

What is the effect?

March 2008
www.nzinstitute.org

WHAT DOES CLIMATE CHANGE MEAN FOR AVIATION?

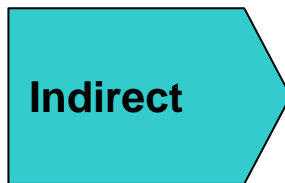
Effects



Patterns of rainfall and temperature altered



Resource constraints require relocation of economic activities



Consumers prefer products with lower carbon footprint



Governments impose restrictions and/or costs based on greenhouse gas emissions

THE IPCC REPORT REVEALS SCIENTIFIC CONSENSUS OF FURTHER CHANGE

Phenomenon and direction of trend	Likelihood of future trends based on projections for 21 st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	Virtually certain
Warmer and more frequent hot days and nights over most land areas	Virtually certain
Warm spells / heat waves. Frequency increases over most land areas	Very likely
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	Very likely
Area affected by droughts increases	Likely
Intense tropical cyclone activity increases	Likely
Increased incidence of extreme high sea level (excludes tsunamis) ⁹	Likely

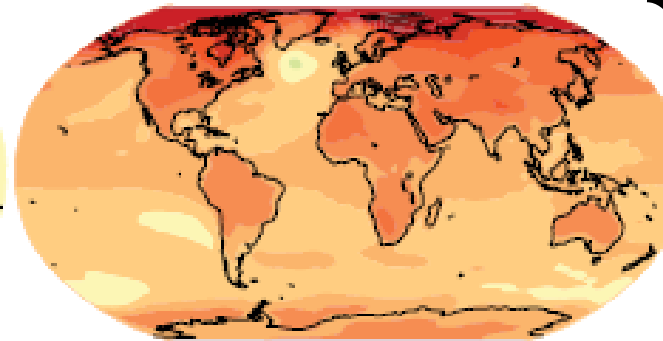
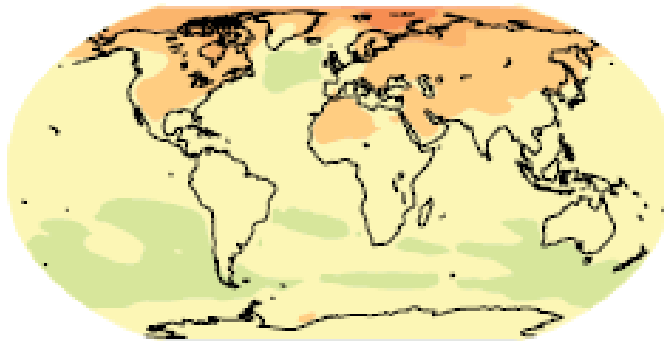
SUBSTANTIAL REGIONAL VARIATION IN TEMPERATURE INCREASES

Scenario: In our lifetime (2020-9)

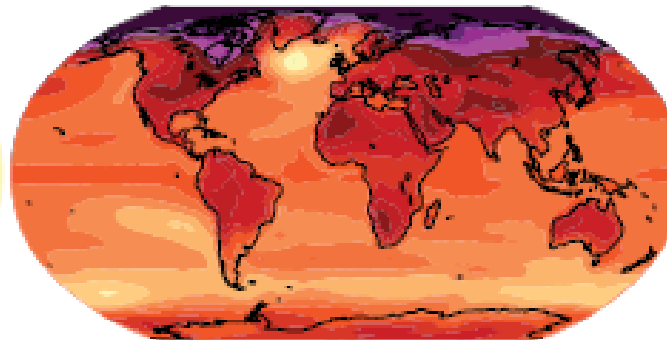
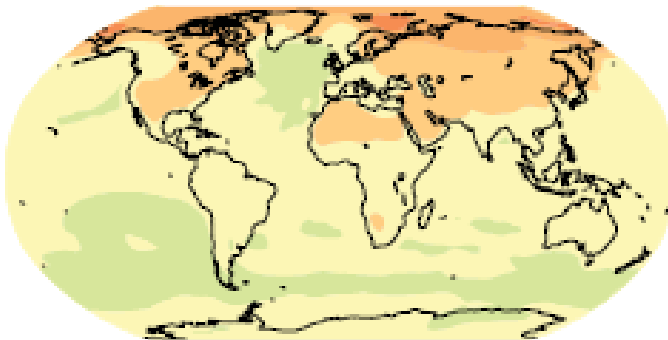
For our grandchildren (2090-9)

Outcomes:

B1



A2



Regional variation of up to 6 degrees

Temperature rises greatest at the poles

Northern Hemisphere effects appear greater than in the Southern Hemisphere

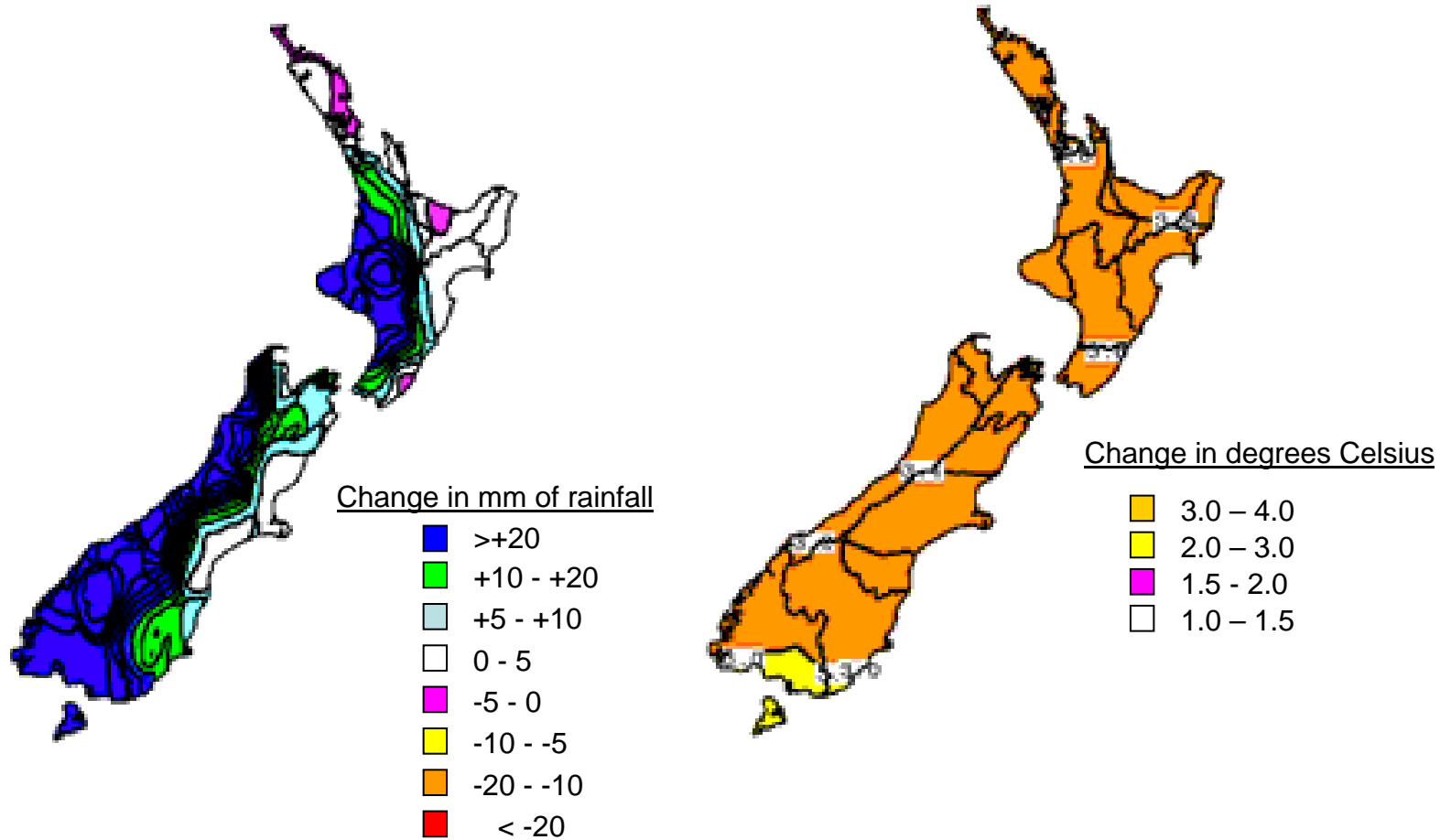
Projected surface

temperature change (C)



EXPECTED RAINFALL AND TEMPERATURE CHANGE BY THE END OF THE CENTURY

Rainfall and temperature variation, highest modeled in 2001 for the end of the 21st century



THE RESULTING CHANGES ARE NOT DISTRIBUTED EVENLY ACROSS THE WORLD

Relative vulnerability to climate change:

Least vulnerable countries:

1. Norway
2. Finland
3. Sweden
4. Switzerland
5. Canada
6. Japan
7. Austria
8. France
9. USA
10. Denmark
16. New Zealand

Most vulnerable countries:

90. Senegal
91. Kenya
92. Angola
93. Yemen
94. Benin
95. Rwanda
96. Ethiopia
97. Mozambique
98. Somalia
99. Bangladesh
100. Sierra Leone

NEW ZEALAND CAN EXPECT CHANGES IN ITS CLIMATE, BUT LESS THAN IN OTHER COUNTRIES

New Zealand will experience some change

New Zealand will be warmer, with more rain in the west and less in the east. This is not expected to have a major negative impact on the primary sector, although effects will vary by region and adaptation will be required.

This change will occur on a variety of fronts

New Zealand may also experience increased risk of invasion by pests, threatening agricultural industries, as well as coastal erosion due to sea level increases.

New Zealand is relatively well off

New Zealand appears to be better off than many other countries, such as Australia who may experience severe drought in many agricultural regions.

Overall, significant costs are not expected

Overall, it does not seem likely that the projected rainfall and temperature variation will impose a significant cost on the New Zealand economy over the next few decades (at least based on the current scientific projections).

CONSUMERS - POTENTIAL FOR IMMEDIATE EFFECT?

