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## EXECUTIVE SUMMARY

The Tourism Industry Association of New Zealand commissioned this report *‘as a definitive reference point for the Tourism sector with regard to its greenhouse gas emissions (CO<sub>2</sub>) and the potential impacts on the sector, in order to establish the underpinning knowledge required for a subsequent TIANZ response and policy formulation with the Government post the Kyoto Protocol ratification’*.

The value of the tourism sector, in terms of GDP and employment is self-evident but there is also growing awareness of the New Zealand environment by the international market which is critical to New Zealand’s future prosperity. Both the tourism sector and the Government recognise the importance of the ‘state of New Zealand’s environment’ and the need to genuinely sustain the image of ‘100% Pure New Zealand’, as it is implicitly linked to maintaining credibility and growth in a highly competitive market.

It is important to recognise that The Kyoto Protocol requires a package of integrated measures/responses. There is no single solution, but there are a number of measures that many businesses and individuals are already addressing that provide CO<sub>2</sub> co-benefits in terms of reducing greenhouse gas emissions. For example, the transport, energy and waste strategies are intended not only to improve resource use efficiency but also deliver co-benefits in reducing greenhouse gas emissions. These need to be explored further as one implication is that saving money through those strategies can also produce a reduction in greenhouse gas emissions.

With the exception of Australian visitors, New Zealand’s quality environment scores highly with the long haul (UK, German, Japanese and US), travellers. It would seem to confirm that this key aspect of New Zealand’s ‘image’ is important. It is also important to recognise that Government’s policy and associated publicity about the impact of long-haul travel on greenhouse gas emissions could prove a significant barrier in the future.

The direct energy consumption in 1997/98 by the tourism sector was 27.53 PJ<sup>1</sup>, and this energy use resulted in 1,438,000 tonnes of CO<sub>2</sub> emissions. Given national totals of 440.64 PJ of energy and 28 million tonnes CO<sub>2</sub> in 1997/98, the tourism sector accounts directly for 6.2% of direct energy use and 5.1 % of CO<sub>2</sub> emissions.

Domestic tourism is responsible for 74% of tourism’s direct energy use and associated CO<sub>2</sub> emissions. This is mainly explained by the much larger tourist volume of more than 16 million trips per year compared with international tourist arrivals of about 1.7 million per year.

When measuring the direct and indirect pressure on the environment in the form of energy use and CO<sub>2</sub> emissions, tourism ranks 19<sup>th</sup> out of 26 sectors, whereby the 26<sup>th</sup> consumes most energy and produces the largest amount of CO<sub>2</sub>. ‘Households’ (134 PJ), ‘Basic Metal Products’ (54 PJ), and ‘Transport and Storage’ (44 PJ) are the largest energy consumers and CO<sub>2</sub> producers.

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<sup>1</sup> Measured in tonnes of oil equivalent, see Glossary.

Figures on absolute energy use are not particularly informative since they do not take into account the size of the sector and the economic activity associated with it. For that reason it is more relevant to look at an “eco-efficiency” measure, where eco-efficiency is the ratio of “environmental cost” (CO<sub>2</sub> emissions) to GDP. On this measure, tourism ranks 17<sup>th</sup> out of 26 sectors. However, it should be noted that this ranking is not on an equivalent basis for all sectors (for example, the agriculture and forestry sectors do not include any of the processing required before their products are exported).

A CO<sub>2</sub> price of emissions (PE) equivalent to \$25 per tonne of CO<sub>2</sub> equates to a direct cost of \$36 million and a total (direct and indirect) cost of \$67 million, which is equivalent to about 0.8% of both direct and total value added in the industry.

CO<sub>2</sub> emissions will continue to increase, due to growing tourist numbers, and if present technological improvements continue (the most optimistic scenario), emissions in 2007 will have increased by a total of 15 % or 1.5 % per year compared with the base year of 1997/98. However, the costs of a CO<sub>2</sub> PE as a proportion of revenue will decline with the improvement in technology.

Transport is responsible for about 70% of all energy use in tourism. Private vehicles (private cars and rental cars) and domestic air travel are the most important modes in terms of energy use and CO<sub>2</sub> emissions. Within the accommodation sector, hotels are the largest energy consumers and producers of CO<sub>2</sub>). Private homes are also important contributors but do not lie within the responsibility of the tourism industry. Tourist attractions are often large businesses with substantial CO<sub>2</sub> emissions per year, however, tourist activities consume more energy per tourist than attractions and also produce proportionally more CO<sub>2</sub> because of their dependence on motorised vehicles. Other sub-sectors, such as administration, retail and education play a minor role in terms of greenhouse gas emissions.

There will be reasonably significant impacts on the sub-sectors of tourism such as transport and some parts of adventure tourism, where the direct costs of a CO<sub>2</sub> PE at \$25 per tonne of CO<sub>2</sub> will be equivalent to about 2.5 % of value added (1.2 % of turnover), and the total (direct and indirect) CO<sub>2</sub> PE costs could be as high as 4 % of value added (about 2 % of turnover). Accommodation and restaurants will be less affected, with the direct CO<sub>2</sub> PE equivalent to 0.8 – 1.4 % of value added (0.3 – 0.8 % of their turnover) and the total CO<sub>2</sub> PEs equivalent to as much as 2.2 % of value added (around 0.7 – 1 % of their turnover). Finally, there will be sectors such as visitor attractions, tourism offices and retail where the effects of a CO<sub>2</sub> PE of \$25 per tonne will be smaller and equivalent to perhaps 0.1 – 0.4 % of their turnover and 0.2 – 1.0 % of their value added.

Clearly, New Zealand could be severely affected by the integration of international air travel into international agreements (currently international travel is not in the Kyoto Protocol), because the average tourist travel distance to New Zealand is 12900 km one-way. The competitiveness of New Zealand as tourist destination could be put at risk in two ways. First of all, New Zealand could be less competitive in a commercial sense in that airfares become relatively more expensive compared with countries that are closer to main countries of origin. And second, New Zealand may face difficulties when marketing the destination because of moral concerns by environmentally aware tourists.

There are several options to improve the environmental record of international travel, and, thus reduce emissions. These include increasing the average length of tourist stay, hence increasing expenditures per tourist and maintaining present tourist volumes for international tourists. Promoting domestic tourism, and increasing promotion efforts in countries that are geographically close to the destination is another option to reduce CO<sub>2</sub> emissions from international air travel. The option of offsetting carbon emissions from international travel needs to be explored. It is not simply a question of whether this is a cost-effective way of paying for CO<sub>2</sub> emissions, but is also a question of whether this is an effective means of altering the perceptions of environmentally-aware visitor and persuading them that travel to New Zealand is environmentally responsible.

## BACKGROUND INFORMATION

### Introduction

Since 1997 a series of reports and actions have reinforced both the importance of tourism to the economy and critically the value of sustainable tourism as a concept. Both of these are underpinned by a growing awareness of environmental factors to the continued success of the sector.

- The Parliamentary Commissioner for the Environment (1997)<sup>2</sup> report on ‘The impacts of tourism on the biophysical environment in New Zealand’ generated one principle recommendation – “facilitate and resource the strategy for sustainable tourism in New Zealand”.
- The New Zealand Tourism Board launched its “100% Pure New Zealand” brand in 1999, with its strong emphasis on visitor ‘experience’. It is argued that if this branding is to have credibility and substance there must be good evidence that New Zealand is “clean and green”.
- The Government set up the Tourism Strategy Group to develop a sector-wide strategy for the next decade (i.e. to 2010) by March 2001. It confirmed that the strategy is focused on *sustainable* tourism development to ensure the benefits accruing from the sector’s growth will not be short-lived. Sustainability is essential. Two critical success factors of the strategy were:
  - Ongoing investment by operators in product development, technology, quality systems and marketing in parallel with ongoing funding support from government reflecting the public good nature of much of the marketing, research and development, policy and environment conservation effort.
  - Managing the natural environment and environmental sustainability.
- In support of these developments the sector needed a credible method to measure its environmental performance. In 2001 the TIANZ introduced ‘**Green Globe 21**’ to New Zealand, an environmental improvement, benchmarking and certification programme for Travel and Tourism, intended to achieve an overall enhancement of an operation’s environmental performance (part of triple bottom line performance reporting<sup>3</sup>).

### The significance of the tourism sector to the New Zealand economy

New Zealand’s inbound tourism<sup>4</sup> rebounded strongly after the 11<sup>th</sup> September terrorism attack in the USA, with March 2002 arrivals recording growth of 14.5%, contributing to a 7.8% growth for the first quarter of 2002 compared with the same period last year. The strong inbound performance in March quarter will likely be reflected in additional earnings of around \$150 million from international visitors, to over \$2 billion in earnings for the quarter.

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<sup>2</sup> Office of the Parliamentary Commissioner for the Environment. 1997. *Management of the Environmental Effects Associated with the Tourism Sector*. Office of the Parliamentary Commissioner for the Environment, Wellington. ISBN 0-908804-74-1

<sup>3</sup> Triple Bottom Line Reporting records traditional financial measures, alongside environmental and social performance measures

<sup>4</sup> Tourism New Zealand, leading indicators monitor 22<sup>nd</sup> April 2002

These figures also take the 12-month total to a new record of 1.955 million arrivals; a growth rate of 5.8% for year ended March 2002. International arrivals are gradually returning to an underlying pattern of sustained growth. To the year ending March 2002, the United Kingdom market was up by 16,709 arrivals or 8%; the Australian market up by 41,109 arrivals or 7.2%; the United States up 0.3% with Japan down by 5.1%.

The Tourism Satellite Accounts (March 2000) by Statistics New Zealand reveal that tourism was:

- a \$13.2 billion industry (total (direct and indirect) tourism expenditure that equals 9.7% of GDP)
- the largest export sector at 16%
- accounts directly and indirectly for employment of 163,000 FTEs

From latest available data (December 2000), domestic tourism generated \$6.27 billion; \$4.05 billion on overnight travel, \$2.23 billion on day trips. Over the preceding year domestic tourism declined by 9.2%.

### *Summary*

The value of the tourism sector, in terms of GDP and employment demonstrates its growing significance to the New Zealand economy but there is also growing awareness of the New Zealand environment by the international market, which is critical to New Zealand's future prosperity. Both the tourism sector and the Government recognise the importance of the 'state of New Zealand's environment' and the need to genuinely sustain the image of '100% Pure New Zealand', as it is implicitly linked to maintaining credibility and growth in a highly competitive market.

### **The New Zealand Government's Climate Change Key Preferred Policies**

The Government has made an in-principle decision to ratify the Kyoto Protocol with a final decision to be made in July, with a view to ratification in August. In that context the tourism sector needs to explore the implications of ratification on the sector (and sub-sectors). These will be influenced by the policy framework as set out below.

Before ratification the Government needs to complete three actions:

- The Foreign Affairs, Defence and Trade select Committee has examined the National Interest Analysis (published on 13<sup>th</sup> February 2002, it considers the economic, environmental and social benefits of ratification), and reported back to Parliament in mid-May.
- The Climate Change Response Bill putting in place the constitutional arrangement to enable New Zealand to ratify, was introduced to Parliament in mid-May.
- Final decisions on the policies needed to begin the process of meeting New Zealand's obligations under the Kyoto Protocol will be made in July 2002. This requires a further



round of consultation on the ‘preferred policy options’<sup>5</sup> – published 30<sup>th</sup> April 2002’ that emerged out of the first phase of consultation in November 2001:

- What should be done
- How should measures be applied to the New Zealand economy
- Over what time frame.

The key points of the preferred policy package are:

- none of the new policies will be implemented for the first commitment period until the Kyoto Protocol comes into force – the Kyoto Protocol will enter into force 90 days after it has been ratified by at least 55 Parties to the United Nations Framework Convention on Climate Change, including developed countries (Annex 1 countries) accounting for at least 55% of carbon dioxide emissions in 1990. At the time of this report around 26% of developed countries have ratified. Countries critical to achieving the threshold of 55% signatories are Japan and Russia.
- building on the foundations of existing policies through the National Energy Efficiency and Conservation Strategy (NEECS), New Zealand Waste Strategy, New Zealand’s Transport Strategy, the Resource Management Act (this theme of co-benefits through other policy initiatives is discussed later)
- introduction of Projects; a specific activity aimed at delivering defined reductions in greenhouse gas emissions both in the pre 2008 and 2008-12 commitment period.
- introduction of Negotiated Greenhouse Agreements (NGAs) for Competitiveness-at-risk firms; a transition mechanism to protect firms at risk in a carbon constrained economy
- no price measures before 31<sup>st</sup> December 2007.
- an emissions charge in the first commitment period will be capped at \$25 per tonne of CO<sub>2</sub> equivalent.
- the principle of revenue recycling; this refers to using the balance of net revenue, after funding policies such as projects, NGAs and NEECS, for recycling back into the economy.
- retention of sink credits and their associated liabilities
- research for agriculture with exemption for the first commitment period for methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O).

### *Summary*

In anticipation of this process, the Tourism Industry Association of New Zealand (TIANZ) commissioned this report ‘*as a definitive reference point for the Tourism sector with regard to its greenhouse gas emissions (CO<sub>2</sub>) and the potential impacts on the sector, in order to establish the underpinning knowledge required for a subsequent TIANZ response and policy formulation with the Government post the Kyoto Protocol ratification*’.

