PREPARING FOR WHITE SWANS: CLIMATE CHANGE & OPPORTUNITIES FOR THE ECONOMY
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CO2 and Temperature
- Joseph Fourier – 1820s
  Speculated that the atmosphere keeps the Earth warm
- John Tyndall, Irish earth scientist, 1860s
  Found the key greenhouse gases
  Block heat from escaping to space
- Svante Arrhenius, Swedish chemist, ~1900
  Doubling CO2 would raise temperatures 5°C
- Athol Rafter, DSIR scientist, 1950s
  Noted that fossil carbon building up in atmosphere

BLACK SWAN
- The event is a surprise
- The event has a major impact

WHITE SWAN
- Navajo tradition the Great White Swan can call up the Four Winds
- The Great Spirit will use white swans to work its will
- A symbol of transformation

CLIMATE CHANGE:
THE SCIENCE AND ITS IMPACTS
CO2 and Temperature

- CO2 doubling best estimate 3°C (2.0 - 4.5°C)
  - This century
- CO2 concentration now 38% above pre-industrial
  - Half that increase in last 30 years
- Most of the CO2 there for centuries to come
  - Oceans & ice sheets take centuries to adjust

The greenhouse effect

- Long-term balance controlled by:
  - Amount & distribution of sunlight (nature)
  - Greenhouse gas concentrations (man & nature)
- Atmosphere is 0.04% CO2
  - Difference between +15°C and -18°C

Increases in greenhouse gases

- Global atmospheric concentrations of CO2 and CH4 have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice core measurements spanning the last 650,000 years.
Sources of climate change

**Temperature change WITHOUT human factors**

**Temperature change WITH human factors**

Degrees Celsius

G. Meehl, NCAR, 2007

"Most of the observed increase in global average temperatures since the mid-20th century is very likely\(^*\) due to the observed increase in anthropogenic greenhouse gas concentrations."

(IPCC, 2007)

\(^*\) very likely = more than 90% chance

The climate is changing

Global Surface Temperatures

- NASA Goddard Institute for Space Studies
- Met Office Hadley Centre/Climate Research Unit
- NASA National Climatic Data Center
- Japanese Meteorological Agency

Temperatures are rising

Results from four global datasets: NOAA (NCDC Dataset), NASA (GISS USA), combined Hadley Centre and Climate Research Unit (UK) and Japanese Meteorological Agency (JMA)
The climate is changing

- 100-year change & year to year change about 0.9°C

- 140 - year change about 1.4°C

Extremes are increasing

Europe August 2003
Wide area temperature anomaly of about 3°C Was more than 7°C warmer than usual in some places About 30,000 premature deaths Unprecedented drop in crop yields This is now twice as likely as it was 50 years ago due to global warming
2010 Pakistan record breaking floods began in late July 2010, resulting from heavy monsoon rains in Pakistan and affected the Indus River basin.

- Drought and widespread fires in Russia at the same time as near-record flooding across much of China is raising the question of correlations between extreme events.
- Extremes like this have been expected to become more frequent, for some time. But climate scientists are now concerned about likely connections between them.

Much of July and August was defined by excessive heat across the southern and eastern two-thirds of the United States.

- Millions of Americans were affected by the temperatures, with relative humidity, produced heat indexes of 43°C or higher across a wide swath of the nation.
- In July 78 extreme maximum temperature records were broken with 209 record warm nights.
- Over 140 million people affected.

- In north Texas, heat duration, combined with record drought conditions was the big story. Dallas/Fort Worth, Texas had 40 consecutive days (July 2nd–August 10th) reaching 37.8°C or greater.
- For Waco, Texas the record stood at 72 as of August 25, dwarfing the previous record of 42 set during June 23rd–August 3rd, 1980.

Global warming ‘influencing weather extremes’

By Isaac Davison 5:30 AM Friday Jul 15, 2011

Human-influenced global warming has played a role in the severe weather events in New Zealand and abroad over the past year, says a visiting climate expert, Christchurch-born climate scientist Kevin Trenberth, now employed by the US National Centre for Atmospheric Research.

Weather-related disasters in the past year range from a heatwave in Russia to flooding in Pakistan, China, India, and Queensland and drought in Brazil. New Zealand also broke temperature and rainfall records and experienced a deadly tornado in Auckland. After the deadly US spring storms, Dr Trenberth said: “When natural variability is compounded by human influences on climate this is what we get. Records are not just broken, they are smashed.”

