



**SOLID ENERGY**  
Coals of New Zealand

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# Energy, emissions & the economy: opportunities and challenges for NZ

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September 14, 2007



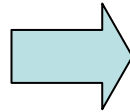
# Millennium Development Goals (UNDP)

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**Good land  
Good climate  
Fresh water  
Natural resources  
Energy resources**

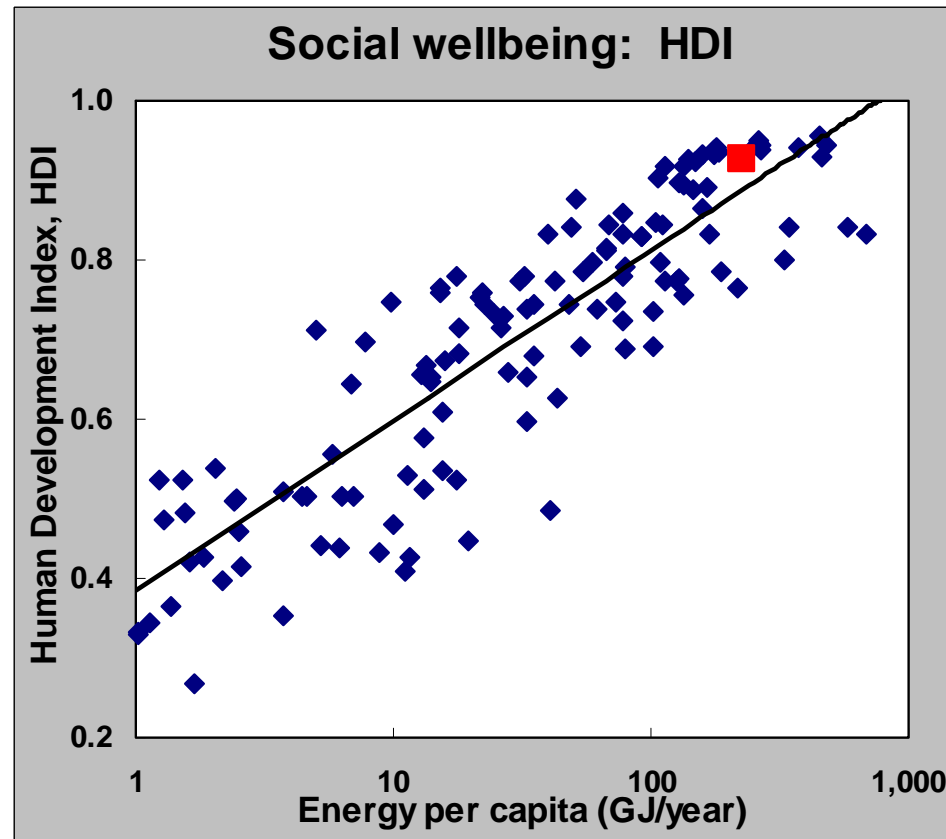
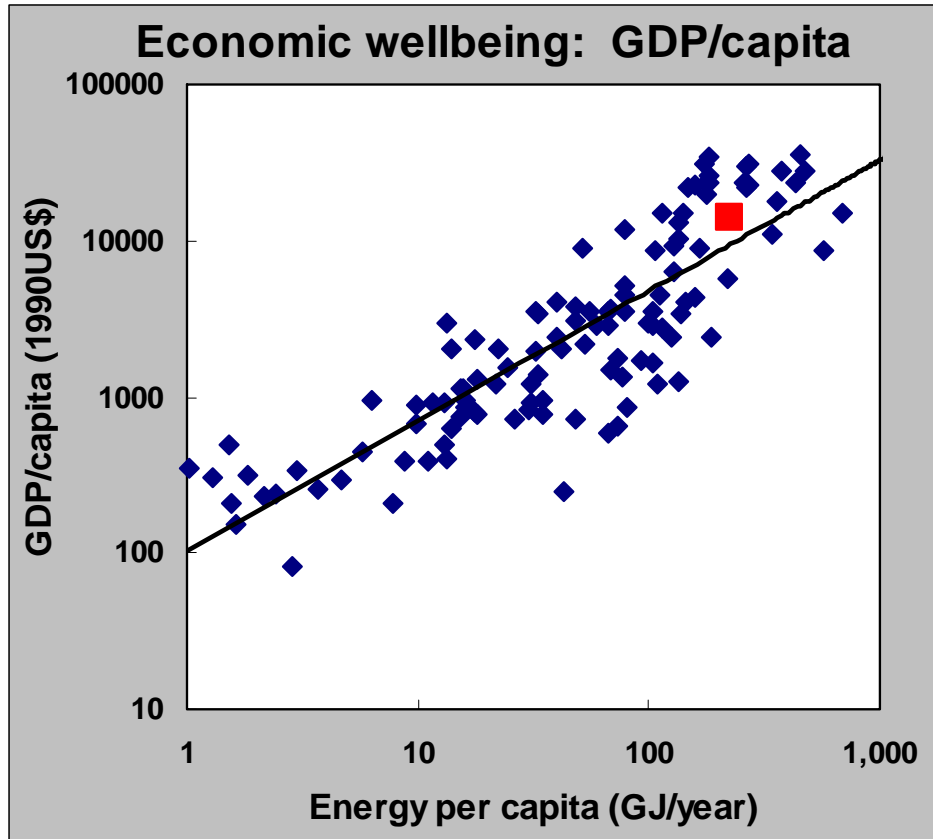


**Life  
Long life  
Quality of life  
Standard of living  
GDP/capita**



- 1. Eradicate extreme poverty and hunger**
- 2. Achieve universal primary education**
- 3. Promote gender equality and empower women**
- 4. Reduce child mortality**
- 5. Improve maternal health**
- 6. Combat HIV/AIDS, malaria and other diseases**
- 7. Ensure environmental sustainability**
- 8. Develop a global partnership for development**

# Energy supports economic and social prosperity



- NZ's energy dependence is near (but below) the global average
- A more prosperous world will demand much more energy

# But conventional energy reserves are running out ...

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## Ratio of proved reserves to current production

<b>Oil</b>	<b>45 yrs</b>
<b>Gas</b>	<b>63 yrs</b>
<b>Coal</b>	<b>147 yrs</b>

**More resources will be developed into reserves**

**But ...**

- **demand is increasing (+71% by 2030 - *IEA*)**
- **production can not keep increasing to meet demand until the last PJ is used, then just stop**

# But conventional energy reserves are running out ...

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## Ratio of proved reserves to current production

<b>Oil</b>	<b>45 yrs</b>	<b>30 yrs?</b>	<b>Peak by 2010?</b>
<b>Gas</b>	<b>63 yrs</b>	<b>40 yrs?</b>	<b>Peak by 2015?</b>
<b>Coal</b>	<b>147 yrs</b>	<b>75 yrs?</b>	<b>Peak by 2025?</b>

## NZ:

<b>Renewables</b>	<b>Very high (per capita)</b>
<b>Coal</b>	<b>1500 yrs (2<sup>nd</sup> highest per capita)</b>

