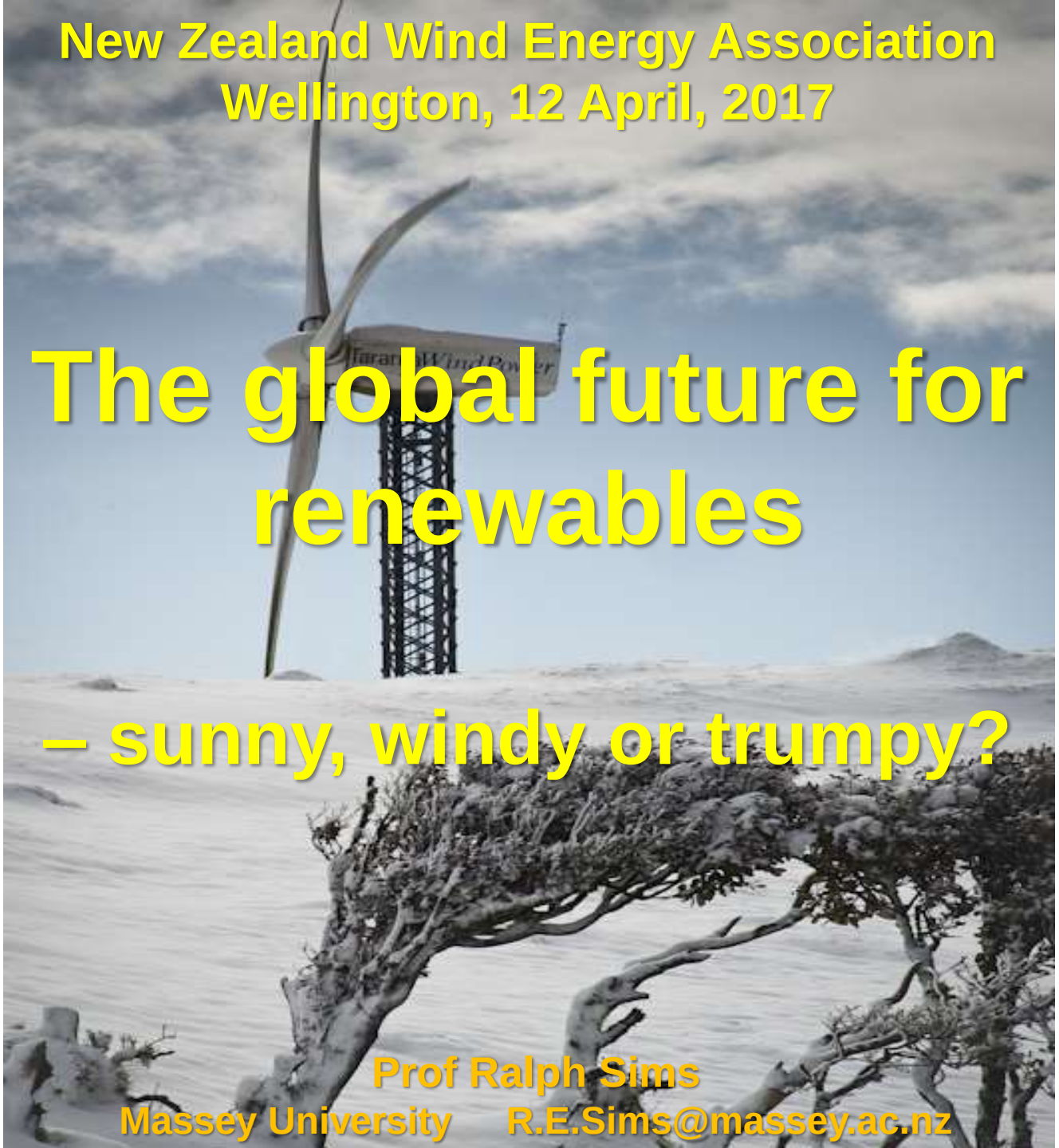
New Zealand Wind Energy Association
Wellington, 12 April, 2017



The global future for renewables

– sunny, windy or trumpy?

Prof Ralph Sims
Massey University R.E.Sims@massey.ac.nz

So what has happened in the past year?....

- World population increased by around 78 million.
- Around 1.3 million people per day moved into cities.
- US$ 286 billion was invested in renewable energy.
- Wind turbine, solar PV and battery prices reduced further.
- Electric vehicle sales grew 50% as did car-sharing schemes
- The 17 Sustainable Development Goals were endorsed.
- 2016 was warmest year ever recorded; (1909 the coldest).
- Extreme weather events around the world increased.
- Sea level rose 3.3 mm as confirmed by satellite and surface data. (200 million people live less than 1m above sea level).
- Thousands of refugees fled into Europe and elsewhere.
- The Paris Climate Agreement came into legal force.
- Donald Trump became President of the USA and aims to support fossil fuels and renegotiate the Paris Agreement.
- We continued to move further into the *Anthropocene age* with the major Planetary Boundaries being exceeded as a result of the “Great Acceleration”.


Population
Real GDP
Foreign investment
Urban population
Primary energy
Fertiliser
Large dams
Water use
Paper
Automobiles
Atmospheric CO2
Surface temperature
We cannot continue along these exponential pathways so innovative solutions are urgently required to protect the "Global Commons"

“First Energy Plan”, White House USA

1) Energy is an essential part of American life.
2) Seek freedom from dependence on foreign oil.
3) Reduce energy costs for hardworking Americans and maximise the use of American resources.
4) Increase wages of the energy sector by more than $30 billion over the next 7 years.
5) Eliminate policies such as the Climate Action Plan.
6) Embrace the shale oil and gas revolution to bring jobs and prosperity to millions of Americans.
7) Seek energy independence from the OPEC cartel and any nations hostile to American interests.
8) Take advantage of the estimated $50 trillion in untapped shale, oil and natural gas reserves, especially on federal lands.
9) Work with our Gulf allies to develop a positive energy relationship as part of our anti-terrorism strategy.
10) Refocus the EPA on its essential mission of protecting our air and water and preserving our natural reserves and resources.

