CONSERVATION IS NOT ENOUGH

Initiatives in sustainable architecture in New Zealand as demonstrated by* Architecture New Zealand*, 1970 – 2000

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"[…] the crisis of ecological scarcity can be viewed as primarily a moral crisis in which the ugliness and destruction outside us in our environment simply mirrors the spiritual wasteland within; the sickness of the earth reflects the sickness in the soul of modern industrial man, whose life is given over to gain, to the disease of endless getting and spending that can never satisfy his deeper aspirations and must eventually end in cultural, spiritual and physical death."

W. Ophuls in Architectural Ecology and the Politics of Scarcity [1]

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[1] Stephen Rainbow, *Critical Issues in New Zealand Society*. Auckland, New Zealand: Oxford University Press, 1993, p.21.

Cover HSW Express, *Black Gold - How the World Floats on Oil*. Atlanta, Georgia, United States, Retrieved Mai 28, 2008 from the World Wide Web: http://express.howstuffworks.com/exp-oil.htm.

ABSTRACT

This research paper explores the development of sustainable architecture as demonstrated by *Architecture New Zealand*, formerly known as *New Zealand Architect*, between 1970 and 2000. Furthermore, it examines international conferences and political events, which have influenced New Zealand's sustainable movement. In this case, the report identifies the Stockholm Conference in June 1972 as the beginning of public awareness in terms of environmental problems. It examines the influence of the two oil crises in October 1973 and during the Iranian Revolution in 1979 and shows their influence on the sustainable movement. In order to indicate the critiques and developments in New Zealand's sustainable history during the 1970s, the paper examines articles by Peter Bartlett (1978), Graham Stevens (1978) and Ivan M. Johnstone (1980).

The Brundtland Commission in 1983 and the Earth Summit in Rio de Janeiro in 1992 are explored by the research paper to show that the sustainable movement was widely recognised as an opportunity to reduce the carbon dioxide emissions, after the international community started to agree that climate change was more than a controversial theory during the 1980s. Therefore, the paper examines national efforts to reduce the carbon dioxide emissions after the Earth Summit and considers an international architectural competition by the Wellington City Council, which marks the beginning of national efforts in New Zealand. The Kyoto Protocol in 1997 is the last subject that is determined by the paper to identify the beginning of global action against climate change. This report examines articles that were published by Graeme Robertson (1991), Richard Lambourne (1992), Nigel Isaacs (1993), John Storey (1993, 1994, 1995), Russell Hawken (1993), Roman Jaques (1993), Sean Lockie (1994) and Michael Donn (1996, 1997) to describe the development during the 1980s and 90s.

Overall, the paper shows that the 1970s can be seen as a turning point in the development of international environmental politics that indicate the beginning of public concerns in terms of the sustainable movement. It explains that sustainability was widely seen as a problem during the 80s, and a rethinking in architectural design started to be the goal. The paper concludes that the international community realised during the 90s, that they have to reduce greenhouse gas emissions to reduce global warming and started to support and to establish sustainable architecture.

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ABBREVIATIONS

ANGOA	Association of Non-Governmental Report Organisations of Aotearo
BRANZ	Building Research Association of New Zealand
CFCs	Chlorofluorocarbons (Haloalkane)
CO_2	Carbon Dioxide
COP-3	UNFCCC Conference of Parties in Kyoto, Japan
DHW	Domestic Hot Water
EU	European Union
ECNZ	Electricity Corporation of New Zealand
GHG	Greenhouse Gases
NZBC	New Zealand Building Code
NZIA	New Zealand Institute of Architects
OAPEC	Organization of Arab Petroleum Exporting Countries
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of Petroleum Exporting Countries
R-value	Thermal Conductivity
U-value	Thermal Transmittance Value
UIA	International Union of Architects
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
WCED	World Commission on Environment and Development
WCC	Wellington City Council

INTRODUCTION

A particular interest in the relationship between historical and political events, such as international conferences, and architectural design has inspired this research into the development of sustainable architecture in New Zealand, between 1970 and 2000.

