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Adventures in Risk
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Institute of Actuaries of Australia

Climate Economics

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Overview

- The journey from Gore to Stern
- What do the numbers mean?
- Where to now – an insurance perspective
- Emissions trading – a reality check

The journey from Gore to Stern

Late 2006 tipping point:
climate change reached the forefront of public, economic and political concern

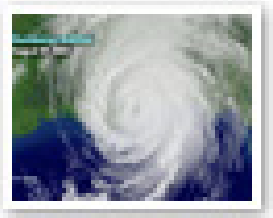
Al Gore's popularly accessible message: An Inconvenient Truth, 2006

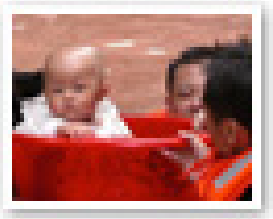
"If the vast majority of the world's scientists are right, we have just ten years to avert a major catastrophe."

Source:
An Inconvenient Truth website

Gore: global warming is real, happening, and caused by human activities

- "The number of Category 4 & 5 hurricanes has almost doubled in the last 30 years"
- "At least 279 species of plants and animals are already responding to global warming, moving closer to the poles"
- "The flow of ice from Greenland glaciers has more than doubled over the past decade"



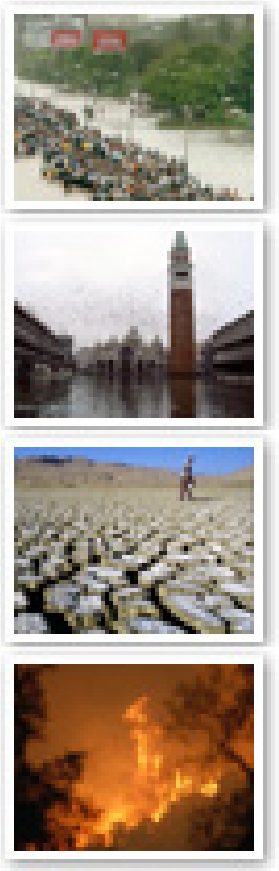


Source: An Inconvenient Truth website

Gore: If the warming continues, we can expect …

- "Deaths from global warming will double in just 25 years"
- "Global sea levels could rise by more than 20 feet with the loss of shelf ice in Greenland and Antarctica, devastating coastal areas worldwide"
- "Heat waves will be more frequent and more intense"
- "Droughts and wildfires will occur more often"

Source: An Inconvenient Truth website



Stern Review on the Economics of Climate Change, 2006

"Climate change presents a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen. The economic analysis must therefore be global, deal with long time horizons, have the economics of risk and uncertainty at centre stage, and examine the possibility of major, non-marginal change."

Sir Nicholas Stern,UK Treasury, October 2006

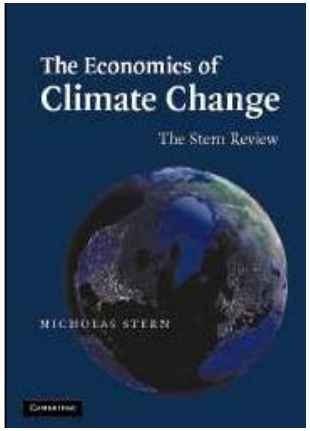
Stern: numerous challenges to analyse economic impacts of action vs inaction

- Risks of outcomes much worse than expected (emissions, temperatures, physical effects) are uncertain but real
- How to allow for 'non-market' impacts, eg direct impacts on the environment and human health? What about 'socially contingent' impacts eg social and political instability?
- What weights should economic modelling place on the richer and poorer regions of the world?
- Estimating the costs of low-emission technologies as they develop over the next several decades?
- Estimating how fossil fuel prices will evolve into the future?

Climate modelling: what discount rate should apply?

- How should economic models like Stern's treat costs & benefits several decades into the future?
  - Should any inherent pure time discount apply? Is it ethically appropriate to apply different value weightings to people in different generations?
  - Future conditions are uncertain: should a risk premium be included?
  - Consumption levels, if they continue to grow, will be higher – implying a lower marginal utility of additional consumption. Should a higher discount rate apply?
- Stern: "If you care little for the future, you will not wish to take action on climate change"

Stern's key economic message



- Climate change under "Business As Usual" is estimated to cost a global average reduction of at least 5% in per-capita consumption, now and forever
  - 11% if you factor in non-market impacts
  - 14% if you also factor in suspected risks around positive feedbacks in the climate system
  - 20% if you also give stronger relative weight to the burden on the world's poor
- In contrast, costs of action can be limited to around 1% of global GDP each year.

Additional considerations

- The **social cost** of GHG emissions comprises both private costs and, importantly, external costs
- We are developing a good understanding of the costs of policies to reduce GHG emissions, and the sectors most likely to be impacted. But what about the costs of adapting to the warming that's already locked in?
  - Need research to identify and prioritise vulnerable sectors & areas, and analysis to assess different adaptation options
- Note scope for biofuel production to compete with food production for land & water resources: what impact will this have on our region and on world agricultural markets?

What do the numbers mean?