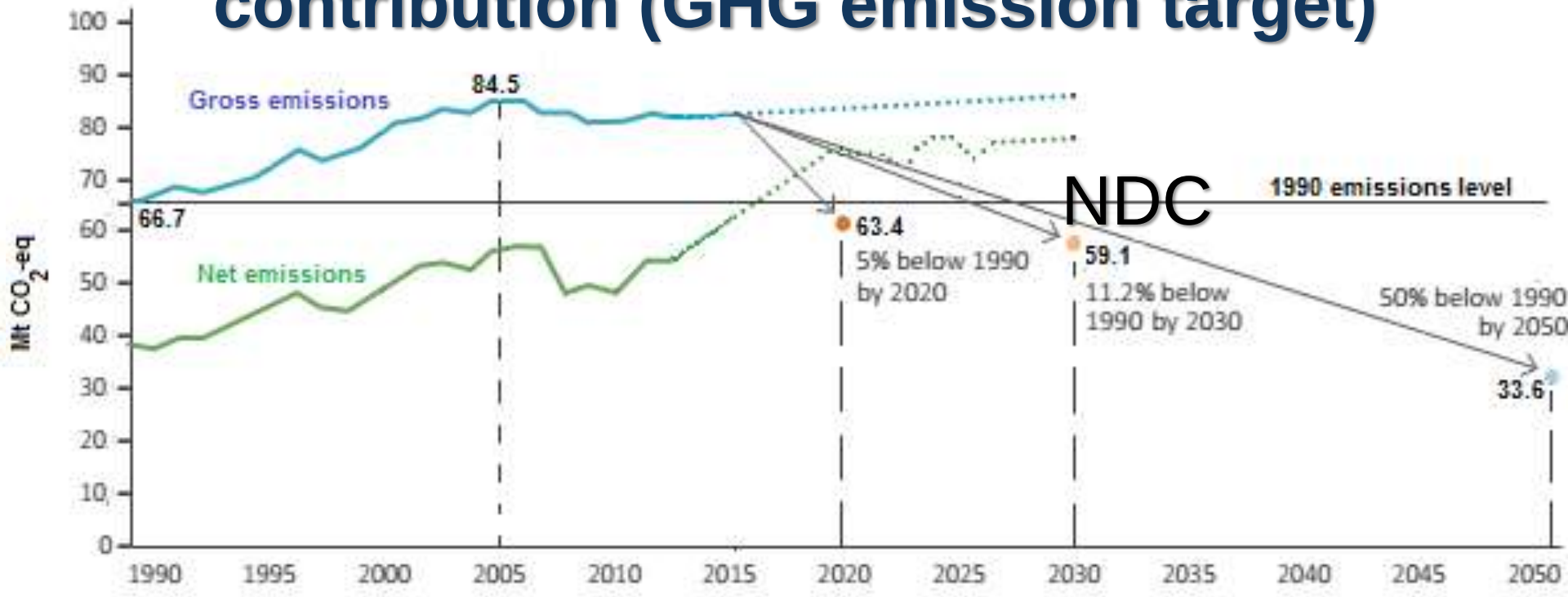
New Zealand is responsible for 0.22% of total GHGs and is one of the signatories to the Paris Agreement.

Minister of Climate Change Issues, Paula Bennet, has signed and ratified the Paris Climate Agreement.

So now we have to do something.

But what do we do – given we have one of the highest per capita emissions in the world?

New Zealand's nationally determined contribution (GHG emission target)



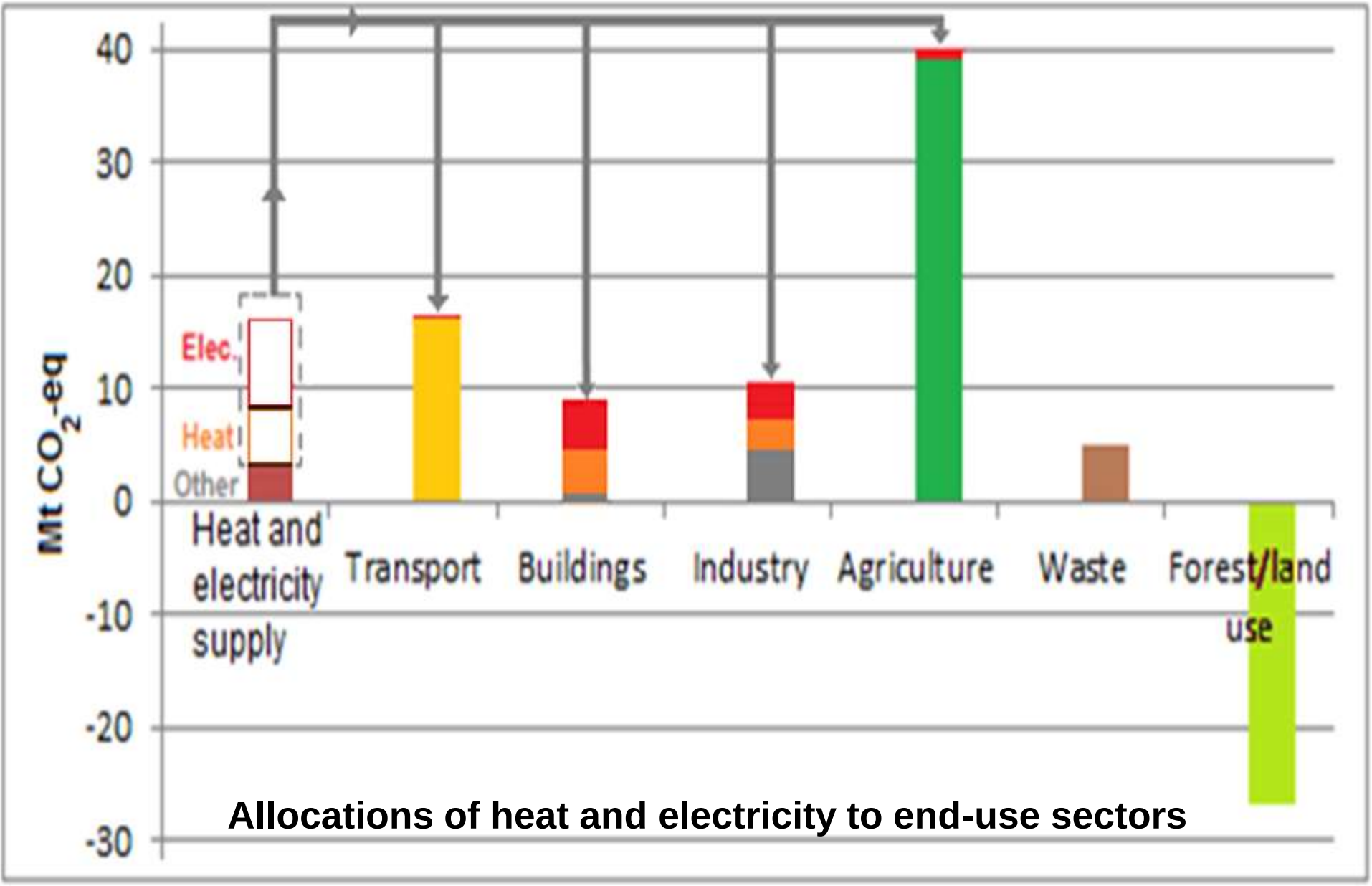
Subject to international agreement, our NDC can be met by a combination of:

- **purchasing carbon credits off-shore;**
- **CO_2 removals by forest sinks;**
- **reducing domestic GHG emissions**
  - **including the electricity sector.**


Transition to a low-carbon economy for New Zealand
April 2016
the ROYAL SOCIETY of NEW ZEALAND
TE APĀRANGI
Climate Change Mitigation Options for New Zealand
Latest report on climate change mitigation options


Climate Change Implications for New Zealand
April 2016
the ROYAL SOCIETY of NEW ZEALAND
TE APĀRANGI
Climate Change Implications
Read latest expert advice report on implications of climate change for New Zealand

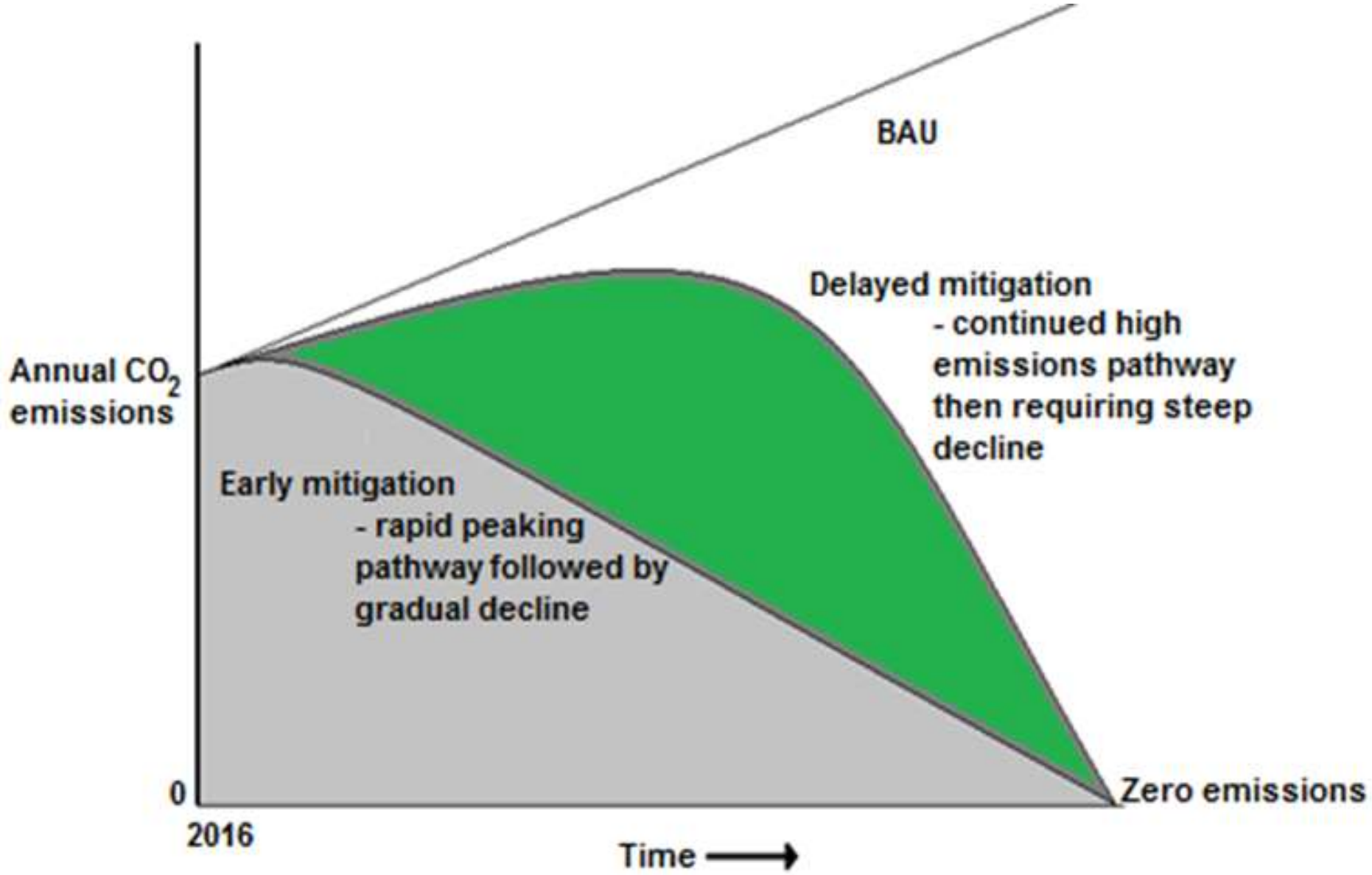
New Zealand's current GHG emissions



Allocations of heat and electricity to end-use sectors

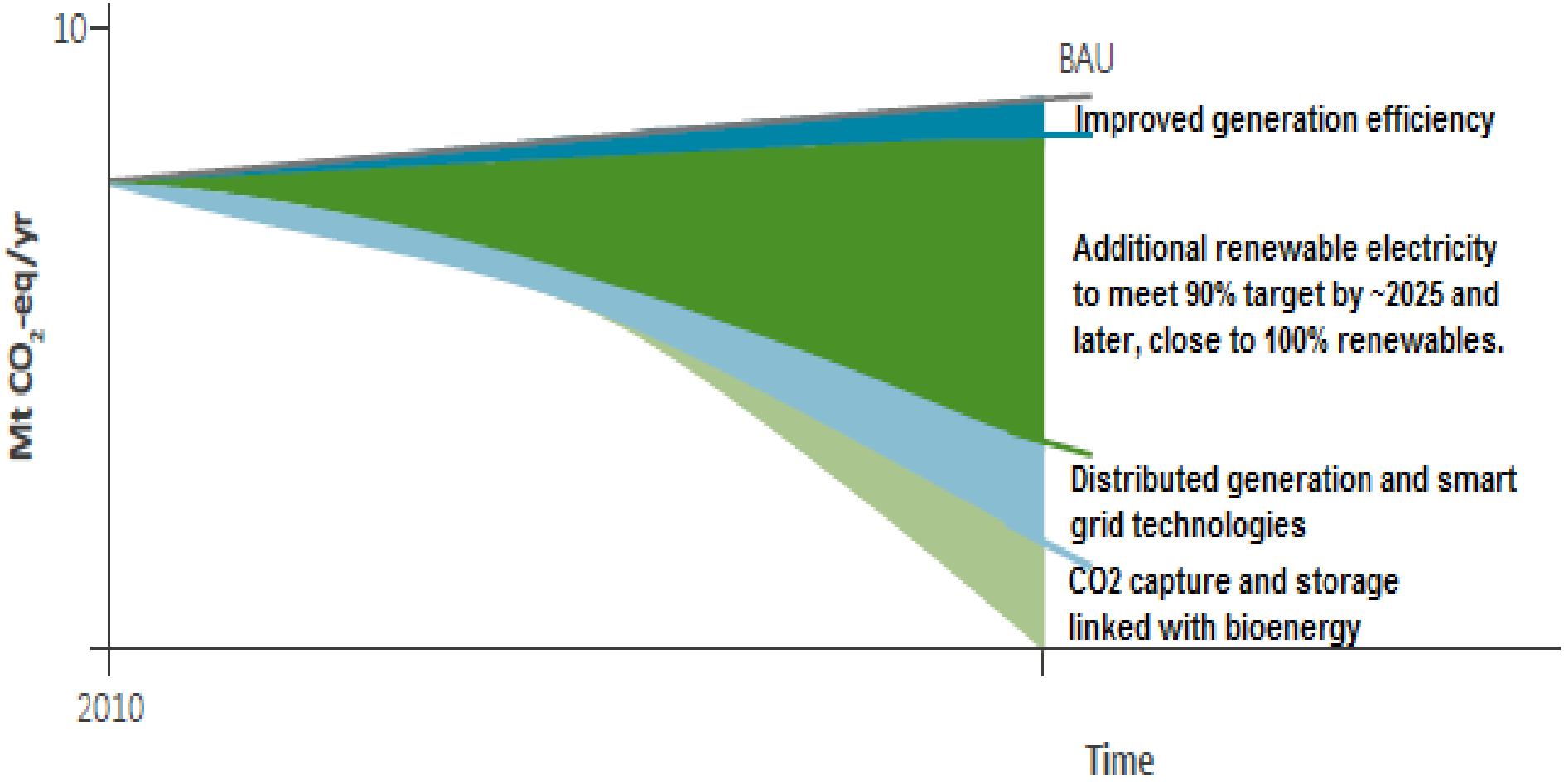
(Royal Society 2016 "Transition to a low-carbon economy for NZ")

Delaying mitigation actions results in a greater amount of emissions overall since CO_2 accumulates in the atmosphere



Good opportunities to reduce GHG emissions were identified for all sectors.

Electricity generation for example:



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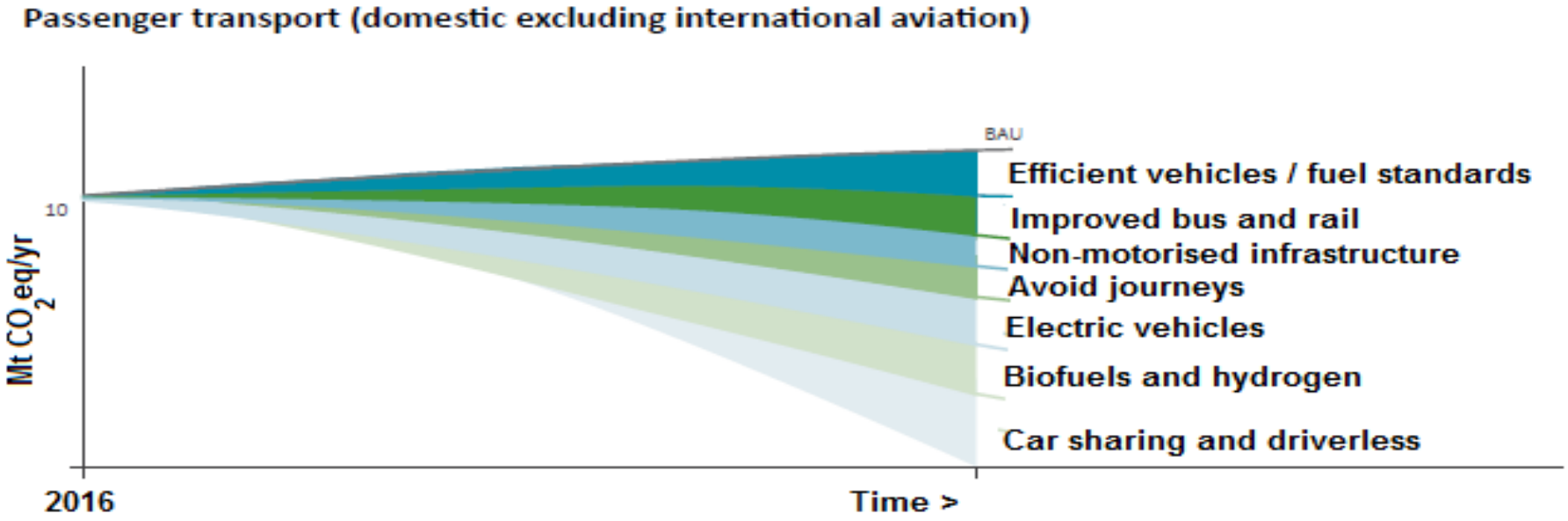
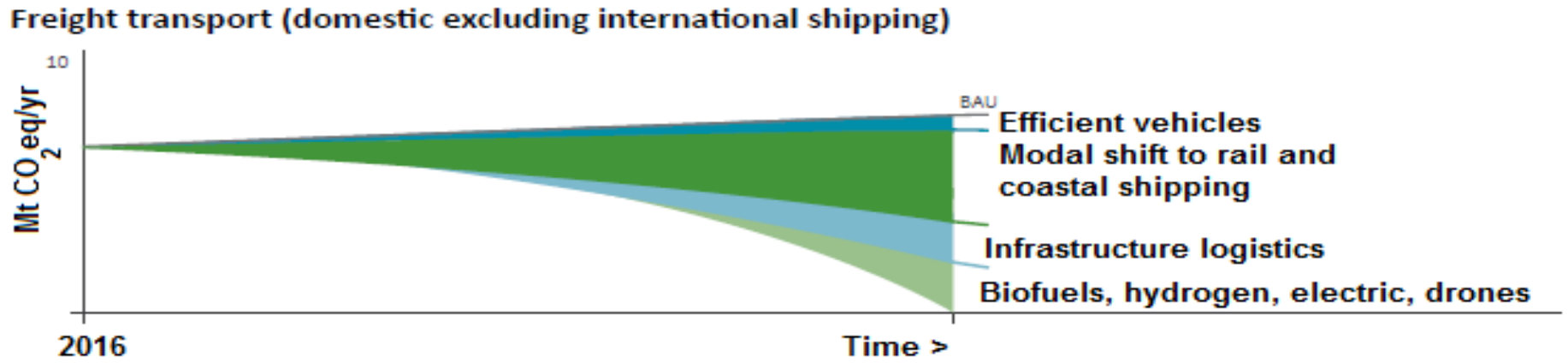
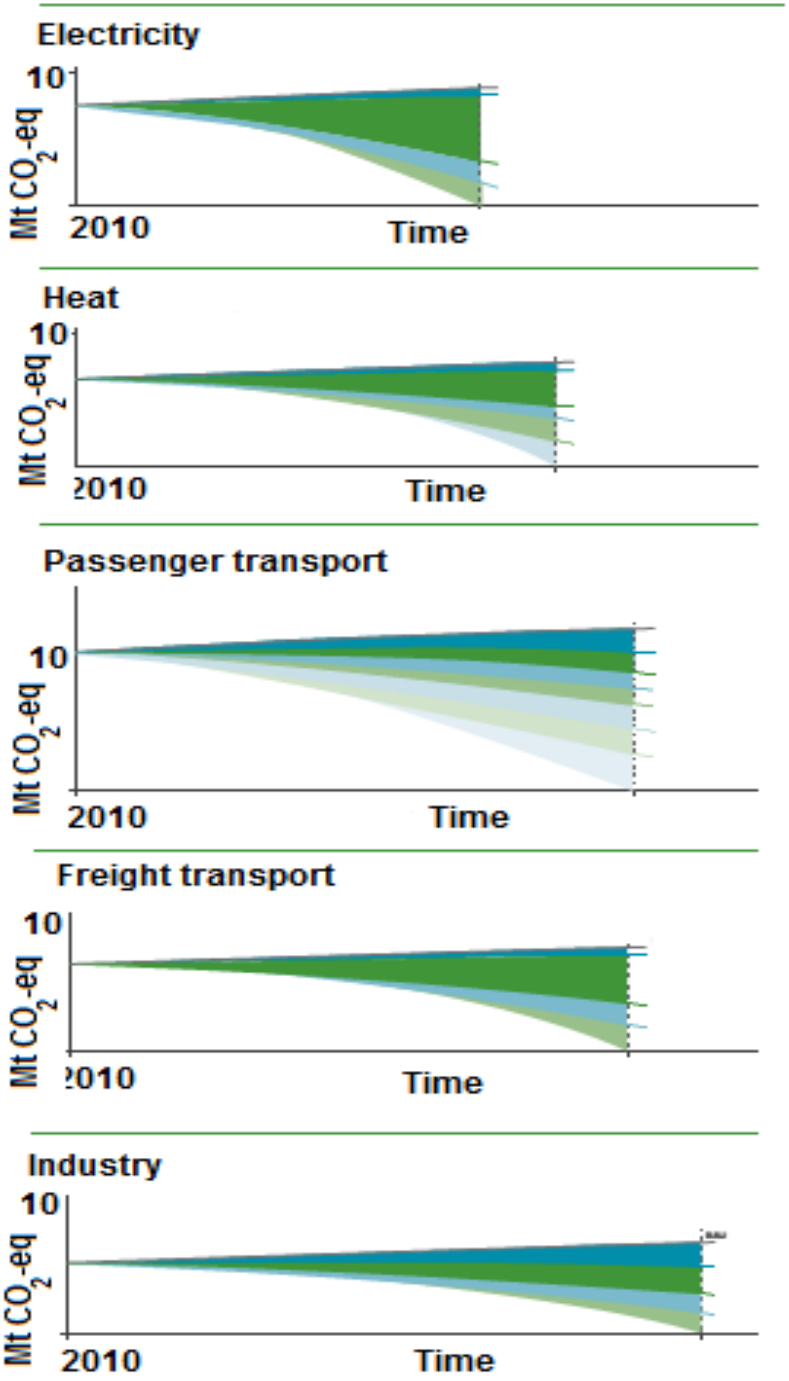
Transport example:






Electricity
10
Mt CO_2-eq
2010
Time
Heat
10
Mt CO_2-eq
2010
Time
Passenger transport
10
Mt CO_2-eq
2010
Time
Freight transport
10
Mt CO_2-eq
2010
Time
Industry
10
Mt CO_2-eq
2010
Time
Commercial buildings
10
Mt CO_2-eq
2010
Time
Residential buildings
10
Mt CO_2-eq
2010
Time
Agriculture
40
Mt CO_2-eq
2010
Time