# ... and the cost of energy is increasing fast

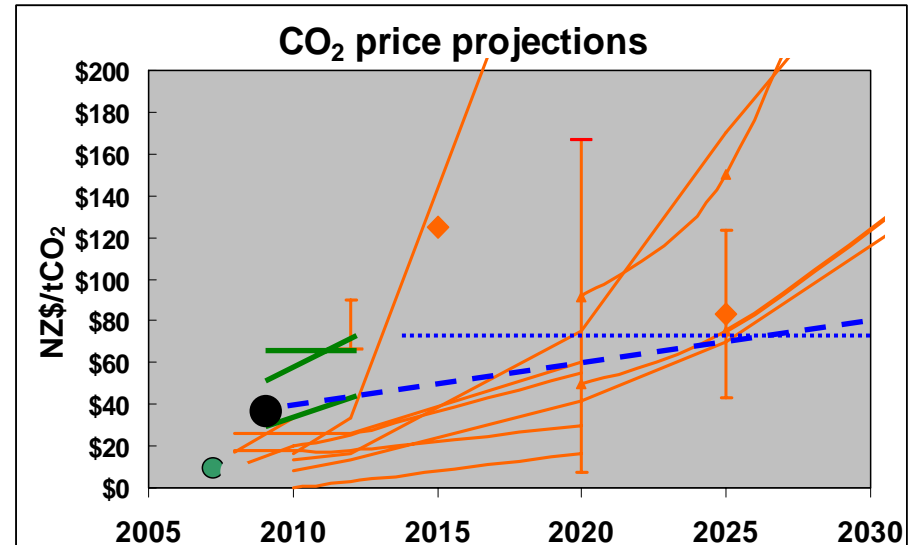
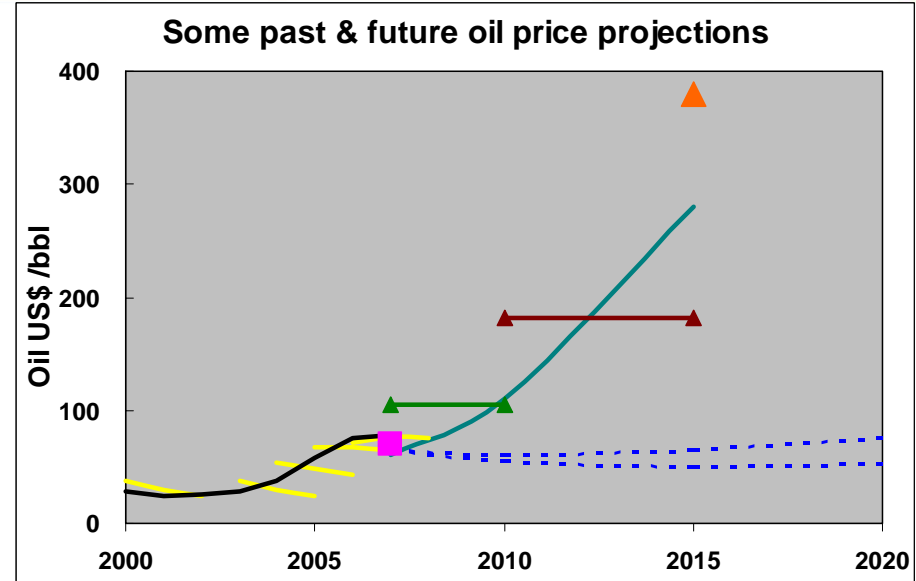
## Oil:

- 2010: US\$ 90 - 190/bbl
- 2015: US\$ 170 - 380/bbl
- 2020: US\$ 200/bbl + ?

## Carbon:

- 2008-12 NZ\$ 30 - 80/tCO<sub>2</sub>e
- 2015: NZ\$ 40 - 120/tCO<sub>2</sub>e
- 2020: NZ\$ 40 - 300/tCO<sub>2</sub>e

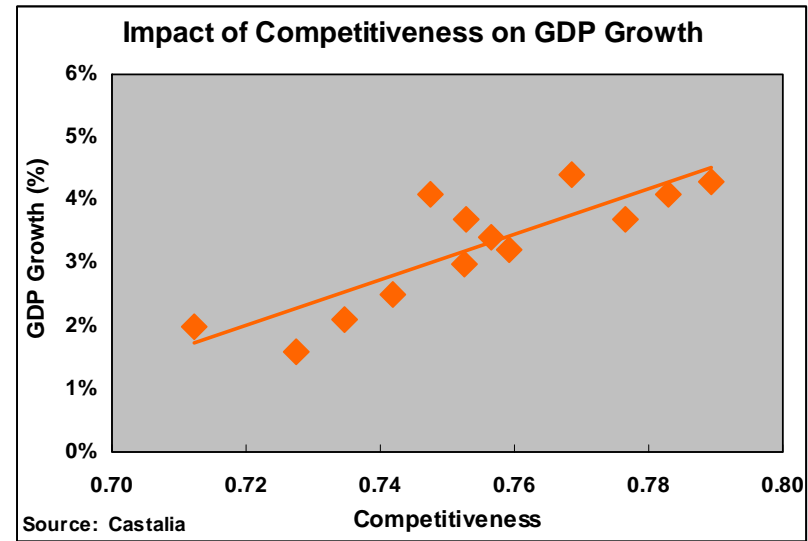
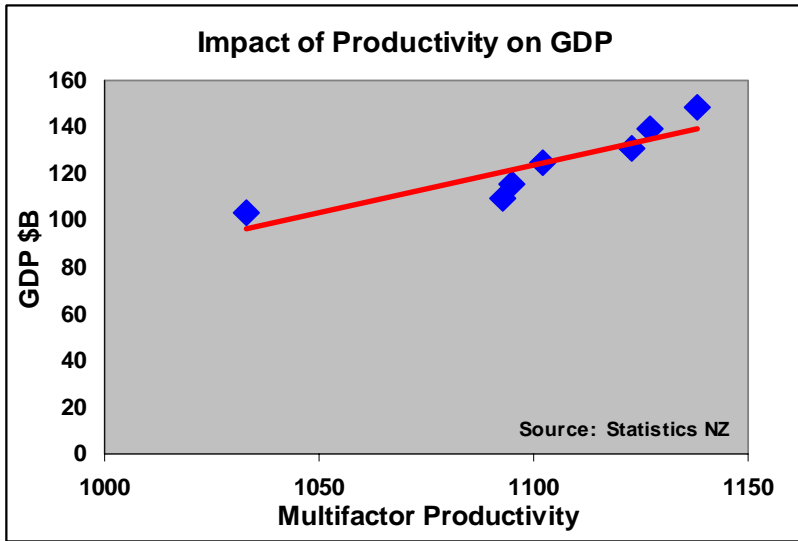
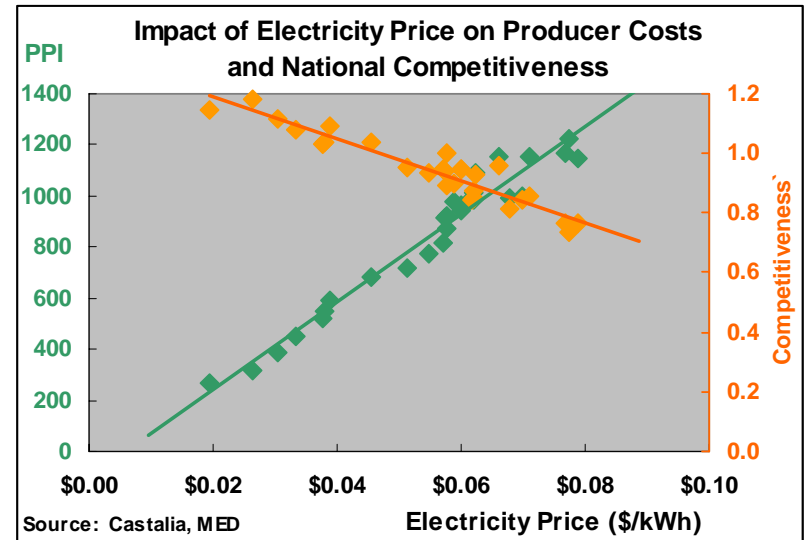
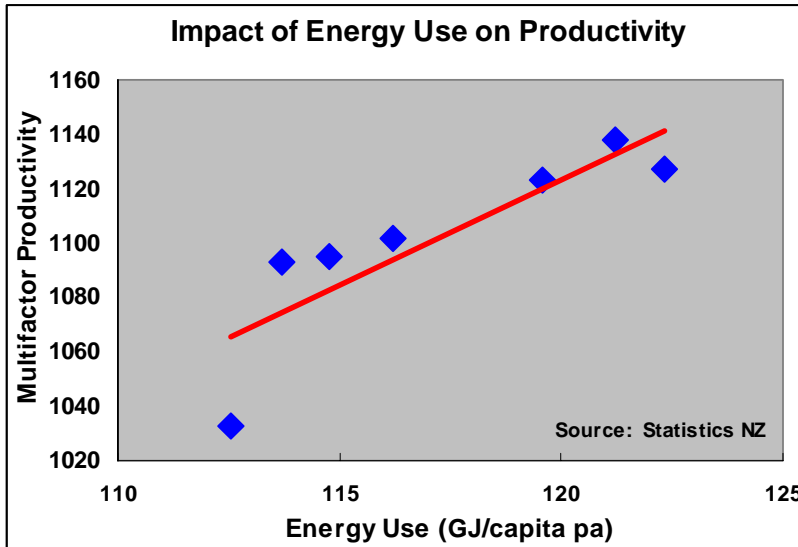
NZ's energy prices may double, treble or more within 10-15 years