An early action will be the need for TIANZ to determine whether the sector or some of its sub-sectors could be regarded as ‘Competitiveness-at-risk’. The high level criteria for determining this are:

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<sup>5</sup> The New Zealand Government's Climate Change Key Preferred Policy Package - 30<sup>th</sup> April 2002 - further information available on website [www.climatechange.govt.nz](http://www.climatechange.govt.nz)

- there is significant risk of industry output and emissions shifting to another country that does not impose emission costs; and
- there is significant risk to a firm's competitiveness in the export market(s); and/or
- there is significant risk of imports displacing domestic production.

The tourism industry has a reverse resource flow profile compared with many exporters – it exports the promise of a service and an image that results in the import of the customer. Environmental perceptions are very important in tourist decision-making. Tourism is highly substitutable - tourists can either go to another destination or determine to stay at home (and/or purchase other 'luxury' goods).

The tourism sector's largely fragmented structure and small/medium enterprise (SME) profile complicates any attempt to develop a generalised response to issues such as The Kyoto Protocol. However, some form of policy response is necessary as the sector (sub-sectors) could be regarded as being 'competitively-at-risk' because it is vulnerable to additional costs through its heavy reliance on transport and energy. This will be explored in greater detail later in the report.

However it also needs to be recognised that the sector has to engage constructively with the climate change debate, for example, with regard to its '100% Pure New Zealand' image, high levels of park and coastal visitation, which indicate visitors relate strongly to the clean and green image.

The risk of potential damage to New Zealand's reputation for being 'clean and green' was highlighted in an MFE report<sup>37</sup> *'Our clean green image: What's it worth?'* In summary the study found that the extent of change in purchasing behaviour varied by country. "...Under worsened environmental perceptions, tourists in New Zealand would alter their stay by an average of, ...: Australia 48% reduction, Japan 79% reduction, UK 77.5%, US 70% reduction". The annual loss to New Zealand from the five markets covered would be between \$530 million and \$938 million, depending on whether lost wages and GST are taken into account.

The report concludes that New Zealand's clean green image does have a value. Environmental image is a substantial driver of the value New Zealand can derive for goods and services in the international market place.

- New Zealand is relatively clean and green. This is mainly attributable to our low population density resulting in relatively benign environmental pressures.
- However, there are environmental problems that are sufficient to raise questions about the sustainability of the value of New Zealand's exports attributable to its environmental image. There is a risk that New Zealand will lose the value created by the current environmental reputation if we are not vigilant in dealing with the problems that could threaten the image.

The challenge for the tourism sector is how to manage the balance between potential additional costs from the ratification of The Kyoto Protocol, as opposed to the potential damage to market

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<sup>6</sup> "Our Clean Green Image: What's it Worth? Report by PA Consultants commissioned by the Ministry for the Environment, 2001.

image if the sector doesn't respond positively to climate change issues that flow out of the government's ratification of The Kyoto Protocol.

In summary it is important to recognise that The Kyoto Protocol requires a package of integrated measures/responses. There is no single solution, but there are a number of measures that many businesses and individuals are already addressing that provide CO<sub>2</sub> co-benefits in terms of reducing greenhouse gas emissions. For example, transport, energy and waste strategies are intended not only to improve resource use efficiency but also deliver co-benefits in reducing greenhouse gas emissions. These need to be explored further as one implication is that saving money through those strategies can also produce a reduction in greenhouse gas emissions.

The lead-in time to the commitment period (2008-12) can also be used by the sector to explore project-based initiatives related to energy use and transport, to mitigate the sector's heavy reliance on these important sources of greenhouse gas emissions. These could relate to energy conservation, locally-sourced renewable energy projects and bio-fuels.

There is also the opportunity for early engagement by the sector in encouraging protection of (non-harvest) forest sinks that will underpin the sector's 'clean and green' image. All these initiatives contribute towards the tourism sector's own framework of benchmarking and certifying environmental and social performance, using 'Green Globe 21'.

### **The Kyoto Protocol and what it requires of signatory nations**

In much of the debate that has preceded the second round of consultation on the Government's Preferred Policy Package, there has been broad recognition that climate change was a threat, but the debate has focussed largely on the unknown potential costs of ratification to industry in New Zealand. For the tourism sector these additional 'climate change' costs need to be understood, as far as current research allows, and their relevance to the various sub sectors of the tourism industry. This is particularly relevant when considering the profitability of the tourism sector. In a report on New Zealand's Wealth Creators: Stern Stewart's NZ 'Performance 40' 2000,<sup>7</sup> it notes: "...create long term value for your shareholders and you will be rewarded; fail to do so and the market will judge you for it." The argument is that all businesses need to create positive economic value that generates sufficient income to cover operational costs and re-investment in capital infrastructure. The belief is that in the tourism sector, there is insufficient income to fund 'future growth value' or the re-investment in capital infrastructure, and therefore any additional costs have longer-term implications for tourism operators.

However the costs associated with a 'carbon-constrained' economy in New Zealand are only one aspect of the commercial case. There is increasing evidence of growing public awareness of climate change. The political thrust of those countries committed to ratification of the protocol will create market opportunities for the 'Kyoto club' of countries that ratify. Conversely, those countries and their business sectors that do not ratify will be adversely affected. The Australian Institute was recently reported as saying that "the Australian government frequently talked up the

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<sup>7</sup> New Zealand's Wealth Creators: Stern Stewart's NZ 'Performance 40' 2000, Evaluation, Volume 3, Issue 7, June 2001.

business costs of ratifying the protocol, the real issue was the costs of failing to ratify". This was in response to the EU confirming that Australian companies investing in clean energy projects in developing countries will not be able to sell the carbon credits for saved emissions to Europe. Only those other countries in the 'Kyoto club' will be able to access the carbon credit market.

There is also growing evidence that ratification could generate new business opportunities. For example, there has been considerable speculation about Canada's position on ratification particularly given its close trading position with the US and that it could be significantly disadvantaged competitively with the present Bush Administration opposition to The Kyoto Protocol. However, Canada has established an 'Action Plan 2000 on Climate Change', a C\$1.5 billion federal programme aimed at reducing greenhouse gas emissions over the next five years. In addition a recent report – 'The Bottom Line on Kyoto'<sup>8</sup> found that the net economic benefits for Canada over and above "business as usual" projections would produce a cumulative net saving of C\$1.4 billion per year by 2012, an increase of C\$2 billion in GDP, with the net addition of 52,000 jobs.

In addition many global businesses in the US and some of the union states are ignoring the present political position of the Bush administration and are strategically planning for the next decade, where the need to address climate change will be a strategic issue.

It is in the context of the marketplace starting to determine competitive behaviour, that it can be argued that the tourism sector will need to respond positively to international perceptions on climate change, in that a negative attitude could impact on New Zealand's brand image of '100% Pure New Zealand'. This brand was launched in 1999, when Tourism New Zealand moved to focus its activities toward developing and communicating a single, concise brand position across all markets. New Zealand's landscape, adventure, people and culture, are the four elements of the New Zealand experience. New Zealand has always been renowned for its landscape, and it is within this environment that visitors can take part in a distinctly New Zealand adventure, experience our unique culture and meet New Zealand people.

It will also be important to assess how major potential signatory nations' visitors may view New Zealand, a view that may or may not be influenced by their own government's position on The Kyoto Protocol. In this regard the TIANZ are specifically interested in Australia, USA, UK, Germany and Japan.

In a competitive market the TIANZ has already recognised the risk of visitor perception and in 2001 introduced the global 'Green Globe 21' programme. Issues surrounding climate change, including energy management and greenhouse gas emissions, are addressed within the programme.

It would appear essential that at the very minimum the tourism sector sustains its current position and that potential tourists to New Zealand understand that the sector is committed to the environment not just locally but globally. The tourism sector will need to address a broad range of environmental issues, but for the purposes of this report, the focus will be on the direct and

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<sup>8</sup> The Bottom Line on Kyoto, Tellus Institute and Marshall Goldberg MRG& Associates – April 2002 ISBN 0-968731-1-6

indirect greenhouse gas emissions, and the issue of air travel and its associated greenhouse gas costs, which are significant given the distances tourists need to travel particularly from Europe and the US.

This not only reflects the growing awareness of the public and tourists to issues such as climate change but also the perceived commercial opportunities that are beginning to emerge for one sub-sector in the market place. Recent research from Otago University<sup>9</sup> acknowledged that whilst environmental values of visitors to ecotourism operations varied, respondents favourably reported on the extent to which ecotourism operations challenged visitors to consider their environmental values. The study made a number of recommendations but most critical to this issue was that ecotourism should focus on enhancing the environment as a central theme. This would represent a significant move away from mitigating negative impacts to maximising positive impacts, much to the benefit of the international reputation of New Zealand as an ecotourism destination. This approach supports the TIANZ strategy to target potential high value growth sectors that support and develop the '100% Pure New Zealand' image.

## **New Zealand's key markets**

### *Australia*

The Australian Government has made the decision not to ratify the Kyoto protocol. The Kyoto protocol's target for Australia allows for a 10% increase in CO<sub>2</sub> over the 1990 baseline but a recent draft report from the Australian Greenhouse Office suggests this maybe difficult to achieve with a projected figure estimating a 33% rise over baseline by the year 2010.

**The Australian tourist market** contributes \$857 million<sup>10</sup> pa in foreign exchange. They are short haul travellers who visit for 'holiday', to visit family and friends and for business purposes. They have the highest number of repeat visitors, with 70% having visited New Zealand before. They are less likely to use organised tours or visit tourist attractions. In terms of competition for next visit holidays, New Zealand competes directly with Asia, Western Europe and the US.

The largest determinant for those visitors intending to visit New Zealand is family, friends, non-specific and skiing. Beautiful/scenic country was not a significant factor.

The '100% Pure New Zealand' has had a significant impact on the Australian traveller (41% recall the advertising) whilst the barriers are 'many other places to visit', 'time' and 'value for money'. There is recognition of the quality of the landscape, lifestyle etc but this does not translate into a major justification to visit New Zealand.

Given the Australian Government's position on the Kyoto protocol and the low rating of the environment it would appear that there is little advantage to New Zealand in visitor perception through the tourism sector's adoption of positive action on greenhouse gases.

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<sup>9</sup> *Ecotourism in New Zealand*, Higham, Carr and Gale, Research Paper 10, Dept of Tourism 2001

<sup>10</sup> Tourism New Zealand 'Market Tracking Research' January 2001

## *USA*

The USA in particular has made it clear that it will not ratify any agreement unless key developing countries (for example China, India) make some meaningful commitments to control future emissions. President Bush has questioned the validity of scientific research which finds that the global climate is warming. According to Bush it is not beneficial for the USA to bind itself to the emission reductions.

**The US tourist market** contributes \$756 million<sup>11</sup> pa in foreign exchange. They are long haul travellers who visit for 'holiday' reasons and the vast majority are first time visitors. They are less likely to travel alone and more likely to be on a multi destination trip. They enjoy dining out, visit museums, galleries, botanical gardens, and go on scenic cruises and drives. In terms of competition for next visit holidays, New Zealand is not a significant destination with western and eastern Europe predominant.

The largest determinant in those visitors who intend to visit New Zealand is general curiosity and beautiful country/scenery, significant constraints being competition from other countries and distance.

The '100% Pure New Zealand' campaign has had a significant impact on the US traveller (39% recall the advertising) - the barrier is largely one of competition from Europe.

Given that the EU are major advocates of the Kyoto protocol but do not have the environmental image to compete with New Zealand, the US predisposition to curiosity and recognition of New Zealand's 'beautiful/scenic' country image, there is an opportunity to exploit this facet of the US sector.

## *United Kingdom*

The UK wishes to position itself as a world leader in the fight against climate change. The UK's ratification of the Kyoto Protocol is a clear public statement of its commitment to the Protocol. The UK continues to believe that it presents the only workable option for the international community to take serious action and it urges other countries to ratify as soon as possible. The Protocol was formally laid before Parliament on March 7<sup>th</sup>, to enable the Foreign Secretary to sign the UK's instrument of ratification in April 2002.

**The UK tourist market** contributes \$598 million<sup>12</sup> pa in foreign exchange. They are long haul travellers who visit for holiday reasons but are also the largest group who visit for family reasons (with the exception of Australians but they are short haul). The generalised visitor profile is of older travellers, travelling as a couple who also include Australia in their itinerary. They are more likely to eat out, enjoy sightseeing tours, beaches and visit family and friends. In terms of competition for next visit holidays Western Europe and US vastly exceed other destinations including New Zealand.

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<sup>11</sup>Tourism New Zealand 'Market Tracking Research' January 2001

<sup>12</sup> Tourism New Zealand, 'Market Tracking Research', January 2001

There is a considerable and growing interest in New Zealand as a destination. Most will be first time visitors. Family and friends are the major determinants for visiting New Zealand with its close proximity to Australia also another significant factor. Beautiful country/scenery is the least significant factor.

Whilst the '100% Pure New Zealand' campaign has had some impact on the UK traveller (28% recall the advertising), Australia attracts one third of the UK market whilst New Zealand attracts only one in ten. The key is to exploit 'must-see, add-on' and piggy back off the Australian visit – New Zealand being closer to Sydney than Perth.

In that regard New Zealand could offer a contrasting 'beautiful/scenic' country image for the older customers, one clear value that New Zealand enjoys along with 'time away from it all', 'refreshing' and 'an outdoor experience'.