It may seem that during the last century, society has lost touch with environmental developments, but opportunities for a reversal of this trend were given to the international community that allow to establish the sustainable movement. A report in the *Times* of 18 October 1995 stated that global warming is a confirmed fact and not merely a controversial theory. [1] Also, international business and government communities began holding a series of urgent conferences aimed at finding global remedies. Governments started to admit the vast extent of environmental destruction. [2]

New Zealand is particularly vulnerable through global warming because its primary industries are strongly influenced by the climate. Therefore, New Zealand is vulnerable to the rise of biosecurity risks. The native ecosystem is already under pressure and can be highly damaged, if the climate changes. Furthermore, the rise of sea levels would affect the nearly 90% of New Zealand's population that lives on the coastline, as well as the small island nations in the Pacific around New Zealand. [3] Being faced with this problem, architects and engineers started to review architectural design and building construction during the 1990s.

The goal of this research paper is to examine the development of sustainable architecture as demonstrated by *Architecture New Zealand* (formerly known as *New Zealand Architect),* between 1970 and 2000. *Architecture New Zealand* is the official journal of the New Zealand Institute of Architects (NZIA) and New Zealand's only professional architectural journal. Therefore, the research paper examines the articles in terms of the sustainable movement in New Zealand and looks at the historical background of each. This is e.g. the Stockholm Conference in 1972, which marked a turning point in the development of international environmental politics or the Kyoto Protocol that was adopted in 1997 and is widely recognised as the beginning of global action against climate change.

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[1] Brenda and Robert Vale, *The New Autonomous House.* London, UK: Thames & Hudson, 2000, p.15.
[2] James Wines (ed.), *Green architecture.* London, UK: Taschen, 2000, p.35.
[3] New Zealand's Ministry for the Environment. "Kyoto Protocol: Ensuring our Future - Climate Change Consultation Paper" in *New Zealand Climate Change Programme*. Wellington, New Zealand: Ministry for the Environment, 2001, p.11.

Research for this paper has been primarily literary, using articles that were published in *New Zealand Architect* and *Architecture New Zealand* from 1970 to 2000, to identify the development of New Zealand's sustainable architecture. Additional sources, such as books that are held at the library of the University of Auckland and online sources have been introduced to provide background information in terms of historical and political events. The referencing is achieved using the "Vancouver Method".

The research paper comprises 4 chapters: Chapter 1 considers the United Nations Conference on the Human Environment in Stockholm in 1972 and explores the first oil crisis in 1973 and the second in 1979, also known as the energy crisis. Chapter 2 examines the Brundtland Commission that was created by the UN in 1983 and the Earth Summit in Rio de Janeiro in 1992, as well as the sustainable movement in New Zealand during the 1980s. Chapter 3 considers the development in New Zealand's architecture after the Earth Summit and examines the Kyoto Protocol on Climate Change as the beginning of global action against climate change, in 1997.

Chapter 4 contains the results and outcomes of this research paper. It shows the development of sustainable architecture during the 1970s, the 80s and the 90s, and indicates specific events and developments of each period. Overall, it indicates the 70s as the period of the awakening, the 80s as the period of rethinking and the 90s as the beginning of global and national action against climate change.

1. THE STOCKHOLM CONFERENCE AND THE ENERGY CRISIS

1.1. UNITED NATIONS CONFERENCE ON THE HUMAN ENVIRONMENT (1972)

The beginning of modern political and public awareness of global environmental problems was the United Nations Conference on the Human Environment in Stockholm, Sweden, in June 1972. This conference was the first major conference on international environmental issues by the United Nations (UN), which was attended by representatives of 113 countries and is well known as the Stockholm Conference, today. The outcome of the conference was a declaration that contained principles which concerned the environment and the development of sustainability. One of the issues addressed the usage of Haloalkane (CFCs) that seemed to be a factor in the depletion of the ozone layer at the time. However, global warming was not yet a confirmed fact. [1]

While little of substance was achieved during the Stockholm Conference, it marked a turning point in the development of international environmental politics. Apart from awareness of global environmental problems and issues among public and governments, it was assumed that the conference would pave the way for future developments. One example of a development following the conference is the Environmental and Consumer Protection Directorate, which was created by the European Union (EU) in 1973 and which also composed the first Environmental Action Program. Furthermore, ministries for the environment and national agencies for environmental monitoring and regulation were instated in some governments. [2]

1.2. THE FIRST OIL CRISIS (1973)

Just a few months after the Stockholm Conference, in October 1973, the Organization of Arab Petroleum Exporting Countries (OAPEC) decided to stop supplying oil to the United States, its allies in Western Europe and Japan, because of their support of Israel in its conflict with Syria and Egypt. Furthermore, the Organization of Petroleum Exporting Countries (OPEC) tried to use its leverage to raise the world's oil prices. Following these developments, the oil price increases were dramatic and the affected countries started to develop initiatives to meet the problem of the first oil crisis in order to keep their