Risk management for the planet

Likelihood of events – how they are treated?

An Insurance company is required by Australian Prudential Regulation Authority (APRA) to hold sufficient capital to cover a catastrophic event with a probability of **1 in 200 ie 0.5% probability**

Compare to IPCC scientists' likelihood scale

IPCC likelihood terminology	**Likelihood of the occurrence/ outcome**
Virtually certain	**> 99%**
Very likely	**> 90%**
Likely	**> 66%**
About as likely as not	**33 to 66%**
Unlikely	**< 33%**
Very unlikely	**< 10%**
Exceptionally unlikely	**< 1%**

Very likely that extreme heat, longer heat waves, and heavy precipitation events will continue to become more frequent

Very likely thermohaline circulation will slow down during 21st C however **very unlikely** that it will undergo a large abrupt disruption

Loss of grounded ice leading to substantial sea level rise **very unlikely** during 21st C (excludes West Antarctic ice sheet stability possibilities)

Likelihood an insurance company's capital must be sufficient to cover

Key areas of risk exposure for businesses & policymakers

- **Physical risks:** how will the physical impacts of climate change (eg severe weather events, coastal erosion, reduced security of water supply) affect the lifespan and functionality of assets & infrastructure?
- **Policy:** what will be the social and financial impacts as governments introduce carbon pricing and other regulatory responses to climate change?
- **Reputation:** how will climate change impact on demand for goods & services as consumer preferences change? (eg travel preferences of European market)
- **Technology:** will CCS and other emerging technologies achieve the reliability, technical capacity, social acceptability, regulatory approval, cost effectiveness and market penetration required to deliver the hoped-for emissions reductions within the necessary time frame?

"Insuring the planet" – Goldman Sachs

Source: Goldman Sachs Global Economics Weekly 07/27 "Insuring the Planet"

- **What does it mean to pay Stern's 1% of global GDP to prevent a far-off and unpredictable hazard? Do we have experience of dealing with these sort of events?**
  - **Parallels to climate "insurance"**: Risks for which world already takes out "insurance" include areas like Y2K tech spending, planning for pandemics, natural disasters, national security and anti-terrorism measures.
- These risks are less dire than the worst climate change projections – but they are still serious threats with the **potential to reduce global output by 1 – 3%** or more.
- The costs of "insurance" against these risks are generally in line with what Stern proposes to combat global warming.

Solving problems through insurance framework

- The Y2K problem never materialised - but it did have helpful & unexpected productivity growth consequences with many reviewing and overhauling entire IT systems (aggregate US spending $100bn or 1.1% of US GDP)
- World Bank and US govt study estimates that $40bn in mitigation and prevention spending could have reduced global economic losses from natural disasters in the 1990s by some $280bn. Examples of 'insurance' spending include Thames Flood Barrier, Dutch flood protection and tsunami warning system

Climate insurance is more problematic for two reasons:

1.Time frame. Traditional insurance covers issues that could occur any time. Although impact of climate change are felt today the worst effects are unlikely to occur for several decades, particularly in developed world

2.Political angle. Conventional insurance is largely an individual decision. This requires decisions and sacrifices at national & international level

World Bank advises way to address these problems is to take '**no regrets**' measures. These emphasise dealing with risk hazards that yield current benefits

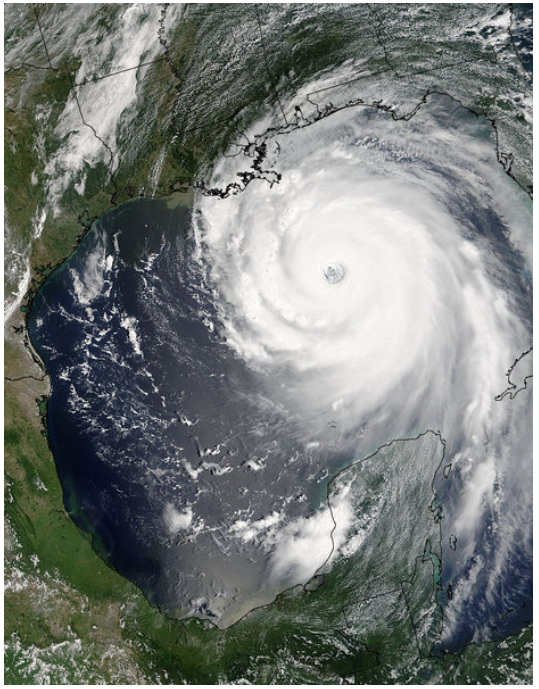
Consider the cost of inaction: Hurricane Katrina

Was size of risk known before?