# NZ's energy use and cost directly impact our productivity, competitiveness - and GDP

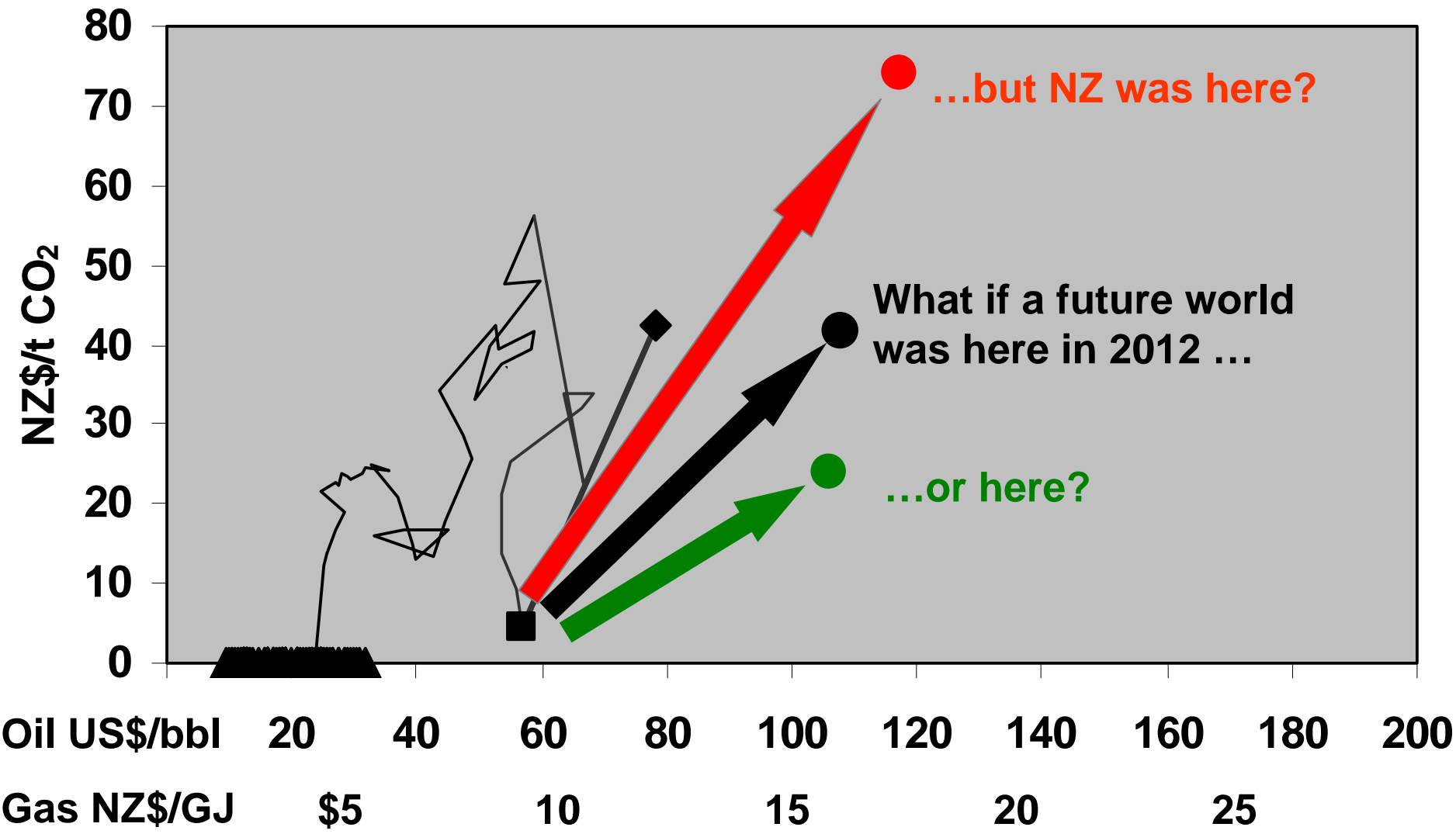
Energy Use +1% => GDP +2%

Energy Cost +10% => GDP - 0.4% pa



# Are there unique opportunities or threats for NZ?

## Oil price vs Cost of carbon



# Are there unique opportunities for NZ to pursue integrated economic / environmental strategies?

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From *Energy Policy for Europe* – Council of the European Union

1. Increase security of supply
2. Ensure the competitiveness of NZ's economy and the availability of affordable energy
3. Promote environmental sustainability and combat climate change

NZ may benefit more than most countries if we balance these

- Others will benefit from us producing food most efficiently
- These objectives integrate well with other strategies:
  - tourism, primary processing, accelerated GDP growth

Less than 30% of NZ's exports by sector are to Kyoto Annex I countries

# SE's 100 yr economic and emissions model

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- **Economy: 15 main sectors including “non-GDP”**
  - Sector growth, inputs, resources, availability/constraints
  - Efficiency improvements by type/sector (→ emissions intensity)
  - Emissions based on resource use
- ➔ **Economic output and emissions**
- **Long-term not short-term, relative not absolute**
- **Emissions by source/type/sector**
  - Forest sequestration included in detail
- **BAU projections and comparisons 2007 – 2100**

**Investigate and compare scenarios**

# BAU: GDP and emissions 2007 - 2100

## Sensitivities:

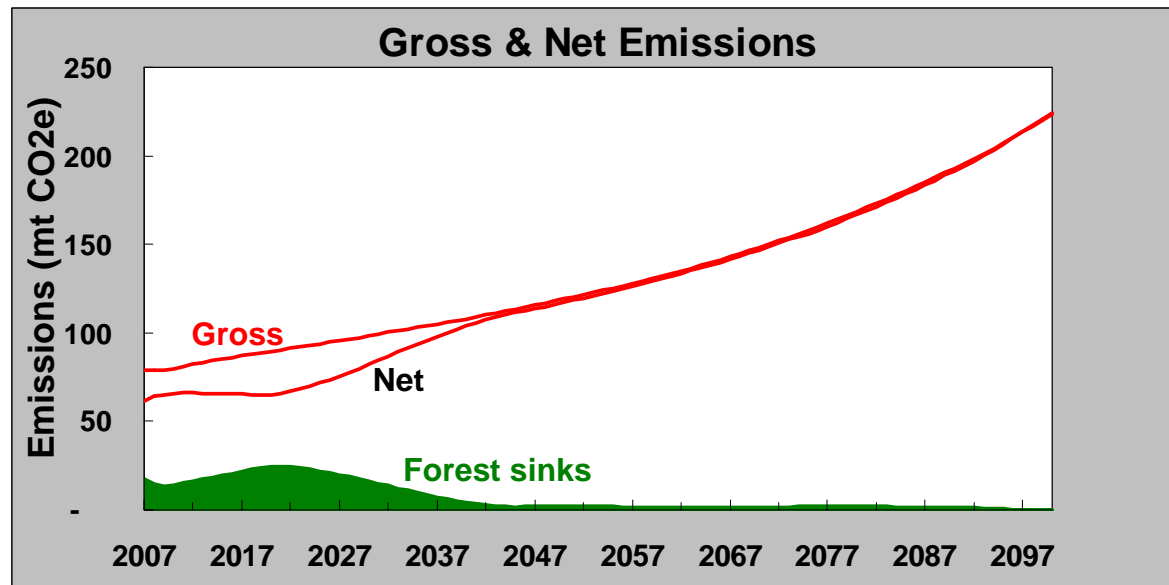
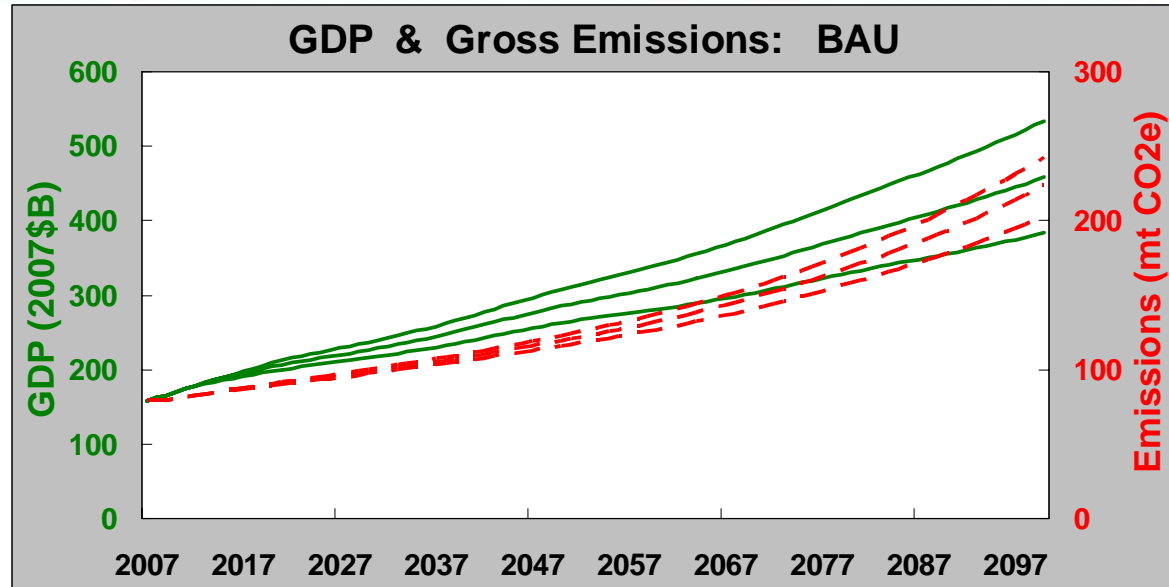
- population / labour
- sectoral growth
- land use change
- transport km/\$ output