[1] Mostafa Kamal Tolba, *Evolving environmental perceptions: from Stockholm to Nairobi*. London, UK: Butterworths, 1988.
[2] John Baylis, Steve Smith, *The Globalization of World Politics*. Oxford, UK: University Press, 2005, pp.454-455.

independence. [3] In order to address these themes, the *New Zealand Architect* published an article from Peter Bartlett, Professor of Architectural Design at the University of Auckland in 1978. Bartlett assumed that the coming energy crisis would make it necessary for society to widely rethink the applied architectural and urban design practices. He considered that the term "environment" would become different to the public in terms of the coming energy crisis. Bartlett stated that this development could be called "environmental awareness" and pointed out that people would perceive their interaction with the environment differently than previous generations. [4]

Graham Stevens, Senior Lecturer at the School of Architecture in Auckland agreed with Bartlett and started a student project in 1978. Under his supervision, the project was to develop a building design suitable to the Auckland region that was based on the idea of creating a thermal solar heated building. [5] A similar project was already published in 1975 by Brenda Vale, Professor of architectural technology, and Robert Vale, senior research fellow at Victoria University of Wellington. Their concept was an *Autonomous House* that received international attention and was a significant move towards sustainable architecture world wide. [6] Therefore, the student's concept introduced passive solar design elements such as passive ventilation to control overheating, a North facing window wall to maximise the solar gain, a trombe wall to exploit thermal heat as well as massive walls inside the house to provide thermal storage devices into their idea of a solar heated house. They believed that the building had to be acceptable to New Zealand's public and therefore, it could not be too radical in its construction and the internal design had to harmonise with the current style of living. Still, they assumed that thermal solar heating in architectural design would become an important feature of future buildings. [7]

1.3. THE SECOND OIL CRISIS (1979)

The second oil crisis started during the Iranian Revolution that transformed the country from a monarchy to an Islamic republic. The new regime under Ayatollah Ruhollah Khomeini resumed the oil exports after the revolution, but at a lower volume that forced the prices to rise. Just a few months later, the Iraqi invasion of Iran severely impacted the oil production in both countries, resulting in what is known as the 2nd oil crisis or energy crisis today. [8]

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[3] Deutsches Historisches Museum, *Weltwirtschaftskrise*. Berlin, Germany, Retrieved Mai 28, 2008 from the World Wide Web: http://www.dhm.de/lemo/html/DasGeteilteDeutschland/NeueHerausforderungen/Weltwirtschaftskrise/index.html.
[4] Peter Bartlett, "Housing and the Coming Energy Crisis", *New Zealand Architect*, n.2, 1978, p.12.
[5] Graham Stevens, "Solar Heated House", *New Zealand Architect*, n.2, 1978, p.24.
[6] Brenda and Robert Vale, The New Autonomous House. London: Thames & Hudson, 2000, p.ii.
[7] Graham Stevens, "Solar Heated House", *New Zealand Architect*, n.2, 1978, p.24.
[8] The Heritage Foundation, *The Iranian Oil Crisis*. Washington DC, United States, Retrieved Mai 28, 2008 from the World Wide Web: http://www.heritage.org/Research/MiddleEast/bg76.cfm.

Taking the oil crises and the increases of energy prices into account, it showed that these events led to greater interest in renewable energy resources and sustainability in New Zealand during the 1970s. As published in the article “Solar Water Heating”, the New Zealand Ministry of Energy noticed a widespread interest in thermal solar water heating systems and the availability of Government incentives. The department instructed the Department of Scientific and Industrial Research to test different thermal solar systems that were already available on the market. By 1980, the ministry was pleased with the results and presented thermal solar systems as innovative ideas that could make a substantial contribution to household energy saving and the possibility to provide a sustainable domestic hot water (DHW) supply. [9]

In order to present these outcomes and to support the integration of thermal solar systems in passive solar design, *New Zealand Architect* published “Passive Solar Architecture” by Graham Stevens. The article claimed a need for built examples in 1980 and Stevens argued that architectural competitions in New Zealand would move forward the development of sustainable architecture. He considered that, for example, the first competition in Europe (run by Ralph Lebens Associates for the Commission of the European Communities) showed that competitions would provide the possibility to present the positive effects of passive solar design especially to the public, as well as to architects and designers in New Zealand. [10]

