Asia-Pacific
Economic Cooperation

Building Energy Codes Report

for New Zealand

June 2009

Prepared by the Building Codes Assistance Project of

the Alliance to Save Energy

BCAP Dedicated to the adoption, implementation, and advancement of building energy codes

Summary

While New Zealand may maintain the look of a small island-economy, the population's carbon emissions and energy use would seem to prove otherwise. The economy itself has set forth many green initiatives to continuously reduce their energy consumption, production of greenhouse gases, and ultimately lessen their contribution to global emissions. Yet, relatively large amounts of energy are still being consumed, as CO^2 emissions continue to support global levels of emissions. Judging by previously implemented green initiatives, New Zealand proves their ability to implement and maintain innovative energy saving solutions, such as building energy codes. It is essential for New Zealand to continue efforts in reducing energy consumption through greater implementation of building energy codes, and ultimately further reduce their global impact.

Economy Background

Political and Social Structure

New Zealand, located in the southwestern Pacific Ocean, consists of multiple islands including the North Island, the South Island, and various other islands. The grouping of islands maintains a parliamentary representative democratic monarchy, with Queen Elizabeth II as the Head of State. The title of Queen is more or less a ceremonial role; the Prime Minister, Governor General, and elected Cabinet members are responsible for governing the economy.[1]

Economic Overview

The economic status of New Zealand has shifted over the past 20 years to a globally competitive, industrialized, free trade market. Subsequently, per capita GDP and income rates have risen, while the income gap (Gini Index) has widened. As of 2008, the economy maintained a per capita GDP of $27,900, an unemployment rate of 4 percent, and a Gini Index of 36.2 (1997). As of 2008, the economy fell into a recession, as did many other global markets. The government has since taken measures to decrease effects of the recession and to jump-start the economy.[2]

Energy Assessment (oil, gas, import/export, renewable, carbon emissions, etc)

New Zealand consumes 153,000 barrels of oil daily (bbl/d) but produces only 65,000 bbl/d, and thus relies on the 88,000 barrels of oil imported daily to meet energy demands. The economy also depends heavily on natural gas, and maintains 900 natural gas reserves that produce 161 million metric feet daily. As a result of the economy's consumption of fossil fuels, in 2006 the

economy's total carbon dioxide emissions was 38 million metric tons, which was ranked 70th in the world[3] for an economy that has the 123rd largest population.[4]

Climate

The climate in New Zealand varies from the north to the south, with temperatures decreasing as you travel south. The southern region of the economy represents subtropical weather with a 9°C/48°F average, while the north region is defined as temperate with an average temperature of about 15°C/59°F. Regardless, since the majority of the economy is coastal, much of the temperature remains mild with moderate rainfall and extensive sunshine. The coldest months in New Zealand take place during June, July, and August, while the warmest occur during December, January, and February.[5]

Construction Overview

The construction sector in New Zealand is currently busy with state-prompted projects, with a value estimated at twenty-five million dollars. New Zealand's Reserve Bank's financial stability report revealed that only ten percent of bank lending was for commercial property development. Strains on the non-bank sector have significantly reduced the developer's access to mezzanine finance, increasing the risk that some projects may remain unfinished and subsequently endangering credit risk. Only a third of the projects are in the private sector, raising market stability issues.

Meanwhile, in an attempt to revitalize the Building Act, the Housing and Construction Minister, Maurice Williamson, is pushing for the requirement of building permits in order to construct new homes in New Zealand. Williamson is making this effort a top priority in his attempts to stop what he describes as "rotting homes".

Scope of Building Energy Codes/Standards

The New Zealand Department of Building and Housing 's Building Act 2004[i] contains regulations for houses and other buildings and applies to new construction as well as the alteration and demolition of existing buildings.[6] The 2004 Act was adopted to strengthen all stages of the building process, including licensing of building professionals[ii], building code review, product certification, added scrutiny in the building consent and inspection processes, and further clarity on building standards and how compliance must be demonstrated.[7] Building Regulations 1992, where the performance-based New Zealand building code (NZBC) is found, is located within Part Two of Building Act 2004.[8]

[i] Amendments to the Building Act 2004 were passed to correct and clarify drafting issues that became apparent when some provisions came into force in March of 2005.These amendments were passed April 14, 2005. Additionally, all new building work must be "designed, constructed, and able to be used in ways that promote sustainable development."