Glaciers are shrinking world wide
Alpine Response

- Southern Alps ice volume has decreased 16% from 55 to 45 km³ 1976 - 2008

Total volume change of alpine ice (solid line)

Arctic sea ice

Observed (red line) and modelled September Arctic sea ice extent in millions of square kilometres. The solid black line gives the mean of the 13 IPCC AR4 models while the dashed black lines represent their range. From Stroeve et al. (2007). The 2009 minimum has recently been calculated at 5.10 million km², the third lowest year on record, well below the IPCC worst case scenario.

Sea level are rising

New data on past sea level rise (blue line and band) for the last 2000 years. It matches with tide gauge data (green) but shows some discrepancy with simple models (red). Source: Real Climate
Sea levels are rising

- Trend 1899–2009: 1.50 mm/yr [Hannah, Denys & Beavan, 2010]
- Glacial Isostatic Adjustment (adjusted for NZ landmass still rising)
  corrected SLR = 1.50 + 0.4 = 1.9 mm/yr or 21 cm over 110 years
  Close to global average

Source of data – Ports of Auckland;
Slide from NIWA (R Bell)

Oceans are becoming more acidic

- 0.1pH unit decrease observed
- Another 0.3pH unit decrease this century
  - Unprecedented for over 20 million years
- Affects corals, shell formation, plankton growth
- May damage whole food chain in the oceans
  - Regardless of “temperature warming”

Future climate

We are at a Y-Junction for the future

Rapid development of new technology and halving greenhouse gas emissions by 2050

This is the critical decade. Decisions we make from now to 2020 will determine the severity of climate change our children and grandchildren experience

Tim Flannery April 2011

Current fossil fuel emissions

Global fossil fuel CO\textsubscript{2} emissions. Dots show estimates from US EPA (1990 to 2009) and BP (1990 to 2010). Coloured lines show the marker scenarios for emissions used in climate models for the last two IPCC assessment reports and the grey band shows the full range of these SRES scenarios. The two vertical bars in 2010 and 2013 show the range of emissions being used for the next IPCC report
Climate tipping points:
- Greenland 1–2 °C (above 1980–1999)
- Arctic sea ice 0.5–2 °C (above 1980–1999)
- Boreal forest 3–5 °C (above 1980–1999) (dieback etc)
- Continental glaciers 1–3 °C (above 1980–1999)
- West Antarctic ice sheet 2–4 °C

Future climate:
- By 2030s 1.0°C, and 2090s 2.0°C warmer, less frost
- By 2030s and 2090s wetter in the west, drier in the east

Sea level rise estimates have changed significantly in the last 3 years:
- Safe Level of CO₂ ~ 350 ppm
- Multiple benefits of solution

Impacts:
- More drought reducing production
- Longer growing seasons, less frost risk
- Sea-level rise likely to exacerbate ocean storm surge damage
- Will cause coastal inundation, erosion, loss of wetlands, salt water intrusion, beach erosion
- Design criteria for extreme events more frequently exceeded
- Increased inundation of transport structures (roads, rail, bridges)
- Failure of flood plain protection and urban stormwater systems
Summary
• More greenhouse gases warm the climate
• Carbon dioxide 38% higher than pre 1750 & rapidly rising
• Temperatures and sea levels are rising, extremes increasing
• Less frosts are occurring, glaciers and sea ice shrinking
• At a critical point in carbon emissions for the future
• Temperatures and sea level will rise significant this century
• Impacts will occur, and mitigation options available for agriculture eventually

MARKET ISSUES FROM CLIMATE CHANGE, CARBON FOOTPRINTING, LIFECYCLE ANALYSIS AND FOOD

Professor Caroline Saunders
AERU
Lincoln University

Enough Food? - World Food Supply
• Currently enough food for 12 billion with pop of 7 billion predicted to rise to 11 billion
• With climate change food supply predicted to increase
• Policies in major countries currently restrict supply, eg: US conservation land 37.6 m ha of which between 4 and 11 million could be used
However.. Enough food but..

- The distribution of food is a huge issue
- Need to empower rural producers
- New production with climate change need
  - infrastructure
  - property rights
  - knowledge of different crops including pests and disease in new areas

So enough food???
But... Does this account for...