### *Japan*

Japan will begin full-scale preparations for ratification of the Kyoto Protocol in 2002, by vigorously promoting the following measures:

- i. To review the current Outline for Global Warming Prevention in order to attain the Kyoto Protocol objectives.
- ii. To implement full-scale preparations for the next ordinary session of the Diet in order that approval of the ratification of the Kyoto Protocol, and the adjustment or establishment of the domestic structures necessary for ratification can be achieved.

Government policy states that "in order that the objectives of the Kyoto Protocol are attained, it is vital that each and every person in Japan changes his or her lifestyle in order to prevent global warming and that socio-economic reforms progress through technological innovation such as the development and dissemination of energy-efficient equipment and machinery. The concerted efforts of both the government and the people of Japan will be necessary in this endeavour and the understanding and action of each person is required".

**The Japanese tourist market** contributes \$731 million<sup>13</sup> per annum (pa) in foreign exchange. They are long haul travellers who visit for 'holiday' reasons rather than family ones and the vast majority are first time visitors. The national profile is group travel (less likely to travel alone than other nationalities), conversely they are more frequent shoppers, sightseeing tours, scenic cruises and farm shows than other visitors. In terms of competition for next visit holidays, New Zealand competes directly with Australia and US.

The largest determinant for those visitors intending to visit New Zealand is general curiosity and beautiful country/scenery, significant constraints being costs and lack of time.

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<sup>13</sup> Tourism New Zealand 'Market Tracking Research' January 2001

Whilst the '100% Pure New Zealand' campaign has had a limited impact on the Japanese traveller (23% recall the advertising) the barriers of time – as affected by distance, and value for money, indicates that any adverse effect on the 'beautiful/scenic' country image could undermine the one clear value that New Zealand enjoys.

The challenge will be how to balance the additional costs of The Kyoto Protocol on the tourism sector, in that it effects the Japanese 'value for money' barrier, whilst maintaining a positive commitment to the environmental perceptions of the Japanese tourist.

#### *European Union – with specific reference to Germany and the UK.*

The European Community took the decision to ratify the Kyoto Protocol on Monday 4th March 2002. The Council Decision will also give legal certainty to the EU agreement. The UK, Germany and other Member States can all now complete their national ratification procedures.

#### *Germany*

On March 22, 2002 Germany's parliament voted unanimously to ratify the Kyoto Protocol. The decision shows Germany's broad-based commitment to seeing the agreement enter into force by September 2002, when nations will come together in Johannesburg, South Africa, for the World Summit on Sustainable Development. "With this decision we are committing ourselves to possibly the greatest challenge of the 21st Century: to limit climate change so that man and nature can live with it," Environment Minister Jürgen Trittin said in a policy statement before the Bundestag vote.

**The German tourist market** contributes \$731 million<sup>14</sup> pa in foreign exchange. They are long haul travellers who visit for 'holiday' reasons rather than family ones and the vast majority are first time visitors. The generalised visitor profile is of an individual or travelling as a couple and are likely to be visiting New Zealand as part of a travel programme including other countries.

German visitors like to participate in a wide range of activities and are more likely to be drawn to natural attractions and to participate in outdoor activities e.g. tramping, glacier walking and swimming. In terms of competition for next visit holidays, New Zealand competes directly with Australia and US.

There is reasonable interest in New Zealand and a pressing need to stimulate the market's interest. The largest determinant for those visitors intending to visit New Zealand is the beautiful country/scenery and unspecified interest, significant constraints being lack of knowledge, expense, distance and other destinations taking priority.

The '100% Pure New Zealand' campaign has had a limited impact on the German traveller (4% recall the advertising) whilst the barriers of other preferred destinations such as South America (for adventure) and multi-destinational trips (Asia and Australia) indicate that New Zealand is

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<sup>14</sup> Tourism New Zealand 'Market Tracking Research' January 2001



losing ground. Tourism New Zealand regards the ‘family holiday’ and more effective marketing of New Zealand to include culture, diversity and excitement with more effective use of the ‘100% Pure New Zealand’ brand as key promotional issues.

Recently the German Government has developed a tourism strategy to improve the environmental performance of the product. Two relevant and key points are

- Promote domestic tourism, especially cycling networks, farm tourism and hiking routes
- Promote international issues to protect climate through emission charges for air travel.

This last bullet point aligns with recent agreement by EU Ministers to support a proposal called Integrated Product Policy – the environmental performance of all goods and services in the EU, which will include greenhouse gas emissions<sup>15</sup>.

It is evident that the German market will get more difficult to target effectively for the reasons outlined, but equally given the sensitivity to air travel and green house gas emissions, the New Zealand tourism sector can now position itself more robustly than Australia (who are not intending to ratify) and Asian countries (who by and large are formed of non-Annex 1 countries that will not be party to the first commitment period targets to reduce greenhouse gas emissions).

### *Summary*

It is acknowledged that this examination of tourist motivation (based on Tourism New Zealand data) and its possible relationship to National level responses to The Kyoto Protocol can only be exploratory and requires further research, perhaps in the form of specific survey questions about whether sector actions on climate change would effect the decision to visit and/or duration of stay.

However, with the exception of Australian visitors, New Zealand’s quality environment scored highly with the long haul (UK, German, Japanese and US), travellers. It would indicate that this key aspect of New Zealand’s ‘image’ is important. It is also important to recognise that New Zealand Government’s position and associated publicity about the impact of long-haul travel on greenhouse gas emissions could prove a significant barrier in the future. The impact of greenhouse gases associated with ‘long-haul’ visitor travel is discussed in more detail later.

## **CARBON DIOXIDE EMISSIONS AND THE NEW ZEALAND TOURISM SECTOR**

The tourism industry needs to understand the significance to the industry of the Kyoto Protocol and the associated CO<sub>2</sub> price of emissions (PE). The effects will arise firstly as a result of the direct cost of the CO<sub>2</sub> PE and hence effects on profitability of tourism businesses, and secondly as a result of the impacts of public sensitivity to greenhouse gas generation on the demand for international tourism in New Zealand. This demand depends not only on price but also on visitor perception. If a visit to New Zealand is seen as “environmentally unfriendly” because of the

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<sup>15</sup> Commission Green Paper on integrated product policy (COM(2001) 68 - C5-0259/2001 - 2001/2117(COS) Committee on the Environment, Public Health and Consumer Policy

greenhouse gas effects, then this could have implications for the NZ tourism industry which are much more serious than the effects of the CO<sub>2</sub> PE itself. In this section of the report we do not address any changes in visitor perception or ways to address this, but focus simply on the commercial implications of the CO<sub>2</sub> PE.

The study reports direct and indirect CO<sub>2</sub> emissions within New Zealand resulting from the tourism sector and also from particular sub-sectors of tourism, and discusses the commercial significance of a PE. The report also discusses briefly the CO<sub>2</sub> impacts of international air travel by tourists travelling to New Zealand.

### **Who Pays the CO<sub>2</sub> PE?**

A CO<sub>2</sub> PE will increase the costs of production for various industries. The amount of the cost increase and profit decrease for any particular business will depend in part on the level of both direct and indirect energy use (and associated CO<sub>2</sub> emissions) and in part on the ability of suppliers to pass the costs of the CO<sub>2</sub> PE on to their customers<sup>16</sup>.

The assumption made in this paper is that all CO<sub>2</sub> PE costs will be passed on to the tourism operator, and the objective here is to express this cost as a proportion of total price charged by the operator to the tourist. This will give an indication of the upper limit of the effects of the CO<sub>2</sub> PE on profitability. In reality, much of the additional costs may be able to be passed on to the consumer and the effects on profits will be less than the maximum that has been calculated here. This is because other producers will be facing similar price pressures and the end result may be a rise in the price of all products. On the other hand, producers of high- CO<sub>2</sub> products (e.g. air-tours) may also be competing with producers of low- CO<sub>2</sub> products (e.g. glacier walks) and the high CO<sub>2</sub> generators have to consider this competitive pressure when deciding by how much to increase their prices. The increases in costs will be split between reduced profit and increased prices, but the exact nature of that split will have to be assessed for each individual enterprise.

### **Significance of CO<sub>2</sub> PE**

The objective of this section is to show the significance of a CO<sub>2</sub> PE by expressing the likely cost in absolute terms and also as *either* as a percentage of turnover *or* as a cost per client in an activity (for example, per jet-boat ride, per bed-night, etc, etc.). It is the level of CO<sub>2</sub> PE compared with total costs and revenue that is most significant from a commercial perspective.

The absolute level of CO<sub>2</sub> produced by the industry may also be significant at a political and marketing level, and hence data on total use are included in this report.

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<sup>16</sup> Their ability to do so will depend on the nature of the market, and the availability of substitute products. The price in a competitive market is generally the marginal cost, and this may rise faster or slower than the average cost. For example, in electricity the marginal energy source may be thermal generation, which has a high carbon content and hence a high CO<sub>2</sub> content, or hydro or wind power which has virtually zero CO<sub>2</sub> content.

### *Data Sources and Analytical Perspective*

This analysis provides two independent estimates of the relationship between the tourism sector and the environment. The first estimate<sup>17</sup> was undertaken using Integrated Economic-Environmental Accounts<sup>18</sup>. This study builds on the Tourism Satellite Account<sup>19</sup> for the financial year 1997/1998, and the energy use by industry in these accounts depends heavily on data provided by the Energy Conservation Authority. The Integrated Environmental Accounts provide ‘top-down’ analysis (i.e. analysis of aggregated data at a national level).

The second estimate of the relationship between tourism and energy is a ‘bottom up’ approach<sup>20</sup> (i.e. analysis at the company or business level), which uses data on the energy use of individual businesses and information on tourists’ travel behaviour to build up a picture of total energy use. Despite the different approaches and a slightly different scope (e.g. different base year) the two studies arrive at very similar results and conclusions. This report integrates results from both studies.

### *Nature of the Tourism Industry and Energy Use*

The tourism sector consists of part of the output of several sectors<sup>21</sup> and it is therefore necessary to identify clearly what (sub)-industry activities for which tourism has to take responsibility when it comes to accounting for greenhouse gases. The tourism sector is made up from 24 economic sectors in the New Zealand Standard Industrial Classification and the Tourism Ratios<sup>22</sup> provided in the Tourism Satellite Account provide information on the purchases by the tourism sector from the other sectors in the economy.

Associated with these economic activities is the consumption of energy in various forms. Energy use is classified ‘direct’, when the tourism sector directly makes use of energy sources (e.g. combustion of fuel, electricity consumption), and ‘indirect’ when the tourism sector consumes services or products in which energy is ‘embodied’, i.e. another sector directly consumed energy to provide the service or product<sup>23</sup>.

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<sup>17</sup> How Clean and green is New Zealand Tourism? Lifecycle and Future Environmental Impacts, Patterson & McDonald, Draft 15<sup>th</sup> March 2002, Massey University.

<sup>18</sup> The framework provides a direct application of a number of analytical methods that provide insights into the tourism sector economy-environment interconnections

<sup>19</sup> Statistics New Zealand (2001). Tourism Satellite Accounts 1997. Wellington.

<sup>20</sup> Energy use in the New Zealand tourism sector. Becken, S., 2002, Draft PhD thesis, Lincoln University.

<sup>21</sup> Tourism is defined on the basis of the output, which tourists consume (e.g. accommodation, jet boat rides). This is in contrast to most other industries, which are defined in terms of what they produce.

<sup>22</sup> The proportion of output of each sector, which is consumed by tourists.

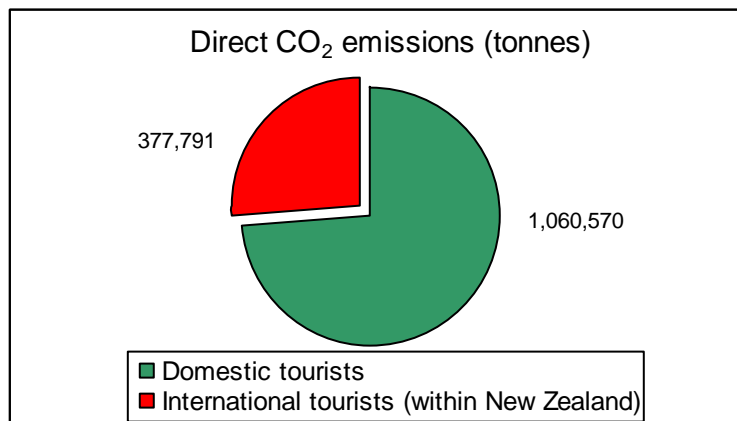
<sup>23</sup> For example, the accommodation industry uses direct energy use for heating, and uses indirect energy via laundry services who clean towels, chemical companies who provide washing powder to laundry services, transport operators who deliver the washing powder for the chemical companies, etc. etc. Energy is also used by households who earn their income from the accommodation, laundry, chemicals and transport industries.

### Direct Energy Use by Tourism

The direct energy consumption in 1997/98 by the tourism sector was 27.53 PJ<sup>24</sup>, and this energy use resulted in 1,438,000 tonnes of CO<sub>2</sub> emissions. Given national totals of 440.64 PJ of energy and 28 million tonnes CO<sub>2</sub> in 1997/98, the tourism sector accounts directly for 6.2% of energy use and 5.1 % of total CO<sub>2</sub> emissions.