[ii] Under Part 2 Building, Subpart 4 Requirements of Building Work, Section Eighty-four, Building Act 2004: *All restricted building work must be carried out or supervised by a licensed building practitioner who is licensed to carry out or supervise the work*. Please see Attachment 1, an example of a Building Consent Authority's verification of a builder's technical skills.

At this time, the New Zealand government is making major reforms in the building sector, including a comprehensive review of the building code that will be completed in November 2009. This two year quest will examine the building code "from top to bottom" along with the supporting infrastructure: performance of building consent authorities[iii], improved energy efficiency measures in homes and workplaces, and a streamlined system to respond to building disputes and determinations.[iv]

During this interim period, New Zealand continues to utilize the previous building code[v], which sets minimums standards, is performance-based, and "covers aspects such as stability, fire safety, access, moisture, safety of users, services and facilities, and energy efficiency."[9] The New Zealand building code consists of two preliminary clauses, commencement & purpose and principles, along with thirty-five technical clauses. Each technical clause has three levels describing the requirements:

1. "Objective - the social objective that the completed building work must achieve
2. Functional requirement - what the completed building work must do to satisfy the social objective
3. Performance criteria - qualitative or quantitative criteria which nominates how far the completed building work must go in order to comply."[10]

The pyramid below illustrates the building statutes that dictate the requirements for all construction in New Zealand.

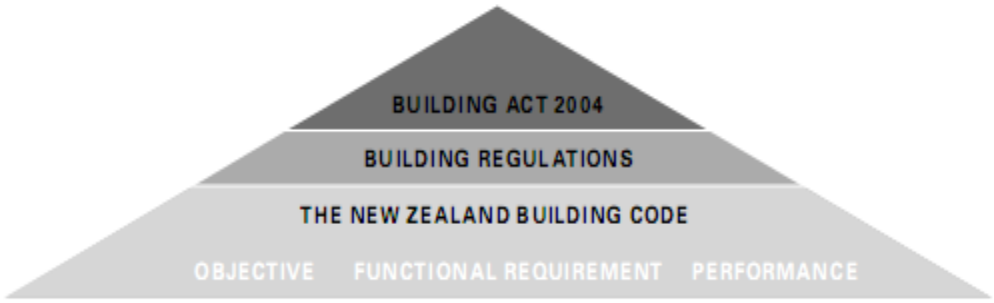

Figure 1.0 Depiction of New Zealand's building control structure. Source: *New Zealand Building Code Handbook*

[iii] Private and registered Building Consent Authorities (BCAs) facilitate many facets of the Building Act 2004 including the building consent form process, perform building inspections, issue notices to fix and follow-up, review compliance schedules and issue code compliance certificates, ensure all forms have been submitted as required by the Building Act 2004 and they also have duties in respect to dam registration.

[iv] The initial Building Regulations 1992 was drafted under the Building Act 1991; the 1991 Act was later modified and portions were included in the Building Act 2004. Schedule 1 (the building code) was the only section of the Building Regulations 1992 included in the 2004 Act was as several provisions were revoked.

[v] The New Building Code (NZBC) provisions for hot water and HVAC systems come into force on February 1st, 2009. There are currently no acceptable solutions or verification methods published for the new building code provisions; however, online guidance is available through the Department of Building and Housing.

Technical Requirements

Energy efficiency provisions are found in Clause H.1[11] of the NZBC and, while the clause only applies to residential buildings, the provisions cover not only building construction, but also artificial lighting, hot water systems, heating, ventilation, and air conditioning systems.[12]

Building thermal performance is managed under the energy efficiency provisions of the NZBC, which require buildings to calculate a Building Performance Index (BPI) and compare results with the limits set within the code. The BPI can be computed by the following formula[13]:

$$BPI = \frac{\text{heating energy}}{\text{heating degrees total} \times (\text{floor area} + \text{total wall area})}$$

However, another option in calculating the BPI is the Annual Loss Factor (ALF3) method. The ALF3 method combines the "building envelope R-values, the window solar gains and the heat loss of the building depending on the climate zone."[14]

New Zealand has two energy efficiency requirements for buildings: NZS 4218:2004 and NZS 4243:2004.