- Water shortages – 2/3 world predicted to experience water stress
- Oil- the availability of cheap supplies
- Inputs such as fertiliser and pesticides
- Less land with predicted loss of 12 mill ha
- Loss of ecosystems and their services
- Changing diets

Future market conditions

- In theory enough food but distribution even more an issue
- The important factor in world markets including food and oil is the fluctuations and uncertainty
- The fluctuations are factors which lead to imperative for change

Imperative to change

- Frequency of oil crises: Political factors, exploration in ecologically vulnerable areas.
- Climate change: Floods, droughts, shift in production.
- Food crisis
- Financial crisis
- Commodity speculation
- Fluctuations in prices
  - Hit the vulnerable, lead to political crisis.
NZ Brand

- NZ does brand itself as Clean and Green
- Generally surveys overseas show positive reaction to NZ brand (100% pure; Zespri)
- Need to maintain this to access high value premium markets
- Price not important for consumers in these markets but attributes of products are such as how it is produced
- Retailers are vying with each other to develop schemes to attract this type of consumer

So for NZ

- We can't feed the world (2% dairy)
- But need to maintain high value for products based on sustainability and help other countries with our technology
- But... to access high value markets need to assess attributes of product
- This includes being aware of market requirements and policy
- Assurance schemes can lead to win win situation for NZ

Market schemes

- Leaf Marque – UK, Germany, France, Italy, Sweden and Luxembourg
- Natures choice – Tesco
- Eco– Plan A – M & S
- Good Steward Chain – Walmart
- Assured Food Standard – Red tractor label
- GLOBAL G.A.P.– 93,000 producers 100 countries
Risks and opportunities for our exports

• To access premium market segments have to consider sustainability including social & environmental factors
• Often these are defined by overseas markets
• We have to ensure these factors are defensible and not pseudo
• Food miles ignores production resource use

Food Miles

• ‘the number of miles (kilometres) a product has to be transported from the farmer/grower to various stages of production until it reaches the supermarket and finally the plate of the consumer’.
• Simplistic concept .. But traction with popular press and some environment and other ‘groups’
• Ignores energy use and emissions in production
• We compared UK produce to NZ produce delivered to UK market

Dairy: NZ Versus UK

• NZ uses under half energy than the UK does
• Even despite not being able to obtain as detailed data on UK capital inputs
• Even when methane and nitrous oxide included the UK produces 34% more GHG emissions per kgMS & 30% more per ha

Sustainability & Market Access Issues

• Carbon Footprinting
• Local food and seasonal consumption
• Lower meat and dairy consumption
• Ethical food - fair trade and organic!
• Biodiversity and wildlife
• Water quality and quantity
• Ageing Population
• Food waste
Carbon Footprinting Methodology

- Food miles recognised as flawed concept
- Retailers and others now carbon footprinting
- 15 schemes implemented world wide
- UK Carbon Trust in 2006 did 3 products
- Tesco in 2007 said they would do all 70,000 products (done 6 product lines)
- Japan, Germany, Thailand, Korea, Sweden and Switzerland also have schemes.

Issues with Carbon Labelling

- Cost of carbon footprinting especially for developing countries and small suppliers
- Concern re: methodology and science
- Concern that a monopoly certifier will emerge
- Potential for acting as a trade barrier
- Unidimensionality of carbon footprint against other sustainability criteria
- Lack of understanding of the footprint

Surveyed with other attributes UK and Japan

UK
Ranks:  
Vitamins, water and waste/ recycling and then carbon

Japan
Water, waste vitamins and then carbon

Cutting carbon footprints!

- Modelled producer assuming unrealistic cuts in inputs of 50% and 15% increases in yield – affected footprint by -4%
- However modelling consumers making half trips to supermarket and dropping waste from 11% to 9% reduces footprint by 14%
- More emissions in trip to pick up air freighted vegetables than the air freight
- Hence most impact is made by changes at top of supply chain – by consumers
Food Waste

- UK 30% of food wasted (60% edible)
- US 40 – 50% wasted
- FAO study 1/3 food wasted

Local Food and Seasonal Consumption

- Growing demand for local food
- UK and US government promoting local food and food miles! (sausages from supermarket would have to travel 227,727 miles to have same footprint as those from local shop)
- Growth in local farmers' markets, box schemes etc
- Seasonal consumption also may not be better for the environment
- Also consider wider sustainability implications

Crisps

Vegetables
Waitrose -

- Waitrose will be the first supermarket to stock their own 100% British dairy products, and customers will be able to trace its provenance from farm to fridge.
- This is great news for the cows and the British farmers and the environment. The cows are being raised in the lap of luxury. They are living in light airy barns, with clean beds of straw or a specially designed comfy mattress; nutritional advisors to ensure a healthy diet and pedicures—their hooves are regularly trimmed.

