BIOENERGY
the renewable fuel

Bioenergy Association
Occasional Paper 22

Collaborative Action to Achieve the Greenhouse Gas Emission Reduction Targets

May 2016

Contents

This Collaborative plan of action has been developed collectively by a stakeholders group of 22 industry organisations and territorial councils around the opportunities that renewable and energy efficiency can contribute to achieving the greenhouse gas emission reduction targets announced by Government in Paris in late 2015.

The content of this report is an edited collective view of the individual contributions from the stakeholder organisations from a symposium held in May 2016. The respective information provided by each is in Part 2. The report does not address the adequacy of the targets, or of other business initiatives outside this scope.

The work was undertaken using existing data and funded from the limited income received from the symposium held as part of the project. This report is essentially a scoping exercise to identify where further effort should be put and to guide Government and the stakeholder organisations as to priorities for action to achieve greenhouse gas emission reductions.

For specific information and the views of each stakeholder contact should be made to the Individual stakeholders.

Audience image at the “Yes we can!” symposium, May 2016

Stakeholder organisations

Aotearoa Wave and Tidal Energy Association
Bioenergy Association
Business NZ Energy Council
Energy Management Association of NZ
Forest Industry Contractors Association
Generation Zero
Geothermal NZ
Heavy Engineering Research Association
Institute of Refrigeration, Heating & Air Conditioning Engineers
National Energy Research Institute
NZBIO
NZ Farm Forestry Association
NZ Forest Owners Association
NZ Geothermal Association
NZ Home Heating Assoc
NZ Pacific Solar and Energy Storage Council
NZ Wind Energy Association
Pure Advantage
Royal Society of NZ
Sustainable Business Council
Sustainable Business Network
Sustainable Energy Forum
The Better NZ Trust
Venture Southland
Wellington City Council

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Pioneer Energy
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Nu Capital Works
University of Waikato Energy Research Group

Approval for Publication

BANZ Executive Officer	Name	Signature	Date
	Brian Cox		May 2016

Executive Summary

– Collaboration to Achieve the Greenhouse Gas Emission Reduction Targets

The purpose of this report is to:

- Identify market led opportunities to meet NZ's climate change targets by domestic mitigation and outline activities currently being undertaken and what more could be achieved with Government support.
- Facilitate the engagement of stakeholder groups with government and officials so as to jointly develop and implement a co-ordinated plan of action to meet NZ's climate change targets.
- Reduce the risk for the government in purchasing carbon credits in the future at unknown pricing

Government signed up to the Paris UN agreement to reduce greenhouse gas (GHG) emissions at the Framework Convention on Climate Change in December 2015. New Zealand will meet its targets through domestic emission reductions, removal of carbon dioxide by forests and participation in international carbon markets.

New Zealand's latest greenhouse gas inventory was published in May 2016[1] showing in 1990 New Zealand's total emissions (excluding removals from forestry and other land use) were 65.8 million tonnes of carbon dioxide equivalent (Mt CO_2-e). In 2014, New Zealand's total greenhouse gas emissions were 81.1Mt CO_2-e, which means total emissions are now 15.3 Mt CO_2-e higher than the 1990 level, a 23 per cent increase.

Table 1 – Governments Emissions Reduction Targets from where we are now

Emissions Targets	By 2020		By 2030	By 2050
(2014 base line= 81.1Mt CO_2-e)				
NZ Required Emissions Cap	**63.7 Mt**	**59.2-52.7 Mt**	**58.6Mt**	**32.9 Mt**
NZ International Targets	5% below 1990 unconditionally	10-20% below 1990 with conditions	30% Below 2005	50% below 1990
Carbon Emission Reductions CO_2-e Required	Min 17.4 Mt unconditional	21.9 – 28.4 Mt conditional	Min 22.5 Mt	Min 48.2 Mt
Cost of International Units if 100% of reduction has to be acquired $m per annum	@$15 to $25/t **$261mill**	@$15 to $25/t **$329 to 710mill**	@$25 to $50/t **$563 to 1125mill**	@$50 to $100/t **$2410 to 4820mill**

The government's reduction targets are substantial and the future costs of acquiring international emissions units will be material to the economy unless domestic mitigation and forestry contributions to emission reductions are significant. If there is a risk that international units may have to be purchased then spending the money that would be spent (refer table 1) instead on increasing domestic mitigation is prudent investment and would provide lasting economic and wellbeing benefits.

[1] http://www.mfe.govt.nz/publications/climate-change/new-zealand-greenhouse-gas-inventory-1990-2014 updated by MfE.

In May 2016 22 energy efficiency and renewable energy organisations, and territorial councils held the "Yes we can!" symposium, to identify how a significant component of the GHG emission reductions could be met by domestic emissions reductions. This would avoid the need to purchase emission reduction units from international carbon markets redirecting otherwise required emissions unit acquisition costs back into growth in the domestic economy through new employment, business opportunities and achievement of environmental outcomes.

Table 2 – Symposium Reduction Opportunities

Symposium Summary - Domestic Reduction Opportunities			
Symposium Scenarios	**Business as Usual**	**Encouraged Growth**	**Accelerated Growth**
Potential to Reduce Emissions (Mt CO_2-e)			
Renewable Electricity			
Geothermal/Wind/Solar supply	0.3	0.3	0.3
Commercial buildings	0.4	1.0	2.0
Street lighting	0.1	0.1	0.1
Heat			
Residential	0.1	0.1	0.1
Conversion coal to biomass	0.6	1.4	1.8
Geothermal	0.1	0.2	0.4
Industrial process heat	0.2	1.7	3.6
Transport			
Liquid biofuel	0.8	1.0	3.2
Light and heavy electric vehicles	0.8	1.1	3.7
Urban transport	0.2	0.4	0.8
Methane reduction from waste	0.1	0.2	0.5
Total Domestic Reductions above Baseline	**3 Mt**	**7Mt**	**16Mt**
Balance of Internationally Traded Units or forestry	**14.4 Mt**	**14.5 Mt**	**31.2 Mt**
Cost of Units Acquired	@$15 to $25/t	@$25 to $50/t	@$50 to $100/t
$m per annum	**216 to 360m**	**362 to 725m**	**1560 to 3120m**
Avoided Unit costs			
$m per annum	**36 to 60m**	**243 to 285m**	**1035 to 2070m**

The relationship between different sectors and reduction options for heat, transport and electricity applications is complex, with many different sector parameters to consider. To get an initial alignment, the Symposium worked across the different sector organisations to align three generic scenarios – Business as Usual (BAU), Enhanced Growth and Accelerated. These initial scenario inputs from each sector are summarised in Part 2 of this report.

The symposium and analysis of the potential domestic mitigation achievable under the Business as Usual Scenario showed that there is already significant mitigation being undertaken by business and communities and that up to about 3 Mt CO_2-e per annum GHG mitigation could be achieved by 2050. This level of GHG reduction is around 6% of the 2050 target.

The sectors where GHG mitigation could come from are shown in Table 2. The potential GHG mitigation from the sector could be about 7 Mt CO_2-e per annum by 2050 and 4Mt CO_2-e by 2030 under an encouraged scenario, and up to 16 Mt CO_2-e per year by 2050 and 5Mt CO_2-e by 2030 under the accelerated scenario.

Under the Accelerated Scenario a reduction of approximately 13Mt CO2-e above the business as usual scenario results in 13Mt CO2-e of international carbon units which would not have to be purchased at a saving to the country of $1-2million per annum.

The symposium has shown how by working collaboratively those interested in renewable and efficient use of energy can leverage each other's strengths and achieve more than individual initiatives. In each of the Electricity, Transport and Heat sectors there is a BAU baseline that generally accounts for substitution of competing technology's, the strongest example to date being growth of renewable electricity generation substituting thermal generation and this could be expected to continue.

Within a sector, however the opportunities are limited by market demand. As scenarios are expanded to Enhanced and Accelerated, the opportunities for cross-sector substitution become apparent. For example, the linkage between electric vehicle demand and the supply of renewable electricity is a case in point.

By also aligning the different sector options with a focus specifically on carbon emissions reduction, opportunities are identified where emissions intensities are greatest. For example, direct emissions of methane provide strong drivers for the use of biomass and waste to produce heat.

There are many barriers and inter-dependencies to New Zealand achieving cross-sector substitution opportunities for renewable and lower carbon fuels and Part 2 of this report outlines many of these and some ideas on how these might be overcome. The next step would be to identify the option costs to industry and government to move industries from the BAU to the Enhanced Growth scenario. The Accelerated scenario is more likely to be driven by the level of international emissions costs.

The "Yes we can" symposium quickly generated a number of ideas. Much of the input data and information from each Sector and each organisation have different market sources, measures and many options are contestable. Nevertheless, the process has been a valuable one for industry and the government to get an initial view of sector and cross sector opportunities to contribute to New Zealand becoming a lower emissions economy.

To test the opportunities identified and develop them further would need government support, to refine these opportunities, prioritise and develop the most effective recommendations. The stakeholder organisations look forward to working with government to establish the terms of reference and scope for this exercise.

By industry and Government working collaboratively we can achieve at least 30-40% of the Paris climate change targets using currently available renewable energy and energy efficiency technologies. This would result in a saving of $1-2million per annum from avoided purchase of international carbon units

1. Introduction

The New Zealand Energy Strategy sets out goals and objectives for "developing our energy potential" and has priorities for:

- Diverse resource development
- Environmental responsibility
- Efficient use of energy, and
- Secure and affordable energy

These priorities can lead to increased use of our renewable natural resources, so emissions reduction objectives need to be considered in the context of increased use of energy for wealth and wellbeing. Bringing the respective sector initiatives together identified common, sector wide policy mechanisms which could be realistically supported by business and central and local Government.

The Government also has a Business Growth Agenda, the Emissions Trading Scheme and some additional measures that can support achievement of the greenhouse gas emission reduction targets and has sought submissions on additional measures that could be included in a plan to achieve the Paris targets. To respond to this invitation the stakeholder organisations have identified that by collective action, and being led by industry, the sector can recommend where substantial headway can be made towards achieving the climate change targets agreed in Paris. This will be most effective with a collective Plan of Action, the subject of this report.

The core sector associations (Bioenergy, Geothermal, Wind Energy and Energy Management Associations) invited other interested organisations (refer Appendix 1) to join them to develop this collective Plan of Action. Government has effectively said 'yes we will' by setting the targets in Paris and the stakeholder organisations are responding by saying "Yes we can!" The focus of the work under this initiative has been on the climate change targets, with opportunities arising from wise use of New Zealand's renewable natural resources covering the heat, electricity and transport components of energy.

To initiate development of such a plan and to scope the actions that will need to be taken, the stakeholder organisations hosted a Symposium in May 2016 ***("Yes we can!" achieve the Greenhouse Gas Emission Reduction Targets***) in which representatives presented their respective sector contributions and how collaboratively the Government's targets can be achieved. Summary documents from each sector organisation, and those not able to provide a presenter (refer Part 2), were circulated prior to the Symposium and are available on www.yeswecan.nz . The symposium attendees tested the material presented and then contributed their own ideas for a Plan of Action.