Compliance Methods

A key benefit of the performance-based NZBC is that it allows flexibility in building construction and design through several compliance schemes based on using two primary approaches and one optional approach:

The verification method consists of laboratory tests or calculations using analytical methods and mathematical models that prescribe compliance with the building code.

The acceptable solution approach is a series of step-by-step instructions.[15]

If the building design is innovative and falls outside the building methods described in the two primary compliance schemes, there is a third option called the alternative solution.

The alternative solution method relies on a collection of evidence verifying that the building complies with the NZBC. The means establishing compliance will vary from building to building, but will be based on calculations, modeling, expert testimony, and/or technical data. [16]

Each of the thirty-five technical clauses in the NZBC is supported by a compliance document that contains a verification method or an acceptable solution; however, some documents contain multiple verification methods or solutions.[17] For example, the compliance document for Clause B1 of the building code has two verification methods and three acceptable solutions. The builder or architect may choose which approach they will use to demonstrate compliance.

Unless the work is exempt[vi], a building consent form must be obtained from a local council before construction begins. Building Consent Authorities[vii] (BCAs) examine the detailed plans drawn by the registered architect or designer to decide whether the proposed house or building work complies with the building code. Upon achieving compliance, the builder will be issued a building consent, allowing the work to proceed.

Additionally, under Section Ninety-five of the Building Act, buildings must acquire a code compliance certificate (CCC) upon completion; this is a formal statement that affirms the building work was carried out as specified in the building consent application.[18]

Enforcement Mechanisms and Jurisdictions

New Zealand's building code for residential, commercial, and renovation projects is mandatory and performance-based. Administering the Building Act 2004 is a collective effort among several parties: the New Zealand Department of Building and Housing, territorial governments, building consent authorities, regional authorities, building owners, and licensed building practitioners.[19]

The Department of Building and Housing has several chief and critical functions in regulating the building sector including administering and updating the NZBC, making determinations on technical matters, implementing, and maintaining compliance documents for each technical clause, along with providing information, guidance, and advice for consumers and professionals in the building sector.[20]

Status of Non-regulatory, Market-based Voluntary Programs

The Energy Efficiency and Conservation Authority (EECA) is an organization established by the New Zealand government to encourage, support, and promote energy efficiency, energy conservation, and the use of renewable sources of energy.[21] It is a crown entity that was created by the Energy Efficiency and Conservation Act of 2004. The EECA assists the Minister of Energy in preparing and administering a national energy efficiency strategy. [22] The New Zealand Energy Efficiency and Conservation Strategy (NZEECS) was released in October of 2007. It establishes the action plan for energy efficiency and conservation actions and assigns responsibility for the delivery of each action to a central or local government agency. [23]

[vi] In October 2008, the Department of Building and Housing published a twelve page handbook regarding exemptions, located online at: http://www.dbh.govt.nz/UserFiles/File/Publications/Building/Guidance-information/pdf/guide-to-exemptions.pdf
The original exemptions from the 1991 Act applied to minor building work such as repairs or maintenance, the 2004 Act expanded the exemption to also include other minor projects, such as: construction, removal, or alteration of roads, signs, stopbanks, or culverts; retaining walls < 1.5 meters depth; internal walls in an existing building; construction or alteration on any wall fence not exceeding 2 meters above ground; the construction or alteration of any tanks or pools; tents or marquees that has a floor area exceeding 50 m^2; platform or bridge that < 1 meter off the ground; temporary storage; building work in connection to detached buildings; and, verandas and patios, access points within a drainage system, alterations to drains for house, plumbing alterations, installation, replacement, or removal of a window or door, alterations to doorways, alternations to an interior building (such as a shop within a mall), maintenance and small non-habitable structures)

[vii] BCAs are required by the Building Act 2004 to keep information for the life of any building. This includes the plans and specifications provided when applying for a building consent, inspection reports by BCAs, and code compliance certificates.