Domestic tourism is responsible for 74% of tourism's direct energy use and associated CO<sub>2</sub> emissions (Figure 1). This is mainly explained by the much larger domestic tourist volume of more than 16 million trips (53 million nights) per year compared with international tourist arrivals of about 1.7 million per year. These results are confirmed for the year 2000 through the bottom-up analysis.

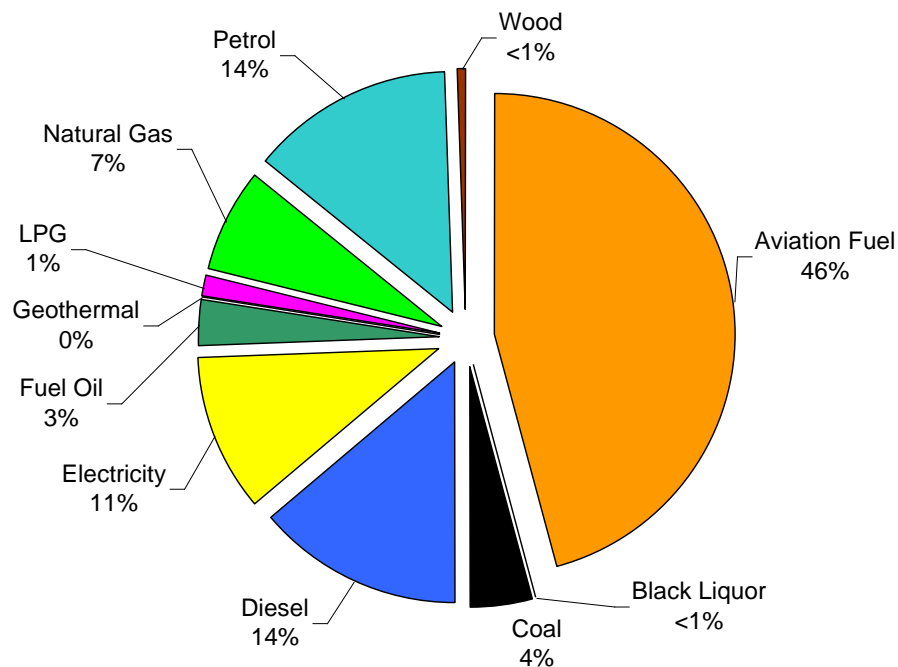
Figure 1 Contribution by domestic and international tourists to direct CO<sub>2</sub> emissions by tourism of 1,438,000 tonnes.



The most important fuel source in terms of direct CO<sub>2</sub> emissions is aviation fuel, accounting for almost half of the emissions (Figure 2). Other fossil fuels (petroleum oils, gas and coal) contribute another 43% of CO<sub>2</sub> emissions, reflecting the importance of transport, while electricity makes up only 11% of CO<sub>2</sub> emissions. The emissions from electricity use stem from the combustion of gas and coal for thermal electricity generation (about 35% of all generated electricity in New Zealand), with hydro-electric generation being zero rated for CO<sub>2</sub> emissions.

<sup>24</sup> Measured in tonnes of oil equivalent, see Glossary.

Figure 2 Tourism industry direct CO<sub>2</sub> emissions from different fuels sources.



The Government has suggested that a CO<sub>2</sub> PE will be imposed at a maximum of NZ\$25 dollars per tonne of CO<sub>2</sub> emitted. Assuming this maximum emission charge, the direct emissions of CO<sub>2</sub> will cost the tourism sector about NZ\$36 million per year (see Figure 4). Given that total output and value added<sup>25</sup> in New Zealand tourism in that year was approximately \$10.4 and \$4.8 billion respectively, then the PE is equivalent to only 0.3 % of output and 0.8 per cent of value added (or 1.4 % of labour costs).

### Indirect Energy Use by Tourism

Tourism's proportional contribution to national energy demand increases when indirect effects are accounted for. The indirect effects are calculated by estimating all the energy embodied in the inputs used by the tourism sector. This is done by using an input – output model with attached energy use and CO<sub>2</sub> emission vectors<sup>26</sup>. The total (direct plus indirect) energy use of tourism in 1997/98 was 47.36 PJ<sup>27</sup> and associated with this was the generation of 2,689,000

<sup>25</sup> Value added is output less all operating costs (excluding wages). Value added is analogous to GDP, and it is what the business has available to pay labour (including management), capital (including interest and depreciation) and land. In accounting terms it is similar to EBDIT + labour and management costs.

<sup>26</sup> Energy use and CO<sub>2</sub> production per \$million of output for each sector. The input-output models are described in Patterson (*op. cit.*)

<sup>27</sup> Measured as tonnes of oil equivalent.

tonnes of CO<sub>2</sub> emissions. Based on this, tourism was directly and indirectly responsible for 10.7% of energy use and 9.6% of CO<sub>2</sub> emissions in New Zealand in 1997/98<sup>28</sup>.

Even when the indirect CO<sub>2</sub> generation is taken into account, and assuming that all the costs of a CO<sub>2</sub> PE were passed on to tourism, then the total direct and indirect costs of the CO<sub>2</sub> PE to the industry as a whole would be \$67 million which is equivalent to only 0.6 % of sales or 1.4 % of value added.

Tourism is characterised by a relatively even contribution of direct and indirect energy use and hence CO<sub>2</sub> emissions (see also Figure 4). The indirect energy use of 19.83 PJ constitutes about 42% of the total energy use, and the direct CO<sub>2</sub> emissions of 1,250,000 tonnes make up about 47% of total emissions in the tourism sector. The large indirect emission of CO<sub>2</sub> is explained by the substantial intermediate inputs purchased by the tourism sector from the emission-intensive 'Transport and Storage' sector. Tourism is also somewhat unique in that core inputs into tourism activities (e.g., agriculture, construction) are often the outputs from other sectors.

The flow-on effects of tourism with regard to energy use and CO<sub>2</sub> emissions are displayed in more detail in the Appendix.

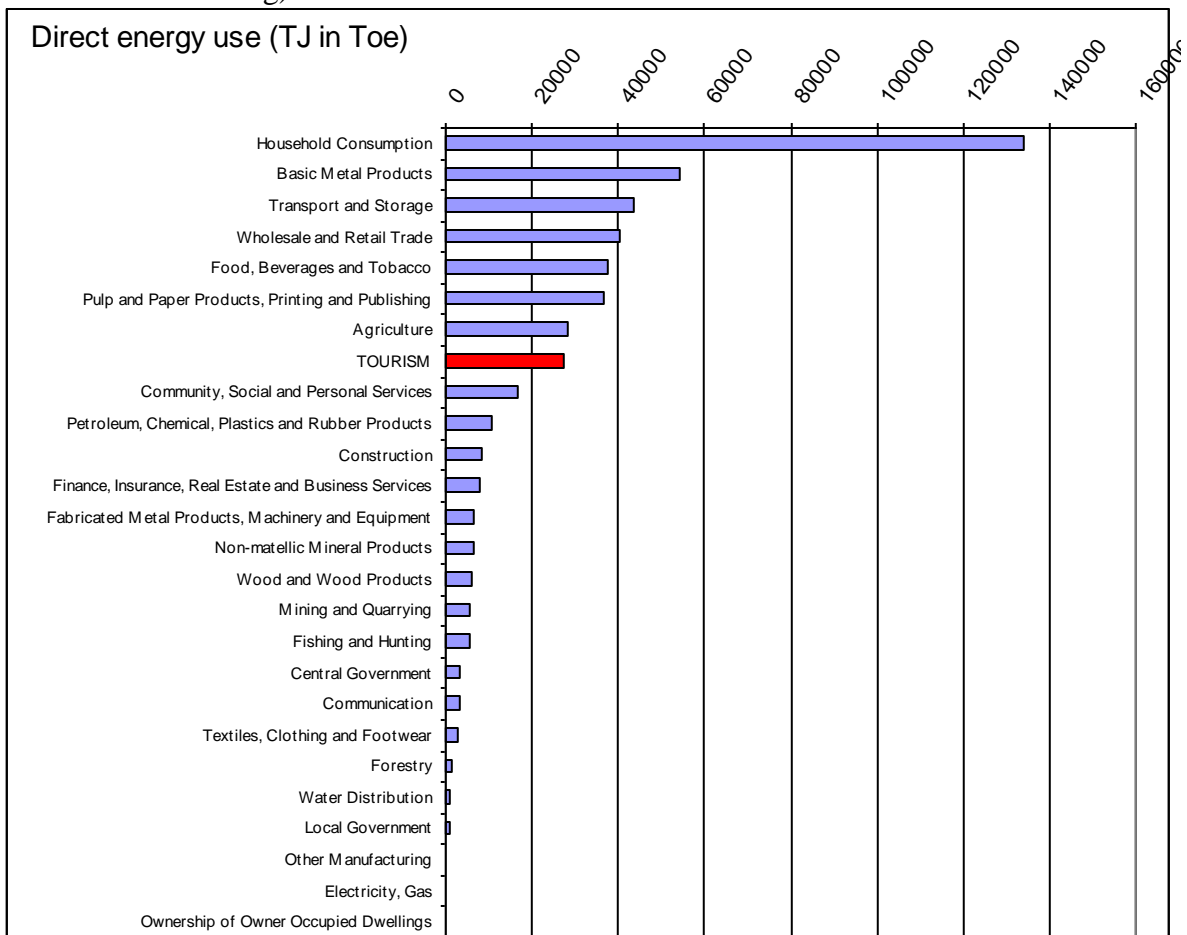
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<sup>28</sup> Due to continuous growth of the tourism sector and to the fact that tourism is growing faster than other sectors, both the level of energy use and the proportion of total energy going to tourism are likely to be larger in 2002.

### COMPARISON OF TOURISM WITH OTHER SECTORS

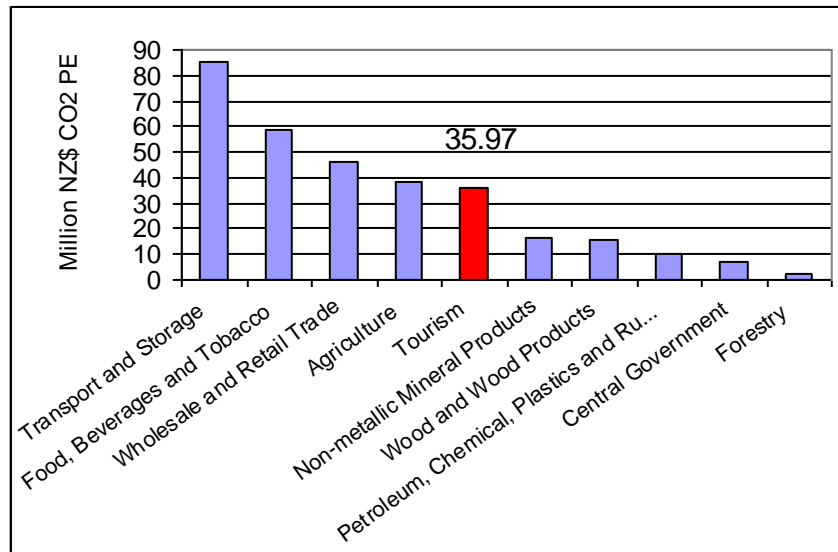
When measuring the direct pressure on the environment (environmental costs) in the form of energy use and CO<sub>2</sub> emissions, tourism ranks 19<sup>th</sup> out of 26 sectors (Figure 3), whereby the 26<sup>th</sup> consumes most energy and produces the largest amount of CO<sub>2</sub>. ‘Households’ (134 PJ), ‘Basic Metal Products’ (54 PJ), and ‘Transport and Storage’ (44 PJ) are the largest energy consumers and CO<sub>2</sub> producers.

Figure 3 Ranking of sectors according to direct annual energy use (CO<sub>2</sub> emissions parallel this ranking).



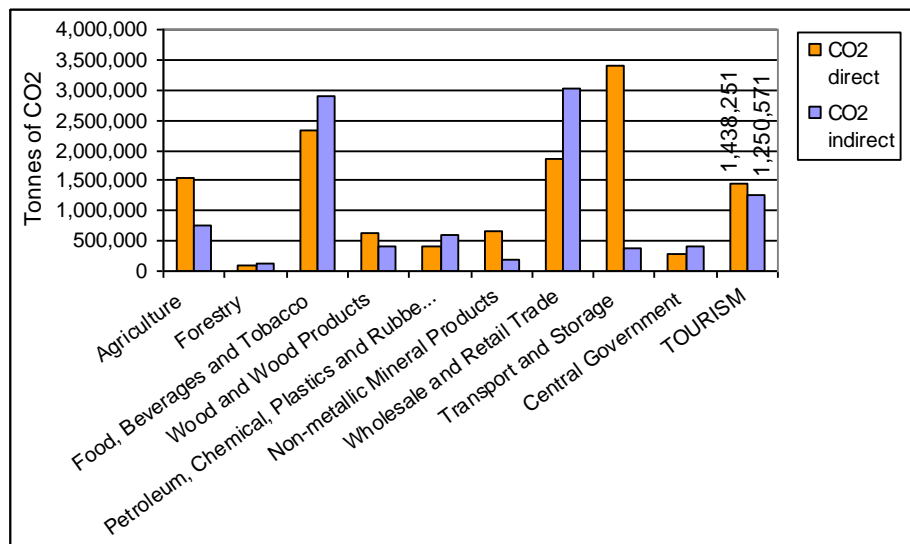
The costs of direct CO<sub>2</sub> PEs of tourism and other sectors of the economy is shown in Figure 4. Direct costs for tourism would be about 36 million dollars per year.