## Forests:

- area constant
- actual sequestration
- gross/net converge

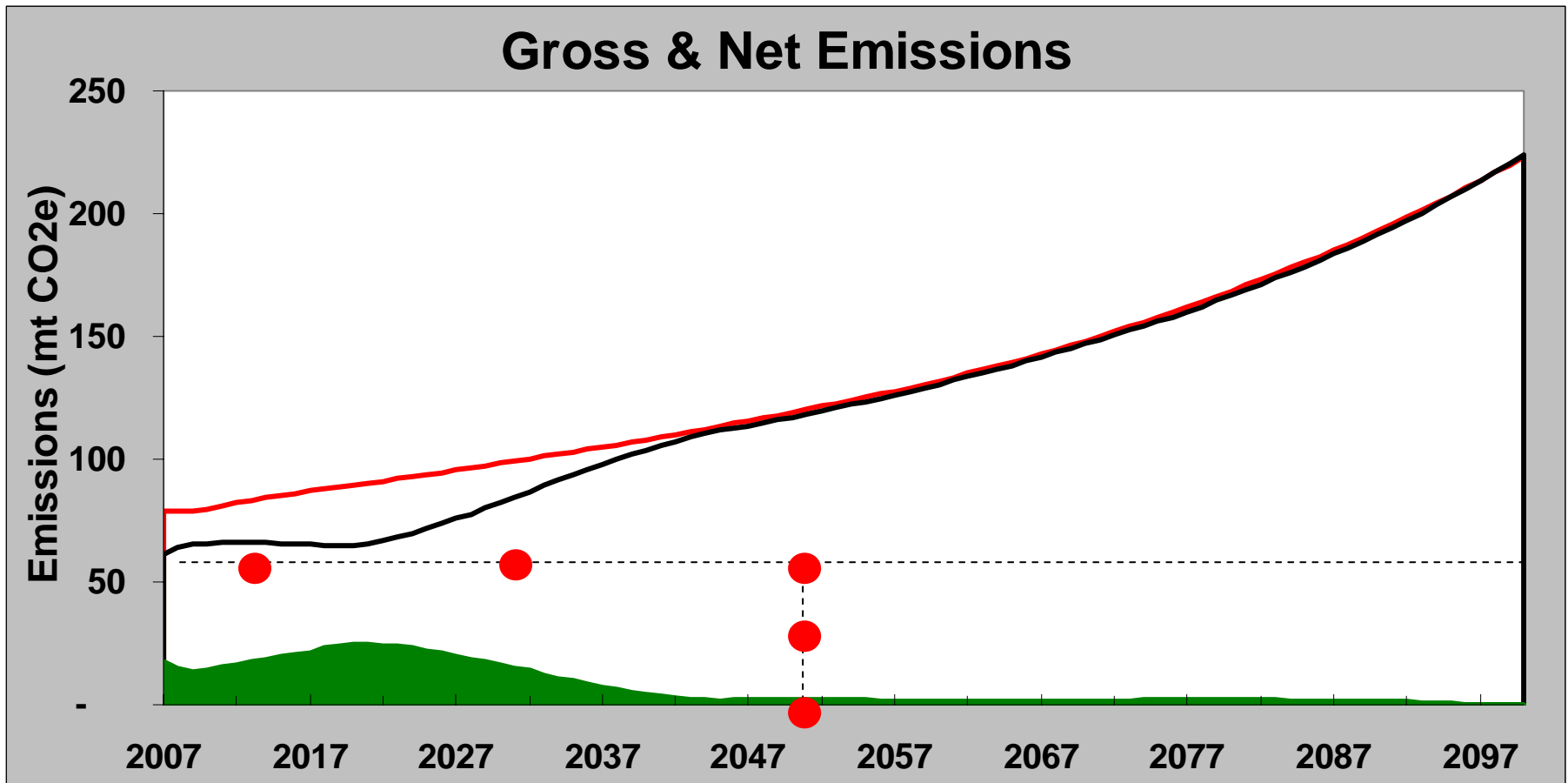
Our (increasing) natural strengths mean continued & increasing economic and emissions growth

Transport will continue to be a significant issue



# Possible net emissions targets?

- 1990 levels by: 2012, 2030, 2050?
- 50% of current levels by 2050?
- 0 by 2050?



# Options to reduce net emissions

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$$\text{Emissions} = \text{Population} \times \frac{\text{Demand}}{\text{Capita}} \times \frac{\text{Output}}{\text{Demand}} \times \frac{\text{Emissions}}{\text{Output}} - \text{Sequestration}$$

## Objectives:

- Decrease demand/capita
- Decrease emissions intensity
- Increase sequestration (forests, geosequestration)

What is the best way to achieve improvements in each?

- Regulation?
- Carbon price?
- Need very good, sector specific information and analysis  
→ Abatement cost curves – detailed, by sector, with time

# Options to reduce net emissions

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## Past/present emissions intensity reduction rates (EIRR) :

- Average autonomous improvement 0.75% pa
- Transport 0% pa (and km/\$ of output - 1.5%)
- Agriculture 0.55% pa
- Process heat 0.75% pa
- Electricity 0.75% pa

NZ EIRRs are consistent with (but higher than) OECD trends since 1990  
- IEA, 2007

## Scenarios:

1. Increase EIRR: immediately/gradually - all / by sector
2. Forest sequestration
3. Combined initiatives

# 1a. Reduce EI: higher constant EIRR

All sectors achieve immediate EIRR increase

Required EIRR to achieve each target (past/now = 0.75%pa):

Green = possible

Red = very challenging

1990 levels by:

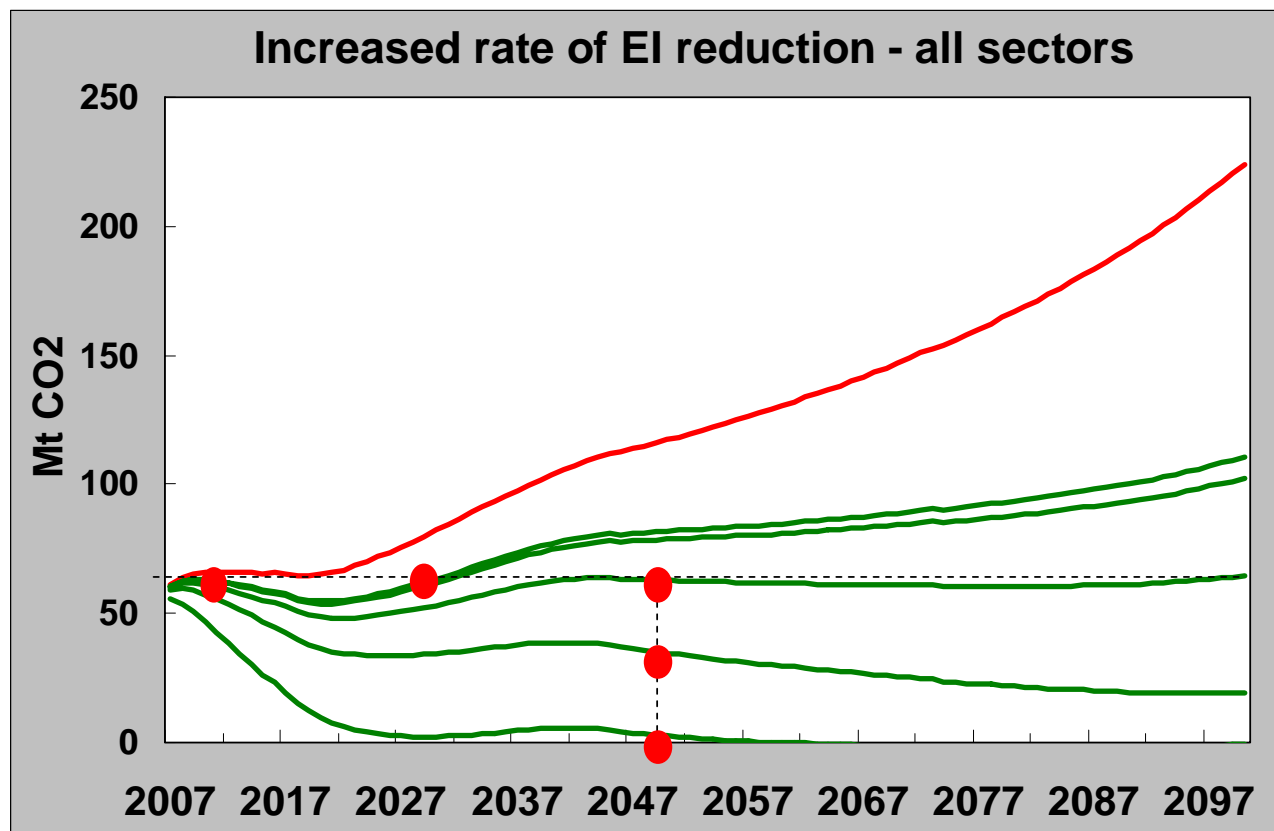
2012: 1.5% pa

2030: 1.6% pa

2050: 2.1% pa

50% 2050 3.4% pa

0 in 2050 7.5% pa



# 1b. Reduce EI: higher constant EIRR

All except agriculture achieve EIRR increase

Required EIRR to achieve each target (past/now = 0.75%pa):

Green = possible

Red = very challenging

1990 levels by:

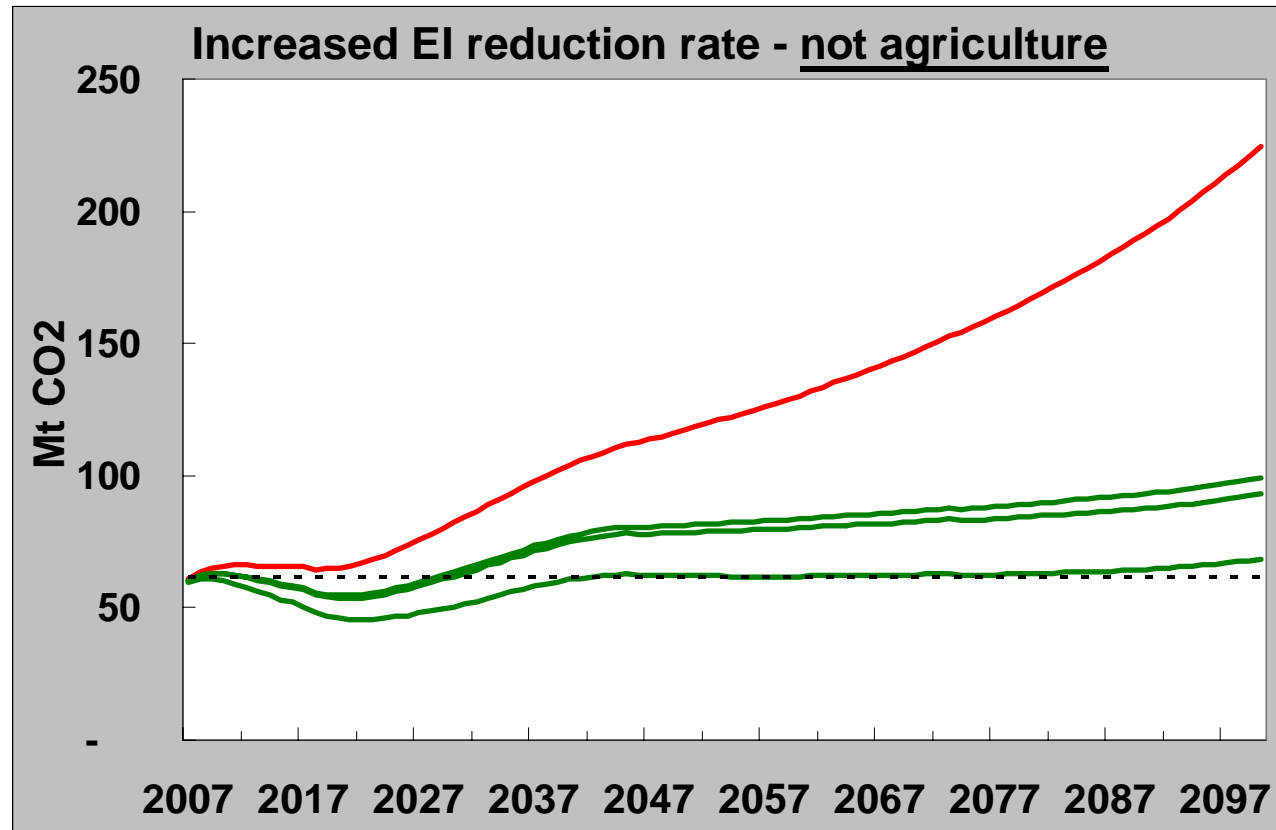
2012: 2.4% pa

2030: 2.6% pa

2050: 4.3% pa

50% 2050 Unachievable

0 in 2050 Unachievable



# 1c. Reduce EI: gradually increase EIRR

All sectors achieve ongoing EIRR increase

Required continuing annual EIRR improvement to achieve each target:  
(starting at 0.75%pa average)

Green = possible

Red = very challenging

1990 levels by:

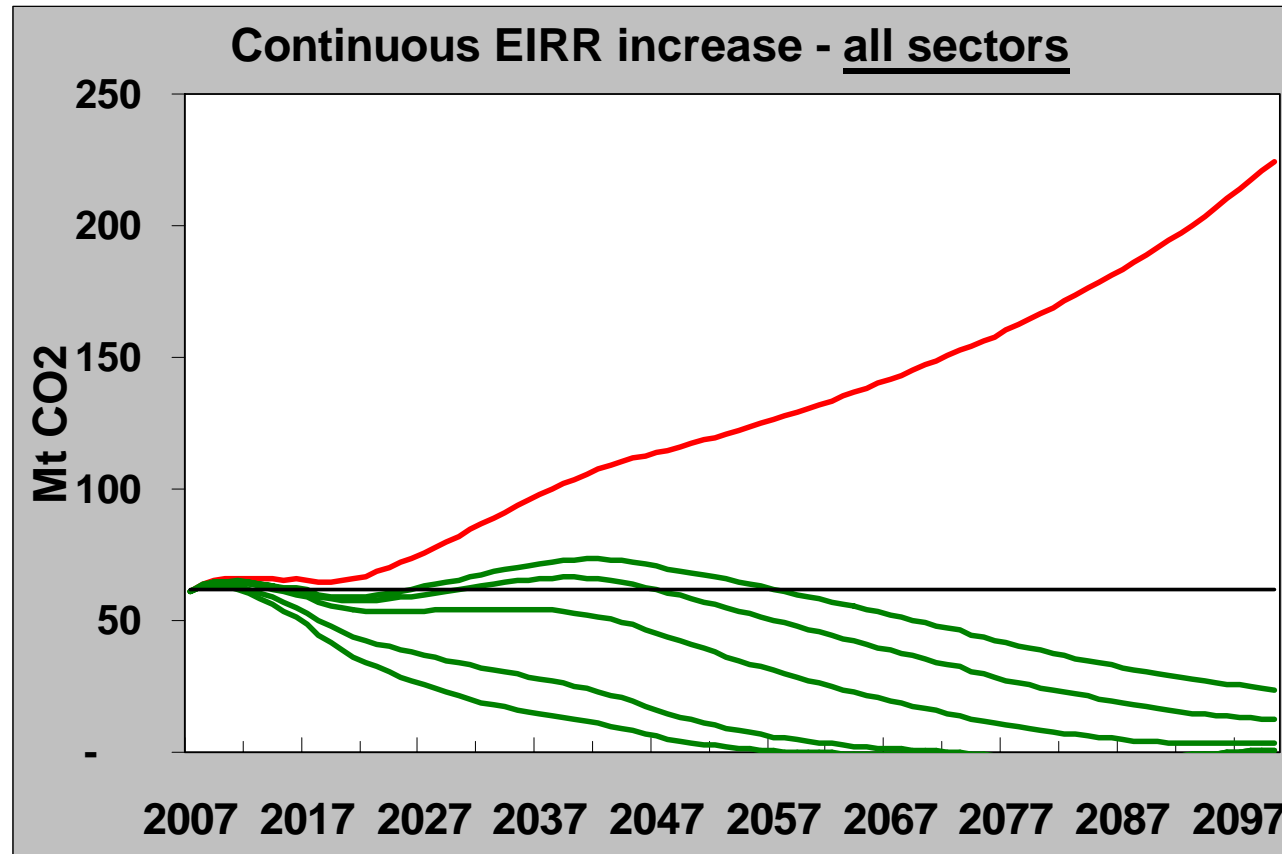
2012: +0.2%pa

2030: +0.07%pa

2050: +0.05%pa

50% 2050 +0.1%pa

0 in 2050 +0.31%pa



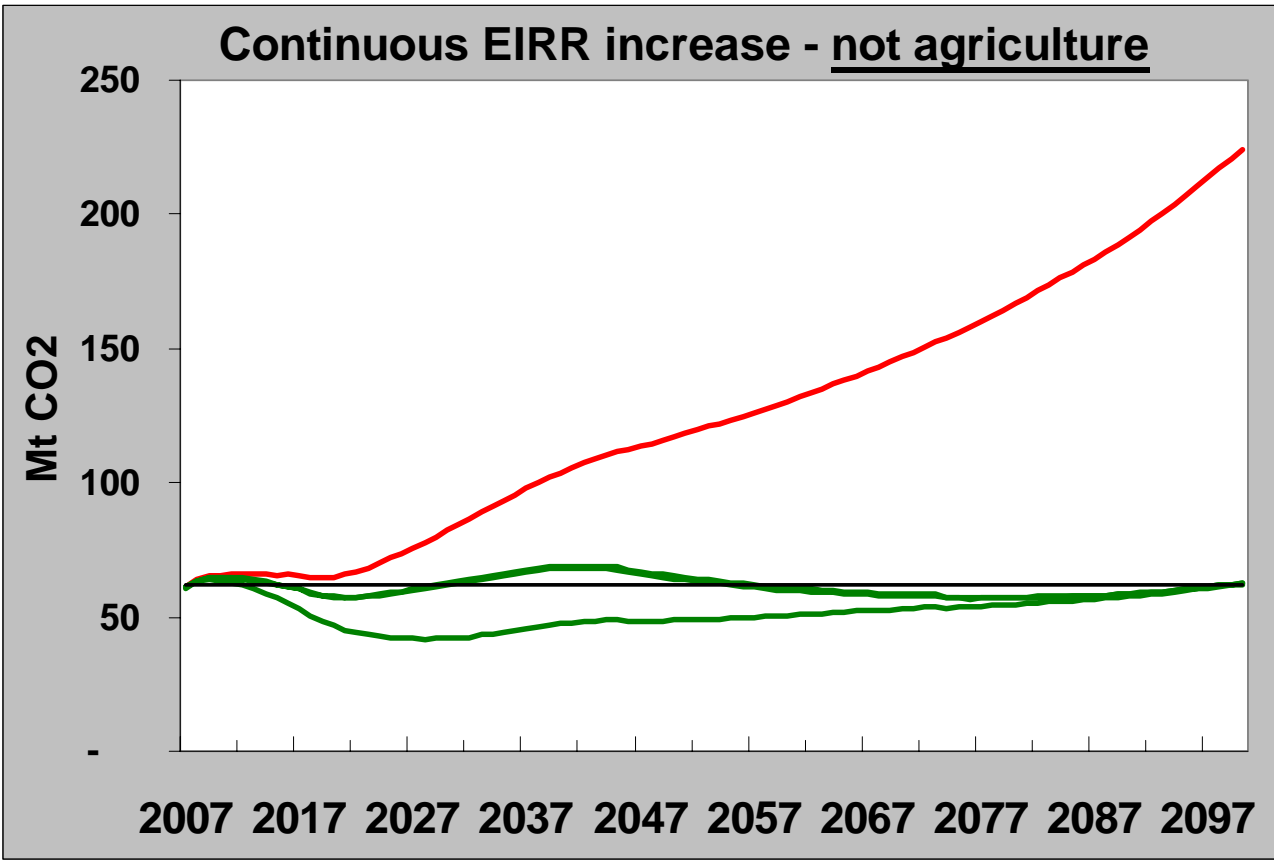
# 1d. Reduce EI: gradually increase EIRR