Another program developed and administered by EECA is ENERGYWISE. ENERGYWISE is a public education campaign initiated by the New Zealand government and supported by many business partners (suppliers, installers, manufacturers, and retailers).[24] The website is a clearinghouse for residential energy savings information, product rebates, driving tips, details on appliance rating and labeling, and funding opportunities for such things as solar heat pumps or even interest-free loans for residential energy efficiency upgrades.[25]

New Zealand's Green Building Council (NZGBC), in partnership with the building industry, developed a rating scheme called Green Star, which "is a comprehensive, national, voluntary environmental rating scheme that evaluates the environmental attributes and performance of New Zealand's buildings using a suite of rating tool kits developed to be applicable to each building type and function."[26] Much like the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED), this is a voluntary program and it addresses the environmental impact a building may have. Green Star evaluates many categories when rating a building, including:

- Management
- Indoor Environment Quality
- Energy
- Transport
- Water
- Materials
- Land Use & Ecology
- Emissions
- Innovation

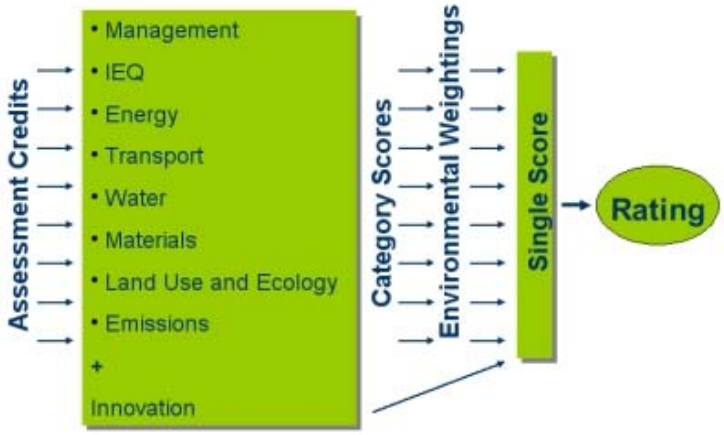

Figure 1: New Zealand Green Building Council Rating Structure, Source: NZGBC

Green Star has three attainable levels that are based on a scoring system:

- 4 Star Green Star NZ Certified Rating (score 45-59) signifies 'Best Practice'
- 5 Star Green Star NZ Certified Rating (score 60-74) signifies 'New Zealand Excellence'
- 6 Star Green Star NZ Certified Rating (score 75-100) signifies 'World Leadership'

The NZGBC has several rating tools in the late design phase, the first being an industrial rating program focusing on large commercial buildings. A pilot project to test the rating program was conducted in northern New Zealand, focusing on a large distribution center for a package delivery company.[27] The success of this project led to the June 2009 release of the Industrial Tool.[28] Strongly modeled after the Australian Interiors Tool, a second pilot program -- Green Star NZ Interiors -- focuses on building and home renovations and is a collaborative effort with several New Zealand government and business partners.[29] Give the significant impacts that can be achieved in the educational sector, it's no surprise the NZGBC has a Green Star NZ – Education tool under development that will center on new school construction and daycare centers. It should be released in June 2009.[30]

Figure 2NZGBC Pilot Industrial Project Site, Source: NZGBC

Moving towards more sustainable practices in the public sector, in May of 2007 the Cabinet[viii] directed public service departments (and invited Ministers responsible for other state sector departments) to adopt a minimum five star Green Star NZ rating for the construction of all new grade A[ix] office buildings. A minimum four star Green Star NZ rating was set for the construction of new grade B[x] office buildings.[31] As decreed by the NZEECS, by 2012 all new government buildings will be required to meet a minimum five star rating.[32]