Lower Meat and Dairy Consumption
Low Carbon Diets

- Demand for reduction in meat and dairy consumption (livestock 18% of worlds total)
- ‘meat free Monday’ Paul McCartney
- Ghent – meat free one day a week
- WWF meat should be labelled 1-3 times a week max
- NHS – reducing meat and dairy in diets

Lower meat and dairy consumption
Low carbon diets

- Demand for reduction in meat and dairy consumption (livestock 18% of worlds total)
- Research shows that dairy based diet not much different from vegan diet for emissions (6%)
- Meat based diet more emissions (23% more)
- Further research into alternative sources of supply for meat and its by products

Emerging markets

- Considerable growth especially for livestock products (but much met by their own increase in production)
- One billion middle class in Asia, Latin America and central and eastern Europe
- Main change from small retailers to supermarkets and global procurement
- Eg China from no supermarkets in 1990 to 60,000
- Growth from western chains (Tesco Walmart) and these likely to require same standards of procurement for their other markets
Other countries being subsidies to met sustainability requirements

- EU Single Farm Payment – subsidises farmers to comply with environmental criteria and will include carbon footprinting (75 billion euros)
- EU also pays extra for farmers for agri-environmental schemes to – (22 billion euros)
- EU pays to help comply with market schemes (92 million ecu)
- US – increase in conservation area (115 million acres)
- Increase in payments for working land conservation (US$3.4 billion)

Conclusion

- Threats to trade changing from regulatory to ‘access-to-market from retailers’
- This has been developing over time
- Carbon footprints are an example of this
- Not just EU markets it is spreading elsewhere
- However win-win more returns for exports and more sustainable production

Agenda

- What’s up?
- Why us?
- Our response
- Our advantage
Our low productivity
- We’re very efficient at producing low value goods and services
- But...we’ve hit the wall, economically, socially and environmentally

Slowth
- No faster after recession than before recession (or before 2008 election)
- ...need 2x faster to close gap with Australia by 2025

Our high energy intensity
- We rely on abundant cheap energy...to produce low value goods

Cheap electricity
Cheap petrol

Big increase in renewable electricity capacity

Energy sources in 2010

• We focus on the higher proportion of electricity generated from renewable sources

• But oil supplies 46% of our total energy needs, thanks to heavy use by transport and some use by industry

• This is a vulnerability in economic and environmental terms
Why New Zealand?

- Our environment matters:
  - Of all OECD countries, we’re the most dependent on our natural environment for earning our living
  - Environmental integrity and brand are vital to earning that living

- Our resources are thin:
  - We are a very, very small, thinly resourced, open economy
  - …we have few people, limited capital
  - We have to innovate fast and efficiently, in business and government
    - E.g. world’s first independent Central Bank; fiscal responsibility act

- We think and act globally to create opportunities…e.g.:
  - World Trade Organisation; sponsoring China’s admission; first FTA
  - WTO agricultural negotiations
  - UN in general.
  - …UNFCCC in particular, e.g. on agriculture and forestry
  - …Kyoto chairman is Adrian Macey, a NZ diplomat
Role of NZ government – overseas

- Global Research Alliance on Agricultural Greenhouse Gases
- Proposed by NZ government at Copenhagen in 2009…to:
  - Reduce emissions; increase food production
  - Help developing countries to join global climate change frameworks

- Alliance now has 36 countries + 3 observers including the EU
  - 70% of global agricultural GHGs; agriculture = 15% of total GHGs

- Three main workgroups:
  - Livestock, led by NZ and Netherlands, 483 projects identified to-date
  - Croplands, led by US, 429 projects to-date
  - Paddy Rice, led by Japan, 60 projects to-date
  - Secretariat: NZ

- Successful Ministerial Summit in June

- What in means to NZ:
  - Bedrock science for us; our biggest international science collaboration
  - Government has committed NZ$45m over four years 2010-13

Business engagement

- After years of scepticism, engagement is growing
- Some leaders emerging, e.g.
  - Fonterra in the dairy sector
  - Air New Zealand
  - Zespri in kiwifruit
  - Mighty River, Meridian and Contact in renewable electricity
  - NZ Post in transport

- Investment in renewable electricity accelerating
- Some fuel switching e.g. from coal to wood chips in industrial plants