All sectors except agriculture achieve ongoing increase

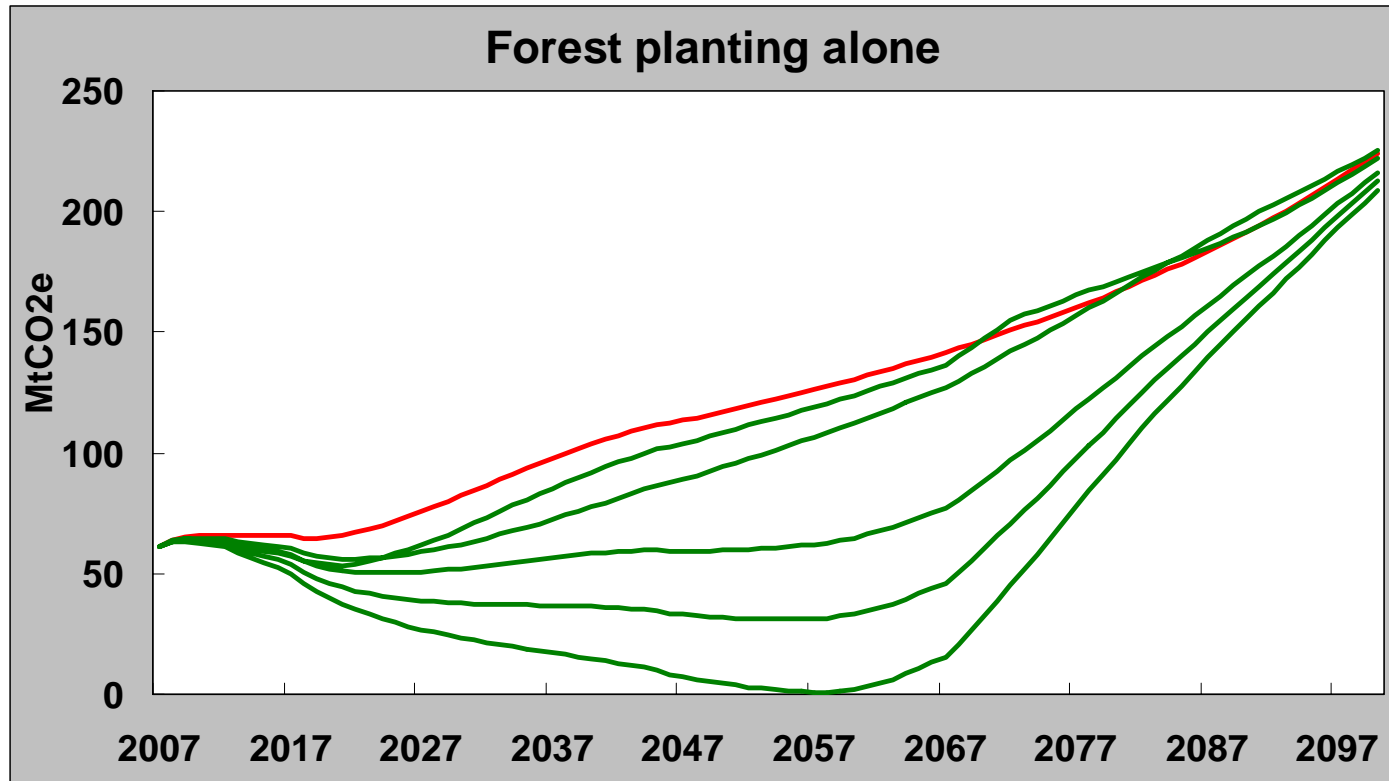
Required continuing annual EIRR improvement to achieve each target:  
(starting at 0.75%pa average)

**Green = possible**  
**Red = very challenging**

- 1990 levels by:
- 2012: **+0.5%pa**
- 2030: **+0.14%pa**
- 2050: **+0.14%pa**
  
- 50% 2050 **Unachievable**
- 0 in 2050 **Unachievable**



## 2. Sequestration: forest planting alone



<b>1990 levels by 2012:</b>	<b>92,000 ha pa</b>
<b>1990 levels by 2030:</b>	<b>39,000 ha pa</b>
<b>1990 levels by 2050:</b>	<b>57,000 ha pa</b>
<b>50% reduction by 2050:</b>	<b>85,000 ha pa</b>
<b>0 in 2050:</b>	<b>112,000 ha pa</b>

### 3a. Combined initiatives:

Reduce EIRR (sector-specific) and plant forests

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Process heat EIRR 0.75% pa → 1% pa

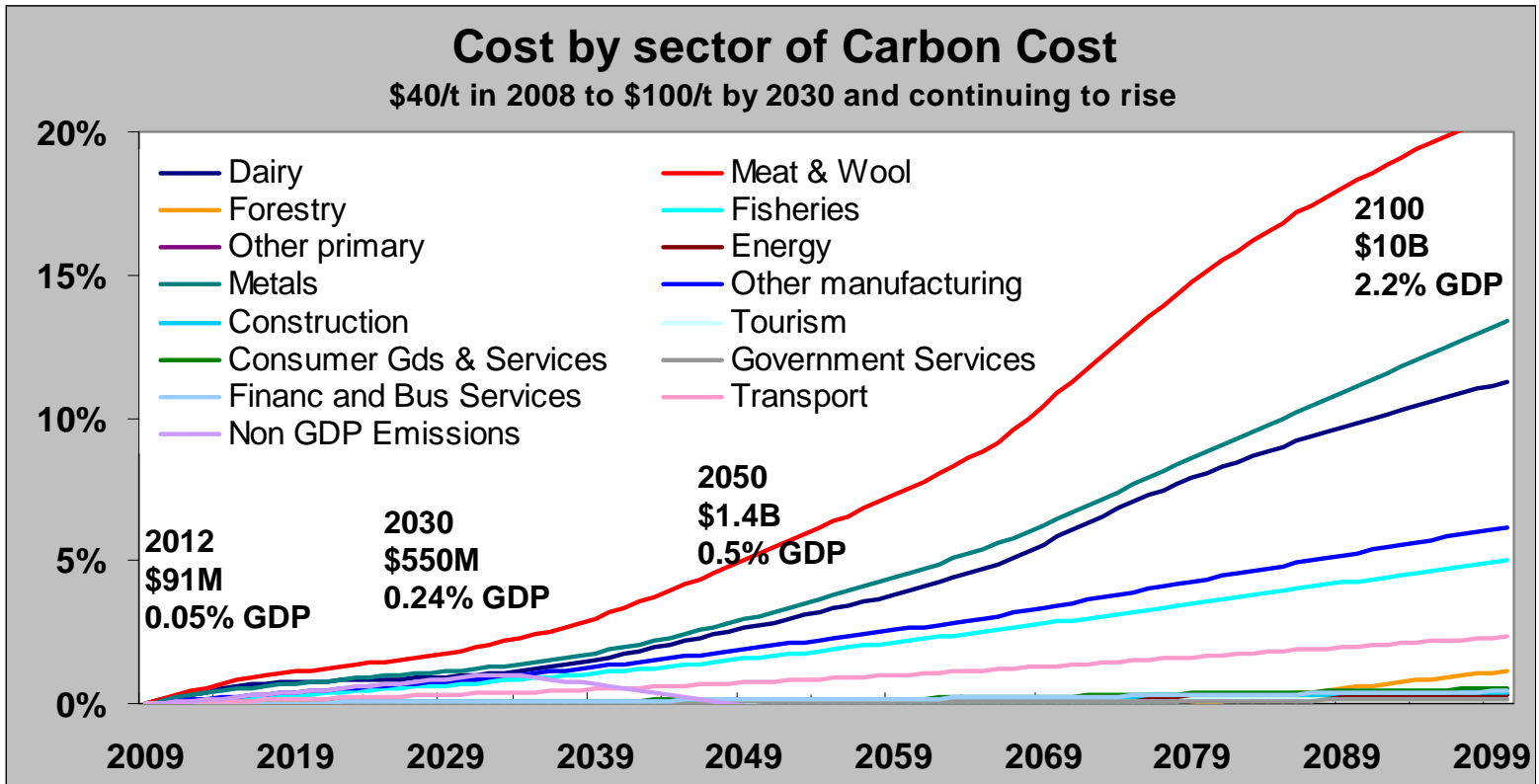
Transport EIRR 0% pa → 1% pa, km/\$ -1.5% → 0% pa

Electricity 80% 'carbon neutral' by 2030

Planting required for	1990 levels by 2012	curr/new = 363,000 ha
	1990 levels by 2030	37,000 ha pa
	1990 levels by 2050	23,000 ha pa
	50% reduction by 2050	51,000 ha pa
	0 in 2050	78,000 ha pa

# 3b. Combined initiatives - maintain 2007 emissions: Reduce EIRR, plant forests, then buy international credits

Process heat	EIRR	0.75% → 1.0%
Electricity	EIRR	0.75% → 0.8% (+80% carbon neutral by 2030)
Transport	EIRR	0% pa → 0.75% pa, km/\$ -1.5% → -1% pa
Forestry planting		10,000ha per year
Additional credits		Purchased at international price (lowest end of range)