There have also been several initiatives in the residential sector. The Household Energy End-use Program (HEEP) was a long-term study with the objective of measuring and modelling energy use in New Zealand homes. It was launched in 1995 as a pilot study collecting data on home energy use for 400[xi] New Zealand residents. The resulting data provides both regional and national statistics.[33] Homes were monitored[xii] for approximately eleven months, generating the basis for a model of residential energy use as well as providing specific information on energy consumption patterns.[34] The model was then employed to generate current and projected national household energy requirements and also proved useful in evaluating the implications of building and appliance performance changes.[35]

Another program to address residential energy use is the Home Energy Rating (HERs) program which focuses on cost-effective retrofits to improve efficiency and comfort. A home energy rating is an assessment of the energy efficiency performance of a home and examines how the building's design, materials, construction and orientation affect comfort and efficiency.[36] A qualified assessor[xiii] evaluates

[viii] The Cabinet is the central decision-making body of New Zealand's executive government. It provides a collective forum for Ministers to decide significant government issues.

[ix] Grade A buildings are generally commercial or industrial buildings greater than 20,000 m^2

[x] Grade B buildings are generally commercial or industrial buildings at least 10,000 m^2 http://www.propertynz.co.nz/files/Research/Quality%20Grading%20Matrix.pdf

[xi] Homes were located throughout New Zealand so as to ensure all three climate zones and environments were incorporated in the study. Urban and rural, north and south.

[xii] All forms of fuel types were monitored: electricity, natural gas, LPG, solid fuel, and solar water heaters.

[xiii] Assessors use a computer modeling tool called AccuRate NZ to generate accurate and comparative ratings across New Zealand. Originally developed by Australia's Commonwealth Scientific and Industrial Research

the home and then generates a report containing star ratings from zero to ten showing the home's energy performance.[37] The assessor offers homeowners professional recommendations on the most appropriate actions to improve the home's rating. HERs is a joint activity among EECA, the Ministry for the Environment, and the Department of Building and Housing.

Consumers may also save money on a home upgrade by utilizing the Window Efficiency Rating Scheme (WERS) when replacing old windows. Consumers look to the window's rating and label for its annual energy impact on a whole house. The ratings vary from five to one star, with five star windows being the top performers and one star indicating poor performance.[38] This government-sponsored program is a variant of Australia's WERS and is supported by the Windows Association of New Zealand, a commercially neutral forum for those "involved in any aspect of the New Zealand window industry."[39] When "up to forty percent of a home's energy is lost through windows," these ratings can certainly help consumers save energy.[40]

Figure 3: Example of WERS Label,
Source: The Design Navigator

Lastly, New Zealand's EECA recently passed one of the nation's most significant energy efficiency initiatives. The program involves spending $323M to subsidize insulation retrofits in New Zealand homes.

BCAP Recommendations

Currently New Zealand maintains a variety of energy efficient building practices and rating systems, such as Green Star ratings and the Window Efficiency Rating System (WERS). These green initiatives often refer to the construction of new building, such as Green Star minimum level requirements for commercial buildings, and in most cases are voluntary. To achieve higher levels of energy efficiency and reduce energy consumption nationally, minimum Green Star rating levels could be made mandatory for private sector buildings – commercial buildings, as well as residential. In addition, instead of looking solely at new construction projects, minimum levels of Green Star ratings could be required for older homes and retrofit/renovation projects. Tax breaks or subsidies could be given to homeowners who choose to update appliances and make their existing homes more energy efficient, similar to the most recent legislation in New Zealand for subsidizing retrofit insulation. Given the current global economy, financial incentives could serve as the perfect motivation for homeowners who wouldn't otherwise consider making their homes more energy-efficient.

[1] http://en.wikipedia.org/wiki/Politics_of_New_Zealand

Organization (CSIRO), AccuRate NZ is a sophisticated tool that allows the assessor to model the energy efficiency performance of a home.