The growth of environmental awareness made it necessary to rethink architectural and urban design to optimise the energy consumption by buildings, but Ivan M. Johnstone, University of Auckland, concluded that solar design and energy conservation were actually not enough to meet the problem of the energy crisis. In 1980, he considered in his article “Conservation is not enough” that the oil embargo and the increases of energy prices concerned the public and also led to the integration of energy conservation techniques in building design. However, Johnstone argued that energy saving through energy conservation in buildings was limited to the obvious direct operational energy consumption. Energy was consumed in different life-cycle periods, such as the planning and construction process, as well as the maintaining and operating period. This energy consumption was simply not so obvious, compared to the more direct operational energy costs. Overall, Johnstone underlined that the construction process included the production of building materials, the transport, as well as the usage of machines that were – indirectly - a part of the overall energy consumption of a building. Therefore, it was also necessary to consider the holistic construction process to optimise energy saving. [11]

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[9] New Zealand Institute of Architects. “Solar Water Heating”, *New Zealand Architect*, n.3, 1980, p.38.
[10] Graham Stevens, “Passive Solar Architecture”, *New Zealand Architect*, n.5/6, 1981, p.41.
[11] Ivan M. Johnstone, “Conservation is not enough”, *New Zealand Architect*, n.5, 1980, p.44.

2. THE BRUNDTLAND COMMISSION AND THE EARTH SUMMIT

2.1. THE WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT (1983)

The World Commission on Environment and Development (WCED), also known as the Brundtland Commission, was created by the UN in 1983. The purpose of the Brundtland Commission was to address the interests in and concerns about human environments and natural resources, as well as consequences in terms of economic and social developments. The UN realised that environmental problems were the results of global problems and, therefore, identified a common interest to establish policies for sustainable development by all governments. [1]

A few months later, the *New Zealand Architect* changed its name to *Architecture New Zealand*. However, the research could not identify any following articles that were published in context to sustainable architecture or the Brundtland Commission, from 1983 till 1991. Afterwards, Graeme Robertson, senior lecturer in the Department of Architecture at the University of Auckland and member of the International Union of Architects (UIA) published his article “Environmental response”, in 1991. He was a member of the project group, “The Implications of the Greenhouse Effect for Architecture and the Built Environment”, and considered that the greenhouse effect and the associated global warming had to be taken into account and could not be ignored anymore. Furthermore, he argued that architects needed to become part of the sustainable movement. Robertson illustrated that sustainability in architecture would not have to imply a reduction of quality or have to lead back to primitive forms and materials. Furthermore, he proclaimed that a rethinking in architectural design would enhance the quality of buildings and respond to the natural environment. [2]

In this context, Graeme Robertson agreed with the Brundtland Commission that considered a common interest to establish policies for sustainable development and he pointed out that a policy for change had to have an impact on global, national, industrial and individual responsibilities. In this case, Robertson assumed that architects could also act without any regulations and specifications to design sustainable architecture. He gave his opinion that architects had to become more aware before it was too late and had to take up their

[1] William Lafferty, Katarina Eckerberg, *From the Earth Summit to Local Agenda 21: Working Towards Sustainable Development*. London, England: Earthscan, 1998, p.271.
[2] Graeme Robertson, “Environmental response”, *Architecture New Zealand*, November/December, 1991, p.125.

responsibility to support the building industry in producing a built environment to achieve a high quality of sustainability in architecture. [3]

Another problem that Robertson pointed out, were New Zealand's carbon dioxide (CO_2) emissions. Robertson explained that the global rate of increase was about 0.5% per year, but in New Zealand it was about 2% per year. He explained that it would be impossible for the government to realize their agreement to reduce the CO_2 emissions by 20% till 2000. Beyond this goal, he argued that it was necessary to reduce the CO_2 emissions by over 70% per capita to achieve true sustainability. Faced with this fact, he underlined that global warming was not a Third World tropical rainforest problem, which was a common misunderstanding, but rather a problem that was created by developed countries. [4]