1.1 Greenhouse gas emission targets

Based on New Zealand's latest greenhouse gas inventory published in May 2016[2], in 1990, New Zealand's total emissions (excluding removals from forestry and other land use) were 65.8 million tonnes of carbon dioxide equivalent (Mt CO_2-e). In 2014, New Zealand's total greenhouse gas emissions were 81.1Mt CO_2-e, which means total emissions are now 15.3 Mt CO_2-e higher than the 1990 level, a 23 per cent increase.

The Government has four national targets for reducing New Zealand's greenhouse gas emissions that cover both the medium and long term. New Zealand will manage these targets using an emissions

[2] http://www.mfe.govt.nz/publications/climate-change/new-zealand-greenhouse-gas-inventory-1990-2014

budget approach and meet them through a mix of domestic emission reductions, the removal of carbon dioxide by forests[3] and participation in international carbon markets. The four targets are:

- a provisional post-2020 target of 30 per cent below our 2005 greenhouse gas emissions levels by 2030. Based on the latest available data and using an emissions budget approach, emission between 2021 and 2030 would need to average approximately 58.6 Mt CO_2-e per year. (approx. 22.5 Mt CO_2-e reduction target)
- an unconditional target of five per cent below our 1990 greenhouse gas emissions levels by 2020. Based on the latest available data[4] and using an emissions budget approach, emission levels between 2013 and 2020 would need to average approximately 63.7 Mt CO_2-e per year. (approx. 17.4 Mt CO_2-e reduction target)
- a conditional target range of 10 to 20 per cent below our 1990 greenhouse gas emissions levels by 2020, if there is a comprehensive global agreement. Based on the latest available data and using an emissions budget approach, emission levels between 2013 and 2020 would need to average approximately 59.2 Mt CO_2-e and 52.7 Mt CO_2-e per year respectively. (approx. 21.9 – 28.4 Mt CO_2-e reduction)
- a long-term target of 50 per cent below our 1990 greenhouse gas emissions levels by 2050. Based on the latest available data and using an emissions budget approach, emission levels for the 2050 target period (which has not been defined to date) would need to average approximately 32.9 Mt CO_2-e per year. (approx. 48.2 Mt CO_2-e reduction)

The post-2020 target to reduce greenhouse gas emissions to 30 per cent below 2005 levels by 2030 has been tabled internationally with the United Nations at the Paris United Nations Framework Convention on Climate Change in December 2015. The new post-2020 target is equivalent to 11 per cent below 1990 levels by 2030. This target will remain provisional until the new international agreement is ratified.

The stakeholder organisations are strong in their support for renewable and energy productivity targets and are pleased that these are being developed by Government.

With the adoption of targets, a consequence is that improvements are needed in the collection of data. In particular is the collection of heat data which currently is the only energy end use data not collected by the Ministry of Business, Innovation and Employment (MBIE). A consistent message from attendees was “If you don’t collect it you can’t measure it.”, and further “If you don’t measure it, how can you set a goal for improvement?”

2. Symposium Scope

This initiative is limited to the energy related greenhouse gas mitigation opportunities shown shaded in Figure 1. For convenience the analysis of the greenhouse gas reduction initiative has been limited to the following:

- Reducing the use of fossil fuels for heat;

[3] The rules to account for removals from forestry may differ for each target. As a guide, in 2014, the net amount of carbon dioxide removed from the atmosphere (net removals) through afforestation, reforestation and deforestation under the Kyoto Protocol was 11.9 Mt CO2-e.

[4] See New Zealand’s Initial Report for its 2020 target http://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/New%20Zealand%27s%20Initial%20Report%20July%202016.pdf

- Continuing substitution of thermal electricity generation by renewable energy and Improved energy productivity;
- Methane capture and reduction from municipal and manufacturing organic waste;
- Reducing use of fossil fuels in transport.

The drivers for greenhouse gas emission reduction have many business, environmental and societal benefits that can often be of such significance that they become the primary decision-making driver and the climate change benefits are ancillary and are achieved, essentially, at zero cost. For example, improved land use can increase farm business resilience, lead to new revenue streams, improve discharge to waterways and can justify investment by the land owner – GHG mitigation is a co-benefit which supports such investment but would not necessarily justify private investment as it is a public good.

For simplicity the data has been analysed into the following user groups:

Heat

- Food processing – includes meat and dairy
- Community facilities – includes schools, swimming pools, recreation
- Manufacturing – excludes food processing, includes wood processing
- Large build – includes accommodation, rest homes, prisons, universities, large commercial buildings
- Domestic living

Transport

- Marine (coastal only) and rail
- Aviation (domestic only)
- Heavy road vehicles
- Light road vehicles

Electricity

- Wholesale market
- Large build
- Distributed generation
- Community facilities,
- Manufacturing
- Domestic living

Reduction of methane from waste

- Landfill and waste water treatment

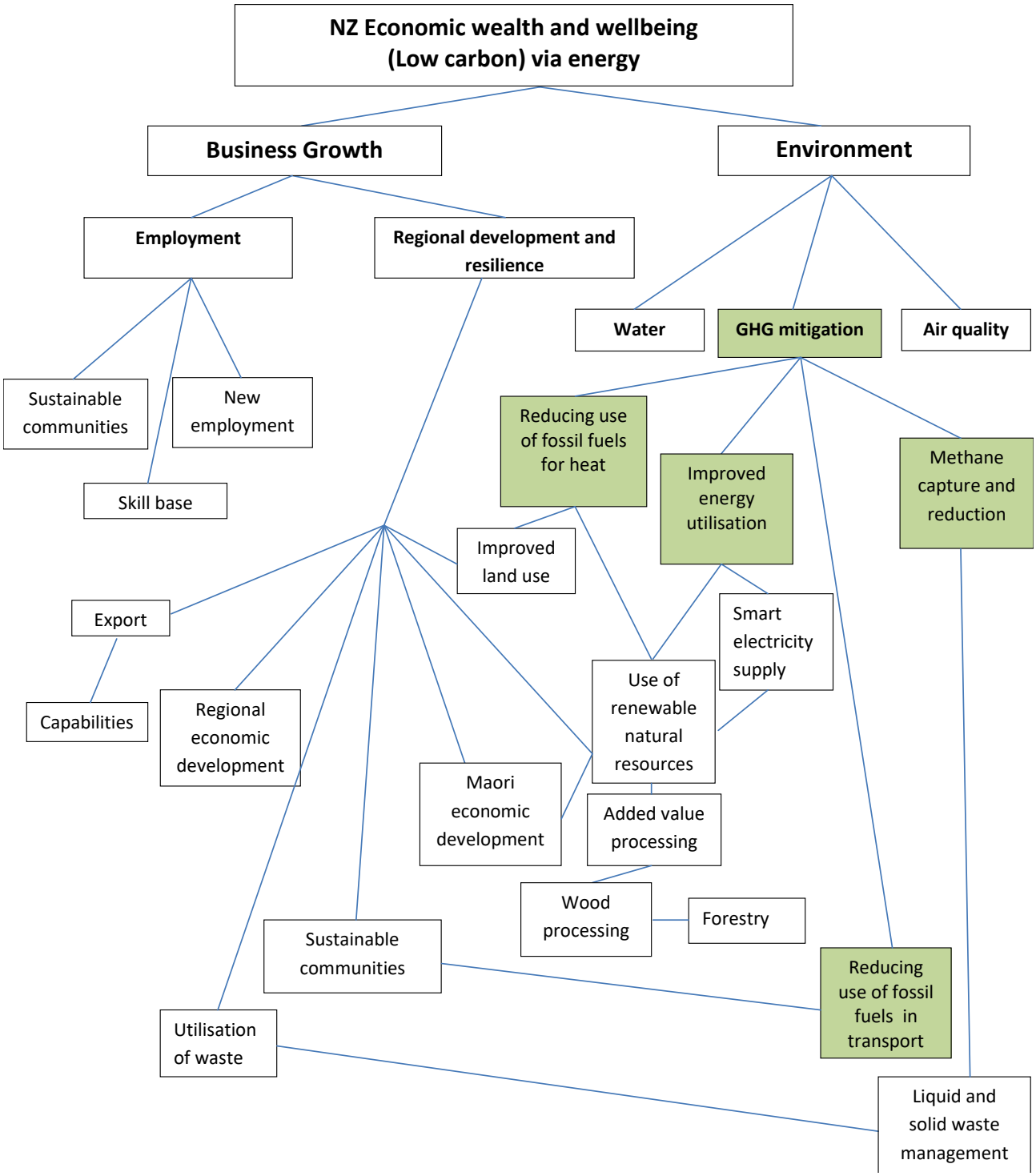

Figure1: Scope of GHG mitigation for this initiative

Figure 1 shows some, but not all, of the interlinkages between GHG mitigation and other business growth activities.

A key message from the initiative is that because the co-benefits, including employment, regional and Maori economic growth and wider environmental improvement are critical to achieving the climate change benefits the climate change programme needs to include territorial government, sector associations and Central Government all as partners with coordinated and an agreed plan of action.

3. Sector Definitions and Reduction Scenarios

New Zealand has an abundance of renewable energy (both existing and potential new sources) which could be utilised for economic growth and wellbeing. This provides an international comparative advantage but at a sector level fossil fuels are still the dominant input energy source. The Symposium required a workable framework for alignment of sector emissions reduction targets, which was selected from Waikato University Energy Research Centre work on energy sector and emissions, as summarised in Figure 2 below;

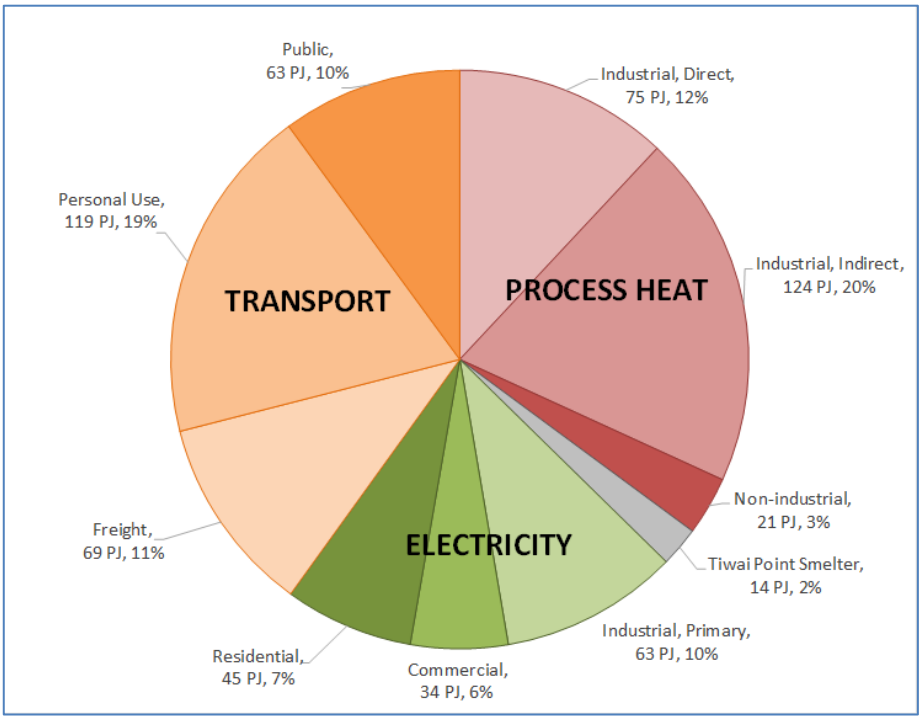

Figure 2 – Sector Energy Framework – Waikato University Energy Research Centre

With reference to this framework each stakeholder organisation was requested to prepare three possible emissions reduction scenarios from their industry knowledge base:

- **Business as Usual** – assuming the markets and businesses are generally left on their own; that international carbon emission units are readily traded and liquid; that unit carbon prices range from $15 to $25/tonne; and that the economy and export products are not materially impacted by global climate change impacts. The renewable and energy productivity sector continues in low growth mode and lacks investor incentives – possible future development options are not progressed because of limited market pull.