Surveys consistently indicate consumers care

- Awareness increasing in all countries

But action is not yet evident

- In part because they lack tools to act (metrics not established)
- In part because they feel their action alone will do little

And premiums are not likely

- Small (but growing) segments of concerned consumers (organic)
- More likely that green credentials provide volume

Surveys indicate majority of consumers expect government intervention to provide change

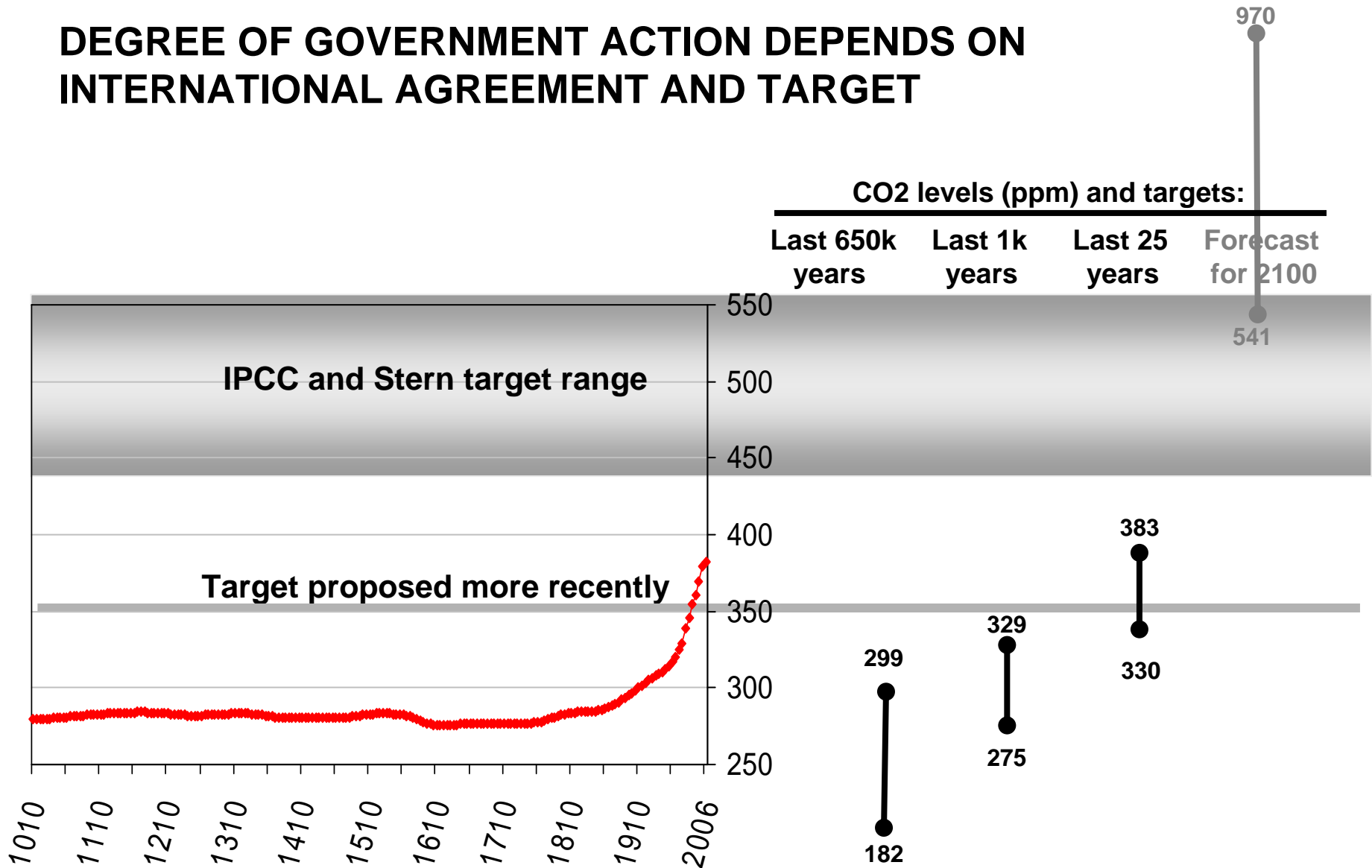
RETAILER RESPONSE MAY DRIVE CONSUMER RESPONSE

Company	Intentions	Actions
Tesco	Reduce the carbon footprint of existing facilities around the world by 50% per cent by 2020 restrict air transport to less than 1 per cent of products	Halved 2000 carbon footprint by 2008, ahead of 2010 target
Marks & Spencer	Will “change beyond recognition” the way it operates <ul style="list-style-type: none"> • Become carbon neutral, • Only using offsetting as a last resort; Intend to mobilise suppliers to reduce their carbon footprint as well	Has given several New Zealand suppliers 24 months to demonstrate carbon neutrality
Sainsbury	More local sourcing, more seasonal foods and improved energy efficiency Enable customers to make more informed choices	Cancelled order with New Zealand supplier due to air freight
Wal-mart	Declared intentions of 100% renewable energy, zero waste, and sustainable products, with same decade commitments for more than 30% of volume, business, or facilities	Metrics available on website

A RANGE OF EMISSIONS REDUCTION TARGETS UNDER DISCUSSION FOR POST-2012

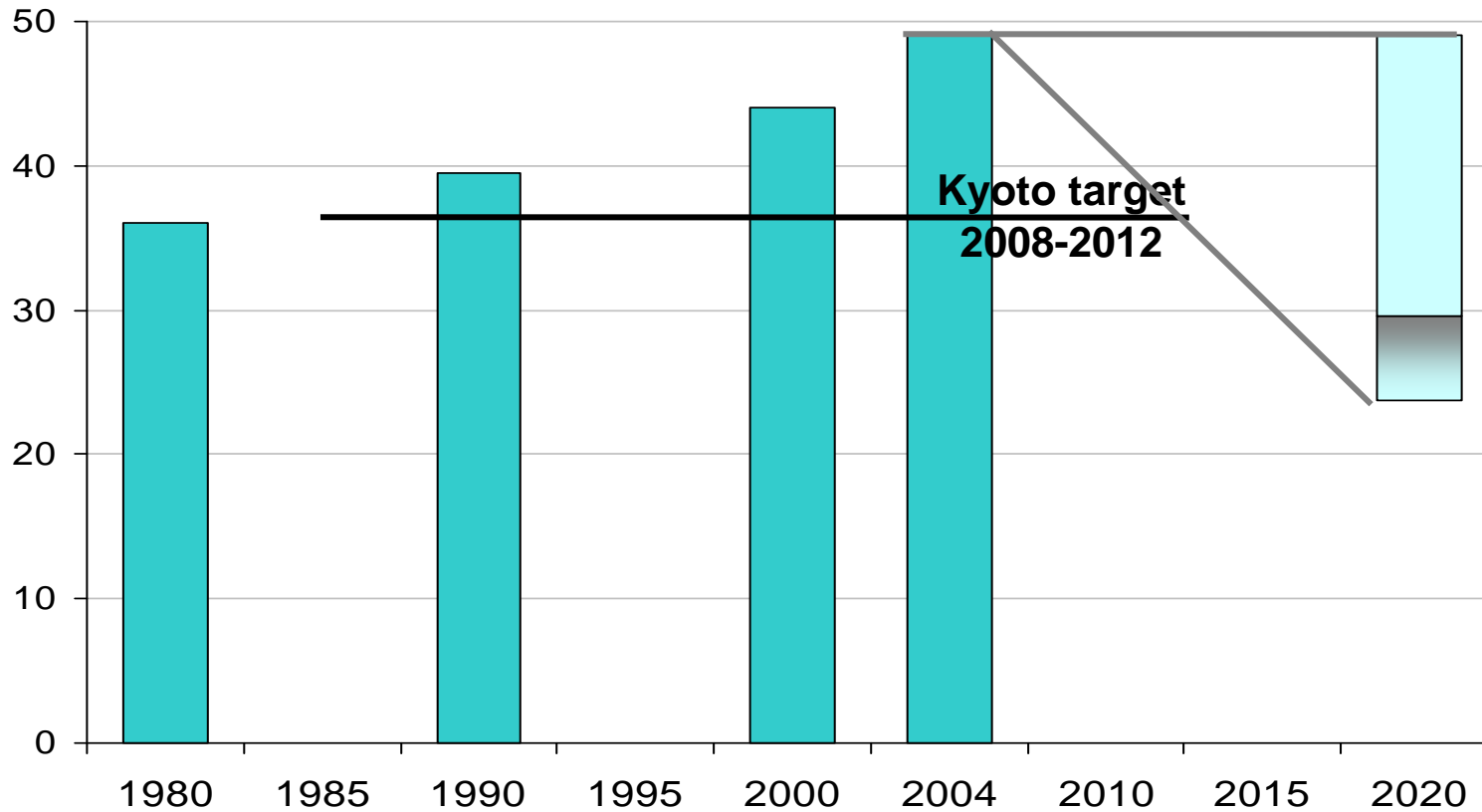
Source	Proposed target
Bali discussions	20-45% below 1990 levels by 2020
IPCC	60-85% below 1990 levels by 2050
Australia	60% below 2000 levels by 2050
Norway	Carbon neutral through offset purchases by 2050
California	80% below 1990 levels by 2050
USA	Leading legislation proposes 70% below 1990 by 2050
Germany	40% below 1990 levels by 2020
EU	20% below 1990 levels by 2020 or 30% reduction depending on action by other countries
Sweden	25% below 1990 levels by 2020