2.2. A MISSING DEFINITION OF SUSTAINABLE ARCHITECTURE

Richard Lambourne, designer and researcher at Lambourne Architects (Auckland, New Zealand) explained in his 1992 article, that he noticed an increased usage of terms, such as "environmentally conscious design", "ecological design", "sustainable architecture" and "green architecture", during previous few years. Therefore, he indicated a need for criteria and a definition of sustainable architecture. He assumed that these criteria should ask for a high quality of integration in terms of the natural environment and a reduction of the CO_2 emissions to meet the problem of global warming. Furthermore, it would be necessary to reduce the energy consumption in materials, construction and during the operation of the building, as well as to introduce materials from sustainable sources, which were healthy and non-toxic. [5]

Lambourne stated that climate change and the integration of energy conservation systems in building design had to be a major environmental issue. In this context, he agreed with Robertson's argument and underlined his statement that architects had to take up their responsibility for the environment by themselves. Furthermore, he explained that the reduction of CO_2 emissions through the reduction of the energy usage had to be the most significant aim of sustainable architecture and disclosed that the average of New Zealand's energy consumption had increased steadily against the average of Japan, Australia and the data of the Organisation for Economic Co-operation and Development (OECD) since 1974. In order to meet this problem, he illustrated that it would be possible to save energy in new houses by up to 60% without the loss of quality. Lambourne argued that this goal could be

[3] Graeme Robertson, 1991, p.127.
[4] Graeme Robertson, 1991, pp.125-127.
[5] Richard Lambourne, "A green theme: Growing awareness of green architecture", *Architecture New Zealand*, May/June, 1992, p.84.

realised through the integration of different building technologies, such as passive solar design, thermal solar systems and high quality of insulation. [6]

In 1993, Nigel Isaacs, member of the Energy Research Group and teaching and research fellow at the Victoria University of Wellington, reflected on the situation in terms of the New Zealand Building Code (NZBC). He showed that the NZBC had a limited definition of energy efficiency, but against this limited definition there had been an interest in thermal insulation in New Zealand many years ago. He explained that thermal insulation was a possibility to deal with moisture and mould problems, but that there had not been any formal requirements until the 1970s. Isaacs considered that the Waimairi County Council required thermal insulation in residential buildings in 1971 as one of the first councils, which was followed by the Christchurch City Council in 1972. As a result of this development, Isaacs presented the local Government Act that was introduced to require thermal insulation from 1 April 1978. He noted that the Building Act 1992 required that energy efficiency had to be considered in most buildings, especially where non-renewable energy was used since January 1993. [7]

2.3. THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT (1992)

In the 1990s, the international community began to accept that climate change was a confirmed fact and not merely a controversial theory. What followed was a global response to take up the challenge to limit greenhouse gas emissions, which was adopted at the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, in 1992. During the conference the first international agreement in this area was adopted; the agreement of the United Nations Framework Convention on Climate Change (UNFCCC). Its scope was to stop the steady global increase of greenhouse gas emissions and to stabilise these at a level to reduce the negative impacts expected from future global warming. Another important outcome was the Agenda 21 programme that was related to sustainable development and intended to involve action at international, national and regional as well as local levels. In this context, the New Zealand Ministry of Environment produced a national guide according to this programme, such as a guide that could be used for national and local projects. Overall, this conference, in combination with the UNFCCC and the Agenda 21 programme, provided the basis for the Kyoto Protocol. [8]

The Earth Summit moved forward the sustainable development in New Zealand. John Storey, senior lecturer at the Victoria University of Wellington, showed that it was necessary

[6] Richard Lambourne, 1992, p. 84-85.
[7] Nigel Isaacs, "Energy-efficient buildings: How to comply the Building Code's definition of energy efficiency", *Architecture New Zealand*, July/August, 1993, p.73.
[8] Brenda and Robert Vale, *The New Autonomous House*, London, UK: Thames & Hudson, 2000, p.12.

to inform the public and professionals about the possibilities in order to establish sustainability in New Zealand's architecture and to ensure that they became familiar with this subject. He considered that building providers had to join the sustainable movement and the government had to support research to discover effective solutions to reduce the waste of energy in buildings. Storey identified that buildings that were built in the second half of the 20th century were often problematic in terms of energy consumption. He explained that these buildings were designed with the thought of an ongoing growth of materials and energy supply. He came to the conclusion that, at the end of the 20th century, this basis did not exist anymore. [9]