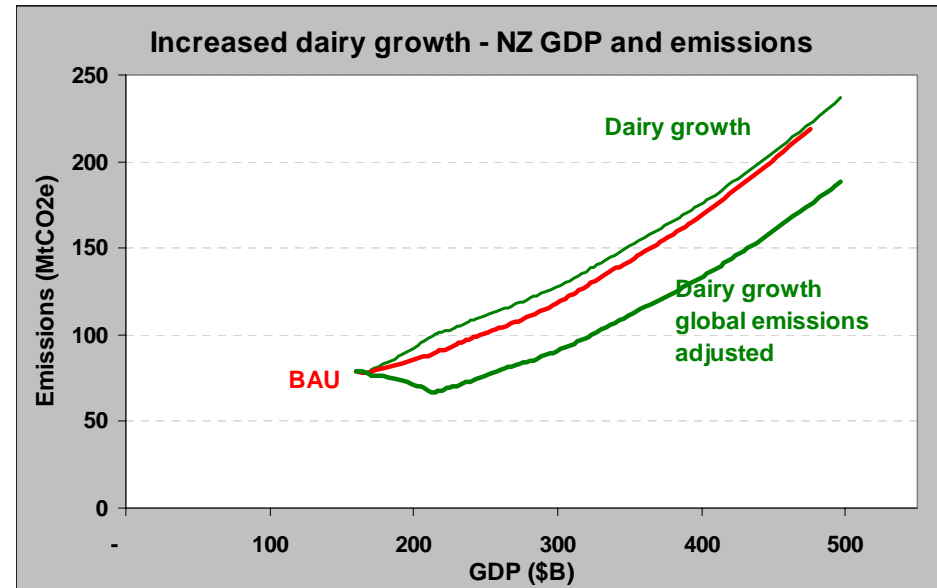
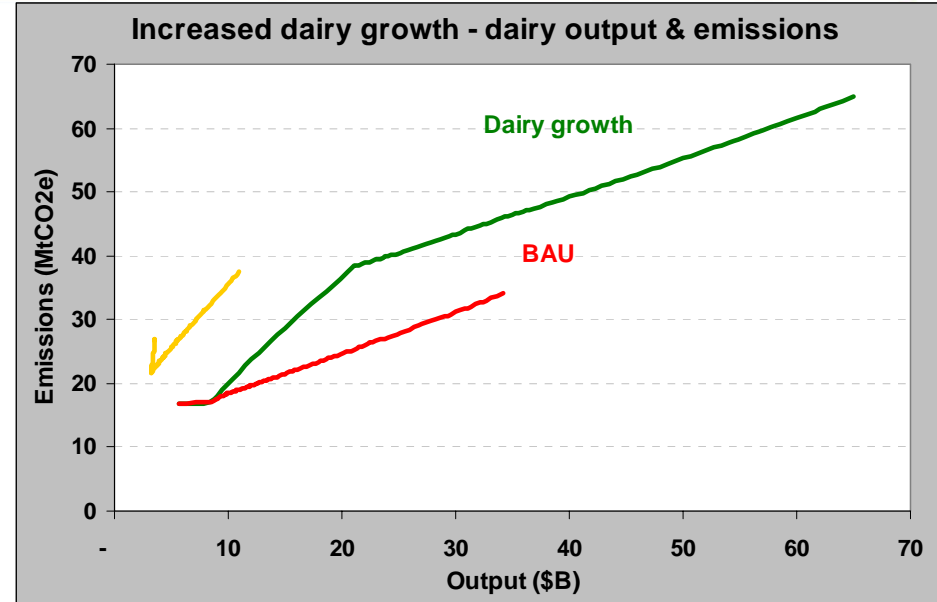
# 4a. Increased dairy growth

Grass fed cows have 40% lower emissions than grain-fed cows

- NZ GDP increases
- NZ emissions increase

but

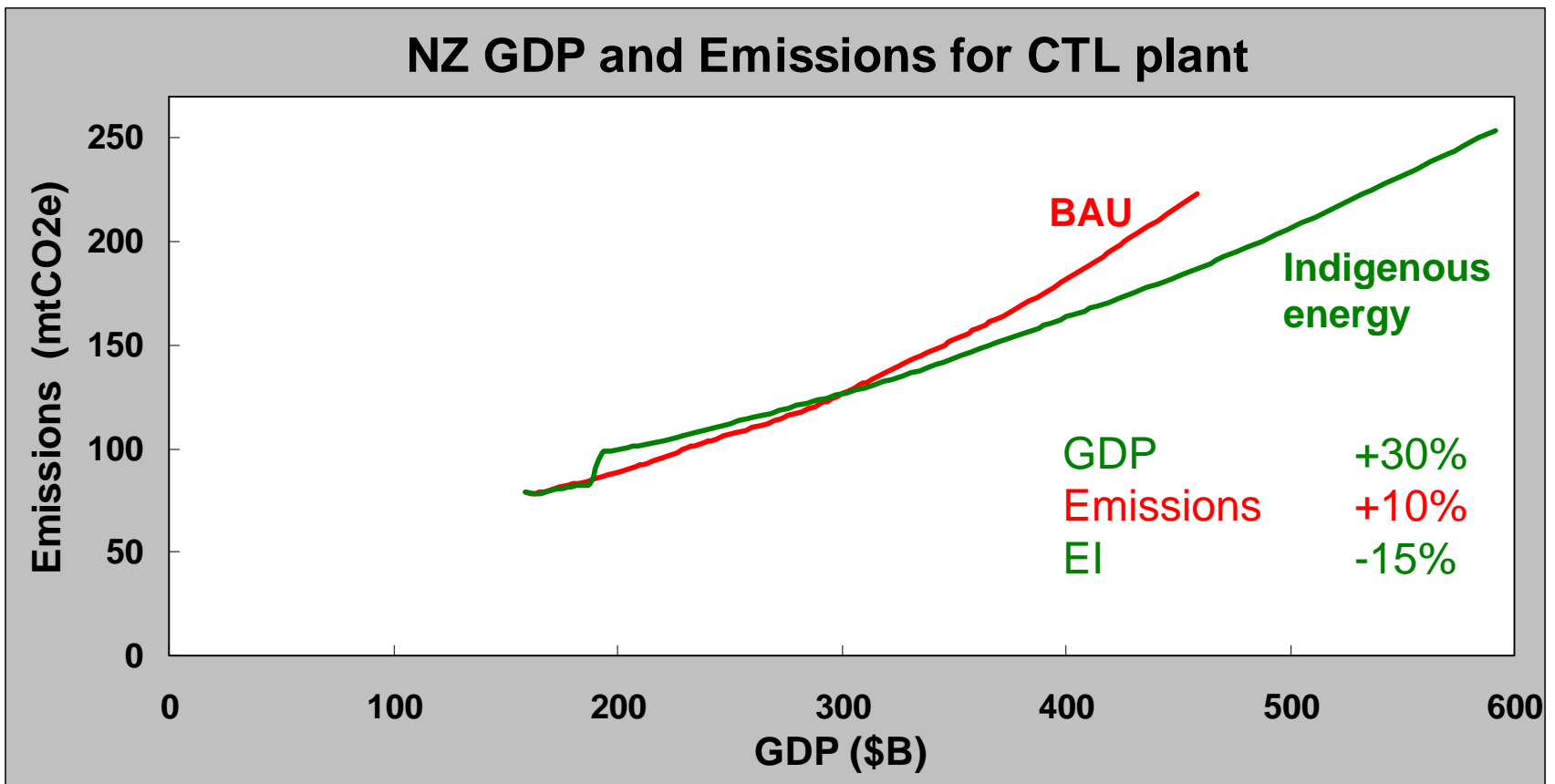
- Global emissions reduce faster



## 4b. Indigenous energy security

What if we used NZ lignites to produce/displace imported fuel?

- Global fuel/energy costs rise, NZ exporter costs remain constant
  - International export commodity prices rise, NZ exporters benefit
  - NZ emissions increase, global emissions reduce
- ➔ GDP rises much faster than emissions even without sequestration



# NZ does have unique opportunities to pursue integrated economic / environmental strategies

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**Objectives - accelerated GDP growth, primary processing, emissions reduction**

- Increase security of supply
  - Ensure the competitiveness of NZ's economy and the availability of affordable energy
- 3. Promote environmental sustainability and combat climate change**

**Our best abatement opportunities are medium-long term, but are probably not influenced much by carbon pricing – focused regulation will be more effective**

**Absolute emissions targets may be difficult – but also probably not optimal**

- Emissions intensity targets and strategies – by sector - are a very good route for NZ
- Carbon capture and storage can play a key role in the right locations and sectors
- In the medium term CCS by forest planting is a major opportunity for NZ

**NZ's natural & increasing competitive advantages in a resource constrained world will our accelerate BAU growth – GDP, but also emissions**

- But key parts of NZ's emissions growth can reduce global emissions