Figure 4 Costs (assuming a CO<sub>2</sub> PE of \$25 per tonne of CO<sub>2</sub>) from direct CO<sub>2</sub> emissions for selected sectors of the economy.



The contribution of direct and indirect CO<sub>2</sub> emissions for major sectors is shown in Figure 5. Tourism is a major producer of CO<sub>2</sub>, and on the face of this it is suggests that tourism will be one of the sectors most affected by a CO<sub>2</sub> PE.

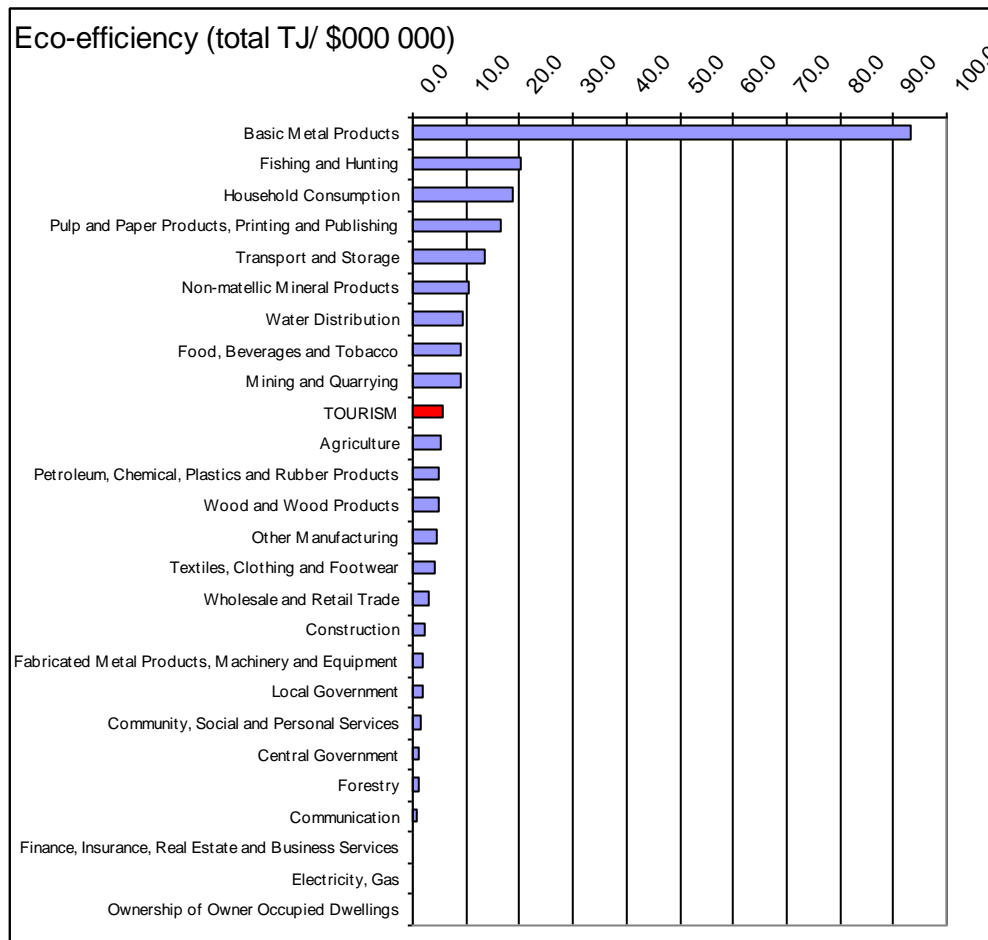
Figure 5 Comparison of selected sectors in terms of direct and indirect CO<sub>2</sub> emissions





Figures on absolute energy use are not particularly informative since they do not take into account the size of the sector and the economic activity associated with it. For that reason it is more relevant to look at an “eco-efficiency” measure, where eco-efficiency is the ratio of ‘environmental cost’ (CO<sub>2</sub> emissions) to GDP. On this measure, tourism ranks 17<sup>th</sup> out of 26 sectors (Figure 6).

Figure 6 Ranking of sectors according to their eco-efficiency based on total (direct and indirect) energy use



However, it should be noted that this ranking is not on an equivalent basis for all industries (for example, agriculture and forestry do not include any of the processing required before products are sold or exported), and there are other environmental costs besides CO<sub>2</sub>. Agriculture in particular, is characterised by the emission of greenhouse gases other than CO<sub>2</sub>. In 1999, CO<sub>2</sub> made up 39% of New Zealand’s contribution to atmospheric warming, whereas methane (CH<sub>4</sub>) comprised 45% and nitrous oxide (N<sub>2</sub>O) 16% (MfE, 2000). Agriculture is responsible for 90% of all methane and 94% of nitrous oxide emissions. When measured in Global warming potential (see Glossary) different greenhouse gases can be compared on the basis of ‘CO<sub>2</sub>-equivalents’. When considering CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, agriculture emits about 30 times as much greenhouse gases as tourism. About 3 % of the agricultural production is purchased by the tourism sector, hence tourism’s contribution to agriculture’s emission of other greenhouse gases is minor.

## The future position of the sector

Given the predicted and desired growth of tourism in New Zealand as well as potential moderations as a result of technological change, it is important to assess the implications for CO<sub>2</sub> emissions over time. To this end, three scenarios are calculated (Figure 7 and 8). The scenarios explore total (direct and indirect) energy use and CO<sub>2</sub> emissions under the assumption of three different levels of technical change based on time series from 1975 to 1998:

- A: No technical change over 1997-2007
- B: Mid-range technical change
- C: Historical level of technical change (current trends)

In each scenario it is assumed that visitor numbers grow in line with forecasts prepared by McDermott Fairgray Group Ltd (1998)<sup>29</sup>. These forecasts assume an increase to 2.744 million international tourists and 19.06 million domestic trips in 2007. In 2007, domestic tourism will be characterised by more frequent but shorter (in time) trips. The total number of domestic tourist nights (53 million nights) remains steady from 1997 to 2007. It is therefore difficult to assess the implications on CO<sub>2</sub> emissions. It is possible that the energy use per trip will decrease slightly if tourists travel less distance for shorter duration trips. Previous analysis of the Domestic Tourist Study, however, indicates that trip length and duration are not strongly related, and that domestic tourists do not adapt travel distances to their length of stay. In the scenario analysis presented here it is assumed that energy use per trip is not influenced by changing trends in domestic tourists' travel behaviour<sup>30</sup>.

Given the predicted growth in tourism from the year 1997/98 to 2007, and assuming no technological change at all (Scenario A), total energy use will increase by 84% for international tourists and by 21% for domestic tourists. Total energy use will increase by 37% and CO<sub>2</sub> emissions will increase at the same rate. Total emissions will then amount to 3,686,000 tonnes of CO<sub>2</sub>.

Scenario B considers moderate changes in eco-efficiency. The increase in total CO<sub>2</sub> will slow down to a total of 3,379,000 in 2007; an increase of 26% compared with 1997. Under the assumption of continuing improvements in energy efficiency (Scenario C) total energy use between 1997 and 2007 increases by 15 % overall, including a 54 % increase for international tourists and a 1% increase for domestic tourists. Clearly, technical change can substantially reduce the rate of increase in energy use, particularly for domestic tourists.

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<sup>29</sup> This forecast slightly overestimated the total volume of international tourism, which could lead to an overestimate of energy use. However, there is a trend of tourists staying longer, hence using more energy per trip. This latter trend may outweigh the former effect.

<sup>30</sup> New Zealanders are very highly committed to car travel (77% use their private car for travelling) and travel long distances of 623 km on average per trip (New Zealanders are 4<sup>th</sup> highest per capita car users in the world)

Figure 7 Three scenarios for total (direct and indirect) energy use for tourism from 1997 to 2007

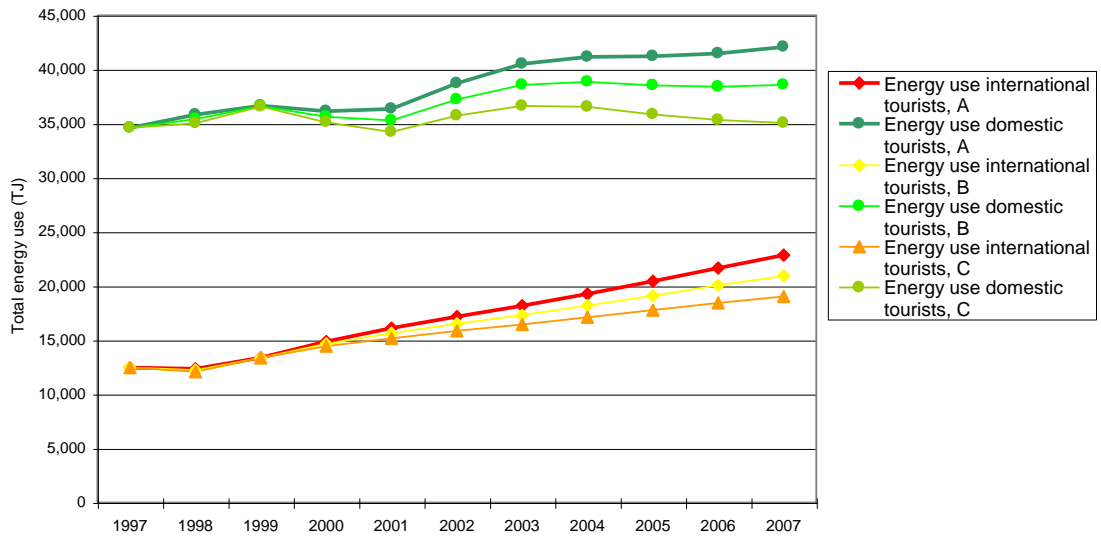
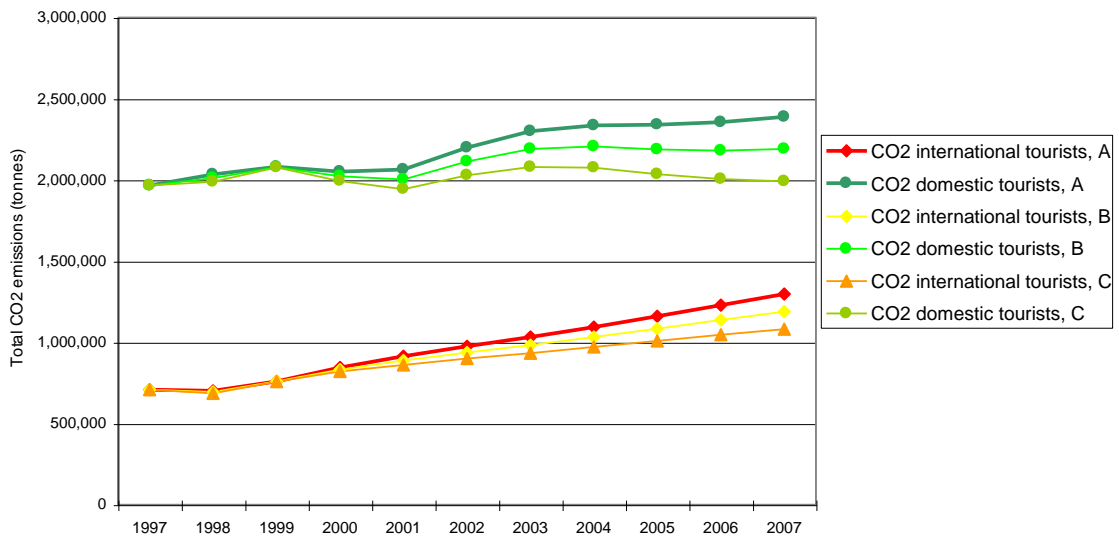


Figure 8 Three scenarios for total CO<sub>2</sub> emissions from 1997 to 2007



## **Economic Impacts of a CO<sub>2</sub> PE at a Tourism sub-sector level**

It was shown above that for tourism (excluding international travel) a CO<sub>2</sub> PE will be equivalent to only 0.3 % of output and 0.7 % of Value added. However, the effects are very variable for different sectors. In this section we look at energy use and CO<sub>2</sub> generation by different sectors and where possible compare the CO<sub>2</sub> PE to sector output. In other cases we are able only to express costs only on a per visit basis.

The TIANZ structures the tourism sector into the following sub-sectors<sup>31</sup>:

- Air transport
- Surface Transport
- Accommodation providers
- Hospitality (restaurants)
- Adventure Tourism and Outdoor Activities, and Attractions and Cultural Tourism
- Regional Tourism Organisations (RTOs) and Visitor Network Information
- Distribution and Shopping
- Other service (e.g. Human Resources Development and Research)

A brief description of the sub-sectors can be found in the Appendix. Unfortunately a number of these sub-sectors are not consistent with national accounts industry groups, and in this case we are able to give less precise information as to the significance of a CO<sub>2</sub> PE to these groups.

The most carbon intensive sub-sectors are air and surface transport. Accommodation is the most important of the non-transport related sub-sectors. Together, transport and accommodation make up about 78% of total direct energy use and CO<sub>2</sub> emissions in the tourism sector.