Storey considered the fact that renewable energy resources were also not well realised by designers, even though it was well known that buildings used almost 50% of the overall energy supply in New Zealand. Furthermore, buildings consumed energy embodied in the building materials, such as steel, aluminium, glass and concrete. He also indicated that the transport of materials and the effort to put them in place required large amounts of energy as well as energy for cleaning, maintenance and replacing of low durability materials during the lifetime of a building. Storey pointed out that even demolition required energy and these energy factors were poorly considered during the design process. [10]

Storey came to the conclusion that the public also needed to stop their profligate ways to reduce the waste of energy and to reduce global warming. However, he also showed that New Zealand's greenhouse gas emissions were low in relation to New Zealand's overall energy supply management, because nearly 65% of it came from renewable sources that led to a green image of the country., which became important to New Zealand in terms of the tourist trade. Storey considered that the New Zealand Institute of Architects (NZIA) took the initiative and realised a comprehensive environmental policy, but he indicated that a green policy needed to be supported from government, building providers and the building industry in order to be implemented. [11]

2.4. ARCHITECTS HAVE TO TAKE UP THEIR RESPONSIBILITY

Russell Hawken, chairman of the NZIA, disclosed in his article that architects as builders of human habitats were responsible to the client, as well as in relation to the future of the planet. He considered that not all architects agreed that sustainability was an essential development and pointed out that some architects still had the opinion that sustainability was unimportant and were practicing in the same way as they always had done. However, he

[9] John Storey, "Green Design", *Architecture New Zealand*, March/April, 1993, pp.72-73.
[10] John Storey, 1993, p.72.
[11] John Storey, 1993, p.73.

illustrated that architects who observed climatic change would totally agree with the sustainable movement and he believed that architects should have a sense of social responsibility. [12]

Furthermore, Hawken claimed that only a few members of the International Union of Architects (UIA) had been part of the United Nations Conference in Rio de Janeiro in June 1992. In this case, he assumed that Architects had not realised that they had to play an important part in the development of a sustainable society. This might be related to the problem that the UN organisers had recognised this fact only a few months before the conference actually started. Russell Hawken stated that sustainability was widely seen as a problem of others during the 1980s, such as the underdeveloped countries and not in context to the cities of the developed World. However, he indicated that architects realised sustainability not as a problem, but more important as an opportunity to reduce the carbon dioxide emissions, from 1993 onwards. [13]

Hawken considered that the Rio Programme on Sustainable Human Settlement developed an international programme to educate architects in terms of sustainable matters. Furthermore, he realised the Agenda 21 that was signed by New Zealand's government as one of the main outcomes of the Earth Summit. Overall, he came to the conclusion that the next international congress had to be critical and to evaluate the progress that had been achieved till 1992. [14]

At the end of 1980s, the research noticed an increasing number of articles that considered sustainable developments that marked the beginning of rethinking in architectural design in New Zealand. Compared to the few articles that were published to support the beginning of awareness of global environmental problems during the 1970s, authors, such as Graeme Robertson and Nigel Isaacs looked at specific problems and underlined solutions that were available to take up the challenge and to reduce global warming.

[12] Russell Hawken, "Reports from the XVIIIth UIA Congress: Architecture at the Crossroads – Designing for a Sustainable Future", *Architecture New Zealand*, September/October, 1993, p.28.
[13] Russell Hawken, 1993, p.29.
[14] Russell Hawken, 1993, pp.29-30.

3. SUSTAINABLE DEVELOPMENT AND THE KYOTO PROTOCOL

3.1. NEW ZEALAND'S CO^2 EMISSIONS AND THE HERO SYSTEM

After the Earth Summit in Rio de Janeiro 1992, Roman Jaques, member of the Building Research Association of New Zealand (BRANZ), considered that New Zealand's contribution of greenhouse gases was only 0.1%, but its per capita CO_2 emissions were among the highest in the world. The amount of greenhouse gas emissions per capita was about twice that of the world wide average. Furthermore, he illustrated that the CO_2 emissions in the commercial and domestic building sectors would be about 19% of the total emissions. In this context, he assumed that New Zealand had an important role in the challenge against climate change. [1]

Jaques outlined the BRANZ-developed Home Energy Rating Options (HERO) Scheme. This rating system was developed as an energy efficiency rating system for houses, for the Electricity Corporation of New Zealand (ECNZ), in 1992. HERO made it possible to rate the energy efficiency of existing houses and gave information to the occupants and house owners on how to improve their energy performance. He showed that this system rated the energy efficiency of a household as an open-ended system of stars awarded for performance. For example, one star described the energy performance of an older uninsulated house with an original hot water system, against a seven or a higher star rating that would describe the energy performance of a passive solar design with energy efficient appliances that might include thermal solar systems. Jaques came to the conclusion that there was a gap of information in terms of the energy consumption and environmental impact of buildings, materials and components that were used in New Zealand. [2]