Trends in the wind industry

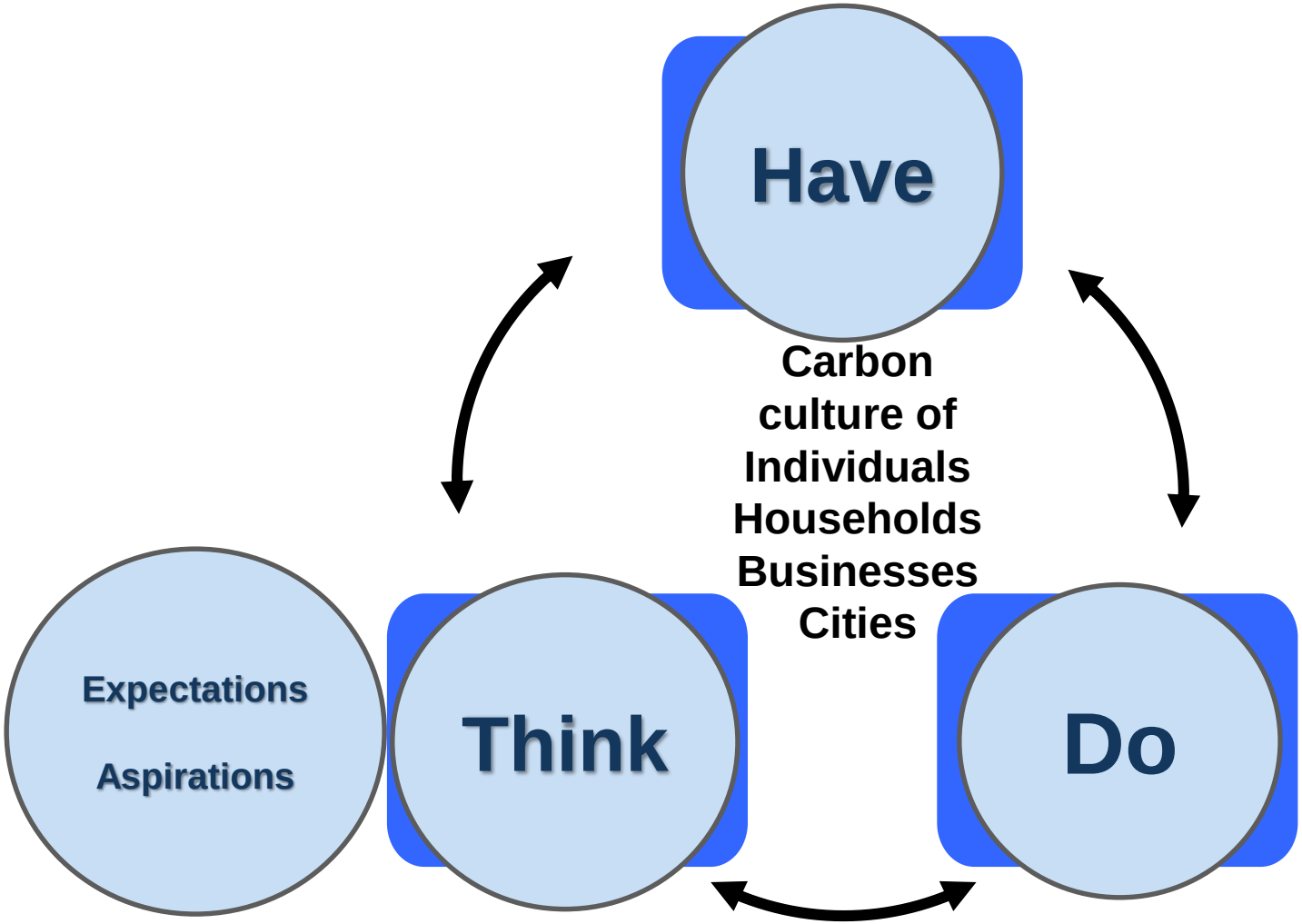
- Globally wind capacity increased 54 GW in 2016 to reach 487 GW total. Growth in China slowed but 29 countries now exceed 1 GW.
- Average turbine size ordered in EU was 7.7 MW and average LCOE was USD 70/MWh.
- Several turbine manufacturers moved to wind/solar PV hybrids and also wind/PV/diesel.
- Wind turbine prices fell significantly over this period due to scale, standardisation, etc.
- Wind generation in NZ rose 9.3 % between 2007 and 2011 and 5.0% between 2011 and 2015.
- So have Government policies and targets had any effect on this growth?

National Policy Statement on Renewable Electricity 2011

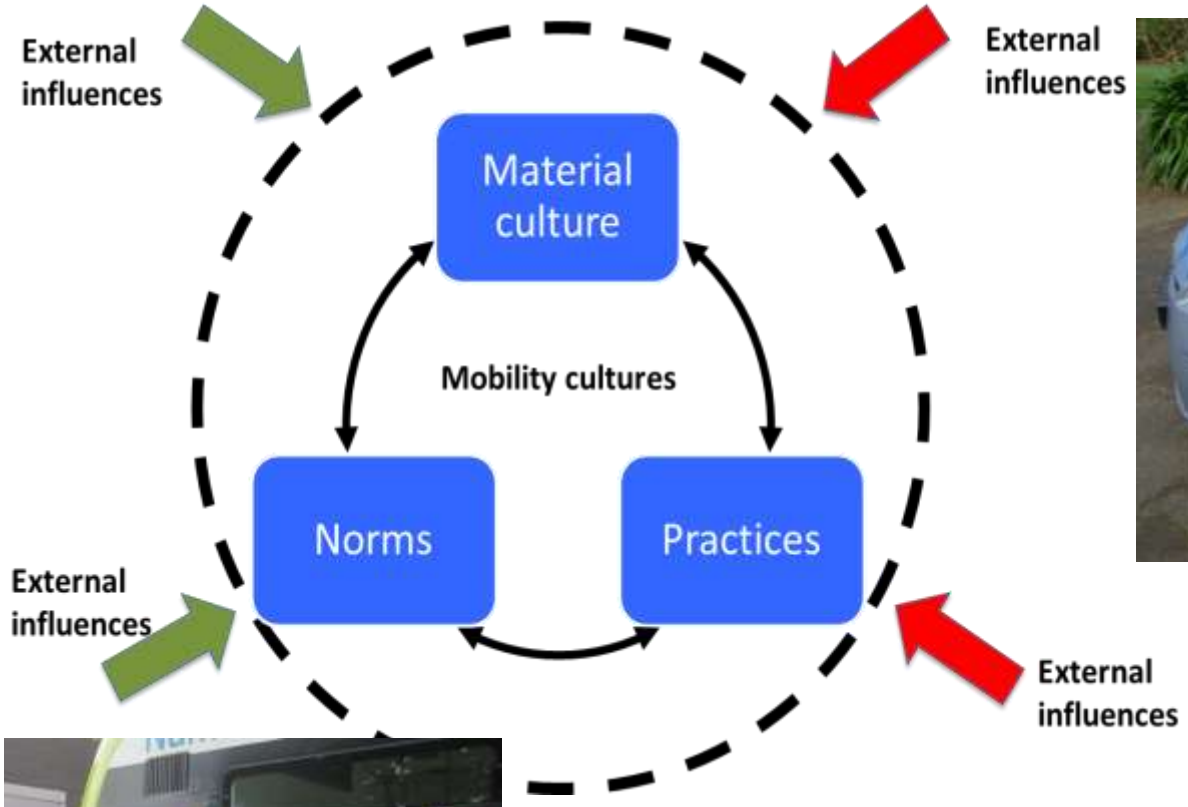
- Aims were to: increase shares of renewables in order to reduce GHG emissions;
- create consistency by local councils in the way applications to construct renewable electricity plants are treated; and
- to give more weight in the planning process to the environmental benefits of renewable generation.
- MfE and MBIE 2017 evaluation: “So far, it has not resulted in nationally consistent approaches to the drafting of regional and district plans”.
- “Nor has it had any significant impact on the time and costs associated with obtaining resource consents for renewable generation plants”.

