• These buildings are dependent on a constant and uninterrupted supply of electricity in order to remain habitable and productive.

NZGBC (2010) web site content
NZGBC Office Design Case Studies

- 25% weighting for ‘energy’ in rating tool

- Only 2/3rds of these points are for building envelope performance

- Case studies of air conditioned offices on NZBCC web site average 50% of total energy score

- Therefore the typical NZ green building values energy in the design of its envelope as:
  
  \[25\% \times 66\% \times 50\% = 8\%\]
Why is Energy Important?

We are now in an era where there is a general understanding that fossil fuels are depleting and our dependence on an adequate supply of energy cannot be assured.

To be sustainable, buildings should usefully last for many generations.
Energy Demand Increasing

PHEVs Electric demand

5000 times greater by 2040

Domestic Air-conditioning cooling demand

100 times greater by 2040


Energy supply reducing

International Peak Oil

NZ Peak Gas?
NZ Peak Hydro

• 50% of hydro electricity generated from melt water¹
• Glaciers are NZs largest water store for hydro (53 Km³)²
• “Glaciers across the globe are continuing to melt so fast that many will disappear by the middle of this century”³
• Melt water increases in the short-term, peak, then declines

Energy, Climate and Building Performance In NZ

- High proportions of glazing lead to an overall poor energy performance of a building
- As the climate gets hotter the optimum proportion of glazing reduces
- With increased temperatures, the peak demand for electricity will shift towards summer
- Glacial retreat due to climate change and a greater reliance on renewable energy makes electricity supply less secure in the summer
- Highly glazed air-conditioned buildings become less resilient
Changing the Criteria for ‘green’ rating tools

If the mission of ‘green’ rating tools is to “accelerate the transformation of the global built environment towards sustainability”¹, then it needs to reconsider the criteria to take account of energy depletion, climate change and the consequent need for adaptation by building occupants.

NZGBC (2010) web site content
Brand Image vs. Resilience

The rental value of commercial property in CBDs is rated (generally A to D) according to its desirability. An essential characteristic for A and B rated buildings is air-conditioning.

While electricity is abundant and cheap, these building types are desirable.

However, this could all change if electricity supplies become insecure.

Naturally ventilated buildings have a greater potential to remain productive than air-conditioned buildings.