### *Domestic Transport*

The total energy use of tourist transport (excluding international air travel) was 19 PJ in 2000. This means that tourism contributes directly 16% to total passenger transport energy use. Most of this energy was used for road transport (58%) and air travel (42%) (Figure 9). Sea and rail transport played a minor role, although both are energy-intensive transport modes<sup>32</sup> compared with other public transport, such as intercity buses or shuttle services. Domestic tourists consumed about three times as much transport energy as did international tourists.

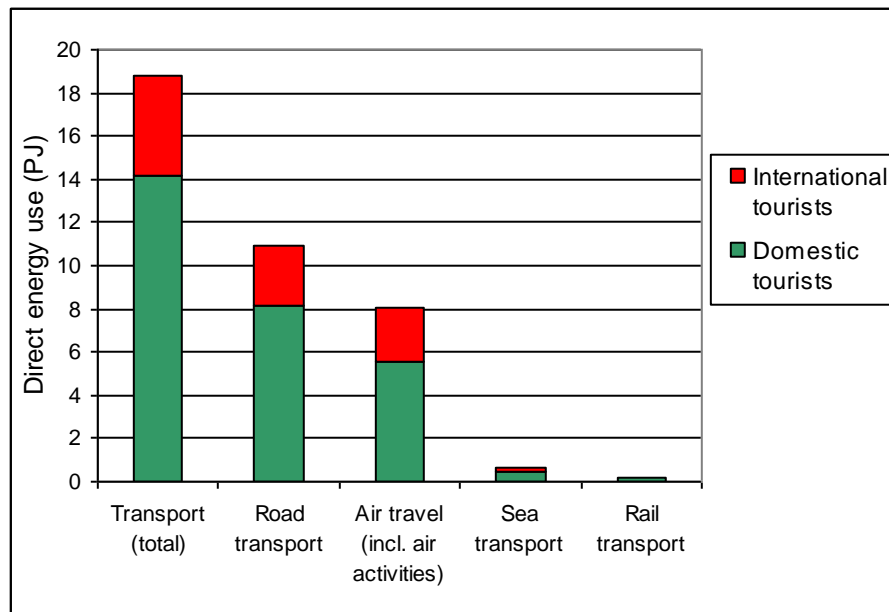
Transport is the largest source of energy consumption of an individual tourist. For domestic tourists, transport contributes 85% to direct energy use, while for international tourists transport within New Zealand makes up 69%. Clearly, the largest reduction potential for 'individual energy bills' of tourists is within transport.

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<sup>31</sup> The results presented in this section refer to Becken (2002) and may differ slightly from earlier results referring to Patterson and McDonald (2002).

<sup>32</sup> Rail travel in New Zealand is relatively energy intensive because of hilly terrain and often low passenger loadings.

Figure 9 Direct energy use for transport (air travel includes scenic flights and other air sports, sea transport included recreational water activities, such as scenic boat cruises, sailing trips and jet boat rides).



Carbon dioxide emissions associated with transport are directly dependent on the transport mode, its fuel source and operational efficiency (passenger loadings). Accordingly, the impact of a CO<sub>2</sub> PE varies for different transport modes. Table 1 shows the CO<sub>2</sub> PE costs per 100 passenger kilometre for a CO<sub>2</sub> PE of \$25 per tonne of CO<sub>2</sub>, (average occupancy levels and technology are assumed):

Table 1 Comparison of transport modes, energy and costs

	<i>Energy intensity (MJ/pkm)</i>	<i>CO<sub>2</sub> per passenger kilometre (g)</i>	<i>Costs per 100 passenger kilometre (NZ\$), \$25/tCO<sub>2</sub></i>
Domestic air	2.75	188.9	0.47
Rental car/ company car/ taxi	0.94	62.7	0.16
Private car	1.03	68.7	0.17
Coach	1.01	69.2	0.17
Camper van	2.06	140.9	0.35
Cook Strait Ferries	2.40	165.1	0.41
Train (diesel)	1.44	98.9	0.25
Scheduled bus	0.75	51.4	0.13
Backpacker bus	0.58	39.7	0.10
Motorcycle	0.87	57.9	0.14
Ferry (other)	3.53	242.9	0.61
Helicopter	4.68	321.5	0.80
Yacht	1.75	116.6	0.29

This implies CO<sub>2</sub> PEs for typical trips as follows:

- One-way flight from Auckland to Christchurch (744 km): \$3.51
- Car travel for typical trip by domestic tourists (about 600 km): \$1.03
- Coach travel for typical international tourist (about 1,130 km): \$ 1.95
- Domestic air travel for typical international tourist (about 1,039 km): \$4.96
- One-way travel on Cook Strait Ferry (96 km): \$0.34

A comparison of a CO<sub>2</sub> PE to the total cost is more difficult to assess because of the wide variety in modal costs. However, typical direct CO<sub>2</sub> PEs (at \$25/tonne of CO<sub>2</sub>) seem likely to be of the order of 1.2% of travel costs and 2.1-3.2% of value added. Total direct and indirect CO<sub>2</sub> PEs seem likely to be about 1.7% of transport costs and 2.9-4.2% of value added in transport.

Another way of looking at the cost is that the direct cost of the proposed CO<sub>2</sub> PE is equivalent to around 5.7 cents per litre of petrol and 6.5 cents per litre of diesel (or 4.6 cents and 5.3 cents respectively for the equivalent energy in CNG or LPG).

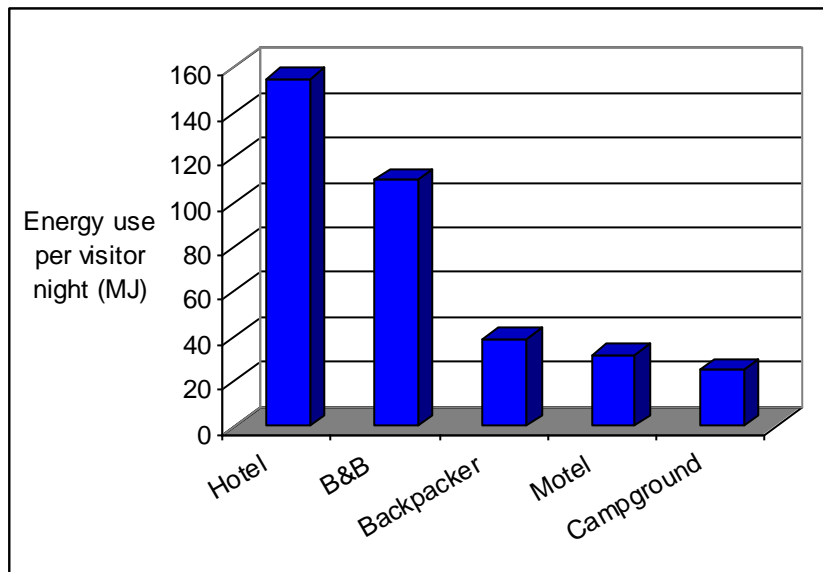
### *Accommodation*

The commercial accommodation sub-sector contributes about 4 PJ (about 5%) per year to the total direct energy use of tourism. Hotels are usually the largest businesses in terms of capacity and visitor nights. Therefore, total energy use per year is larger for a hotel (2250 GJ/yr) compared with other categories (e.g. 253 GJ/yr for backpackers)<sup>33</sup>. Furthermore, as a result of a higher service levels, one person-night in a hotel consumes about three times the energy of one person-night in a motel or backpacker. Campgrounds or motor camps are most energy efficient in terms of energy use per visitor-night. A general principle emerges: the higher the service level, the larger the energy use per visitor night (Figure 10). However, because higher levels of service are associated with higher accommodation charges, the energy cost and CO<sub>2</sub> PE are expected to be a roughly constant proportion of the cost of accommodation. Indications are that a \$25 PE on CO<sub>2</sub> emissions would be equivalent to about 0.3% of accommodation charges (sales) and 0.8% of value added in the accommodation industry. Total direct and indirect CO<sub>2</sub> PEs are likely to be equivalent to about 0.7% of sales and 2.2% of value added in the industry.

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<sup>33</sup> Beckens, S., Frampton, C. & Simmons, D. (2001). Energy Consumption Patterns in the Accommodation Sector – the New Zealand Case. *Ecological Economics*, 39 (3), 371-386.

Figure 10 Energy intensity(direct energy use per visitor night) of major accommodation categories



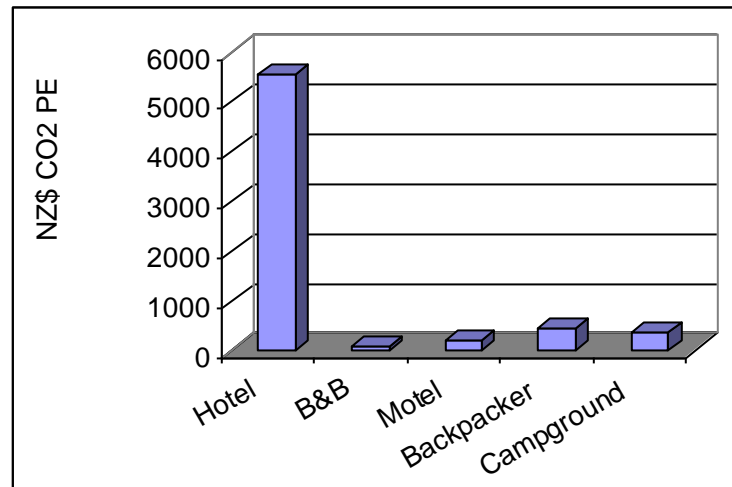
It is important to keep in mind, that most visitor nights are spent at private homes with friends and relative. In fact, both for international and domestic tourists private homes are the most popular place to stay, with 34.3% and 58.3% respectively of all guest nights being spent there. Energy use occurring in private homes is accounted for by the ‘household’ sector.

The contribution of an accommodation category to total accommodation energy use differs slightly for domestic and international tourists. For domestic tourism, private homes and holiday homes are the largest contributor with 51% of energy use in the accommodation sub-sector, followed by hotels (33%), motels (6%), campgrounds (5%), B&Bs (4%), and backpacker hostels (1%). For international tourists most energy is consumed in hotels (51%), while private homes (including student accommodation) contribute 26%, backpackers 9%, B&Bs 7%, motels 5% and campgrounds 3%. In summary, hotels and ‘homes’ are the most important categories in which to achieve energy savings.

Since accommodation businesses generally rely mainly on electricity<sup>34</sup>, CO<sub>2</sub> emissions are lower compared with transport. Survey data suggests that an average hotel with about 28,100 visitor nights per year emits about 222 tons of CO<sub>2</sub>. This translates into additional costs of about \$5,550 for CO<sub>2</sub> emissions per year (Figure 11).

<sup>34</sup> In motels 94% of all energy use is based on electricity, while B&Bs cover only 43% of their energy demand through electricity.

Figure 11 Costs per business per year for different accommodation categories assuming a CO<sub>2</sub> PE of \$25 per tonne. Business sizes in visitor nights per year: Hotels (28100), B&Bs (830), Motels (6,200), Backpackers (10,700), campgrounds (10,800).



The costs can also be estimated on a per visitor night basis. The additional cost for one night in a hotel is about \$0.2 (Table 2) or about 0.2-0.3% of the accommodation tariff. This survey data is consistent with the economic modelling results shown above, which suggest the emissions costs will be equivalent to about 0.3% of the tariff.

Table 2 Comparison of accommodation categories, energy and costs resulting from a CO<sub>2</sub> PE of \$25 per tonne.

<i>Category</i>	<i>CO<sub>2</sub> per visitor night (kg)</i>	<i>Costs per visitor night (NZ\$), \$10/tCO<sub>2</sub></i>	<i>Costs per visitor night (NZ\$), \$25/tCO<sub>2</sub></i>
Hotel	7.895	0.08	0.20
B&B	4.142	0.04	0.10
Motel	1.378	0.01	0.03
Backpacker	1.619	0.02	0.04
Campground	1.364	0.01	0.03
Home <sup>1</sup>	1.579	0.02	0.04

<sup>1</sup> EECA (2000). Energy-wise monitoring quarterly. Residential sector energy use: Highlights. Issue 15, June 2000. Wellington.



### *Tourist attractions and tourist activities*

Tourist *attractions* include museums, art galleries, botanical gardens, zoos, wildlife parks, industrial attractions (e.g. breweries or wineries), natural attractions such as the glow worm caves and thermal attractions, casinos, cinemas and theatres. Theme parks (e.g. Shantytown), experience centres (e.g. International Antarctic Centre) and ‘experience museums/displays/exhibitions’ are further tourist attractions. Energy use of tourist attractions is mostly associated with operating a building complex. Accordingly, electricity (about 50-70%) and gas (about 5-20%) are the main energy sources. Some energy is consumed for transport or other motorised equipment (for example in botanical gardens). This means, that tourist attractions are less carbon-intensive than tourist activities (see below). Total emissions may be considerable (depending on the size of the attraction). On a per visitor basis, however, attractions generally operate efficiently<sup>35</sup>.

In contrast, adventure and outdoor *activities* often rely on motorised transport, which has a high CO<sub>2</sub> use compared with stationary attractions. Many adventure operators offer a package that includes transport to the activity, the activity itself, and sometimes services after the activity (such as hot showers after dolphin watching) provided at the base of the business. On average, the participation in an adventure activity results in CO<sub>2</sub> emissions of about 2 kg per person. Traditional tourist attractions (e.g. museums, parks) produce about 0.5 kg of CO<sub>2</sub> per visit, whereas more modern, energy-dependent attractions, such as amusement centres and theme parks produce about 1.5 kg per visit.