3.2. THE ECO-HOUSE COMPETITION (1994)

As already suggested by Stevens in 1980, the "Eco-House Competition" article by Sean Lockie underlined that built examples of sustainable architecture would be important to fill this gap of information and move forward the development of sustainability in New Zealand. Lockie illustrated that sustainable design and the introduction of passive solar design offered benefits to the building and its occupants. Furthermore, he introduced the idea by Wellington City Councillor Stephen Rainbow, member of the housing and community development committee, to organize an international competition for the design of an environmentally

[1] Roman Jaques, "Branz: Guide to energy awareness", *Architecture New Zealand*, September/October, 1993, p.86.
[2] Roman Jaques, 1993, p.87.

friendly house. Rainbow suggested a project that would be designed on ecologically sustainable principles to promote sustainable urban design solutions. [3] The result was the Eco-House competition, which was initiated by the Wellington City Council (WCC), in 1994. John Storey illustrated that the Eco-House project would be the beginning of the challenge to reduce the wasting of energy and material resources in the Wellington region. [4]

In 1995, the Eco-House was completed and presented to the public as a compact, user and environmentally friendly home, which was about 112 m² and showcased the possibilities of ecological design. John Storey stated that this building was less concerned with innovative ideas, but with environmentally conscious use of readily available materials and technologies. In fact, the goal was to design a building that would be one of the top rating houses in New Zealand. However, it reached the 10-star barrier on the HERO rating system and became a high quality example of energy efficiency through design, which confirmed a need of similar examples for timber framed houses and the upgrade of existing houses in New Zealand. Storey pointed out that it was assumed that this project would have a significant impact on future developments in the capital. [5]

3.3. THE NEW ZEALAND BUILDING CODE AND ENERGY EFFICIENCY

Michael Donn, senior lecturer in Environmental Science at Victoria University of Wellington in 1996, showed that the New Zealand average of the window area in residential buildings was 40m², which was 30% to 40% of the average of the buildings envelope. Donn argued that it was necessary to introduce energy efficient windows, such as double glazed windows. However, he explained that the New Zealand Building Code (NZBC) defined practice so poor that it should be considered illegal, according to him. [6] Donn realised during a 1997 architectural exhibition called “Home Show” that people were more interested in the appearance of windows than in their energy efficiency. Therefore, he assumed that energy efficiency was still not an issue to the public and faced with this fact, he asked for a change in the marketing. Donn expected to have more discussions of thermal transmittance values (U-values) in the future in order to differentiate windows clearly from the single-glazed value. Therefore he pointed out that it would be necessary to convert thermal conductivity values (R-values) or U-values into a concept, such as an energy bill, to make it understandable to the public. [7]

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[3] Sean Lockie, “Eco-House Competition”, *Architecture New Zealand*, March/April, 1994, pp.18-20.
[4] John Storey, “Eco-House Competition Review”, *Architecture New Zealand*, July/August, 1994, p.104.
[5] John Storey, “A paradigm of the possible”, *Architecture New Zealand*, September/October, 1995, pp.27-30.
[6] Michael Donn, “Out of the window”, *Architecture New Zealand*, July/August, 1996, pp.104-106.
[7] Michael Donn, “Windows: What price thermal efficiency?”, *Architecture New Zealand*, July/August, 1997, p.116.

Donn further explained that the definition of energy performance in the Window Energy Rating Scheme System (WERS) and the NZBC energy efficiency clause H1 could be achieved without any improvements in standard window technology, such as the introduction of double glazed windows. He pointed out that the specification of thermal performance was using a definition of efficiency and cost effectiveness that was 20 years old at the time. Donn argued that this fact was unacceptable and it could not be the standard to buy a large heater to compensate for inefficient energy performance in buildings. [8] Donn came to the same conclusion as Nigel Isaacs in 1993: that the NZBC could not be seen as a definition of "good practice". Furthermore, it was not usable in his mind to feel comfortable with traditional building codes and standards that tried to define "good practice" at all. Overall, Michael Donn argued that consumer awareness of energy efficiency would change, but he emphasised that the NZBC could not be seen as a definition of a high quality. [9]