The Business as Usual scenario summarises the growth in GHG emission reduction based on what business is already doing with regard to mitigation and what it is expected they will continue to do.

- **Encouraged Growth** – assuming international carbon units are being traded at higher prices; liquid but with more volatile unit carbon prices between $25 and $50 per tonne. The cost of carbon to the economy is now material and more difficult to budget for due to price volatility. Higher emitting industries and exporters are looking for more opportunities to manage emissions costs and secure more productive outcomes. With low level support and assistance the renewable and energy productivity sector is encouraged into a phase of greater innovation and exploration of new technology options to meet market needs. Cross-sector opportunities are identified and encouraged by market drivers.

If carbon unit price remains low the encouragement support and assistance stimulates the marginal market opportunities which in themselves provide encouragement to others.

- **Accelerated Growth** – the international emissions market is becoming illiquid; is short with periods of high unit carbon prices up to $100 tonne. At this level, higher emitting businesses are at competitive risk and will be receptive to injecting new capital into their manufacturing and energy efficiency to reduce costs. Substitution and cross-sector solutions become more attractive. Barriers to access capital remain and support and assistance moves to encouraging investors to transition to low carbon solutions.

  If carbon unit price remains low the accelerated support and assistance to investors encourages market leaders to transition to low carbon solutions so that a market push occurs across industrial sectors

The encouraged and accelerated scenarios summarise what business and the sectors can do with assistance from Government and are based around the public good components of climate change. These scenarios were presented and discussed by the representatives across the sectors, highlighting comparative advantages or barriers in different sector groups. It is apparent that the Electricity sector is in a great position to manage its future emission costs however, the Transport and Heat sectors have much greater emissions reduction challenges with many demand inter-dependencies. For example;

- the Transport Sector could take advantage of abundant renewable electricity for electric vehicles , at lower fuel costs, but growth is highly dependent on consumer buying behaviours.

- by contrast, the Heat Sector has relatively concentrated and informed buyers, access to mature low emission and renewable technologies, but capital and fuel input costs are higher, thus are more reliant on international carbon prices for future growth. However public good benefits for regional growth and reduced air pollution are strong drivers for transition from fossil to renewable fuels.

A summary of initial scenario inputs from the Symposium are included in Section 6 below.

4. Cross Sector Opportunities

The Symposium has identified a number of cross-sector opportunities for economic growth from greater use of our renewable natural resources, particularly where there is domestic added value processing, can enhance the GHG mitigation opportunities. For example,

- by increasing the processing of wood within New Zealand and selling added value products, instead of exporting logs, results in there being increased wood fuel available for heat or liquid biofuel production, plus we gain the mitigation opportunity from not exporting residue.
- Similarly, the electricity sector was identified as having abundant renewable resources but is limited by current sector demand. A significant emission reduction opportunity identified is renewable electricity from wind, solar, hydro and geothermal resources to be considered more as part of economic gains to New Zealand from the substitution of transport and heating fuels.

These cross-sector opportunities require transfer of knowledge and promotion of technology substitution into the high emissions parts of sectors that would benefit from renewable electricity supply. The work from Waikato University included in Part 2 of this Report illustrates where the most effective substitution opportunities are within each sector. Across all three sectors more efficient use of energy does not always lead to reduced emissions because it can improve business productivity and lead to an increase in the amount of energy used by business and thus an increase in emissions. Similarly, in domestic applications the use of efficient space heating for example can lead to an

increased use of energy and thus increased emissions, e.g. use of heat pumps for heating. This has been taken into account in the analysis of specific activities.

Use of some specific renewable energy technologies can have consequences for other parties e.g. increased use of distributed solar electricity generation can take business away from the wholesale market electricity generators and retailers, or wood chip used as wood fuel can reduce chip available for other uses. These inter-business interactions are considered as being specific to those activities and are not addressed in this initiative. Because the climate change targets are a national target the collective response in this report is from a national interest perspective. Private interest aspects are noted when relevant.

From a national interest perspective, many of the co-benefits, e.g. employment arising from energy initiatives, can be much bigger than the energy benefits and can not be captured by investors as they are a public good. These benefits can also arise offshore, e.g. export of science and engineering capability. These co-benefits have been included as often an initiative which may have small energy or climate change benefits may have a very large national interest benefit, e.g. development for a small domestic market may lead to large international opportunities for New Zealand-based businesses (international consulting for geothermal projects is a good example)..

Energy substitution to reduce emissions will have an interaction between energy sources. For example, replacing petrol fuelled vehicles with EVs will reduce oil imports and the need for storage, refining and distribution capacity but at the same time increase electricity use and the need for electricity generation and altered network capacity.

Greater use of solar, geothermal, and wind renewable energy for base load electricity generation can allow stored hydro to be used more to meet electricity peak demand and thus allow reduced use of natural gas for meeting peak electricity supply. However, because of the relatively small amount of hydro storage available throughout New Zealand there are clear limits to this capacity. Increasing the level of energy generated from renewable wind and solar sources may also impact on the required capacity and availability of firming reserves needed to ensure system reliability and security.

5. Symposium Results

Once the inputs were presented and discussed in workshop formats, there was a further step in the process whereby the organisers provided feedback to each Association on any aspects that were out-of-sync or where inputs needed further clarification to ensure alignment with other organisation inputs in the sector. This was a very important step in the collaboration process as it generates a lot of further thinking and knowledge transfer between experts and industry representatives. The three initial scenarios were then assembled as summarised below;

5.1 Business as Usual

Figure 3 below shows the collective contributions across the sector under a business as usual scenario.

The Business as usual scenario captures all the activities that industry would normally do as they seek to turn resources into wealth. The natural inclination is to increase activity within the bounds of knowledge, culture, regulations and available funds.

The business as usual scenario assumptions:

- Based on existing policies and market conditions. No policy changes;

- Uses existing technologies and an extension of current trends;
- No 'maybes'. Only realistic activities based on existing sector 'participants' activities.
- Assumes current ETS, 1 for 2 policy is deleted and ETS administration is improved – no significant other changes;
- Assumes EV support policy is successful;
- Price of carbon is around \$25/tonne CO_2 –e by 2030

GHG mitigation under this scenario is likely to be about 3 Mt CO_2 equivalent per annum by 2050. This is principally achieved from the uptake of light electric vehicles which would be fuelled by renewable electricity from solar, wind and geothermal rather than fossil fuels. This level of GHG reduction is around 6% of the 2050 target and by then could save around \$75million pa in avoided purchase of international emission reduction units…

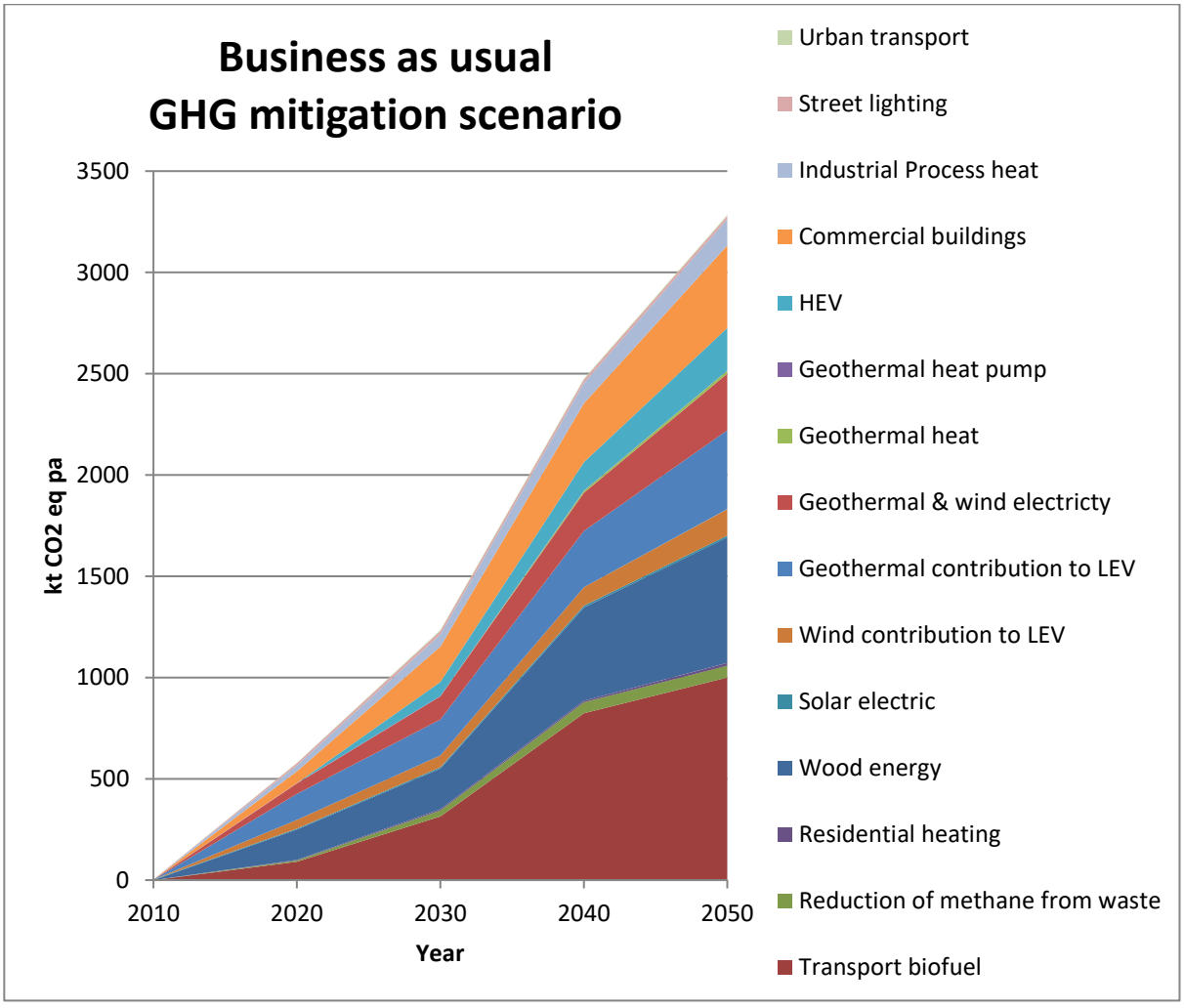

Figure 3: GHG mitigation under a business as usual scenario

Electric vehicle electricity can be adequately supplied from solar, wind and geothermal generation as demand requires.