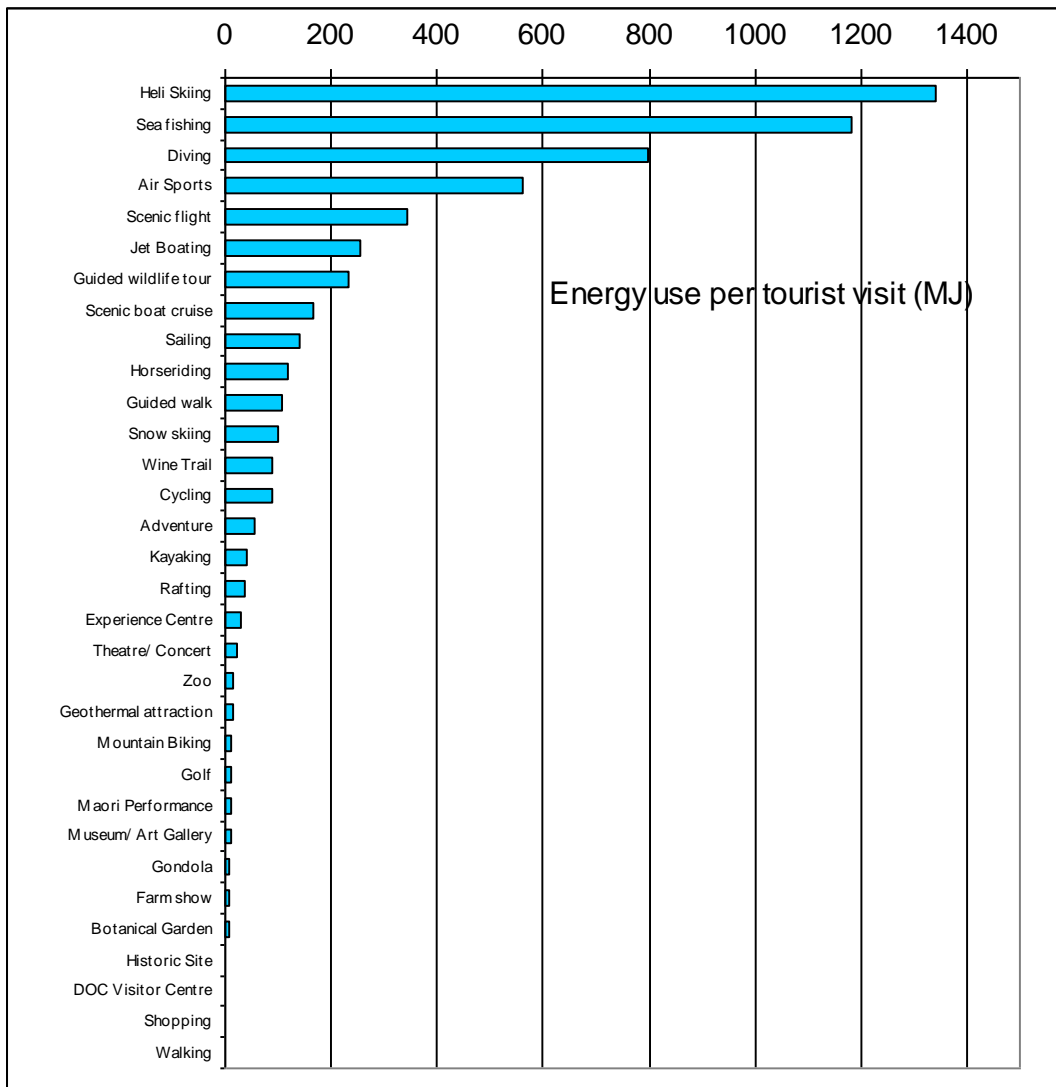
The energy use per visitor differs considerably between various tourist attractions and activities. Figure 12 gives an impression<sup>36</sup> of those attractions or activities, which rely heavily on direct energy input.

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<sup>35</sup> Becken, S. & Simmons, D. (2002). Understanding Energy Consumption Patterns of Tourist Attractions and Activities in New Zealand. *Tourism Management* 23 (4), 343-354.

<sup>36</sup> Breaking activities down to this level of detail means that each business type is represented by a small sample size only, which decreases the reliability of the results.

Figure 12 Direct energy use per visit for selected tourist attractions and activities



To estimate potential costs as a result of a CO<sub>2</sub> PE, the different types of tourist attraction and activity operators are aggregated into 11 categories (Table 3). Large amusement complexes (e.g. theme parks) and entertainment establishments (e.g. theatres) would have to pay about \$8,000-\$11,000 per year (based on their direct emissions). However, the costs per visitor is only about 1 cent per visitor. The cost per tourist participation is higher for other activities, and the highest average costs is for air activities (e.g. scenic flights, ballooning, heli-skiing, parachuting) where a \$25/tonne CO<sub>2</sub> PE would be equivalent to about 70 cents per visitor. At the average charge per person for these activities \$70-100, then the cost would be equivalent to about 1% of revenue and 2.5% of value added. Another way of considering the cost on those relying heavily on fuel is that the CO<sub>2</sub> PE at \$25 per tonne is equivalent to an increase of 5.7 cents per litre of petrol and 6.5 cents per litre of diesel.

Table 3 Comparison of attraction/activity categories in terms of direct costs resulting from a CO<sub>2</sub> PE of \$25/t CO<sub>2</sub>.

	<i>Visitor numbers per year</i>	<i>Costs per business per year</i>	<i>Cents per tourist visit</i>
Building	51,100	214	0
Park	75,000	979	1
Amusement	300,000	11,146	4
Industry	5,700	80	1
Nature attraction	350,000	3,532	1
Performance	75,500	1,077	1
Other entertainment	1,000,000	8,247	1
Air activity	1,890	1,308	69
Sea activity	4,000	1,530	38
Adventure recreation	12,000	670	6
Nature recreation	3,600	150	4

### *Administration and retail*

The administrative sub-sectors contribute only to a small extent to CO<sub>2</sub> emissions of tourism. The total number of administrative businesses is 121 (RTOs and Visitor Centres); in addition there are 200 distribution businesses and about 211 tourist-specific shops (numbers provided by TIANZ). The two latter are likely to be similar in their energy consumption patterns (retail businesses). Together these sub-sectors comprise fewer businesses than for example the backpacker sub-sector (502 businesses). It is estimated that each administration and tourism-specific retail contribute less than one percent to total energy use in the tourism sector.

The following features are characteristic for energy use of these sub-sectors:

- Energy demand is mainly related to the operation of buildings ;
- Buildings require most energy for space heating or cooling (this is mostly electricity) ;
- Electricity is consumed for electronic equipment, mainly office equipment;
- There is often large open space in the building, making heating in-efficient;
- Transport is required to varying degrees.

The Energy Efficiency and Conservation Authority provide information on how to decrease energy use related to office activities.

### **Two examples:**

1. **Visitor Centres** are visited on average by about 80,000 visitors per year and use about 160 GJ per year. Most of the energy use is electricity; and only about one percent is for road transport. On a per capita basis, the visit to a visitor centre requires about 4 MJ, which compares well compared with other 'tourist attractions'. Souvenir shops consume energy (electricity) depending on the size of the commercial area. Energy use per year varies considerably. On a per tourist basis, energy use is about 3 MJ per visit<sup>37</sup>. Economic modelling work suggests that direct CO<sub>2</sub> PEs in retailing will be less than 0.1% of sales and

<sup>37</sup> Becken, S. & Simmons, D. (2002). Understanding Energy Consumption Patterns of Tourist Attractions and Activities in New Zealand. *Tourism Management* 23 (4), 343-354.

0.3% of value added, while total (direct and indirect) CO<sub>2</sub>PEs (direct and indirect) will raise this cost to around 1% of value added (0.5% of gross margin).

## **2. Restaurants and Other Food and Drink**

There are no survey data available for the estimation of energy use in restaurants and hotels. However, economic modelling work suggests that direct energy use is considerably higher than in the retail and accommodation sectors. It is expected that the direct cost of a CO<sub>2</sub> PE of \$25 / tonne would be equivalent to about 0.7 % of sales or 1.4 % of value added in the sector. Total direct and indirect costs would be equivalent to about 1 % of sales and 2.4 % of value added.

### *Summary*

The tourism sector directly contributed \$4,754 million to GDP (4.84%) in 1997/98, directly using 27.533 PJ of energy and generates 1,438,000 tonnes of CO<sub>2</sub> emissions. When flow-on effects through other industries are incorporated, the total value added is about \$13,000 million, which is equivalent to a contribution of 9.7% to GDP. The total (direct and indirect) energy use of tourism is 47.358 PJ, and total tonnes of CO<sub>2</sub> produced is 2,688,823 tonnes. Tourism contributes directly about 5.1% of total CO<sub>2</sub> emissions in New Zealand, with domestic tourism making up three quarters of energy use and CO<sub>2</sub> emissions in the tourism sector. When indirect emissions are also taken into account, tourism is responsible for about 10% of the total national CO<sub>2</sub> emissions.

A CO<sub>2</sub> PE equivalent to \$25 per tonne of CO<sub>2</sub> equates to a direct costs of \$36 million and a total (direct and indirect) cost of \$67 million, which is equivalent to about 0.8% of both direct and total value added in the industry.

CO<sub>2</sub> emissions will continue to increase, due to growing tourist numbers, and if present technological improvements continue (the most optimistic scenario), emissions in 2007 will increase by a total of 15 % or 1.5 % per year compared with the base year of 1997/98. However, the costs of a CO<sub>2</sub> PE as a proportion of revenue will decline with the improvement in technology.

Tourism is among the large direct energy consumers and CO<sub>2</sub> producers, ranking 19<sup>th</sup> out of 26 sectors (with 26<sup>th</sup> being the largest producer). Tourism performs slightly better when measured in 'eco-efficiency', i.e. direct environmental costs per dollar output. However, comparisons with sectors such as agriculture and forestry are difficult as the costs of downstream processing to produce refined products is not included in these two sectors. For example, a refined agricultural product is produced via the Agricultural and Food, Beverage and Tobacco sectors.

Transport is responsible for about 70% of all energy use in tourism. Private vehicles (private cars and rental cars) and domestic air travel are the most important modes in terms of energy use and CO<sub>2</sub> emissions. Within the accommodation sector, hotels are the largest energy consumers and producers of CO<sub>2</sub>). Private homes are also important contributors but do not lie within the responsibility of the tourism industry. Tourist attractions are often large businesses with

substantial CO<sub>2</sub> emissions per year, however, tourist activities consume more energy per tourist than attractions and also produce proportionally more CO<sub>2</sub> because of their dependence on motorised vehicles. Other sub-sectors, such as administration, retail and education play a minor role in terms of greenhouse gas emissions.

There will be reasonably significant impacts on the sub-sectors of tourism such as transport and some parts of adventure tourism, where the direct costs of a CO<sub>2</sub> PE at \$25 per tonne of CO<sub>2</sub> will be equivalent to about 2.5 % of value added (1.2 % of turnover), and the total (direct and indirect) CO<sub>2</sub> PE could be as high as 4 % of value added (about 2 % of turnover). Accommodation and restaurants will be less affected, with direct CO<sub>2</sub> PE equivalent to 0.8 – 1.4 % of value added (0.3 – 0.8 % of turnover) and the total CO<sub>2</sub> PE equivalent to as much as 2.2 % of value added (around 0.7 – 1 % of turnover). Finally, there will be sectors such as visitor attractions, tourism offices and retail where the effects of a CO<sub>2</sub> PE of \$25 per tonne will be smaller and equivalent to perhaps 0.1 – 0.4 % of turnover and 0.2 – 1.0 % of value added.

Again, it must be emphasised that these costs will not necessarily all be met by the tourism business and profits will not necessarily decline by the level of the CO<sub>2</sub> PE, since those supplying inputs and those competing for the visitor dollar will face the same problems, and the increase in costs may be primarily reflected in a higher cost to the ‘end-user’ - the tourist.

## **THE SPECIAL ROLE OF INTERNATIONAL AIR TRAVEL<sup>38</sup>**

Travelling by air requires considerable amounts of energy and releases greenhouse gases into the atmosphere. In a report on aviation and the atmosphere by the Intergovernmental Panel on Climate Change [IPCC] it was estimated that aviation accounts for 2-3% of the world’s total use of fossil fuels, with more than 80% consumed by civil aviation<sup>39</sup>.

New Zealand is an isolated and geographically remote destination with its nearest neighbour, Australia, being at a flight distance of 2.5 hours. Air travel costs are an important factor in travel decisions (Crouch, 1994). However, airfares decreased dramatically in the last decade due to high levels of competition in the aviation industry. This means that not only New Zealand residents increased their travelling overseas, but international tourists also benefited from favourable airfares and more direct flights from Asian hubs. Consequently, New Zealand has developed into a popular tourist destination, positioning itself in the international tourism market, where travel distance and price no longer constitute a major barrier for international tourists. The liberalisation of international air services will continue to constitute an important issue of government policy with the aim of maximising the economic benefits of air travel and transport<sup>40</sup>.

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<sup>38</sup> This discussion is taken from: Becken, S. (2002). Analysing International Tourist Flows to Estimate Energy use Associated with Air Travel. *Journal of Sustainable Tourism*. In press.