- But generally speaking, if companies aren’t directly engaged in the ETS as “points-of-obligation”, then many tend to ignore even basics such as energy and fuel efficiency audits, improvements

- Clean tech activity still very modest
  - …to some outstanding individual companies and investors

Land Use and Climate Change in New Zealand
Suzi Kerr, Motu
Australia-NZ Climate Change Conference, 1-2, August, 2011

Watch Suzi’s conference presentation at www.climateandbusiness.com
Pressure for land use change to 2030

ETS: $25

Forestry engagement
- Forest owners suffered great turmoil because of policy indecision, shifts by last government
  - Impact included virtually no new planting; heavy deforestation
- Much more policy stability now
  - Impact includes big pick up in planting
  - Notably, some sales of Kyoto forest credits to overseas buyers
- But big issues still to be resolved, e.g:
  - For small forest owners, decision whether to opt in or out of the ETS is a big one
  - Uncertain future for permanent forest sinks
  - Likewise, international negotiations on forestry rules
- New Zealand remains very dependent on its Kyoto forests for minimising its Kyoto obligations
- This is a short-term strategy; doesn’t solve long term emissions, mitigation & adaptation; policy and action still inadequate on those issues
Zespri

- April 2009: Published its carbon life cycle analysis:
  - Orchard operations make up 17% of total emissions for EU exports
  - Packhouse & coolstore processes account for 11% of total emissions
  - Shipping accounts for 41% of total emissions
  - Repacking and retailer emissions amount to 9% of total emissions
  - Consumer consumption & disposal comprises 22% of total emissions

  Bottom line: resource efficiency builds a more profitable, resilient business
  - E.G. Kite-assisted ships save 22% of their fuel bills on average

Farming engagement

- Dairy exports are NZ’s largest source of foreign exchange (about 25%)
- Dairy farming is NZ’s largest industrial GHG emitter (about 40%)
- Dairy sector is NZ’s largest export conundrum
  - Can it grow volume and value strongly?
  - Can it do so in environmentally responsible ways?
  - Can it compete against low-cost farmers overseas?
- Sheep & beef farmers have the same issues
- Federated Farmers is the fiercest ETS critic
  - Focuses only on cost and competition…not on opportunities
  - Sceptical about climate change, worries about economic impact
- Strong countervailing voices e.g. Fonterra
- Government is taking reasonably firm line with FedFarmers
  - …pushing the benefits of the ETS, science, int’l engagement

The road to sustainable dairy farming

- The International Dairy Federation began locking on to climate change issues a few years ago
  - Leaders within it include Fonterra, exporter of 90% of NZ’s milk…
  - and David Homer, an IDF board member and UK dairy farmer
- The IDF’s 2010 World Dairy Summit was in Auckland last November
  - 2,250 delegates from 30 countries
  - Sustainable dairy farming was one of the conference streams
  - …attended by 250 farmers and scientists
  - …upbeat assessment of science, environment & business opportunities
  - Some of the delegates responses follow…

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The Lifecycle of a ZESPRI® KiwiFruit

1. Harvest
2. Post-Harvest
3. Storage
4. Transport
5. Repacking
6. Retail
7. Consumer Consumption & Disposal

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IDF World Dairy Summit 2010
Is human activity contributing to global climate change?

1. Yes - 95%
2. No - 4%
3. Don't know - 1%

Is dairy farming contributing to global climate change?

1. Yes - 75%
2. No - 17%
3. Don't know - 8%

From what you've heard today, is dairy farming part of the climate change solution?

1. Yes - 85%
2. No - 15%

How do you rate sustainability as a driver in your farming business?

Highly negative
Highly positive
Before
After
Neutral
Our opportunity

- 1 litre of milk = 940 gm of CO₂ equivalent
  - (According to the lifecycle analysis of milk by Fonterra, processor of 90% of NZ’s milk, and a world leader in the global dairy trade)
  
  \[16,000,000,000 \text{ litres} = 15,040,000,000 \text{ kg of CO₂ eq}\]

- 15.04m tonnes of CO₂ eq per year is not a waste product, or a liability

  Helping animals digest their feed better
  so they produce fewer emissions, more energy
  would help close the nutrient cycle

  This a brilliant business opportunity...
  healthier cows and soil...