Energy productivity improvements in residential and commercial buildings and in industrial heat plant have a big continuing effect.

While there is expected to be a large amount of electricity generated from solar energy without storage this would not have a significant GHG mitigation effect.

Transport biofuel has a big impact but not until after 2040 and most of this would be imported. Switching of coal with wood fuel is negative until 2025 as new heat plant being installed continues to be fossil fuel but after that the use of wood fuel grows slowly. The switching of coal to wood fuel for heat would both continue at their current steady rate because the current price of gas and coal limit the amount of activity in these areas.

5.2 Encouraged Reductions

Figure 4 shows the collective contributions across the sector under an encouraged scenario.

The encouraged scenario assumptions:

- Emissions costs are impacting the economy
- Government signals that it wants to encourage domestic mitigation so as to avoid the need for purchase of international units;
- Based on BAU conditions plus:
  - Limited number of complementary measures pursued and implemented;
  - Government adopts a collaborative growth strategy with each sector;
- Price of carbon is around \$25-\$50/tonne CO_2 –e by 2030.

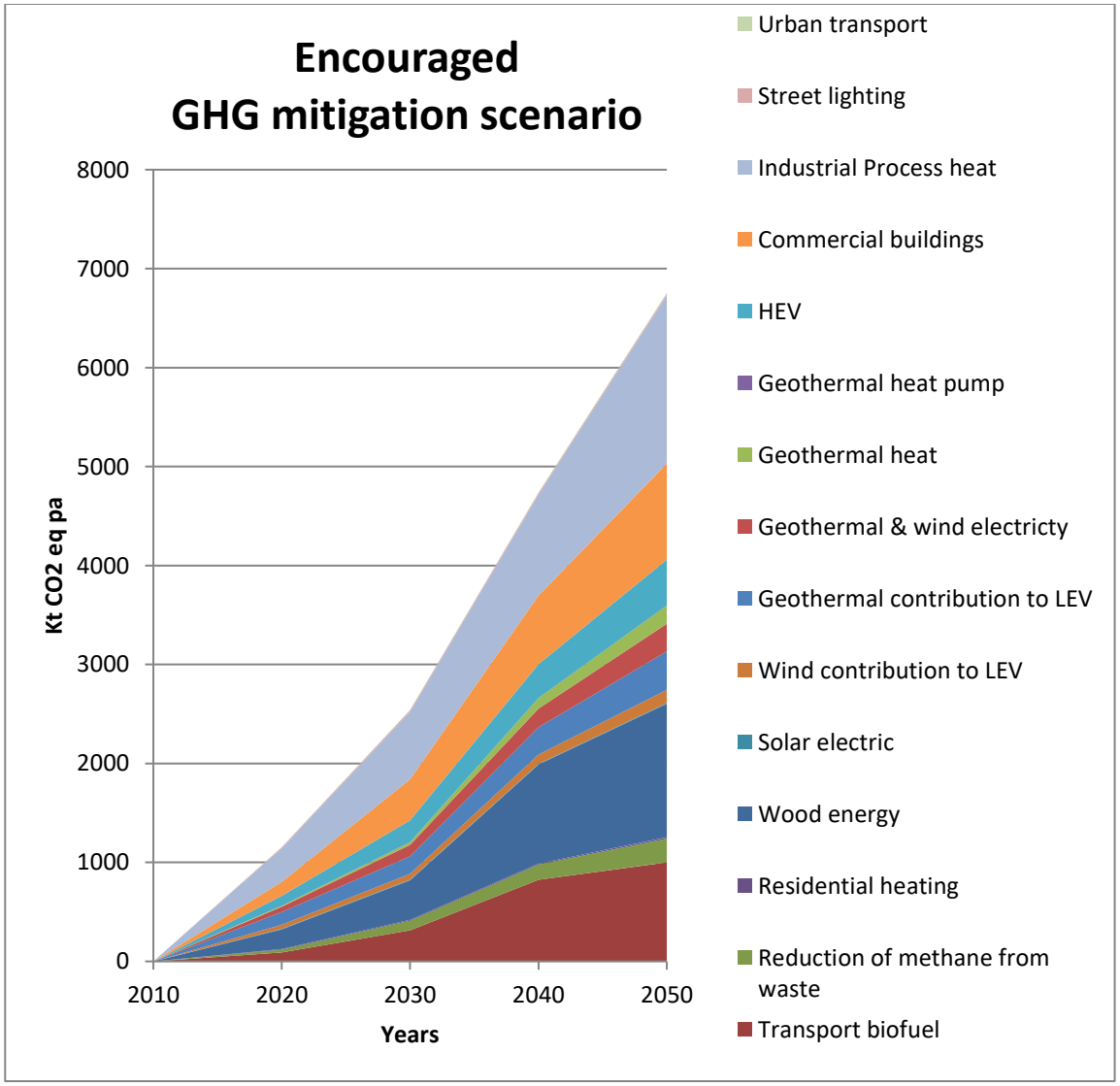

Figure 4: GHG mitigation under an encouraged scenario

The GHG mitigation under an Encouraged Scenario is likely to be about 7 Mt CO_2 equiv. per annum by 2050. This level of GHG reduction is around 17% of the 2050 target and by then could save around $200-400million pa in avoided purchase of international emission reduction units.

Initially, while emission unit prices are low but becoming more volatile, reductions are principally achieved from the higher profile and encouragement shown by Government to achieving domestic greenhouse gas mitigation. For example:

- Government agencies "walking the talk" with demonstration that low carbon solutions are economic and achievable in its own facilities and its own vehicle fleet will encourage business and the public to also make similar decisions.
- Changes in government procurement criteria from lowest capital cost to highest value and associated procurement policies would require that low carbon solutions are always included in the range of options.
- Under the encouraged scenario there would be a significant increase in the use of public transport and improvements to the transport system (including encouragement of use of rail as a public good) but the greenhouse gas mitigation opportunities have been included in the assumptions for light and heavy electric vehicles.

This scenario see's councils also focussing on reducing their emission of methane from liquid and solid waste. This is an extension of existing waste processing facilities and, while not a large contributor to greenhouse gas emission, is an easily achieved mitigation option as improvements to waste treatment are being made each year. Encouragement by local councils to include consideration of the use of solar energy in approving layout of new building subdivisions would have an effect in energy terms but would not significantly increase greenhouse gas emission reduction.

For industry and business, initially there is switching from coal to gas fuels, then switching of coal to wood fuel become more significant from 2025 as some of the larger coal users switch with new investments based on development of the wood fuel supply market. Businesses will also be looking for lower investment substitutions of transport biofuel blends, electric vehicle fleets and energy efficiency programmes.

In the encouraged scenario there is some mitigation achieved from the domestic installation of solar electric panels and adoption of good design of buildings to maximise use of solar heating, as while potentially large in energy terms these are primarily backing out of renewable generated electricity. The use of solar energy for space and water heating can have a significant effect on reduction of the use of gas for these purposes but its quantum is unknown.

Electric vehicle electricity demand is adequately met from solar, geothermal and wind electricity.

There are very big increases in the GHG reduction benefits from energy productivity actions.

5.3 Accelerated Reductions

Figure 5 shows the collective contributions across the sector under an accelerated scenario.

The accelerated scenario assumptions:

- International emissions units market is shortening with greater price volatility, threatening to de-stabilise the economy due to future cost uncertainty.
- Same as Scenario 2 plus:

- Low cost policies introduced to address barriers specific across sectors and within a sector (similar to recent electric vehicle assistance;);
- Government tightens emissions allocations and adopts some complementary measures to the ETS;
- Industry faces increasing mitigation costs and needs to consider capital investment to ensure longer term cost stability.
- Low carbon technologies are increasingly available and reducing in costs.

- Price of carbon is forecasts to be around \$50-\$100/tonne CO_2 –e after 2030.

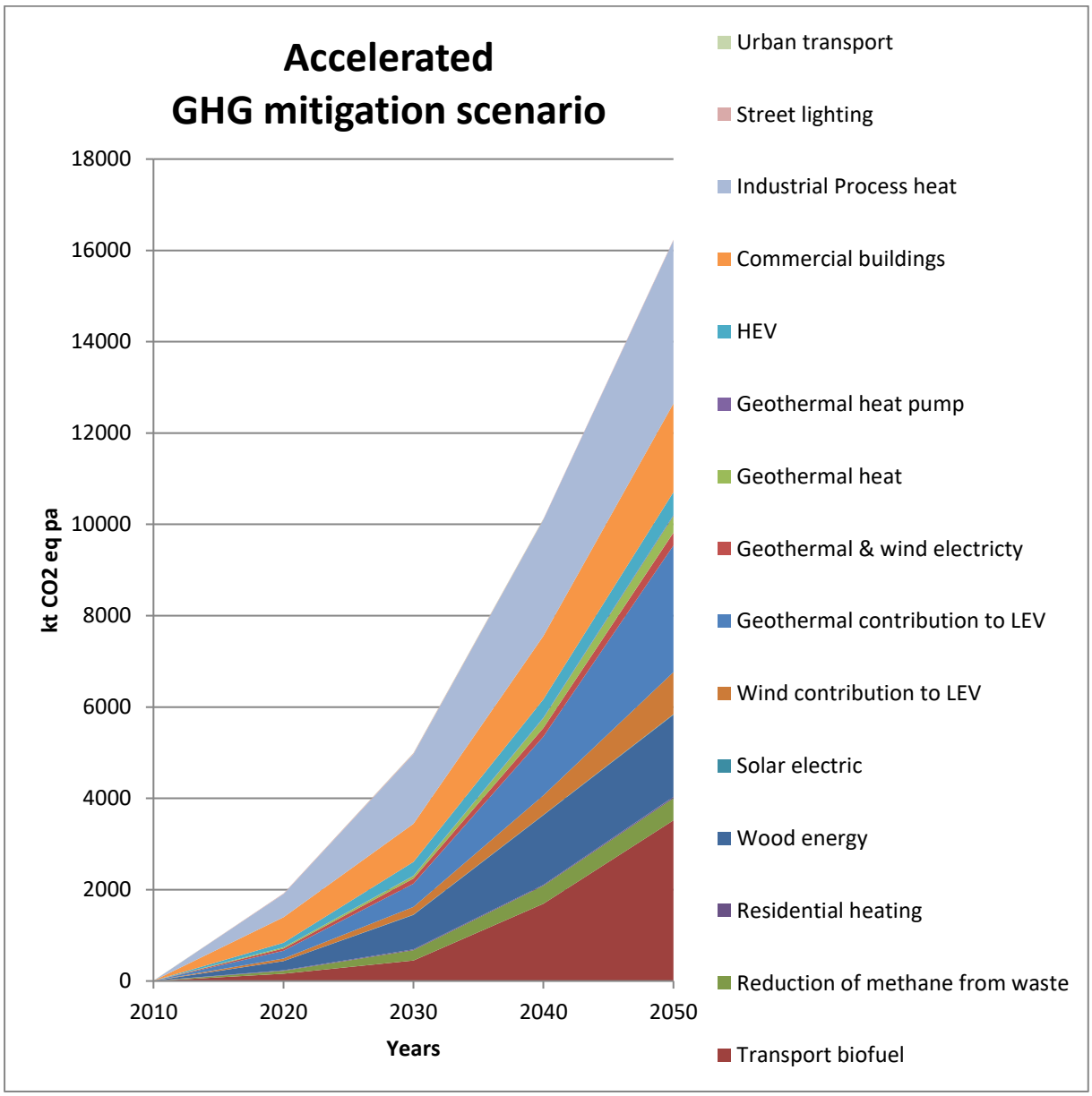

Figure 5: GHG mitigation under an accelerated scenario

Under the accelerated scenario, up to 16 Mt CO_2 equivalent per year could be achieved, principally in the areas of coal switching and energy productivity improvements. This level of GHG reduction is around 35% of the 2050 target and by then could save around \$850- 1700million pa in avoided purchase of international emission reduction units.