DEGREE OF GOVERNMENT ACTION DEPENDS ON INTERNATIONAL AGREEMENT AND TARGET

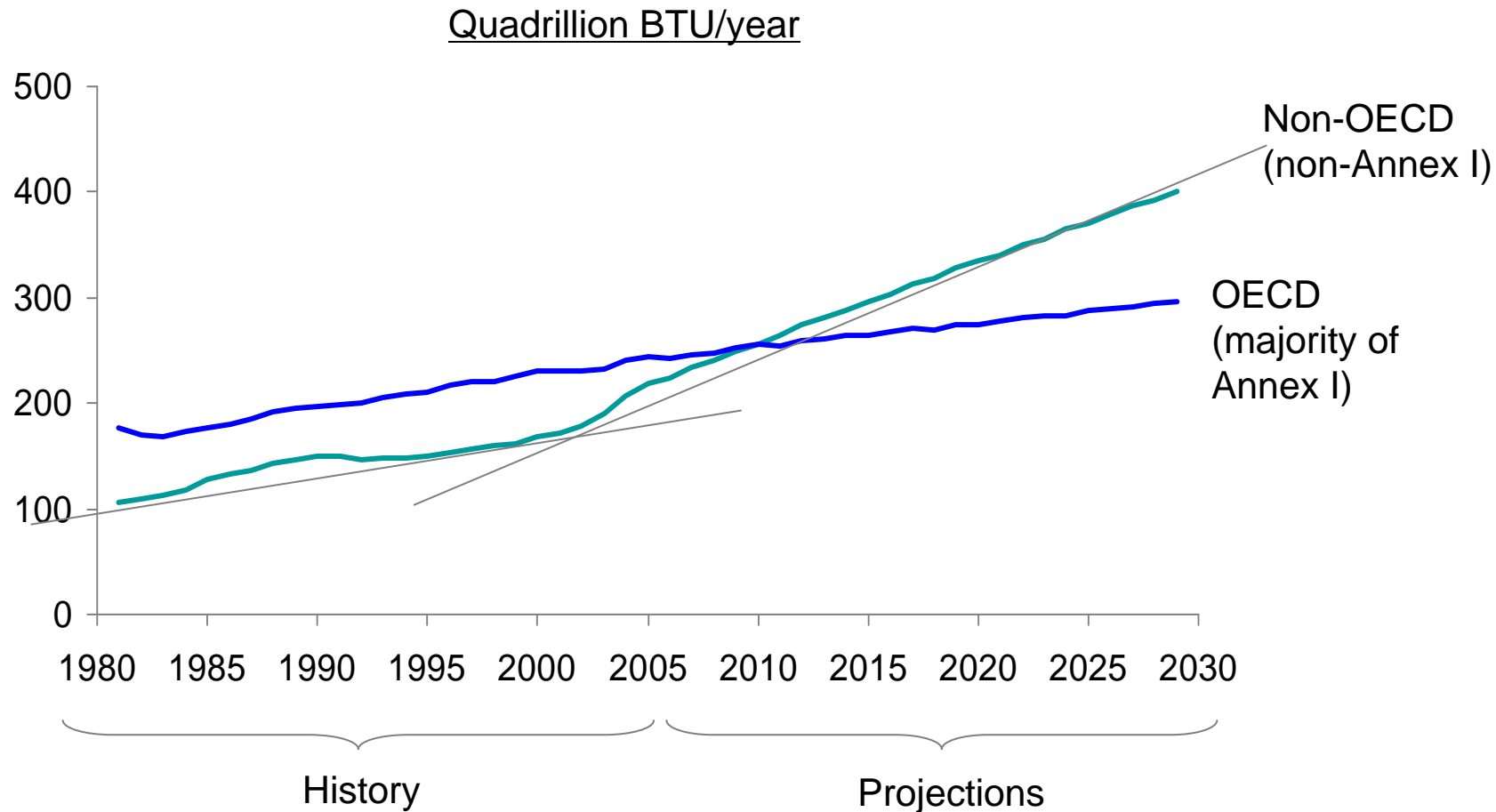


TARGETS ARE NOT ALWAYS MET, HOWEVER

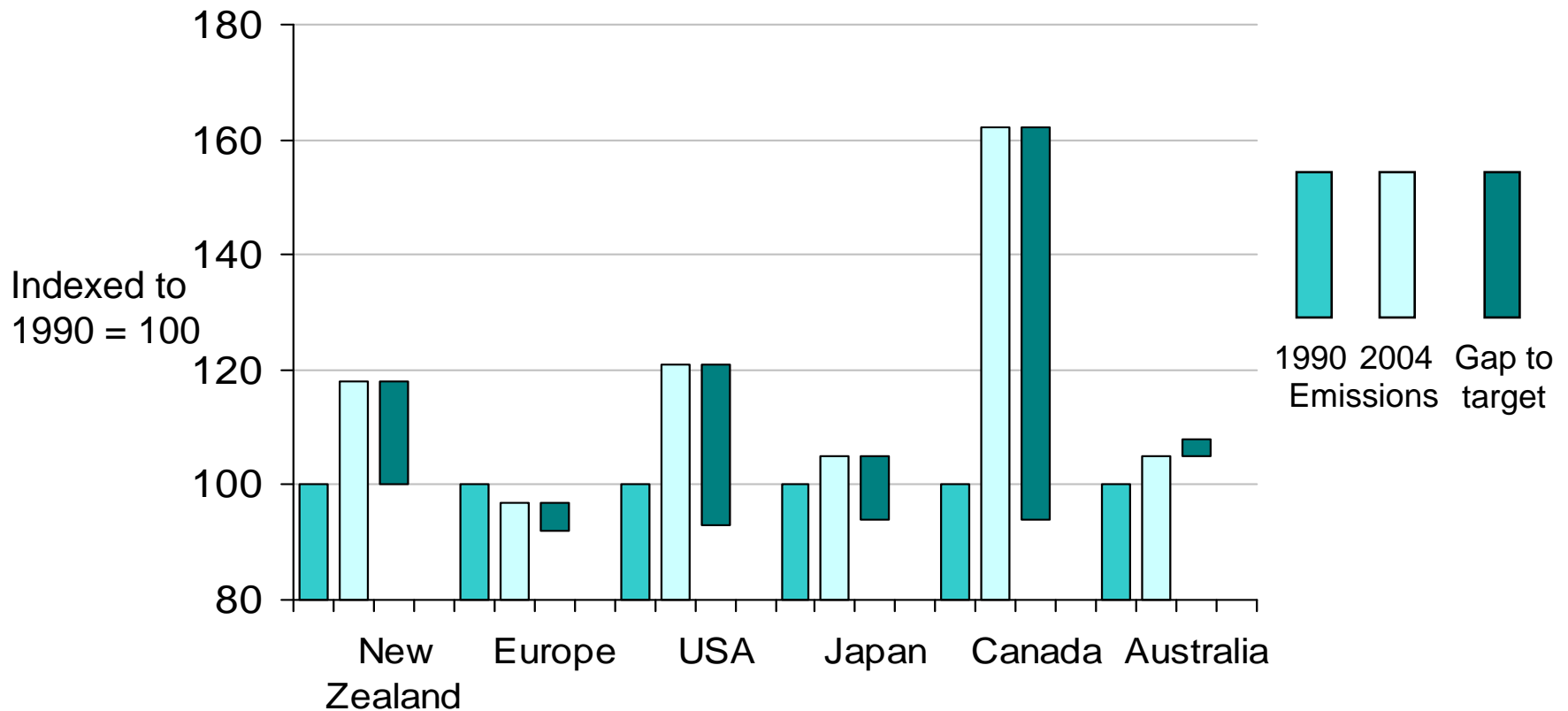
Global greenhouse gas emissions CO₂e gigatonnes



KYOTO TARGET COMPROMISED BY UNEXPECTED CHANGE FROM NON-ANNEX I COUNTRIES

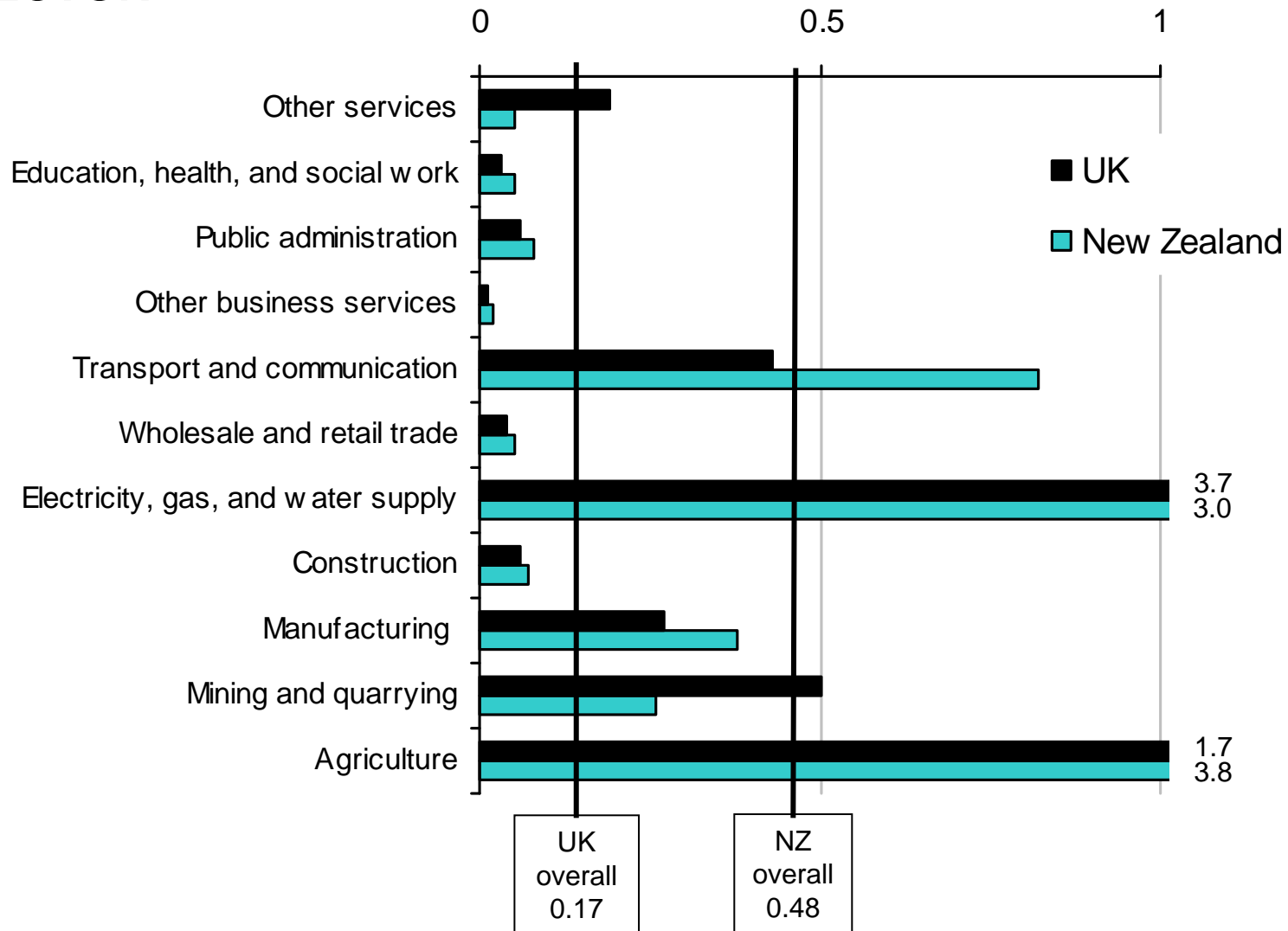


TO DATE, A FAILURE TO DELIVER FROM ANNEX I COUNTRIES AS WELL



Note: GHG = Greenhouse gas. Emissions reported including LULUCF. USA and Australia targets proposed but not ratified.
 Source: United Nations Framework Convention on Climate Change.