“Carbon culture”

Dr Janet Stephenson, Otago University

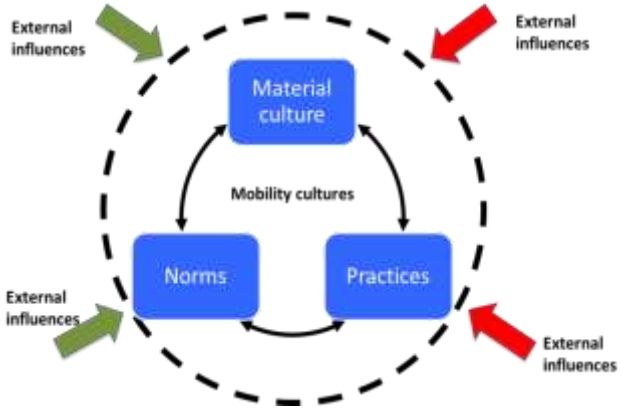


External influences that drive change



1. New technologies, smart systems…

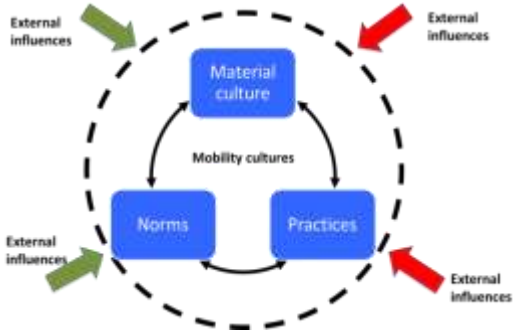
2. New business models…



enterprise CarShare

Cité lib
l'autopartage pour tous

3. New infrastructure, urban form



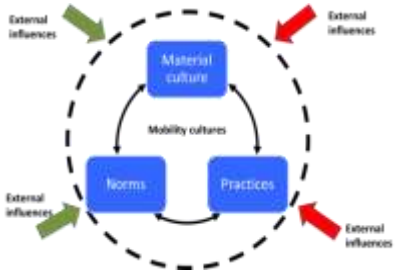
The Infill Design Toolkit:
Medium-Density Residential Development

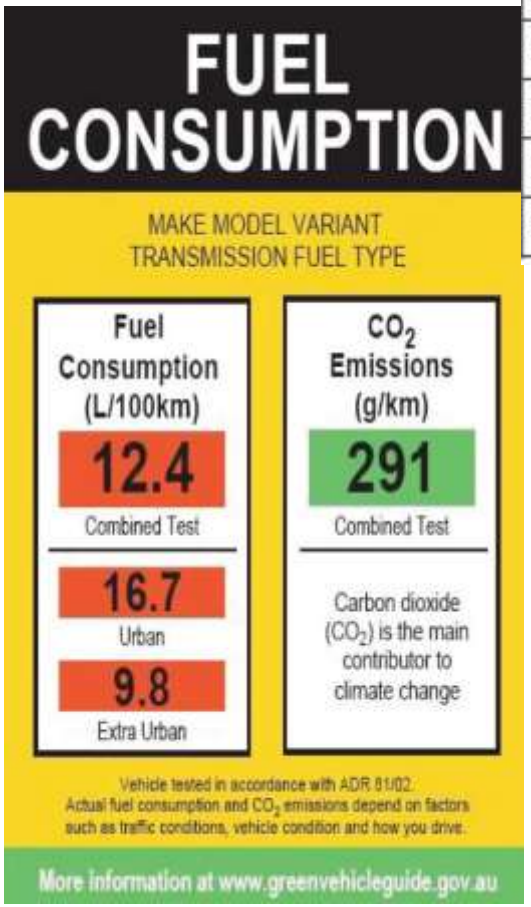
A Guide to Integrating Infill Development into Portland's Neighborhoods