  = more food, better environment, bigger profits

NZ Agricultural Greenhouse Gas Research Centre

- New ways of working
- …on science; on collaboration, NZ and globally
- …on engaging with farmers

Pastoral Greenhouse Gas Research Consortium

- Since 2002, 50/50 government and industry
- $30m investment in science so far

- NZ Agricultural Greenhouse Gas Research Centre
  - Opened March 2010; $48.5m funding next 10 years
  - Four main workstreams…$15.6m committed 2010-14
  - Mitigate methane; mitigate nitrous oxide;
    increase soil carbon; deliver farming solutions

Fonterra’s strategy

- 4.4m milking cows; 19% of agricultural GHGs; 25% of exports

  - Progress:
    - 13.9% cut in energy emissions per tonne of product over last 8 years
      - Its plants began using ETS discipline in 2006
    - 8.5% cut in agricultural emissions per litre over past 8 years

  - Goals:
    - 10% cut in ag emissions per unit of production by 2013 is NZ dairy goal
    - 30% cut by 2030 possible Fonterra believes...
      - “There is no debating the opportunity. We have a head start on some of our competitors.” See Andrew Ferrier at www.climateandbusiness.com

  - Strategy:
    - Pricing ag emissions would cost average farm $22,000 a year
    - So, don’t activate ag emissions in the ETS
    - If they were, production would fall here…rise in higher emission country
      - But it’s argument is deeply flawed
What’s really at stake

- Fonterra: ETS will cost average farm $22,000 a year
  - Fact: This is a minor increase in total operating costs
    - Gov’t will only phase out credits at rate that matches emission cut

- Fonterra: ETS will cut production here
  - Fact: No it won’t; more land will go into dairying
    - Dairying will become more intensive, so more emissions efficient

- Fonterra: What happens in NZ is significant to global industry
  - Fact: World dairy output grows each year by more than entire NZ output

- Fonterra: We don’t need the discipline of ETS…we’ll do this anyway
  - Fact: The ETS and gov’t oversight will keep dairy industry focused
    - These new disciplines drive new analysis, insights, science & tools

- Fonterra must lead…It can drive these emissions & productivity gains better than any other global producer
  - It buys one-third of its milk overseas
  - Its ramping up farming overseas
21st century Christchurch

- Opportunity to create the 21st Century Garden City
YikeBike: radical reinvention

- Grant Ryan’s radical re-think of the bike
- All-electric; no pedals; 10kg; 20 km/h; 10 km range
- ABS brakes; regenerative braking; 45-minute recharge
- Folds in 15 seconds; Guinness Book of Records
- China produced 22m electric bikes last year

LanzaTech...clean tech leader

- Signed commercialisation agreements at the Shanghai World Expo last May with:
  - Chinese Academy of Sciences
  - Baosteel; next pilot plant in China
- Makes biofuel from industrial waste gases
- Turns greenhouse gas liability into profit
- World pioneer of the science
- Auckland-based; NZ Steel pilot plant
- Big venture capital backing
  - Latest round US$18m
  - NZ: Stephen Tindall
  - US: Vinod Khosla
  - China: Qiming Ventures

Auckland Plan

- Taking on the big problems
  - Transport
  - Water
  - Housing
  - Innovation
  - Clean energy
  - Smart grid

- Auckland’s clean energy strategy
  - 50% renewable energy by 2030
  - 100% zero carbon by 2050
- Green Light – Innovation in energy
  - Excellent R&D platform, need smart commercialisation
  - 250 cleantech companies and organisations
  - Invest in our brand
  - New Energy, fuel models + smart use of our available capital + attract investment + business opportunities
  - High end tourism
  - Sustainable Shipping + low carbon fuels = Sustainable Shipping 
  - Sustainable airline
  - Air NZ as #1
  - Renewable resources NZ, best
  - Sustainable airline

- High value migrants + ethical business
  - Own the brand!
  - Smart efficient transport fuels by 2030
  - 70% renewable electricity
  - Leadership in green growth and low carbon economic development unlock wealth & prosperity
  - NZ as laboratory, model, demo site - flagship economy
  - Could NZ leadership in green growth and low carbon economic development unlock wealth & prosperity?

- Minerals
  - Minerals
  - Green Chemistry
  - Geothermal Energy*
Paradox

Abundance

Scarcity

Coal, oil, gas

Renewables

Re-invention

Scarcity

Abundance

Wealth

Renewables

Coal, oil, gas
Paradox

Nuclear-free

Low risk

Big cost

Paradox

Carbon-free

Big risk

Low cost

We campaigned for nuclear-free…

…so why aren’t we campaigning for carbon-free?

…will be

…what we make it

...New Zealand