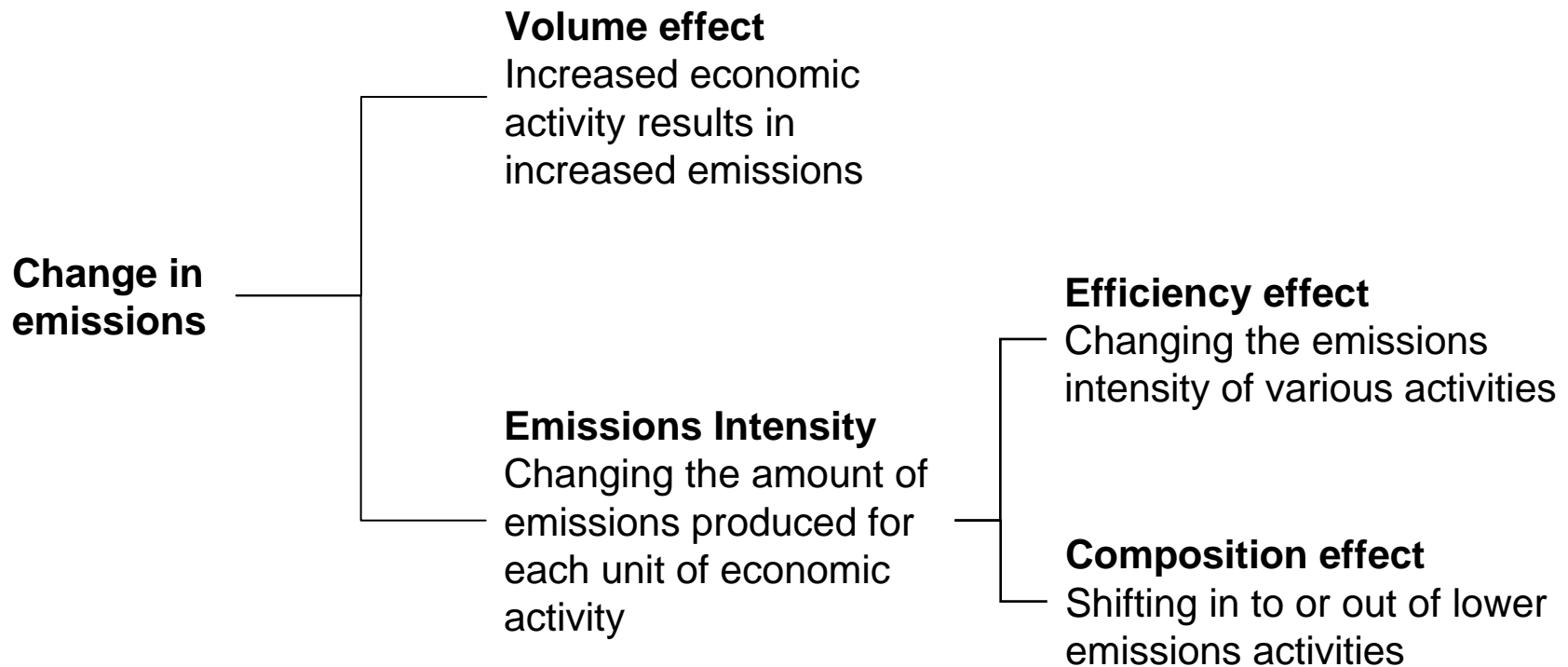
THERE IS SIGNIFICANT VARIATION IN EMISSIONS INTENSITY BY SECTOR



Note: Household emissions excluded. Values shown are emissions per unit of economic value in tonnes.

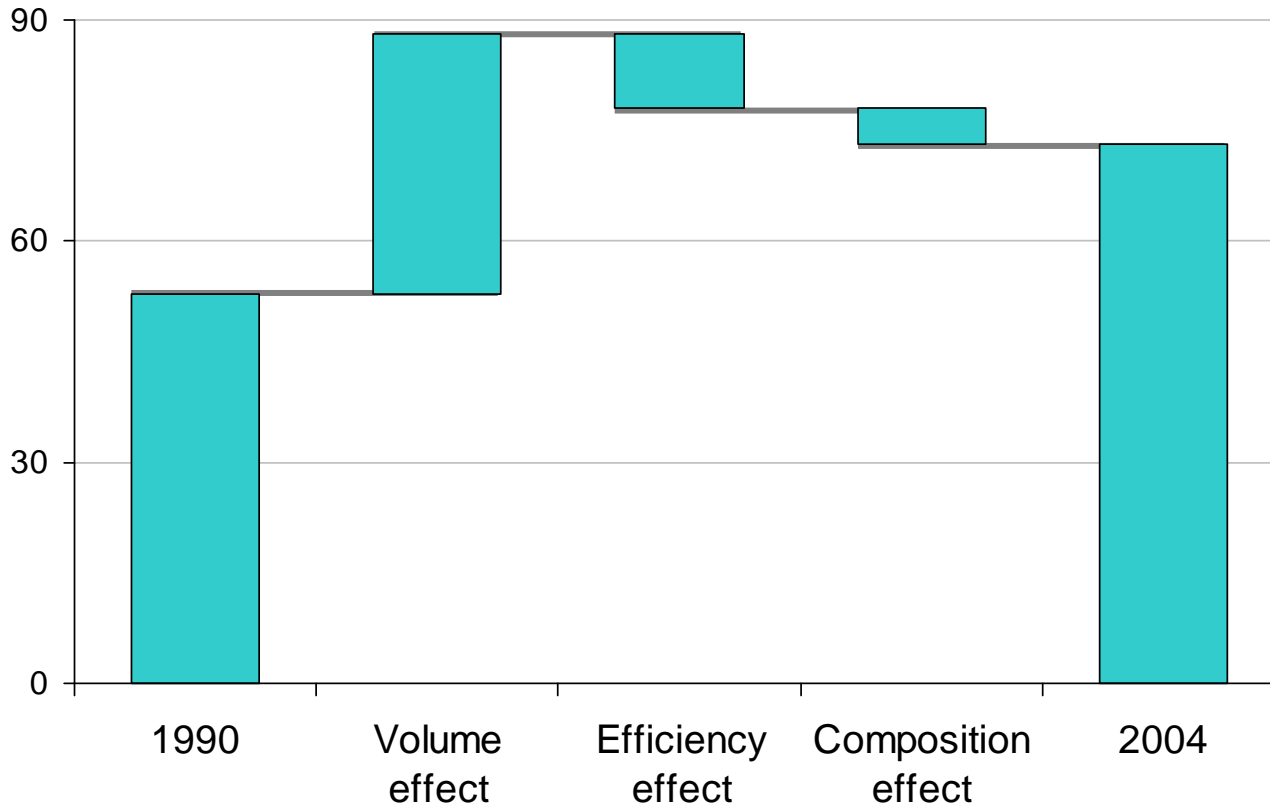
Source: Statistics New Zealand; Office of National Statistics, UK.

DRIVERS OF EMISSIONS CHANGES



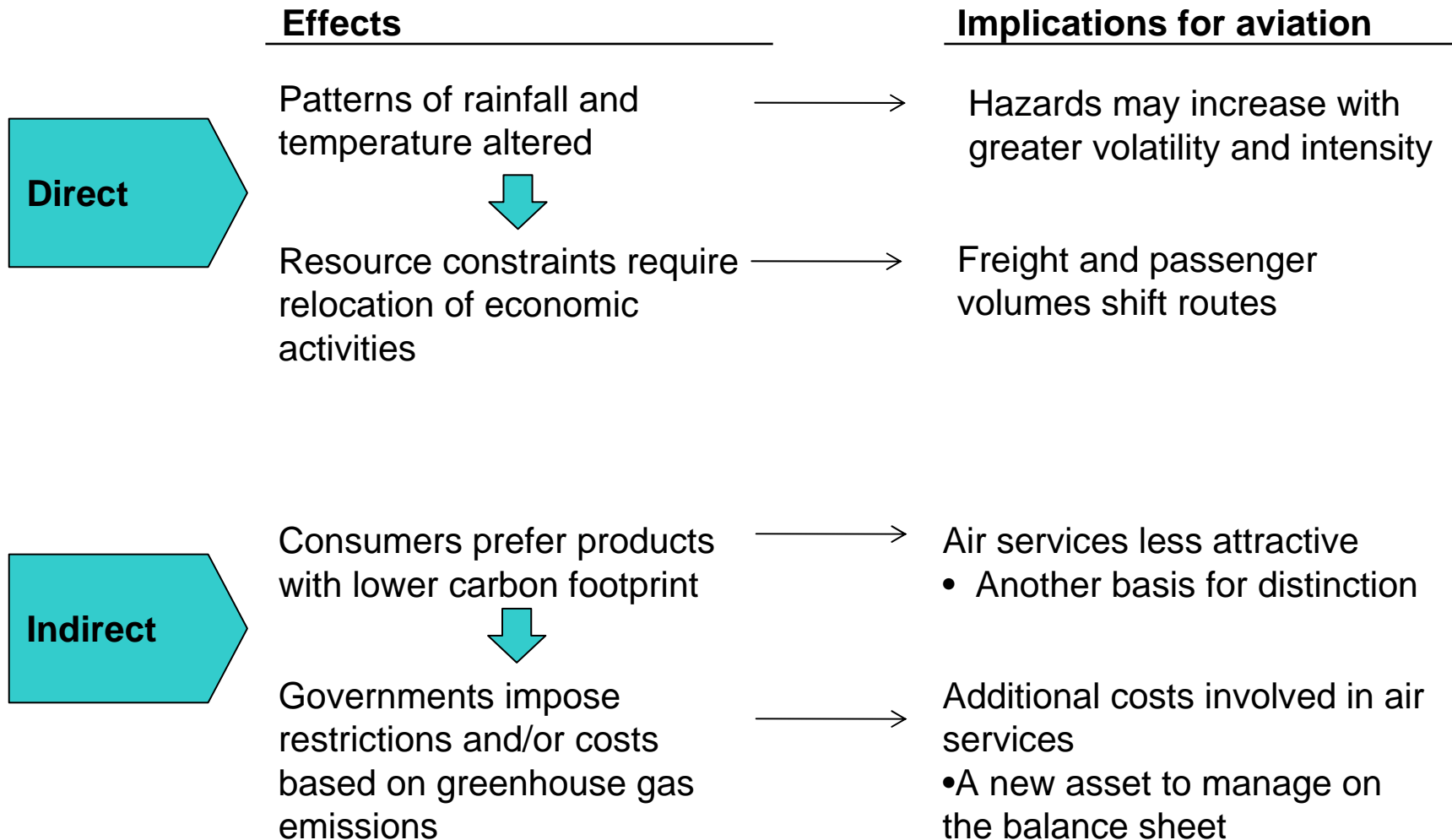
BOTH THE EFFICIENCY AND COMPOSITION EFFECTS HAVE MADE CONTRIBUTIONS TO NEW ZEALAND'S EMISSIONS GROWTH

Change in emissions CO₂e (m), 1990-2004



The composition effect has made a significant contribution in many countries, and is likely to be important for New Zealand given the limited abatement opportunities.

WHAT DOES CLIMATE CHANGE MEAN FOR AVIATION?