December 2008

PLANNING

4. Changes in policies and regulations…



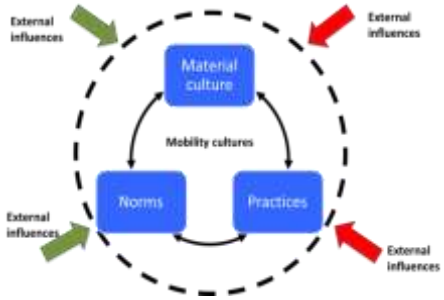


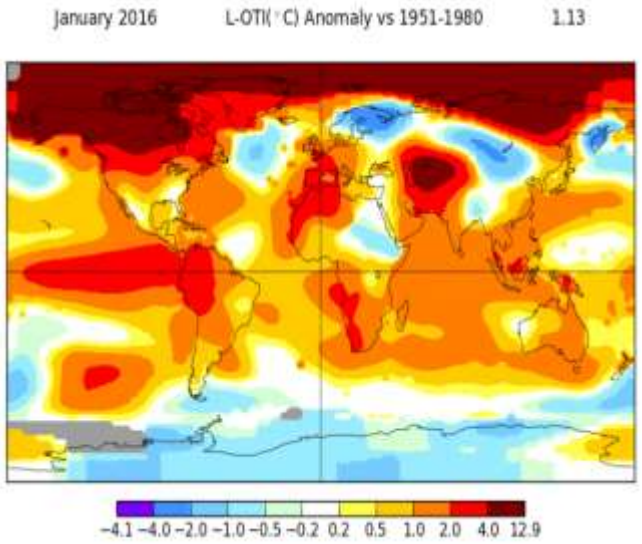
Feebate scheme

Emission rate of CO_2/km	Amount of the penalty in 2012
Between 141 and 150 grams of CO_2/km	€ 200
Between 151 and 155 grams of CO_2/km	€ 500
Between 156 and 180 grams of CO_2 /km	€ 750
Between 181 and 190 grams of CO_2/km	€ 1,300
Between 191 and 230 grams of CO_2/km	€ 2,300
Beyond 230 grams of CO_2/km	€ 3,600

London congestion charge

5. Changing social norms…

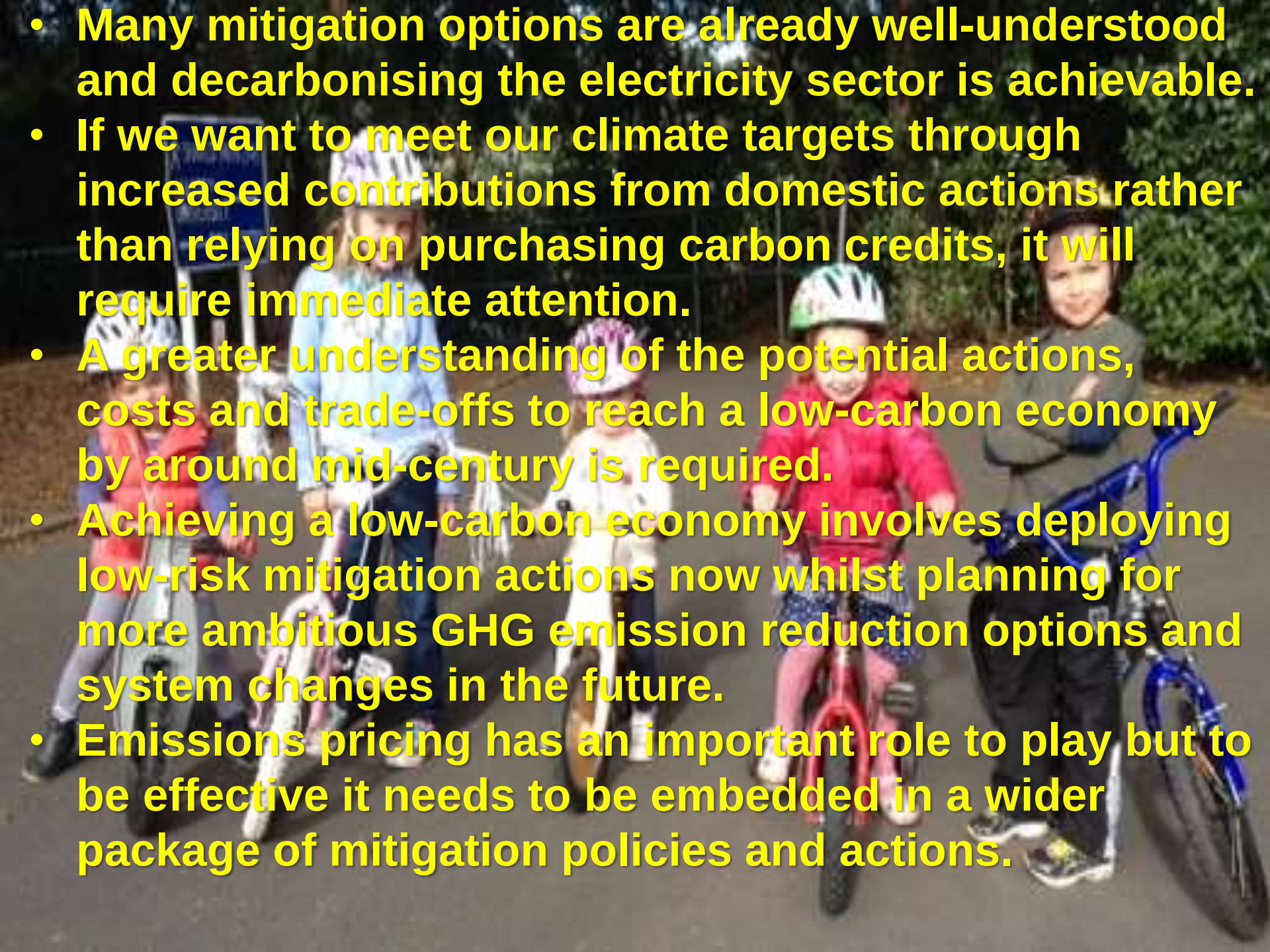




Electric vehicles will increase electricity demand

All New Zealanders will need to:

- understand the risks and uncertainties of climate change and the need to both mitigate, adapt and become more resilient;
- accept that we need to change the way we have acted in the past as a materially focused and wasteful society;
- realise that trade-offs will need to be made - such as accepting the need for a more flexible grid and back-up gas as the share of variable generation grows; and
- become personally involved in making the necessary transition to a low-carbon economy.



- Many mitigation options are already well-understood and decarbonising the electricity sector is achievable.
- If we want to meet our climate targets through increased contributions from domestic actions rather than relying on purchasing carbon credits, it will require immediate attention.
- A greater understanding of the potential actions, costs and trade-offs to reach a low-carbon economy by around mid-century is required.
- Achieving a low-carbon economy involves deploying low-risk mitigation actions now whilst planning for more ambitious GHG emission reduction options and system changes in the future.
- Emissions pricing has an important role to play but to be effective it needs to be embedded in a wider package of mitigation policies and actions.

Final Thought from the Paris Agreement

"This Covenant must amount to more than promises. It must find expression in actions we take today on behalf of this, and all future generations."

UN Secretary General, Ban-Ki Moon