<sup>39</sup> Penner, J., Lister, D., Griggs, D., Dokken, D. & McFarland, M. (eds.) (1999). *Aviation and the Global Atmosphere*. A Special Report of IPCC Working Groups I and III. Published for the Intergovernmental Panel on Climate Change. Cambridge: University Press.

<sup>40</sup> Ministry of Transport (MoT) (1998b) *International Air Transport Policy of New Zealand*. Wellington.

The drawback of this economically desired development is that international air travel to New Zealand by overseas visitors (99% of all visitors) requires a large energy input. For the return flights of all visitors in 2000, a total amount of 55.6 PJ was consumed. This resulted in 3,800,000 tonnes of CO<sub>2</sub> emissions; more than double the CO<sub>2</sub> emissions of direct tourism energy use within New Zealand. It is important to note, that these international emissions do not include CO<sub>2</sub> emissions resulting from New Zealanders travelling overseas. It can be estimated that the 1.28 million New Zealanders travelling overseas per year consume slightly less energy than international tourists visiting New Zealand, because of both lower volumes and the pre-eminence of Australian and other Pacific destinations.

A country of origin specific analysis shows that only four markets account for half the amount of energy consumed for transporting tourists to and from New Zealand. These are the UK, Australia, USA and Japan (the key market analysed earlier). Figure 13 and 14 show that particularly visitors from the UK contribute to energy use and CO<sub>2</sub> emissions from international air travel, when compared with their contribution to visitor arrivals.

Figure 13 Share of direct energy use by different countries of origin in 2000 (Becken, 2002).

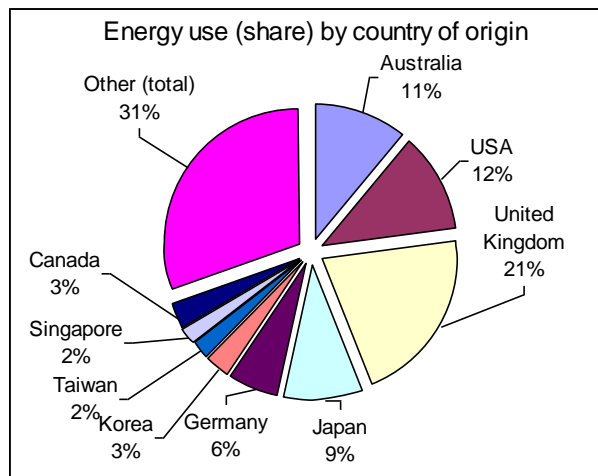
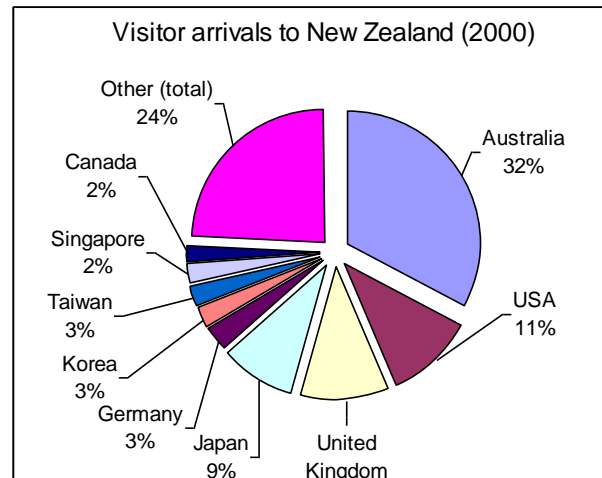


Figure 14 Visitor arrivals (2000) (Statistics New Zealand).



Emissions from international travel are not included in the Kyoto Protocol so far. It seems very difficult to find a solution for allocating emissions to involved countries. The New Zealand Ministry of Transport (1995) investigated the following allocation options:

- i. Emissions from fuel burned within New Zealand's 200 km Economic Zone
- ii. Emissions from fuel purchased within New Zealand
- iii. A half share of the fuel consumed between New Zealand and the first/last port of call overseas
- iv. A half share of the fuel consumed between New Zealand and the origin or destination port.

A half share between country of origin and the destination New Zealand (option iv above) would imply that New Zealand would have to take responsibility for the energy use of 27.8 PJ resulting from international air travel by international visitors. This energy consumption is comparable to the agricultural sector's direct energy use. The CO<sub>2</sub> PE costs of this energy use would amount to \$48 million per year. Another option being discussed by the European Union is the introduction of a CO<sub>2</sub> PE through the airlines. This may be in the order of 5% of the price of the airfare and would increase the fare from Europe to New Zealand by about \$100.

Clearly, New Zealand could be severely affected by the integration of international air travel into international agreements (e.g., Kyoto Protocol), because the average travel distance to New Zealand is 12,900 km one-way. The competitiveness of New Zealand as tourist destination could be put at risk in two ways. First of all, New Zealand could be less competitive in a commercial sense in that airfares become relatively more expensive compared with countries that are closer to main countries of origin. And second, New Zealand may face difficulties when marketing the destination because of moral concerns by environmentally aware tourists. This may particularly be the case for visitors from Europe and Japan, as discussed in the first section of this report.

There are several options to improve the environmental record of international travel, and, thus reduce emissions. These include increasing the average length of tourist stay, hence increasing expenditures per tourist and maintaining present tourist volumes for international tourists. Promoting domestic tourism, and increasing promotion efforts in countries that are geographically close to the destination is another option to reduce CO<sub>2</sub> emissions from international air travel. The option of offsetting carbon emissions from international travel with forest sinks needs to be explored. It is not simply a question of whether this is a cost-effective way of paying for CO<sub>2</sub> emissions, but is also a question of whether this is an effective means of altering the perceptions of environmentally-aware visitor and persuading them that travel to New Zealand is environmentally responsible.

## **GLOSSARY**

**CARBON DIOXIDE (CO<sub>2</sub>):** Greenhouse gas produced as a result of the combustion of organic material (e.g. fossil fuels, biomass), most important contributor to global warming. Other greenhouse gases include methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O).

**DIRECT ENERGY USE/EMISSIONS:** Energy use and emissions directly resulting from tourism activities, such as burning petrol or using gas for heating.

**ECO-EFFICIENCY:** Ratio of environmental costs to economic benefit measured in joules per dollar output. For tourism the eco-efficiency is 5.79 TJ (Toe)/\$1,000,000 GDP and 302.5 tonnes CO<sub>2</sub>/\$1,000,000 GDP. Eco-efficiency was defined by the World Business Council for Sustainable Development as: "the delivery of competitively-priced goods and services that satisfy human needs and bring quality of life, while progressively reducing environmental impacts and resource intensity throughout the lifecycle, to leave at least in line with the earth's carrying capacity."

**GLOBAL WARMING POTENTIAL:** GWPs have been developed to enable the radiative forcing impacts (warming potential) of different greenhouse gases to be compared with carbon dioxide. For example, using 1995 IPCC figures over a 100 year time horizon, carbon dioxide has a GWP of 1, whereas methane has a GWP of 21 and nitrous oxide higher than 500. In other words, methane is 21 times more powerful as a greenhouse gas than carbon dioxide. By summing the annual greenhouse gas emissions on a GWP basis, a sense is gained of the total radiative forcing impact in any one year (quoted from the Environmental Performance Indicator Programme, Ministry for the Environment (2002),

<http://www.environment.govt.nz/climate/emissions/index.html>).

**HEAT EQUIVALENTS:** Conventionally, "energy" is measured in terms of its heat content units in national energy statistics, using joules. This measures the total quantity of heat (energy) that is available to be converted to other forms of energy, relative to the a reference state (25 C, sea level atmospheric pressure etc.). Such Heat Equivalents do not take account of the energy quality. It is therefore misleading to "add-up" energy measured in heat equivalents (joules). It is recommended, in these circumstances, that the data be adjusted for energy quality before "adding up" different energy forms. This can be achieved by using the TOE units.

**INDIRECT ENERGY USE/EMISSIONS:** Energy use and emissions resulting from flow-on effects through the economy. This includes for example energy consumption associated with the production of goods used by tourists (e.g. vehicles or buildings) or energy consumed to transport goods required by the tourism industry (e.g. food products).



**JOULE:** Unit to measure energy; MJ (megajoules) equals a million joules, GJ (gigajoules) equals a million MJ, TJ (terajoules) equals a billion megajoules, PJ (petajoules) is  $10^{15}$  joules or  $10^9$  MJ. An average household in New Zealand consumes about 38000 MJ per year (38 GJ), a one-way flight from Christchurch to Auckland requires about 2050 MJ per passenger, and a human body consumes about 7.5 MJ per day.

**MULTIPLIER:** Indirect effects can be measured through 'multipliers'. Multipliers measure the full amount of embodied energy or CO<sub>2</sub> emissions per unit of sector output. For energy use and CO<sub>2</sub> emissions the multipliers for the tourism sector are: 4.50 TJ/\$million output (value added); and 260.52 tonnes CO<sub>2</sub>/\$million output (value added).

**TONNES OF OIL EQUIVALENT (TOES):** This is an energy measurement that adjusts energy measured in heat equivalents for differences in energy quality. Each energy form (measured in heat equivalents) is multiplied by its respective quality coefficient. These quality coefficients measure the relative efficiency of each energy form in being converted to end-uses of energy in the reference system. The reference system used in this study is the 1997/98 New Zealand energy system. Any particular energy form can be used as the numeraire (unit of account) - in this case, the data is measured in oil units (TOEs), in line with international convention.

## APPENDIX

### *Energy contents and emission factors*

Table 4 Energy content (heat equivalent) of common fuel sources and CO<sub>2</sub> emissions produced when these fuels are combusted.

<i>Fuel type</i>	<i>Energy content</i>	<i>CO<sub>2</sub> emission</i>
Petrol	34.5 MJ/l	66.6 g/MJ
Diesel	38.1 MJ/l	68.7 g/MJ
Marine Diesel Oil	38.3 MJ/l	68.8 g/MJ
Aviation fuels	46.3 MJ/kg	68.7 g/MJ
Kerosene	36.8 MJ/l	68.7 g/MJ
Avgas	37.0 MJ/l	65.9 g/MJ
Wood	7791 MJ/m <sup>3</sup>	No net emissions
LPG	50 MJ/kg	60.4 g/MJ
Natural Gas	40 MJ/ m <sup>3</sup> - 46 MJ/ m <sup>3</sup>	56.2 - 52.7 g/MJ (55)
Coal	25.1 MJ/kg	90.4 g/MJ
Electricity	3.6 MJ/kWh	42 g/MJ

Baines, J.T. (ed) (1993). *New Zealand Energy Information Handbook*. Taylor Baines & Associates. Christchurch.

### *Flow-on effects in the New Zealand economy due to tourism*

The direct and indirect use of energy and the emission of CO<sub>2</sub> by the tourism sector are illustrated with a flow charts attached.

#### How to read the chart, example of CO<sub>2</sub>:

The tourism industry emits directly 1,438,361 tonnes of CO<sub>2</sub> within New Zealand. Another 3,561,591 tonnes are emitted as a result from international air travel by overseas tourists to and from New Zealand.

The indirect CO<sub>2</sub> emissions of tourism for transport services are 419,727 tonnes, of which 376,291 tonnes are produced directly by transport. The remainder is associated with services (e.g. Construction) that the transport sector consumes to provide the service demanded by the tourism sector, and so forth. The total indirect emissions are 2,688,822 tonnes within New Zealand.





### *Sub-sectors of tourism*

- Air transport: airlines, air shuttles and air tours (including scenic flights)
- Surface Transport: Road (in particular rental vehicle companies and coach tour companies), rail (Tranzrail) and water transport (Interisland line and other water transport operators)
- Accommodation providers: Hotels (include 77 top-class hotels, luxury lodges, licensed motor inns, and other hotels), motels, B&Bs (include farm stays and other home stays), backpackers and youth hostels (YHA), campgrounds (motor camps, cabins, DoC huts) and homes (including private homes, batches, rented apartments, time-share, maraes and student accommodation)

Estimated business numbers:

<i>Activity category</i>	<i>Business numbers</i>
Hotels	912
B&Bs	502
Motels	1852
Backpacker	538
Holiday Parks	369
DoC Huts	400

- Hospitality: Restaurants and cafes
- Adventure Tourism and Outdoor Activities: Bungy Jumping, rafting and other activities that take place in the outdoors. Estimated business numbers:

Estimated business numbers:

<i>Activity category</i>	<i>Business numbers</i>
Air activities	174
Motorised water activities	410
Adventure activities	452
Nature recreation	976

- Attractions and Cultural Tourism: Includes built facilities and entertainment facilities. Examples are museums, botanical gardens, zoos, wine trails, glow worm caves, gondolas, geothermal attractions, Maori performances, cinemas, theatres, souvenir shops. Estimated business numbers: 2000
- Administration: Regional Tourism Organisations (RTOs) and Visitor Network Information; organisations that provide a marketing service for tourism operators in the region. Estimated business numbers: 121 businesses
- Retail: Distribution (wholesalers, inbound tour operators, travel agents and other organisations that are involved in distributing the tourism product) and tourism-specific shopping (duty free and souvenir shops). Estimated business numbers: 411 businesses

- Other service: Human Resources Development and Research, i.e. commercial and government educational institutions and other ancillary services, such as websites, insurance companies, translation services.