This is an increase of 9Mt CO_2 equiv. per annum above the mitigation achieved from the Encouraged Scenario and is principally achieved because of the accelerated depreciation and suspensory loan assistance programmes aimed at addressing the capital cost barrier to new technology and productivity investments.

Government and Councils introduce new regulations and codes to ensure consumer market mitigations, for buildings, transport, waste recoveries and public utilities.

Electric vehicle demand is adequately met from solar, wind and geothermal electricity generation. Transport biofuel is a mix of imported and domestic production.

Significant capital investment is required across all sectors, and from all consumers. Renewable electricity supply expands across Transport and Heat Sectors and solar and storage uptake play an important role in maintaining electricity market supply-demand balance, security and capping market prices.

6. Partnering Opportunities

The achievement of the additional GHG emission reductions will require partnering between Government and the private sector as many of the benefits of climate change and the use of renewable energy instead of fossil fuels are public goods. While the benefits of improved energy productivity can often be captured by business, in today's energy market the investment in renewable energy opportunities is often not an economically rational decision for business. Economically, fossil fuel solutions are often least cost and many of the benefits such as increased employment etc. are public goods.

The consequence of not having a partnership is a lack of action beyond BAU to achieve GHG mitigation, or the private sector individual players subsidising the achievement of public goods.

By Government and business working together the synergy between public and private benefits can provide strong drivers for increased GHG emission reduction, while each going alone makes the achievements more difficult. The contributions from the stakeholder organisations showed the extent that business is prepared to push its investment.

For industry and business organisations, signals from government need to be clear and stable if we are to move from BAU to the Encouraged Scenario. The most important signal for significant changes in capital investment will be the carbon price and future price volatility but by Government and industry working together the foundation for that investment can be established.

6.1 Priorities for Industry

Schedules 1 summarises from Part 2 of this Report the areas where Industry organisations can take a lead and where Government can support those actions with policy initiatives.

These actions are based on the strong foundation each organisation has established through leadership of their respective sectors. Each organisation has substantial links to the main participants in the sector and this provides an effective means for delivering on appropriate actions.

The areas where the organisations can focus is on the setting of the details of actions; setting standards; dissemination of information; delivery of independent technical support to potential investors; ensuring quality and assisting professional development and delivery of best practice. These are not new areas of

activity but areas where each organisation has an ability to expand and assist business and the sector members to contribute more to GHG emission mitigation.

However most of the organisations are financially constrained as to what they can do and need to work in partnership with Government to deliver the substantial public good component of the climate change initiatives.

In essence stakeholder organisations are working as best they can to reduce carbon but with assistance far more can be achieved.

6.2 Priorities for Government

Schedules 2 summarises from Part 2 of this Report the areas where Government has to take a lead and where industry organisations can support those actions with advice based on market experience.

Government leadership in the procurement of renewable and energy productivity products and services based on value and not least cost is a key area which sets a strong role model for business to invest in emission reduction initiatives. In some areas this can be supported by establishment of best practice technical standards and alterations to energy market regulation.

The collaboration of Government and the respective stakeholder organisations for the delivery of specific activities needs to be recognised as a tool available to Government in achieving the climate change targets. In some areas this works well while in other areas there is room for improvement.

The New Zealand energy market is entering a new phase where renewable and energy efficiency technologies are allowing energy users to also be energy producers or to source their energy from independent producers and not the wholesale energy market. The substantial heat market is gaining greater recognition and thus policy has to move from a focus on electricity and petroleum to energy.

The private sector is already astutely evaluating their renewable and energy efficiency investment options and as the Business as Usual scenario shows are investing in niche areas where GHG emissions can be reduced by approx. 3 Mt CO_2-e. However because climate change is a public benefit initiative Government has to provide the main lead. As a consequence the levels of achievement of GHG reduction for the encouraged and accelerated scenario's can be achieved.

A lead from government will encourage private sector to look harder at their own investments and it is well documented that when this occurs additional GHG emission reduction opportunities will proceed.

7. Links to other initiatives

Figure 6 show the inter-relationship of this initiative to stakeholders and other initiatives

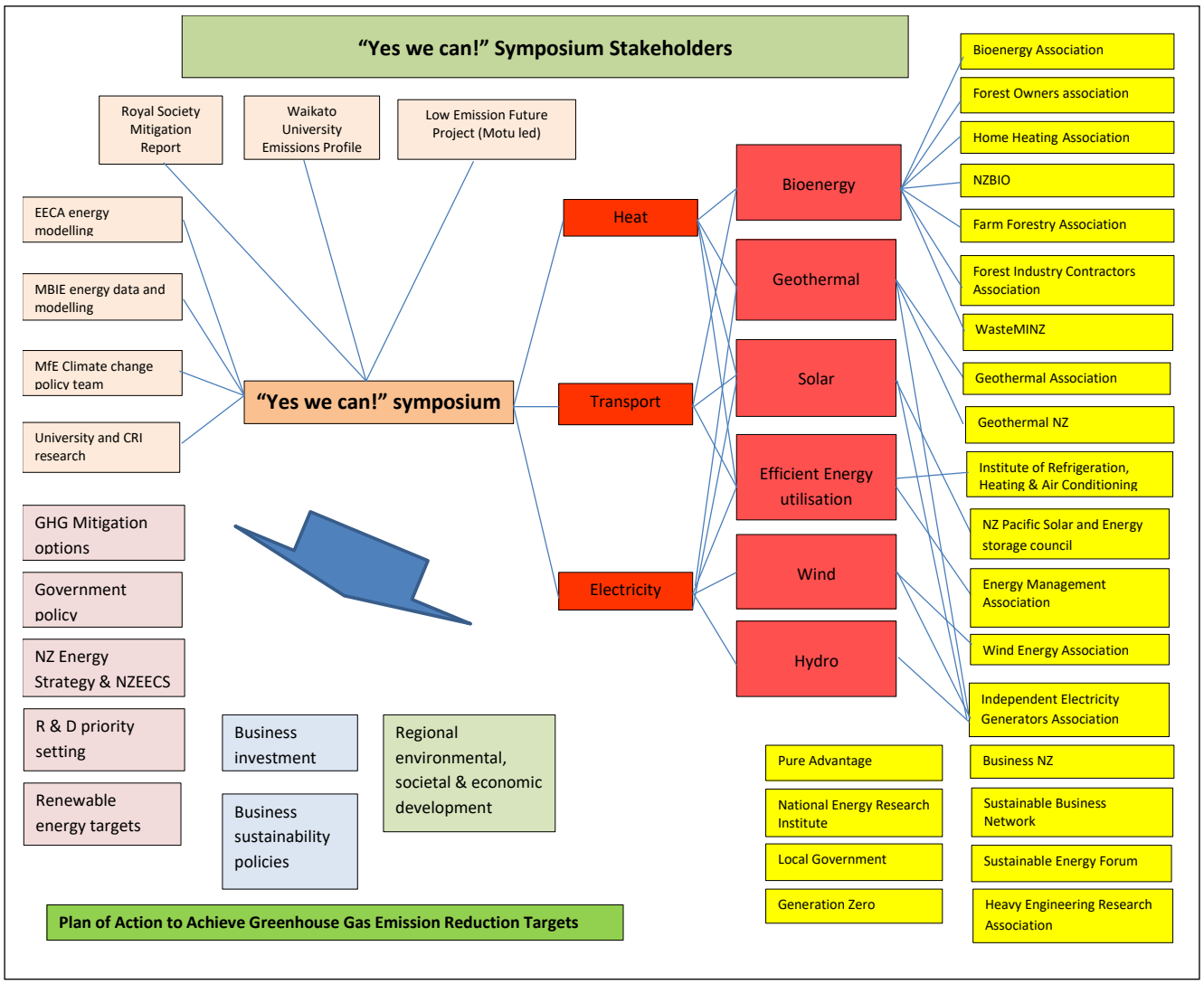

Figure 6: Inter-relationships between stakeholders and other initiatives

- The "Yes we can!" initiative has proceeded in parallel with the Royal Society Climate Change Mitigation Study and the NZ ETS Review being undertaken by the Ministry for the Environment.
- Submissions for the second part of the NZ ETS Review were due on the 30 April 2016 and individual contributions from the stakeholder organisations have been collated into this report.
- Separately, the School of Government at Victoria University has been leading an initiative to see what support there is for establishing a Climate Forum in NZ (similar to the Land and Water Forum).
- Auckland and Wellington City Councils have already developed and published their Low Carbon Plans[5][6] and these have been taken into account in the development of this initiative.

5 http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/theaucklandplan/Documents/lowcarbonauckactionplancoverandapp.pdf

6 http://www.bioenergy.org.nz/resource/report-wellington-city-council-draft-low-carbon-capital-plan

This initiative has been coordinated with the renewable energy, energy intensity and climate change work being undertaken by the Ministry for the Environment, Ministry of Business, Innovation and Employment and the Energy Efficiency and Conservation Authority. Some has already fed into initial considerations for the NZ Energy Efficiency and Conservation Strategy Refresh consultation recently initiated by MBIE and EECA.

8. What Next

The "Yes we Can" symposium quickly generated a number of ideas. This has shown what could be achieved but further work would be required on each recommendation.

To test the opportunities identified, refine them, prioritise and develop the most effective recommendations would need government support of the symposium members.

Development of business case assessments for the opportunities would identify the high value options and also highlight the initiatives that create commercial value.

The stakeholder organisations would like to meet with Government officials to discuss the recommendations, outline the priorities and establish the terms of reference and scope for this exercise.

Schedule 1 – Summary of Industry-Led Actions

The stakeholder organisations identified that there were a number of actions where they should provide the lead. Their ability to deliver on these actions is in many cases however dependent on their ability to attract external funding. Many of the actions are also enhanced if they are implemented in partnership with Government.

A. Sector wide actions

i. Information dissemination – overcoming a market failure

Very often a market failure exists in that adequate information on renewable energy options is not available to decision makers. Industry associations have established good information resource bases and undertake education programmes but have very limited funding so are restricted in their ability to share information outside their core membership. (EECA undertake public awareness raising but do not provide the depth necessary for technical advice and decision making. This is an appropriate role for the sector associations.) Support for raised public awareness through websites, newsletters, case studies, best practice guides, seminars, training courses, renewable industry presentations to user groups (e.g. to a building services conference or a school principal's conference) would mean that industry wasn't just "preaching to the converted".