3.4. THE KYOTO PROTOCOL ON CLIMATE CHANGE (1997)

In December 1997, the UNFCCC Conference of Parties (COP-3) in Kyoto, Japan, adopted the Kyoto Protocol as the second international agreement after intensive negotiations. The paper identified the Kyoto Protocol as the beginning of global action to reduce the emissions of greenhouse gases (GHG) and to stop global warming, but *Architecture New Zealand* did not publish any articles that were relevant to this subject. However, the research paper suggests that the Kyoto Protocol was only the first step to reduce the emissions of GHG in order to slow down, and finally, to reduce global warming. Countries that signed and ratified the protocol committed to reduce their emissions of GHG to 1990 levels on average over the period 2008 – 2012, which would be the first commitment period. [10]

If a government would not reach the goal by 2012, it would have to take the responsibility for any emissions above 1990 levels and also need to offset these GHG emissions. In this case, the protocol gave the possibility to use other emissions units that were acquired under the clean development mechanism to buy additional emission units on the international market or to use sink credits. A sink credit was natural or man-made to absorb GHG and allocated for every tonne of carbon dioxide. Industrialized countries had to reduce their collective emissions of GHG by 5.2%, compared to New Zealand which needed to stabilise its GHG emissions after it accepted the ratification of the Kyoto Protocol in December 2002. [11]

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[8] Michael Donn, 1997, pp.116-117.
[9] Michael Donn, 1997, pp.118-120.
[10] New Zealand's Ministry for the Environment. "Kyoto Protocol: Ensuring our Future - Climate Change Consultation Paper" in *New Zealand Climate Change Programme*. Wellington, New Zealand: Ministry for the Environment, 2001, p.9.
[11] New Zealand's Ministry for the Environment, 2001, p.10.

5. CONCLUSION

The paper identifies the Stockholm Conference in 1972 as the first major conference on international environmental issues that marked the beginning of modern political and public awareness of global environmental problems. Followed by the first oil crisis in October 1973 and the energy crisis in1979, it caused an oil price development that was dramatically inflationary and concerned the public in New Zealand during the 1970s. Furthermore, this development made it necessary to New Zealand's architects to rethink their architectural design that was accompanied by the development of environmental awareness. Furthermore, the government was also concerned about the energy crises and started to support research in renewable energy technologies, such as thermal solar systems.

After the UN realised that environmental problems were the result of global problems, they established the Brundtland Commission in 1983. *Architecture New Zealand* made it clear that it was necessary that architects realised their responsibility by themselves to support the building industry to produce a built environment that reduced the building's energy consumption. The research paper shows that the sustainable movement moved on and a global response considered the global rise of GHG emissions, which was part of the subject at the Earth Summit in Rio de Janeiro, in 1992. According to the Agenda 21 that intended to involve action at international, national and regional, as well as local levels, the paper illustrates that the New Zealand Ministry for the Environment published a national guide that was used for projects, national and local, to reduce global warming.

Another identified gap of information was about environmental impacts and energy efficiencies of existing houses in New Zealand. Therefore, Branz developed an energy efficiency rating system, the HERO scheme, as presented by Roman Jaques in 1993. That followed the international Eco-House competition, which was initiated by the WCC to promote sustainable urban design solutions. Realised in 1995, it was presented to the public as one of the top rated houses in New Zealand with a ten-star rating by the HERO scheme. The research paper shows that this built example moved forward the sustainable movement in New Zealand, but it also assumes that energy efficiency was still not an issue to the public. In December 2002, New Zealand accepted the ratification of the Kyoto Protocol after signing the protocol in May 1998 and agreed to stabilise its GHG emissions over the first commitment period 2008 – 2012.

Overall, the paper shows that the 1970s marked a turning point in the development of international environmental politics, which could be seen as the awakening in terms of the sustainable development. During the 1980s, sustainability was widely seen as a problem, but in the beginning of the 1990s, the international community agreed that the climate change was more than a controversial theory and sustainability became an opportunity to reduce CO_2 emissions and to reduce global warming. Climate change became a confirmed fact during the 1990s, and the New Zealand government started to realise projects to establish sustainable architecture. In this case, the paper identifies the Kyoto Protocol as the beginning of global action in order to take up the challenge to reduce the emissions of GHG and to reduce global warming.

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