[2] CIA World Factbook. https://www.cia.gov/library/publications/the-world-factbook/geos/NZ.html
[3] Energy Information Association. New Zealand Data. http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=NZ
[4] http://en.wikipedia.org/wiki/List_of_countries_by_population
[5] New Zealand Tourism Guide. http://www.tourism.net.nz/new-zealand/about-new-zealand/weather-and-climate.html#climate
[6] New Zealand Department of Building and Housing. Building Regulations Section. http://www.dbh.govt.nz/building-regulations
[7] Id at About the Building Act
[8] Id.
[9] New Zealand Department of Building and Housing 2007. *New Zealand Building Code Handbook*. http://www.dbh.govt.nz/UserFiles/File/Publications/Building/Compliance-documents/building-code-handbook.pdf
[10] New Zealand Department of Building and Housing. About the Building Code Section. http://www.dbh.govt.nz/bcr-about-the-building-code
[11] New Zealand Government. Schedule 1 of the Building Regulations 1992. http://www.legislation.govt.nz/regulation/public/1992/0150/latest/DLM162576.html?search=ad_regulation__building+regulations+1992____ra_rc%40rrev_r
[12] New Zealand Government. Building Regulations 1192, Schedule 1, regulation 4 (1). http://www.legislation.govt.nz/regulation/public/1992/0150/latest/DLM162576.html
[13] New Zealand Building Code, Schedule 1, Clause A2 - Interpretation http://www.legislation.govt.nz/regulation/public/1992/0150/latest/DLM162576.html?search=ad_regulation__building+regulations+1992____ra_rc%40rrev_r
[14] Commonwealth of Australia, Australian Greenhouse Office 2000. *International Survey of Building Energy Code,* at 17.http://www.environment.gov.au/settlements/energyefficiency/buildings/publications/pubs/international_survey.pdf
[15] *New Zealand Building Code Handbook* at 8.
[16] New Zealand Department of Building and Housing. Alternative Solutions. http://www.dbh.govt.nz/establishing-compliance-alternative-solutions
[17] Id.
[18] Id and http://www.dbh.govt.nz/bofficials-code-compliance-cert
[19] *New Zealand Building Code Handbook* at 10 -11.
[20] Id at 10.
[21] New Zealand Energy Efficiency and Conservation Authority. About Section. http://www.eeca.govt.nz/about-eeca/eecas-role/legislation
[22] New Zealand Energy Efficiency and Conservation Authority. About Section. http://www.eeca.govt.nz/about-eeca/eecas-role
[23] Id.
[24] New Zealand Energy Efficiency and Conservation Authority. Energywise Website. http://www.energywise.govt.nz/
[25] Id.
[26] New Zealand Green Building Council. Green Star New Zealand http://www.nzgbc.org.nz/main/greenstar
[27] New Zealand Green Building Council. Green Star Industrial Tool. http://www.nzgbc.org.nz/main/greenstar/elaboration/ratingtools/industrial
[28] Id.
[29] New Zealand Green Building Council. Interiors Tool. http://www.nzgbc.org.nz/main/greenstar/elaboration/ratingtools/interiors
[30] New Zealand Green Building Council. Education Tool. http://www.nzgbc.org.nz/main/greenstar/elaboration/ratingtools/education
[31] Branz. Build Journal. *Energy Efficiency and Conservation Strategy*, 42-43. February/March 2008. http://www.branz.co.nz/cms_show_download.php?id=502

[32] New Zealand Ministry for the Environment. Sustainable Buildings Section. http://www.mfe.govt.nz/issues/sustainable-industry/govt3/topic-areas/sustainable-buildings/government-policies.html
[33] Branz. About the Household Energy End-Use Project (HEEP)http://www.branz.co.nz/cms_display.php?pg=2360&sn=78&st=1
[34] Id.
[35] Id.
[36] New Zealand Energy Efficiency and Conservation Authority. Energy Wise Website http://energywise.govt.nz/ratings-and-labels/home-energy-ratings
[37] New Zealand Energy Efficiency and Conservation Authority. Programmes Section. http://www.eeca.govt.nz/eeca-programmes-and-funding/programmes/homes/home-energy-ratings
[38] Window Association of New Zealand. http://www.wanz.org.nz/about_wanz.htm
[39] Id.
[40] Id.