Each sector organisation can develop an information dissemination strategy and programme of implementation.

ii. Developing and maintaining capability

New Zealand is a world centre of excellence in some forms of renewable energy and energy efficiency but attention must be given to nurturing it so that we can build our low carbon future. We also have the opportunity to export this capability and thus get additional value from climate change through our expertise and capabilities.

A weakness with our current export of capabilities is the lack of financial backing and recognition. New Zealand companies must compete with others who are generally supported by their own investment banks. Establishment of an investment bank to directly invest in international low emission geothermal projects, using our national expertise, in projects which by themselves should be profitable would also ensure that money was linked to real emissions reductions rather than spurious international emissions credit purchases. Currently, our consultants are involved with many projects globally that would go a long way to offsetting our national emissions if benefits could be captured.

Many sector participants are too small to effectively engage in export markets. Geothermal New Zealand has been created to assist the geothermal sector and could be a role model for other parts of the renewable and energy productivity sector.

Each sector could work with Government to develop its own capabilities and expertise programme for both increased domestic mitigation projects, and export of capabilities.

iii. Facilitating international connections

Expertise and knowledge can be enhanced through international connections, either by bringing NZ leaders to international events or by bringing international expertise to New Zealand. This is undertaken at the science level but should also occur at the applied technical implementation level.

Each sector organisation could prepare a programme for an international transfer of knowledge and skills and seek Government support.

iv. Support Appropriate Training Opportunities in New Zealand.

With a stronger emphasis on low carbon opportunities there will be a need to review and upgrade trade and other skill training. Training and currency of information is critical in an expanding industry with ongoing development. There is a need to encourage people to consider low carbon technology careers whether through trades or university studies. There is also a need to upskill many technical advisers so this may be opportunity to develop toolkits for training engineers, architects, drillers and builders for low carbon applications that can also be used to support our export capabilities.

Development of Energy and Sustainability Engineer as a discrete study stream at New Zealand Universities would increase the level of competence for energy efficiency across the sector.

Each sector organisation could prepare a skills development programme and seek Government support.

v. Energy Dating Service.

Some businesses, landowners and potential developers don't have the connections or expertise to realise low carbon aspirations. A service to connect these expert parties with industry and business interests seeking energy solutions can help to unlock this potential. This is done by the sector associations on an as requested basis currently, but funding would enable a more pro-active and involved approach.

Each sector organisation could prepare and obtain Government support for establishment of a programme to provide business technical support.

vi. Showcase and Share Lessons Learned.

Success breeds success. Actively show-casing existing success stories in low carbon energy use increases awareness and stimulates further development. In addition, by sharing lessons learned, future projects have greater chance of success.

Each sector organisation to agree with government a programme for showcasing and providing information from demonstration projects that shares lessons and shows potential investors how to implement low carbon projects.

vii. Specific Information on the Economics of Projects.

There is a great need for micro- and macro-economic cost data to be collected to summarise the benefits of adopting new renewable energy technologies. This can assist decision making. These calculations can be complex so access to tools and assistance to calculate pay back periods for renewable energy projects could encourage uptake.

Each sector organisation to undertake a gaps analysis and identify areas were information on the economics of projects is lacking and prepare a programme of work to meet requirements.

B. Electricity

i. Support for solar industry training initiatives

Solar and battery storage introduce new competencies required for installers and inspectors. The solar and storage industry has the capacity to provide training and ongoing professional development.

NZ Pacific Solar and Energy Storage Council to develop a programme for industry-led training needs to be put in place, allowing the industry to keep practitioners up to date with safety issues as well as the rapidly changing technology landscape.

ii. Continue harmonisation of solar electricity standards and more urgency in the adoption of standards

The promulgation of joint AS/NZ standards will allow New Zealand to benefit from significant savings in regulatory oversight by sharing the costs of establishing safe, industry best practice deployment of solar and storage technologies. Once established, these standards need more certainty of when they will apply. The current practices in this area are sluggish and creates uncertainty and confusion for both installers and electrical safety inspectors alike.

NZ Pacific Solar and Energy Storage Council to develop a programme of work to ensure that solar electricity technical standards are appropriate and universally applied across New Zealand.

iii. Develop standard documentation for financing energy projects.

Overseas experience is demonstrating that a significant barrier for investors financing energy efficiency is the lack of standardisation of investment documentation. For example, how returns are measured and returns on investment calculated. In jurisdictions where standardisation has occurred there are considerably greater investment funds available for energy efficiency projects.

Energy Management Association to lead a cross sector project to develop a technical guide for financing energy productivity projects.

iv. Develop a template energy efficiency green addendum for residential house leases with a process for landlords and tenants to collaborate and share the benefits of working together to reduce energy use.

The addendum should establish a framework that allows market like mechanisms to emerge to solve the barriers for investment in landlord/tenant situations and to provide non market intervention where this becomes necessary.

Energy Management Association to develop a technical guide for residential property owns to implement energy use improvements.

v. Ensure the consistent use of the National Standard for wind farm noise limits.

In 2010 a new standard NZS 6808 was developed to recommend limits on noise from windfarms.

The standard reflects international best practice and is adhered to by all NZWEA members. There is, however, no requirement for local authorities to adhere to the Standard when making consenting decisions under the RMA. Incorporating NZ6808 into the RMA would provide greater consistency in wind farm consent decisions and provide certainty to applicants, thereby reducing consent timeframes and costs.

NZ Wind Energy Association is to lead a project to ensure that wind farm consents incorporate appropriate technical standards across all consent authorities.

C. Transport

1. Encouragement of the utilisation of biogas as a vehicle fuel

Currently 67% of biogas produced is used to produce low value electricity. Biogas can be used as a vehicle fuel and in Christchurch for many years this was done on council vehicles. The Go Bus fleet in Hamilton uses natural gas as a fuel and they could easily use biogas if it were available from the local waste water treatment plant. This could occur if the parties worked together with buses being parked at night at the waste water treatment plant for refuelling.

Food processors who could process their organic waste into biogas could use the gas as a fuel for their plant vehicles or for the production of processing heat.

Use of biogas as a vehicle fuel is a significant opportunity for reducing GHG emissions compared to the generation of electricity which has minimal effect.

Bioenergy Association to develop a programme of work to assist heavy transport use of biogas as a vehicle fuel.

D. Heat

i. Collection of statistics on direct heat use

Currently no or little data is collected on biomass and geothermal use for heating. There is need for a mechanism to ensure that data on the use of biomass, organic waste and geothermal energy is collected on a consistent basis, as it is for electricity and petroleum fuels, so that the actual growth in the sector can be measured. Databases of the location and capacity of some heat plant are held but have a lot of errors because they are not maintained. However, while there is some data on heat plant capacity and location there is no data collected on the use of geothermal, biomass and waste for specific heating applications and so any statistics on the switching from fossil fuels to renewable energy is simply informed guesswork. The same is true for the collection of data on biogas use.

A mandatory reporting requirement could be legislated for developments above a critical size.

Currently, the lack of data on the growth in the direct heat sector makes it difficult to show potential investors that they would be joining a growing sector and that renewable energy is a mainstream energy source, and the level of waste that is already being converted into valuable energy.

Current MBIE data is incorrect in a number of areas of direct use. Data on direct heat use is the only energy use that are not systematically collected by MBIE. Where such data has been crudely collected there are examples of misinterpretation. Industry Associations could be funded to collect and interpret data. Such data will also be required to quantify carbon mitigation.

ii. Air quality Standards

Our national air quality policies should focus on setting appropriate heater combustion standards and the education of wood heating users. Incomplete combustion arising from use of wet wood fuel is far more significant than the use of old but still efficient wood burners.

In many communities wood burning has been actively suppressed and it will take active measures to return it to its former role in New Zealand's energy portfolio. Home wood burning can be an essential part of the systems that enable New Zealand to meet any reasonable carbon reduction target but for that to occur there needs to be better interaction between regulators and industry.

The national environmental standard on air quality needs to consider cumulative exposure to PM2.5, instead of sporadic exposure to PM10 which is much less correlated to mortality from air pollution.

There is a need to adopt standards and procedures for domestic scale wood burning and wood burning equipment which are in harmony with "best practice" countries, i.e. most of Europe.

By so doing we:

- Enable our people to purchase from the massive range of European plant and equipment; and
- Remove a major "non-trade barrier" (by recognising equipment that has been tested elsewhere as being accepted in NZ) to the widespread use of wood burning and related equipment thereby putting our own manufacturer's on the same footing as Europe, enabling them to compete more easily in the European market and driving jobs in NZ..

There is a need for a test method for flue gas emissions from domestic biomass heaters that reliably characterises the quantity and toxicity of the particles and gases emitted or better. This could be achieved by adoption of the more stringent of today's European air quality standards, all of which are far less restrictive than New Zealand's.

There is a need to undertake pilot trials of appropriate numbers of wood burners in both homes and larger-scale facilities to give real data on emissions and not artificial laboratory test results.

Regulation of emissions from larger scale biomass heat plant are variable across the country and often inappropriate to regulating specific plant.

Sustainable Energy Forum, Bioenergy and Home Heating Associations to establish a working group to review the current air quality regulation barriers that limit the use of biomass heating.

iii. Assist development, commercialisation and research on residential wood burning.

There is a need to assist commercialisation of advanced residential heaters which ensure smoke is burnt before reaching any heat exchanger – these are widely used in Europe.

- Research and development on fuel preparation, including pellets, from various feedstocks for wood heating.
- Research on wood combustion which could reduce or eliminate formation of NO_2 and other toxic gases and enable improved automation.
- Social research on barriers to domestic wood burning.
- Trials of multiple-use firewood forestry with amenity values for near-urban area planting, including restoring native trees and fauna.

Sustainable Energy Forum, Bioenergy and Home Heating Associations to establish a working group to assist research and commercialisation of advanced residential biomass heaters.

iv. Encourage the widespread uptake of wood pellet and chip for small/medium size commercial and industrial heating applications by:

- Overhauling the resource consent requirements to make the installation and operation of wood energy plant simple and bureaucracy free.
- Remove the annual "compliance" fees on small/medium scale commercial and industrial plant.

Bioenergy Association to undertake a review of current resource consent practices and establish a Technical Guide to assist regulators and applicants.

v. Expand current research into commercialisation of torrified wood fuel as a replacement for coal as heating fuel

Torrified wood fuel is a suitable drop-in replacement for coal and complements the use of chip, hog or pellet wood fuel. It has the benefit of not necessarily needing additional handling and storage facilities as wood fuel requires.

Developing expertise in the torrification of wood as a fuel would open up export opportunities in S E Asia.

Bioenergy Association to develop a terrified wood working group which progresses the research and commercialisation of torrified wood as a substitute for coal.

E. Reduction of methane emissions from waste

1. Encouragement of waste water facility owners to process liquid trade wastes and municipal organic solid waste.

Economies of scale for waste water treatment can be achieved by communities sharing or co-locating facilities. Liquid trade waste can be more efficiently processed and give economies of scale when accepted at municipal waste water treatment facilities. The gate fees for processing trade waste provides a good income stream which offsets facility operating costs.