WHAT SORT OF TARGET SHOULD NEW ZEALAND PURSUE?

NATIONAL TARGET

Zero emissions

- Not really achievable

Low emissions

- Required if the world is going to stabilise at targets discussed

Net Zero emissions (see offsets)

- Generally understood by neutrality, pursued by a few countries

Climate neutral

- Below the absorptive capacity of the atmosphere
- Sneaky accounting – meeting international targets is climate neutral

Competitive

- “I will if you will”
- “After you”

OFFSETS

Avoid emissions that would have taken place elsewhere

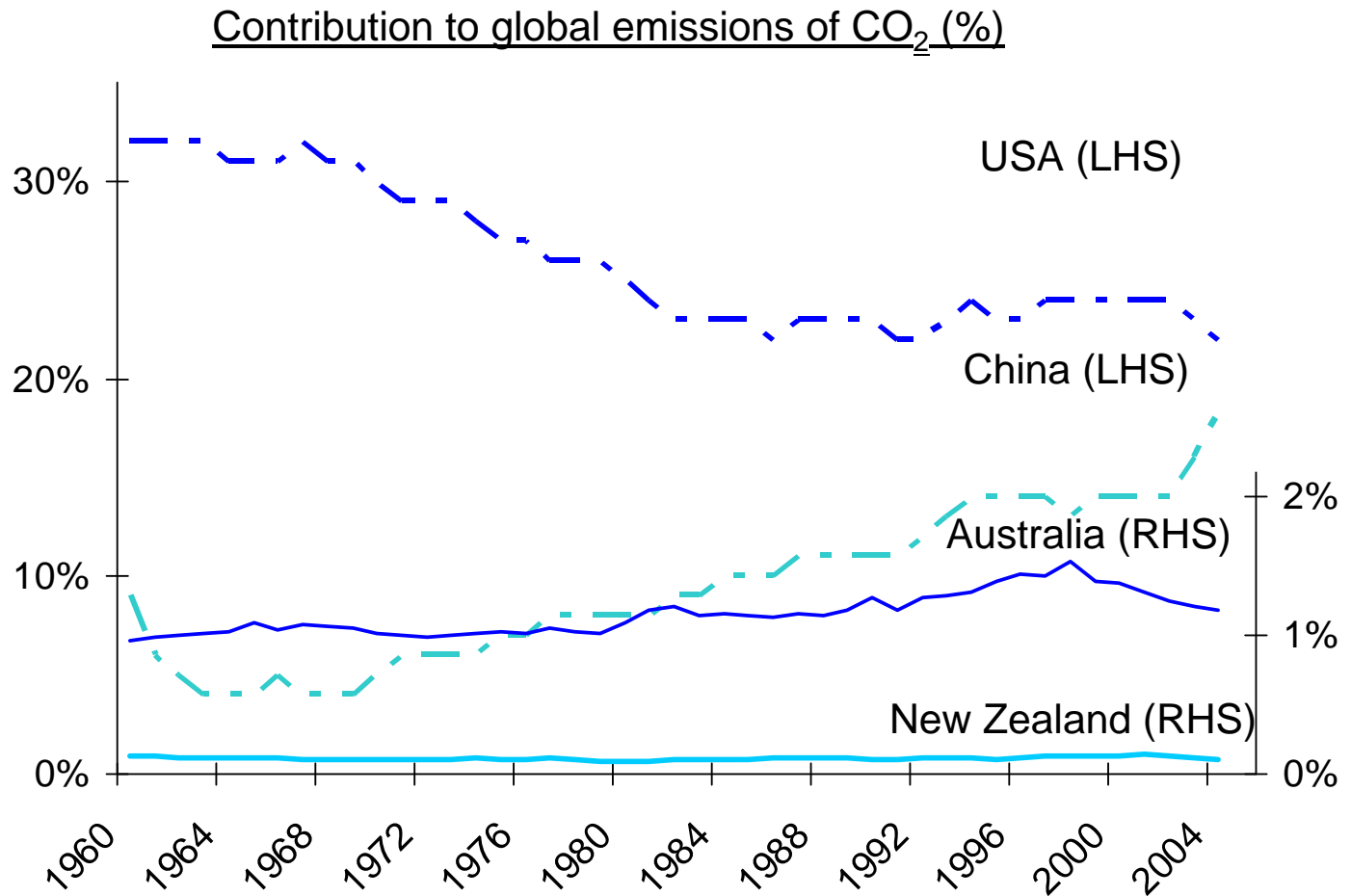
- Challenge in assessing emissions that would have occurred
- Extensive accounting and documentation process

There are other risks

- Finality of capture, risk of later release
- Timing of capture, when do you net out?
- Effectively training foreign competitors

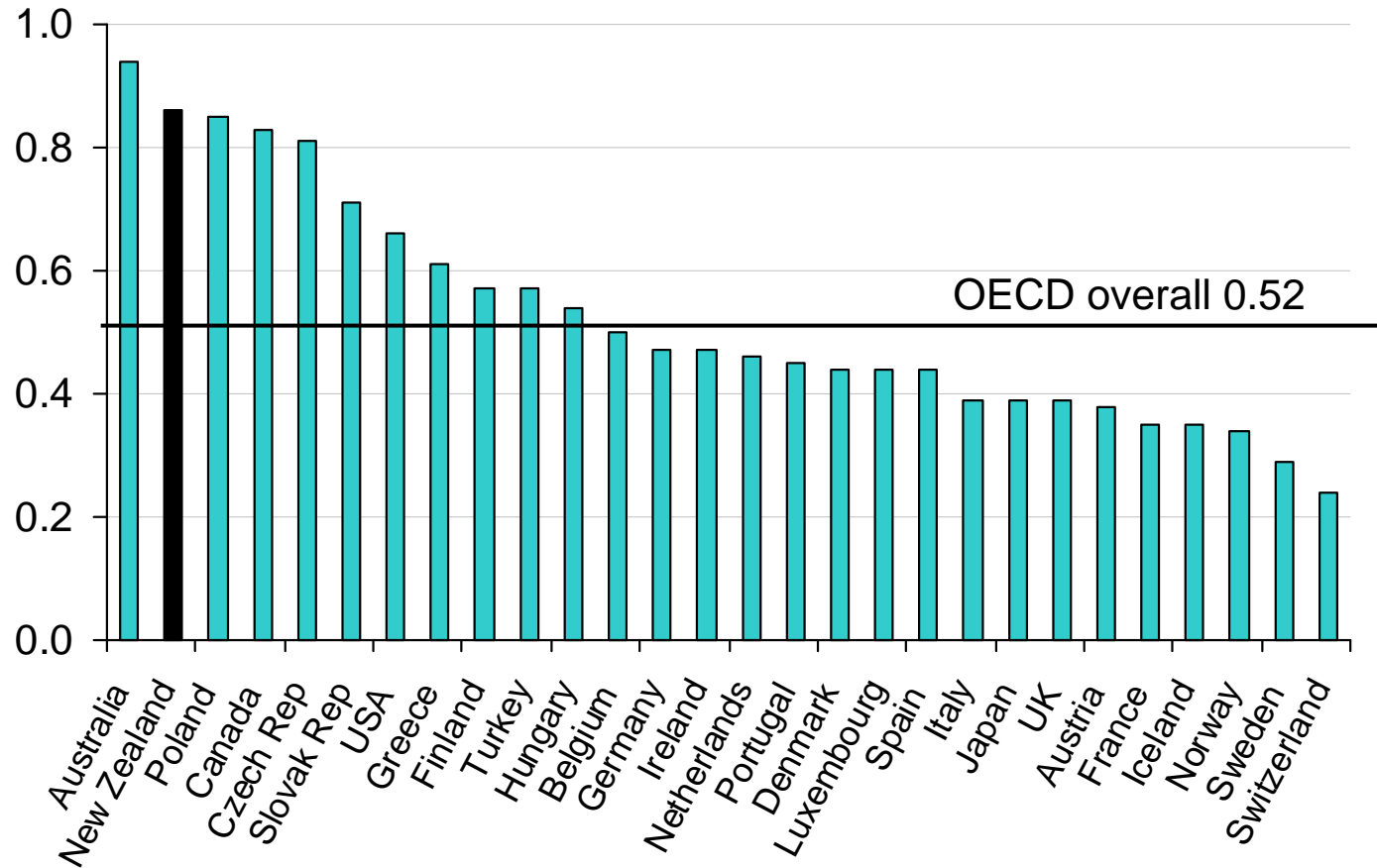
Greatest risk price and availability

NEW ZEALAND IS A MINOR CONTRIBUTOR TO GLOBAL EMISSIONS



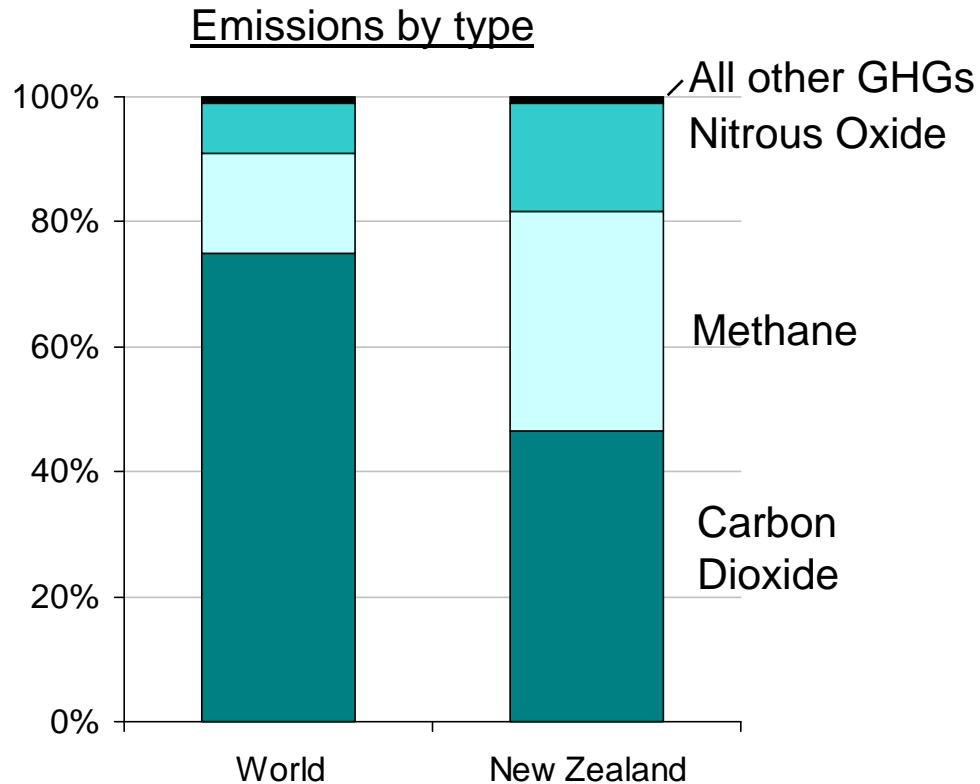
NEW ZEALAND IS THE SECOND MOST EMISSIONS INTENSIVE ECONOMY IN THE DEVELOPED WORLD

Total GHG emissions per unit of GDP, 2004



Note: Data not available for Korea or Mexico. GHG = greenhouse gas.
 Source: United Nations Framework Convention on Climate Change.

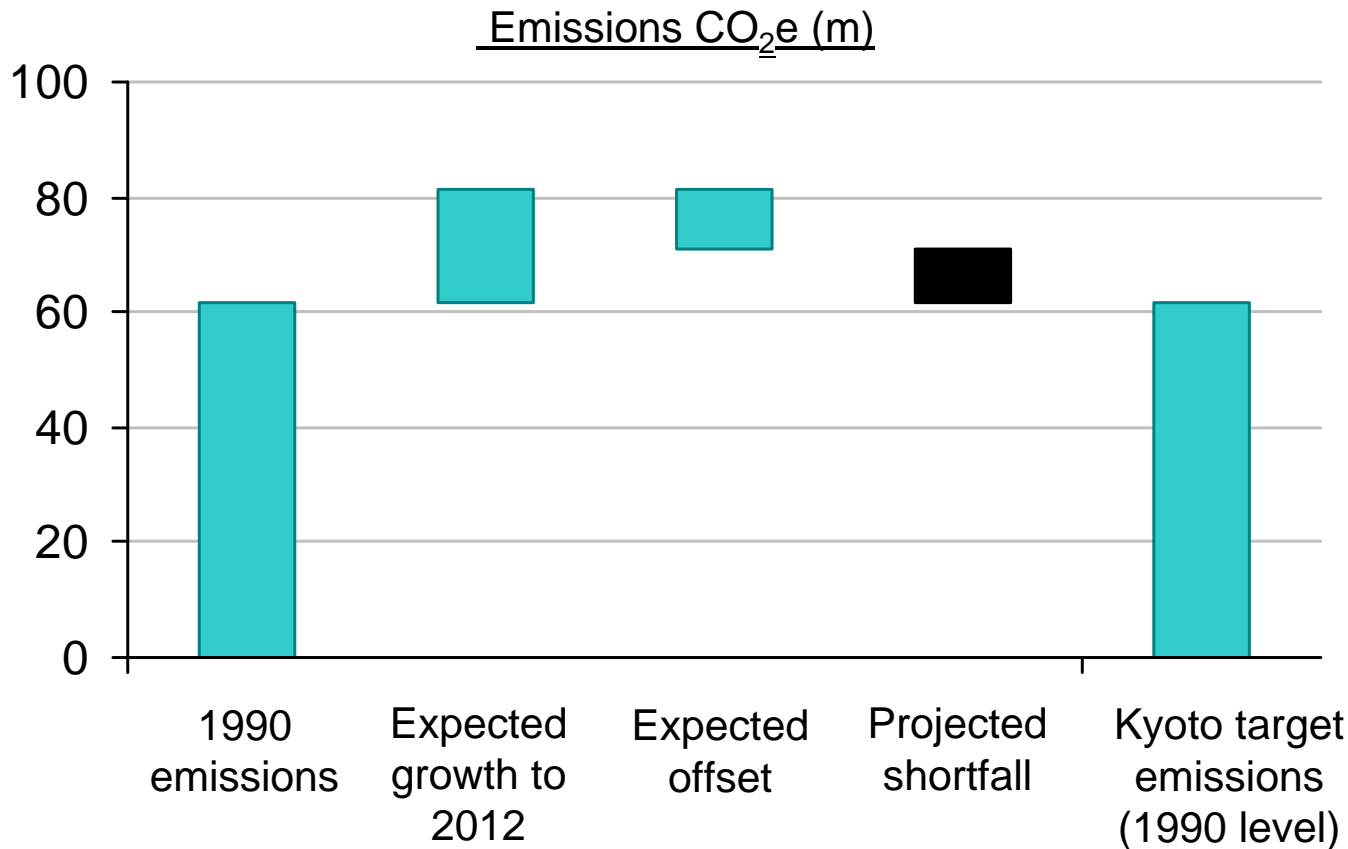
NEW ZEALAND'S EMISSIONS PROFILE IS UNUSUAL



Note: New Zealand data 2005; World data 2004.

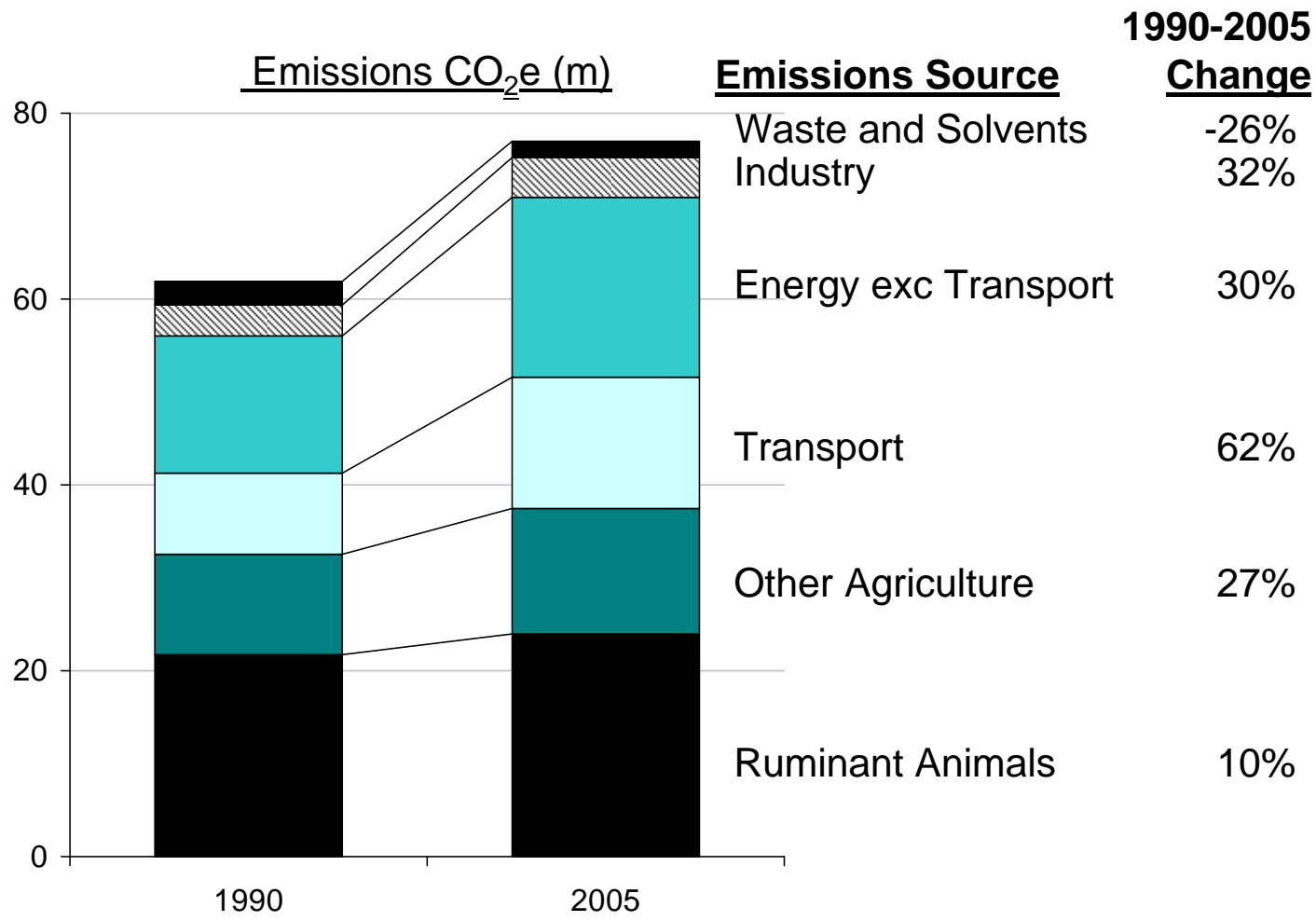
Source: Ministry for the Environment; Netherlands Environmental Assessment Agency.

NEW ZEALAND'S EMISSIONS HAVE BEEN GROWING STRONGLY, MAKING REDUCTION TARGETS MORE CHALLENGING



As of January 2008, NZ's Kyoto liability is estimated by Treasury to be \$963m based on an emissions price of NZ\$21 a tonne.