Bioenergy Association to establish guidelines for communities to reduce emissions of methane from waste water treatment facilities.

Schedule 2 – Summary of Potential Government Led Actions

The Government's main policy response to reducing emissions is the New Zealand Emissions Trading Scheme (NZ ETS). However in the recent review of the NZ ETS it was identified by the Ministry for the Environment (MfE) that in some sectors or cases, there may be other barriers or market failures that also need to be addressed. For example:

- lack of information
- high upfront costs of new technologies
- lack of infrastructure to support new technologies
- unnecessary regulatory barriers to new technologies.

Government has implemented some policies, targets and programmes outside of the NZ ETS (complementary measures) to contribute to reducing emissions. These complementary measures were to address barriers to adopting low carbon technology, or where the Government has a role in encouraging innovation. Key relevant current initiatives include:

Energy efficiency,

- programmes run by the Energy Efficiency and Conservation Authority (EECA) aimed at improving energy and fuel efficiency in industry, commercial buildings and households;
- Crown loans;
- providing technology grants;
- feasibility studies and business cases.

Public and active transport,

- over $1 billion allocated to public transport through the National Land Transport Fund;
- $100 million for cycling through the Urban Cycleways Fund.

Electric vehicles,

- EV support package;
- exempting electric vehicles from road user charges until 2020.

Vehicle emissions reduction,

- a fuel economy labelling scheme for vehicles.

Science and research,

- Scion core biofuel research;
- GNS Science core geothermal research
- biomass to hydrogen rich liquid fuel;
- energy industry symbiosis;
- timber drying kilns, heat exchanger, biogas systems.

Bioenergy and heat,

- support for the Bioenergy Strategy through the New Zealand Energy Efficiency and Conservation Strategy 2011–21;
- Wood Energy South;
- bioenergy education programme;
- bioenergy communications support;

- low carbon meat and dairy programme.

Renewable electricity,

- target for 90 per cent of electricity generation to be from renewable resources by 2025;
- National Policy Statement for Renewable Electricity Generation 2011.

Recommended measures which will speed up the uptake of low carbon solutions and thus the reduction of GHG emissions and increases in economic value were provided by each stakeholder organisation and these are in Part 2. From these, the top common recommendations for each stream were selected and are listed as follows:

A. Renewable energy and energy productivity

i. Government signals to local government and industry that it wants to encourage domestic mitigation so as to avoid the need for purchase of international units and emissions from export industries.

The New Zealand Government can provide strategic leadership through the funding of low carbon solutions for delivery of its own services. In many cases these are sound commercial options and can form case studies for wider industry to follow. Government could require that consideration of greenhouse gas emissions reduction should be a requirement of all capital investment decisions government entities.

Leading by example, Government agencies should be encouraged to consider energy productivity in all of their activities and programmes. This can provide a strong signal to the private sector to constantly look at where they also can make energy productivity gains.

Ensure that the framework for rewarding emissions reductions allows domestic emission mitigation to compete on a level playing field with international units and emission reductions. This will require a transparent and credible market framework.

ii. Actioning and monitoring progress of NZES and NZEECS

While the Government has published the NZES and NZEECS, there has been little notice taken of them when developing energy, climate change and economic growth policies. There has been little monitoring or public information on progress and in some situations, where data has been released, it has sometimes been erroneous. Stakeholder organisations would be pleased to be part of and contribute to the monitoring regime. The renewable energy and energy productivity sectors would like to see Government entities take notice of these strategies.

iii. Recognising the wider benefits of energy policies and programmes

The biggest barrier to the uptake of low carbon solutions is probably the way Government looks at renewable energy and energy productivity sectors as only a form of energy supply. The drivers for many low carbon energy solutions are economic growth, employment and environmental outcomes rather than energy. Energy is an input and not an output. Many low carbon solutions are not evaluated appropriately as they are considered only as energy solutions. Energy is the means to the end not the end point itself.

The Business Growth Agenda may have some encouraging words but fails to include any substance for increasing the use of renewable energy and energy efficiency as a tool for business growth.

iv. Government agency KPI

In the 1990's contracts for employment of public service, senior staff were required to have a KPI requirement stating what they were doing to improve energy efficiency. This was a great driver from the top down and the same could be done for reducing carbon.

v. Establish a domestic mitigation task group

Establish an expert group to work with key industries to ensure they are accounting for the carbon in their value chain and focussing on identifying the key opportunities to reduce their emissions. This has been done with agriculture but not in the renewable and energy productivity sectors.

vi. Develop a strong relationship between Government and the sectors able to provide domestic mitigation.

In the renewable and energy efficiency sectors around 50% of the sector activities relate to public goods. The sector industry organisations struggle financially and are not able to carry the public good component of their activities. Addressing the public good component could involve:

a. Regular meetings between industry associations, ministers and officials with an emphasis on business growth opportunities through climate change initiatives.

b. Active consultation on key policies impacting on the sector.

c. Formal Government-funded partnerships in relation to the public good component to:
   i. assist joint identification of the public good objectives.
   ii. assist with delivery.
   iii. assist with the monitoring of progress and understanding the industry.
   iv. identify and reduce market barriers.

(The EECA / Bioenergy Association and EMANZ collaboration arrangements are a good example of how this can work).

vii. Improved Government procurement policies

Central Government introduces policies to change Government procurement so that renewable efficient energy use options must be considered when making investment decisions and all additional benefits are included in a full life cycle analysis of options. In addition, the Government's project appraisal model could use a higher CO_2 cost than the private sector experiences through the NZ ETS. This approach/modelling is justifiable as it will demonstrate that the Government is taking clear, long term decisions that reflect the likely real price of carbon over the life of the capital plant (i.e. 30 years plus).

Local councils would be required to introduce similar central Government procurement policies for local government procurement and apply the same modelling approach.

Government procurement agencies should be required to consider lifetime benefits and all government policies – not just lowest cost. Renewable energy projects have high capital and low operating costs so lifetime analysis is essential. This may require a fundamental change at Treasury-level.

Government project analysis should use the higher carbon price assumptions to reflect government leadership with regard to the NZ ETS.

viii. Establishment of a green fund similar to Crown loans with availability of suspensory or low interest loans for capital expenditure on renewable energy projects.

Crown loans are available through EECA for renewable energy and energy efficiency investment projects. An entity similar to the NZ Super Fund or ACC should be established to make similar loans available to private sector projects.

Many renewable energy projects can be potentially financially attractive but access to capital is a major barrier. Having provision for suspensory loans which are paid back out of operating profits once the project is operational can assist potential projects get underway.

Suspensory loans from central government or restructured rates schemes at city council level could assist uptake of these low emission technologies. There may be a role for a Clean Energy Fund similar to that in Australia to make money available to private sector projects to compliment the Crown loans available through EECA for renewable investment projects.

The Australian entity is the Clean Energy Finance Corporation (CEFC), whose role is to overcome market impediments and help accelerate Australia towards the transformation to a low carbon economy, minimise its ultimate cost and create positive adjustment for the economy, including through new forms of clean technology business, new jobs, development of new or expansion of existing businesses and development of new technological know-how.

The CEFC places priority on its investments generating economic, social and environmental benefits, including building capacity and capability within the renewable and low carbon energy sector, demonstrating applications and financing for new technologies, development of new or existing businesses and development of new technologies and know-how.

CEFC investments to date - even at this initial phase - are demonstrating the potential to expand Australia's manufacturing capability and create new industry and employment opportunities across the country, particularly in regional areas.

The CEFC's portfolio of contracted investments is expected to earn an average return of approximately 6.1 percent (as reported in their 2014-15 Annual Report). Their participation in the market provides liquidity to ensure efficient pricing. Their lower cost of funds, flexible structuring and capacity to match the term of the financing to the life of the assets has allowed them to de-risk transactions so that private financiers become involved.

The New Zealand Super Fund could be a suitable entity to manage such a fund for on-shore investments to the benefit of NZ as a whole.

ix. Expansion of the National Policy Statement for Renewable Electricity Generation

The National Policy Statement for Renewable Electricity Generation 2011 is consistently referred to as covering renewable energy when it actually only covers electricity. It would be of some assistance to the renewable energy sector if this policy was broadened to include all renewable energy projects and not just those of electricity.

x. Accelerated depreciation for renewable energy and energy efficiency capital expenditure

The access to capital for renewable energy projects is a major barrier affecting uptake. Renewable energy facilities tend to be high capital, low operating cost investments and facilities generally have a 20-30 year economic, life so there needs to be assistance to business to reinvest. An accelerated depreciation regime for renewable energy projects would be near fiscally neutral and provide significant assistance to many projects.

Internationally, accelerated depreciation is a common tool for encouraging pollution control and it has been used in New Zealand.

Depreciation loading of 20% for qualifying items was available in New Zealand until May 2010. It was introduced as an incentive to encourage New Zealand businesses to invest in new capital equipment.

Accelerated depreciation on all energy efficiency upgrades certified by accredited auditors, rather than straight line depreciation at 12.5% allow the spend to be written off over 3 years after implementation and commissioning

xi. *Government does an annual cost-benefit of forward offshore purchase of GHG obligations vs acquiring domestic mitigation through a capital fund which funds the public good component of transitioning low carbon transport fuels.*

Analysis should be undertaken on the relative cost of supporting domestic mitigation compared to spending the same money on purchasing international units which would do nothing for the NZ economy.

xii. *Mandatory carbon emission plans*

Mandatory carbon mitigation and management plan for all organisations with stationary carbon emissions exceeding 2,000 TJ per annum (~1,000 NZ industrial businesses)

Mandatory reporting of energy consumption and carbon emissions in Annual Reports

xiii. *National Emissions Accounting*

Introducing a policy of emissions accounting for public and private bodies creates the ability to set goals and restrictions at finer levels than just the national accounting can achieve. This provides a measure for councils, corporates, industry sectors and geographical regions to quantify emissions reductions progress and performance and hold such groups accountable. Currently activities are uncoordinated across urban authorities and different standards are being applied.

B. Transport

i. *Vehicle fuel efficiency standards*

Fuel efficiency standards that encourage the use of low emission vehicles should be established.

ii. *Change in biodiesel blend limit*

Expanding the blend limitation for biodiesel from 5% to 7% would provide more flexibility for biofuel retailers and allow an increase in the quantities of biodiesel able to be sold in the motor vehicle retail market.

iii. *Reducing sulphur limits in marine fuel*

The International Maritime Organization has introduced new regulations to reduce the maximum sulphur emissions limit for all vessels traveling in Emission Control Areas (ECAs) by 2015. Global refining, bunkering and commercial shipping industries will be affected and any vessels traveling through ECAs will be forced to shift to low sulphur fuels such as Marine Gas Oil, or alternatively stimulate exhaust gas scrubbing. Compliance can also be by way of a number of emission abatement methods including compliant low sulphur marine fuels such as biofuel. Application of such a standard to New Zealand would be good for New Zealand.

iv. *Regulations on fine particulate emissions*

The health related costs of the fine particulates emitted during the combustion of diesel fuel are currently an un-costed externality. This policy is health-driven, as the fine particulates in diesel emissions have been classified as carcinogenic by the World Health Organisation to the same extent as cigarette smoke and asbestos. New Zealand has neither emissions standards that take into consideration fine particulates nor any public health policy initiatives relating to exposure to the fine particulates from diesel combustion. By actively monitoring and seeking reductions in the volume of harmful particulates from fuel combustion in the atmosphere, especially in urban environments, both public bodies and fleet operators will be encouraged to seek clean

alternatives for their heavy vehicles. These clean alternatives are readily available now but are not encouraged by urban transport authorities.

v. Bulk purchase of low carbon heavy vehicles

Larger orders of heavy electric vehicles create economies of scale and accelerate the development of expertise and infrastructure around such vehicles while also lowering the perceived risk. A policy providing appropriate financial support to organisations that consolidate existing and forecast orders into one supply commitment would encourage this.

vi. Electric Vehicle Depreciation

As no market currently exists for second hand battery electric commercial vehicles, the risk associated with the resale value of the vehicle needs to be adequately mitigated. One means of achieving this is the provision of more aggressive depreciation rates than is currently used for internal combustion vehicles reflecting the shorter economic life of electric vehicle batteries.

Higher depreciation rates mean the second-hand sell price of heavy electric vehicles may be lower, which in turn stimulates the second-hand market for such vehicles.

vii. Integrate all transport modes across the transport sector

Currently the lack of integration of road and rail leads to distortions in investment decision making and thus opportunities for GHG mitigation forgone. Roading is treated as a public good, while rail is treated as a private good.

Opening up the rail network to multi-modal use by existing road transport operators reduces the amount of very heavy loads required to be transported long distances by road.

In many areas urban transport is not coordinated so that encouraging smooth movement often doesn't occur eg bus terminals in different parts of a city resulting in passengers not being able to move from say an inter-city bus to local buses. The provision of public funds to support transport operators provides the opportunity for enforced integration.

Regional transport is also not integrated eg Northland where roads are subsidised to a greater level than rail – which sets rail up to fail because of different rules being applied to it. Rail represents an important opportunity to provide existing road transport operators with additional options for long haul, heavy freight where factors such as battery weight and range remain problematic for the option of using electricity.

Rail in New Zealand has characteristics that make it a useful part of the transportation mix of existing road transport operators.

a. Rail benefits are a public good similar to those provided by road.
b. The long-haul rail network is not suffering congestion problems.
c. Rail has significantly lower rolling resistance, significantly increasing electric vehicle range.
d. The North Island main trunk line is already electrified and is able to be used to recharge batteries.
e. Rail accommodates much greater weights which is able to be used for larger payloads and battery packs.

A similar argument applies to the integration of coastal shipping with other transport modes.

C. Heat

i. Government encourages additional domestic added value processing of wood with the consequence that greater volumes of high quality wood fibre are available for heat, biomaterial and biofuel production.

Assist the forestry and wood products sector realise efficiency gains, therefore value. Government encourages additional domestic added value processing of wood with the consequence that greater volumes of high quality wood fuel become available.

The speed of uptake of heat and advanced biofuels production from lignocellulosic feedstocks is going to depend on the availability of wood fibre. In the coming decades this may be constrained by demand from a number of sources. A consequence of a healthy forestry sector with significant domestic processing is that greater amounts of high quality fibre will come available.

Encouragement of the processing of forest wood within New Zealand can produce a large number of economic growth, employment and new business benefits. More domestic added value processing of wood produces more wood fuel as a co-product, and because this is the best quality fuel, heat plant owners will see it as a low risk fuel source.

ii. Increased promotion of use of solar in building heating

The layout of subdivisions, building plans and increasing the use of double glazing can provide significant low carbon opportunities. The layout of residential subdivisions can assist home owners to design buildings that maximise the use of solar energy for space and water heating. This is an area where there is no sector organisation taking a lead.

iii. Require availability of cost of service reflective, time-of-use power tariffs that encourage efficient fuel switching from electricity to other fuel sources at times when it could assist reduction of coal- and gas-fired generation.

Mandatory require delivery of information and price signalling of the cost of generation of electricity so that it can provide all electricity users with incentive to use alternative energy sources to reduce energy costs. Currently, the electricity market only provides customers with the benefit of their avoided cost and not the total benefits to the market and resulting emissions reductions.

Price-responsive demand – targets normal high-price periods with a tariff which reflects actual supply costs including the cost of emissions.

The case for such tariffs needs to be supported by modelling the effect on peak electricity demands and, therefore, on greenhouse gas emissions of significant increases in alternative fuel use (e.g. wood burning).

D. Electricity

i. Reform the energy market regulatory structure and entities.

A number of stakeholder organisations (but not all) saw a need to review the effectiveness of the energy market regulatory structure and entities to meet the goals and objectives of the New Zealand Energy Strategy with a particular focus on ensuring alignment to address climate change.

The current regulatory framework for the electricity market was perceived by some to have outlived its use-by date and requires major reform. The narrow regulatory focus of the Electricity Authority and the Commerce Commission was perceived as being based on a wholesale electricity market and is no longer appropriate for today's energy market.

The Electricity Authority currently doesn't cover all energy yet there are strong interlinkages between electricity, transport and heat and these may be addressed better by broadening the

Authority into being a full Energy Authority with revised objectives related to all Government policies and not just the electricity supply market.

Similarly some perceived that the Commerce Commission regulatory oversight of the electricity distribution entities should be revised so that the objectives of the New Zealand Energy Strategy are achieved. The current regulatory tools particularly of use of ODV was considered by some as being a major barrier to energy efficiency, distributed energy and greater use of renewable energy sources.

ii. Ensure that the market provides appropriate long term signals and contract framework to encourage investment in renewable energy and energy storage and ensure that objectives set for energy regulators include an objective for emission reductions.

New Zealand's advantage is that it currently has a substantial portfolio of renewable electricity production with significant potential to extend further. Extending time of use tariffs to the whole market will encourage energy management, distributed generation and technology switching as tools for ensuring that peak energy supply from the wholesale market is provided cost effectively and with reduced need for fossil fuel produced energy.

Investment in electricity production requires some certainty that demand will exist for its output. Given that there is some need for certainty before investments in emission reducing renewable electricity generation can be made, it will be critical that the long term contract market signals are providing appropriate signals. This is particularly the case for investment in smaller scale, distributed and diversified renewable technologies.

iii. Maintain an efficient and transparent electricity market

Maintaining the electricity market within the context of the wider energy market and ensuring that it develops ahead of the need to allow entry of new technologies. For example, allowing new technologies to secure and be rewarded for the full range of benefits that they provide.

Electricity is linked with the heat and transport markets and the sources of energy are often interchangeable e.g. heating by electricity or wood fuel.

Demand management tools are also linked as alternatives to electricity supply and market mechanisms should facilitate encouragement of the best supply/end use options. Customers need to be recognised as part of the energy market as with emerging technologies purchase and use of energy require transparency of information and options.

Changes are expected in the way distribution companies will charge to recover their costs of providing network connection and network related services. The current uncertainty relating to future network charging structures is likely to be preventing new and existing service providers from offering new and innovative products. A rigorous and sustainable line charge regime based on cost of services provided is needed to give sufficient certainty to investors in renewable energy

iv. Ensure that barriers to competition are minimised

As new technologies will expose monopoly components of the electricity supply chain to competition, it will be essential that monopolies cannot place unreasonable barriers to entry to competitors. An example is where an electricity lines business is providing services from energy storage and claiming this as a regulated service (e.g. recovering its investment through the fixed line tariff). Investment in new energy generation and storage technologies by current monopoly businesses should be adequately ring-fenced and exposed to competition risk.

The current bundling of electricity supply and distribution with regulation linked to sales of electricity should be changed so that end users can choose levels of grid connection and separate purchase of electricity.

v. Review the use of ODV for Commerce Commission monitoring of network companies

In the current climate of falling national demand the continuing use of ODV methodology as a basis for rate determination clearly does not support the Government's drive for efficiency in the energy sector.

vi. NABERSNZ rating mandatory on all buildings leased or sold by 2020

Make 4 star compulsory for all new central and local government accommodation and require existing buildings to be brought up to this standard by 2030. Signal that a NABERSNZ rating will be required on all building space leased or sold by 2020.

vii. Upgrade the building code on insulation, shading and air tightness.

Upgrade of the Building Code will encourage improvements in the design of new buildings resulting in improved energy use and thus reduction in greenhouse gas emissions.

E. Reduction of methane emissions from waste

i. Agree targets to reduce emission from organic municipal and industrial waste by 2020, 2030.

New Zealand is very good at producing municipal and industrial waste but then put it into landfill where it contributes to greenhouse gas emissions or is, at best, inefficiently converted into energy via biogas.

With many territorial councils now separating waste at source it is a simple step to ensure that all organic matter is then collected and used beneficially. Using the organic waste as a feedstock for the production of liquid or gaseous biofuel is commonly done in many countries and this proven technology can be applied in New Zealand.

Municipal waste water treatment plants can very efficiently convert organic waste into electricity for on-site use thus reducing the plant operating costs.

Encouragement in the inclusion of liquid trade waste in waste water treatment facilities can improve the economies of scale and thus make such facilities economic.

Methane is 23 times more significant as a GHG than CO2 so a policy for local government to reduce methane emissions would be a significant GHG reduction tool.

Having targets would necessitate Government requiring local government to report methane emissions from solid and liquid waste facilities.

- The objective is to encourage the reduction of methane emissions from landfills, waste water treatment plants and industrial processes.
- The Bioenergy Association, Local Government and New Zealand Government agree a specific target for the reduction of methane from landfill and waste water treatment plants.
- EECA and Bioenergy Association, under a Collaboration Agreement, agree on a strategy and action plan including: target facilities, promotion, education and information programme: value proposition information, collection and dissemination of demonstration project information.
- MfE to extend the existing mechanism for the collection of data from all landfill and WWTP and to provide an annual report on methane capture and emission presented by region.
- The Bioenergy Association assist to achieve the targets by:
    - Establishing a working group with MfE and LGNZ to develop a work programme for methane emissions reduction from waste.

- Preparation and promotion of regional methane reductions and opportunity plans that provide guidance to the respective organic waste sector suppliers.
- Collating and publishing useful information from any demonstration facilities into a Technical Guide.
- Collating information from local govt on their existing policies with regard to methane reduction. Reviewing the information and report back to local govt as a whole with useful information.
- Hosting regional meetings to assist liquid and solid waste facility owners to be up-to date with methane reduction opportunities and practises.

ii. Widen the criteria for grant allocations from the Waste Minimisation Fund

- Government to review the present use of the landfill Waste Disposal Levy and the criteria for grant allocations from the Waste Minimisation Fund, so as to include methane emission reduction opportunities based on use of the waste rather than just minimisation.
- Current criteria limit funding allocation to minimisation yet use of the waste that is still produced after minimisation can produce positive value were otherwise only cost is perceived. Example are:
  - The collection and pelletising of wheat straw for use as a fuel for heating instead of burning as a means of disposal.
  - The separation of contaminated clean wood from contaminated demolition wood so that the clean wood can be used as fuel.

Biogas produced from landfill can be used as a vehicle fuel.