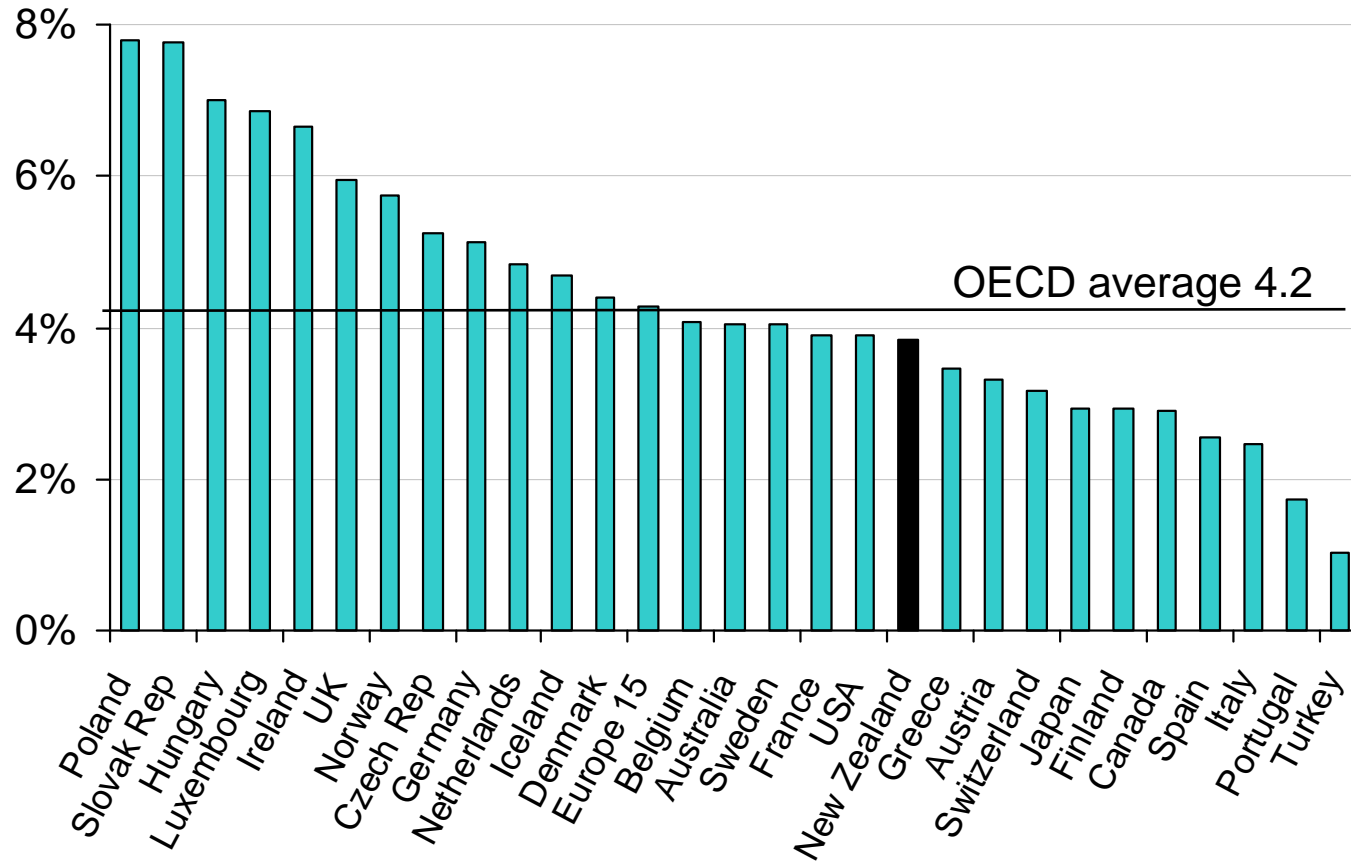
NEW ZEALAND'S GREENHOUSE GAS EMISSIONS HAVE GROWN STRONGLY ACROSS THE ECONOMY



Note: CO₂e = greenhouse gas emissions in equivalent tonnes of carbon dioxide.
 Source: Ministry for the Environment; United Nations Framework Convention on Climate Change.

NEW ZEALAND'S EMISSIONS INTENSITY IMPROVEMENT HAS BEEN BELOW AVERAGE

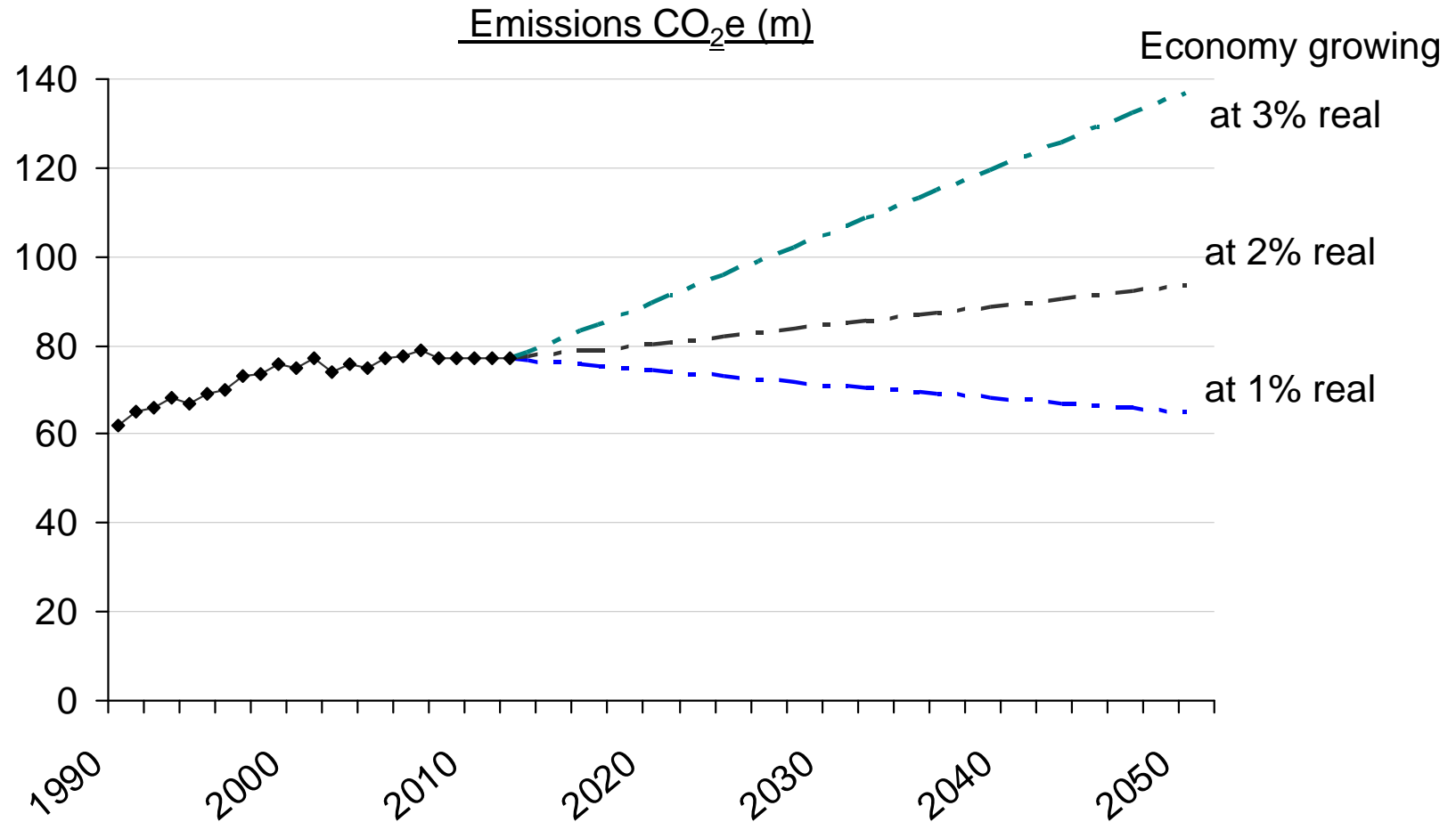
Annual improvement in emissions per unit of GDP, CAGR, 1990-2004



Note: CAGR is Compound Annual Growth Rate. Data not available for Korea or Mexico. Estimates made by OECD to achieve comparable timeframe for Slovak Rep and Poland. Dataset expressed in international dollars to enable cross country comparison, may differ from calculation in local currency due to exchange rate variation.

Source: United Nations Framework Convention on Climate Change; OECD.

ON CURRENT COURSE AND SPEED, NEW ZEALAND'S EMISSIONS WILL CONTINUE TO GROW STRONGLY OVER TIME



Note: Projection 2013 to 2050 includes emissions intensity improvement of 3.4%. September 2007 estimate for first Kyoto period reduced by Minister's expectation of additional 20m tonne emission reduction. CO₂e = greenhouse gas emissions in equivalent tonnes of carbon dioxide.
 Source: Statistics New Zealand; Ministry for the Environment.

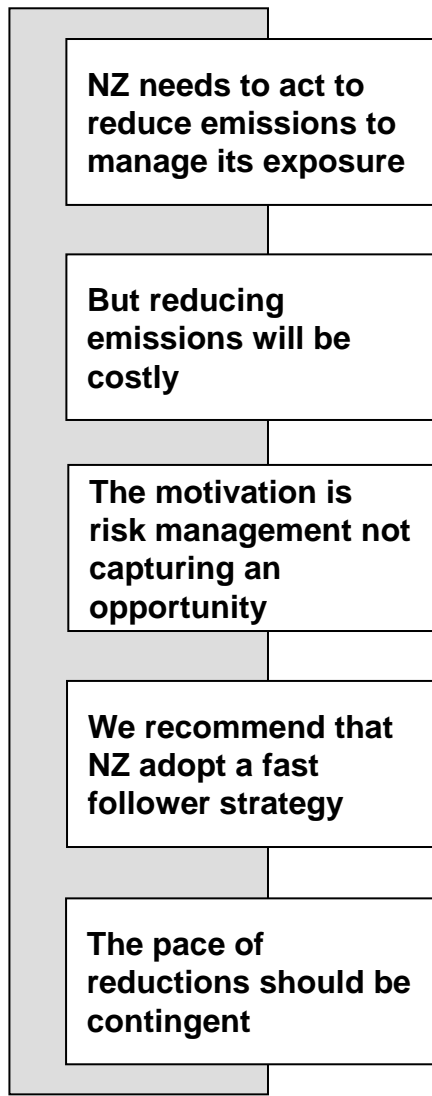
NEW ZEALAND'S RATE OF EMISSIONS INTENSITY IMPROVEMENT WILL NEED TO INCREASE SIGNIFICANTLY

Required emissions intensity improvements, 2012 - 2050

Real economic growth rate	2050 emissions target (below the 1990 level)		
	30%	50%	70%
1.0%	4.4%	5.2%	6.5%
1.5%	4.9%	5.7%	7.0%
2.0%	5.3%	6.1%	7.4%
2.5%	5.8%	6.6%	7.8%
3.0%	6.2%	7.0%	8.3%

New Zealand achieved emissions intensity improvements of 3.4% annually between 1990 and 2004.

WE PROPOSE THAT NEW ZEALAND BE A FAST FOLLOWER



NZ needs to act to reduce emissions to manage its exposure

New Zealand needs to move to a lower emissions mode of operating, as a way of managing New Zealand’s exposure to the risk that governments and consumers will require emissions reductions.

But reducing emissions will be costly

But reducing emissions will be costly given the available abatement opportunities. The aim should be to reduce emissions gradually over time rather than in a big bang way.

The motivation is risk management not capturing an opportunity

The motivation is to act to reduce emissions in order to manage a potentially significant economic exposure, rather than to capture any economic upside that may be generated.

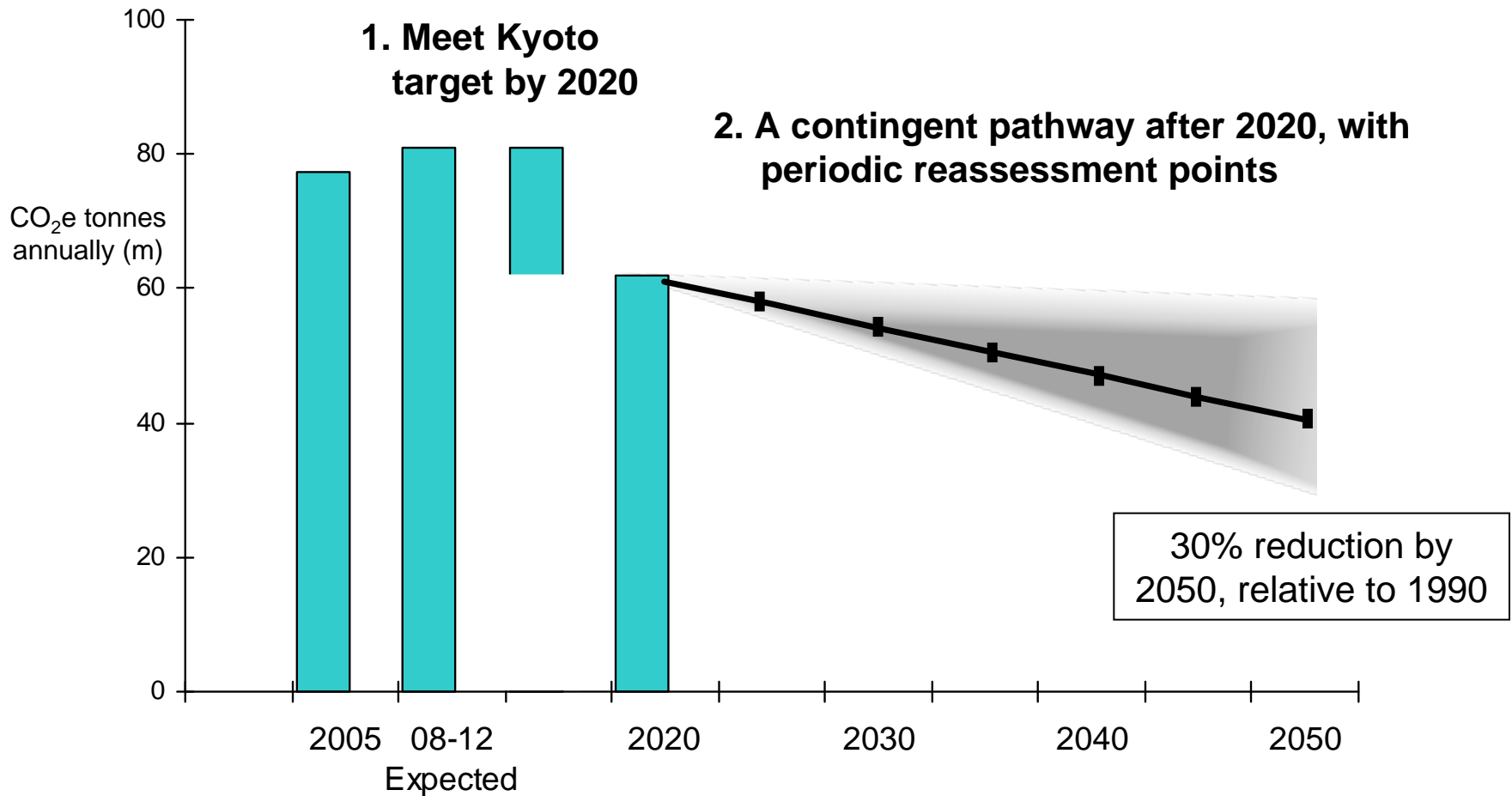
We recommend that NZ adopt a fast follower strategy

On this basis, we recommend that New Zealand adopt a fast follower strategy, aiming to reduce its emissions at a pace roughly in line with the actions of other countries.

The pace of reductions should be contingent

A fast follower strategy is inevitably contingent on the actions that are taken by other countries, as well as demonstrated changes in consumer behaviour and changes in abatement opportunities.

A FAST FOLLOWER STRATEGY TRANSLATES INTO A SPECIFIC INITIAL EMISSIONS REDUCTION PATH, WITH REVIEW



THE GOVERNMENT HAS NOMINATED A RANGE OF TARGETS, WHICH AMOUNT TO AN IMPLICIT 2050 TARGET OF A 40% REDUCTION

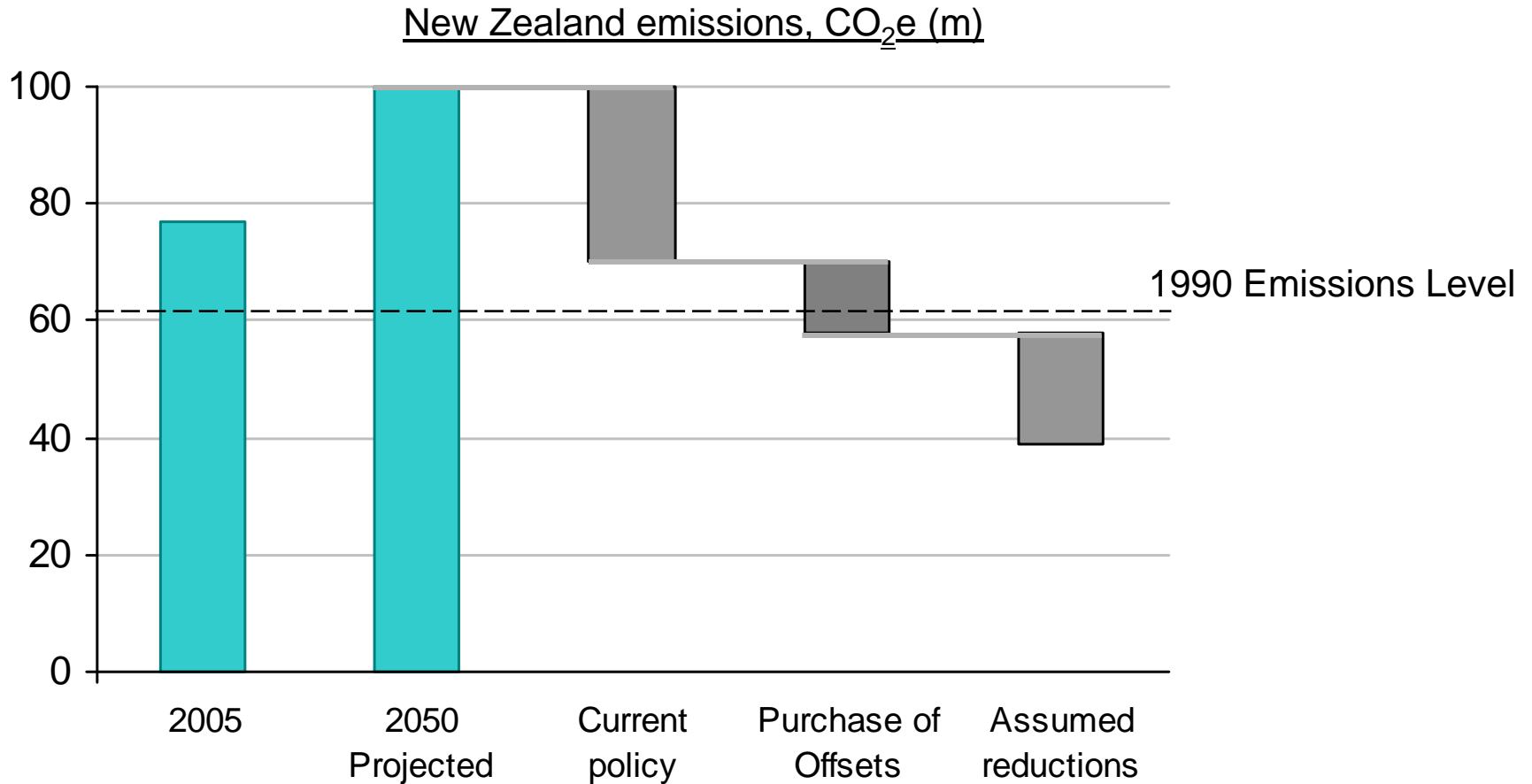
Government targets declared	2050 emissions reduction (m tonnes CO2e p.a.)
<p>Energy excluding Transport</p> <p>Carbon neutral in energy by 2040</p> <p>Carbon neutral in stationary energy by 2030</p> <p>Carbon neutral in electricity by 2025</p> <p>90% of electricity renewable by 2025, no new fossil-fuel generation</p>	29
<p>Transport</p> <p>Carbon neutral in transport by 2040</p> <p>By 2040, per capita transport GHG emissions will be halved</p> <p>One of first countries to widely deploy electric vehicles</p>	26
<p>Agriculture and land use</p> <p>Remain a world leader in agricultural emissions reduction science</p> <p>By 2020 net increase in forest area of 250,000 hectares over 2007</p>	<p>No impact targeted</p> <p>~7</p>
<p>TOTAL REDUCTIONS TARGETED</p>	62
<p>Resulting percentage below 1990 emissions</p>	~40%

MANY POLICIES ANNOUNCED, BUT ESTIMATED TO HAVE MODEST IMPACT

Initiatives to achieve emissions reductions	Impact (m pa)	Associated costs and considerations
Energy excluding Transport Efficient and renewable electricity system ~24 programmes including restriction on fossil-fuel based generation and shift to 90% renewable Energywise Homes ~20 programmes Energywise Business ~35 programmes	8-9	Increased cost of electricity generation Increased wholesale and retail prices Capital costs such as solar heaters, insulation Compliance costs for reporting
Transport Biofuel sales 3.4% of fuel Energywise Transport ~30 programmes planned	4-5	Increased price of fuel Capital costs of abandoned assets Compliance costs
Research and land use Investment in agricultural research and NO reduction By 2020 net increase in forest area of 250,000 ha	~7 ~7	Research funding
Emissions impact quantified	<30	
Additional initiatives Emissions Trading System	TBD	High prices likely to be required to achieve emissions reductions
Total emissions reduction	TBD	

Note: Agricultural emissions impact based on reducing methane emissions by 10-15% and reducing nitrous oxide emissions by 25%. Some programs have not had estimates made of potential impact. Programs are numerous and impact may overlap.

CURRENT EMISSIONS REDUCTIONS POLICIES ONLY GET NEW ZEALAND'S 2050 EMISSIONS TO ABOUT THEIR 1990 LEVEL



Note: Impact of ETS beyond 2012 is not included in current policy.

Source: Ministry for the Environment; Ministry of Economic Development; New Zealand Institute calculations.

THE OVERALL EFFECTS FOR AVIATION REMAIN LARGELY UNCERTAIN

THERE ARE SEVERAL FACTORS THAT REMAIN UNCERTAIN

Will international agreement be achieved?

Will aviation be carved out for global management?

Will the international target be strict? What will New Zealand's share be?

How many countries will rely on offsets – what will be the global price of carbon?

BUT SEVERAL STEPS THAT SHOULD CLEARLY BE TAKEN

Measurement and management necessary

- Not yet drastic

Reductions will be required in the industry and lead to favour at the firm level

Favorable intensity comparisons a recognised defense

Governments likely to signal and be open to management

- Substantial action likely to take time to coordinate and establish

Consumer markets the greatest concern and uncertainty