- 2001: US Federal Emergency Management Agency listed a major hurricane hitting New Orleans as one of the three most serious threats to the nation.
- Estimated cost of improving levees to reduce threat US$1b over 20 years – Katrina cost US$125bn (insured loss $45bn)

Widespread impacts

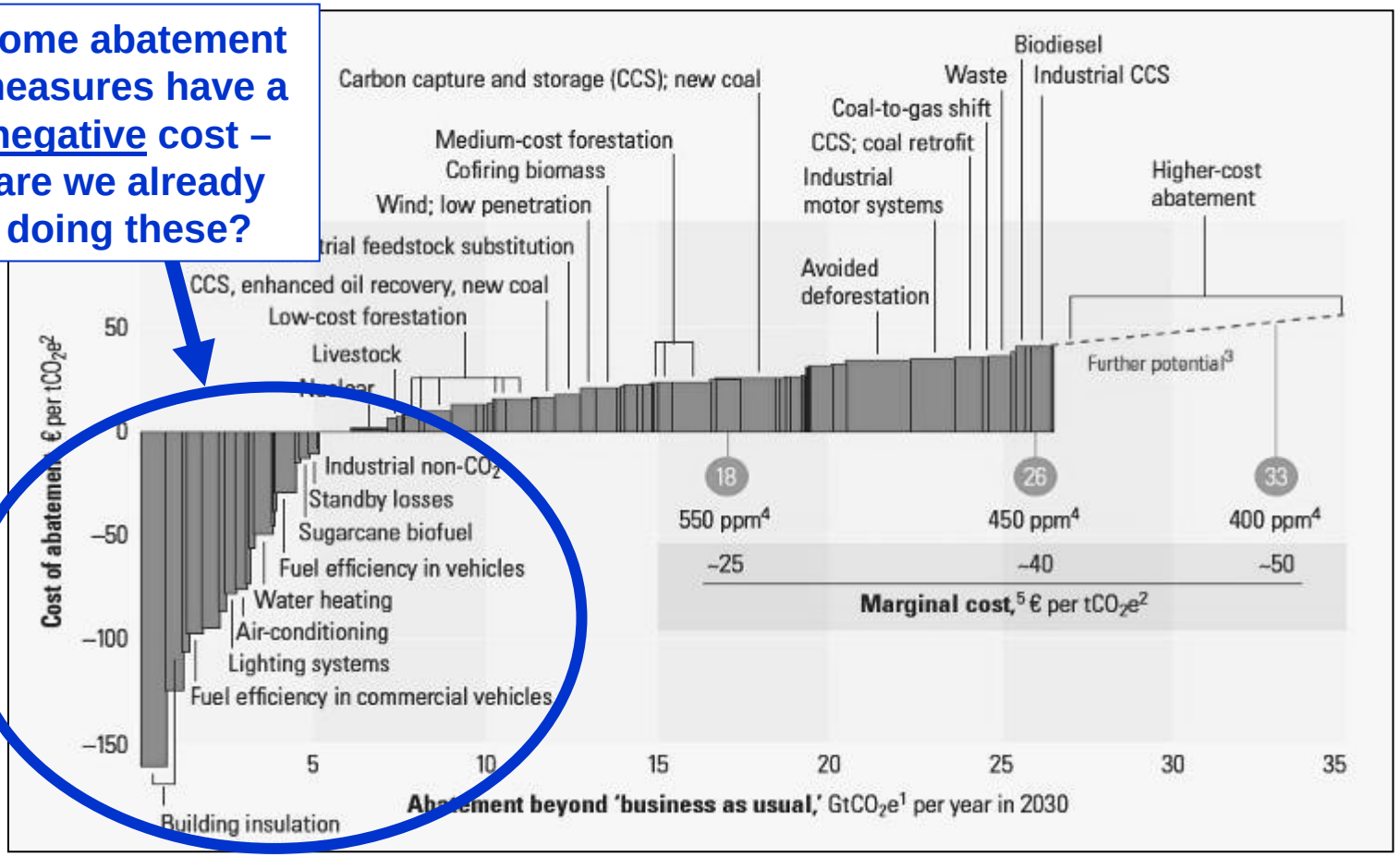
- Floods - 80% of New Orleans city flooded
- Deaths - 1,200 people killed by storm
- Social - widespread crime and tens of thousands homeless
- Oil - International oil prices UK +3% & wholesale +5% (6/9/05)
- Taxes - Mississippi lost US$640k each day casinos closed
- Jobs - Approximately 600,000 jobs in New Orleans
- Reinsurance - Global reinsurance prices increase



Hurricane Katrina
Source: NASA

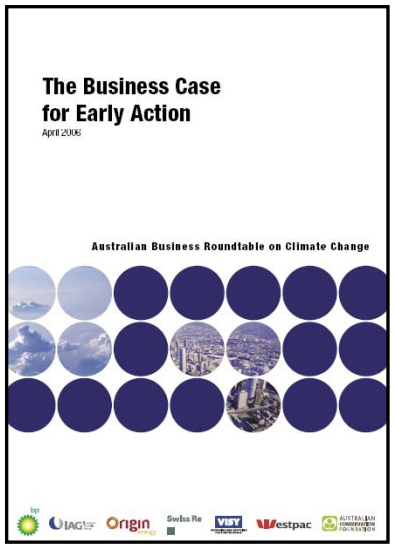
'No regrets' measures: climate policy may spur market efficiencies

Some abatement measures have a <u>negative</u> cost – are we already doing these?



Source: A Cost Curve for Greenhouse Gas Reduction, McKinsey Quarterly 2007 No 1

Australian Business Roundtable on Climate Change



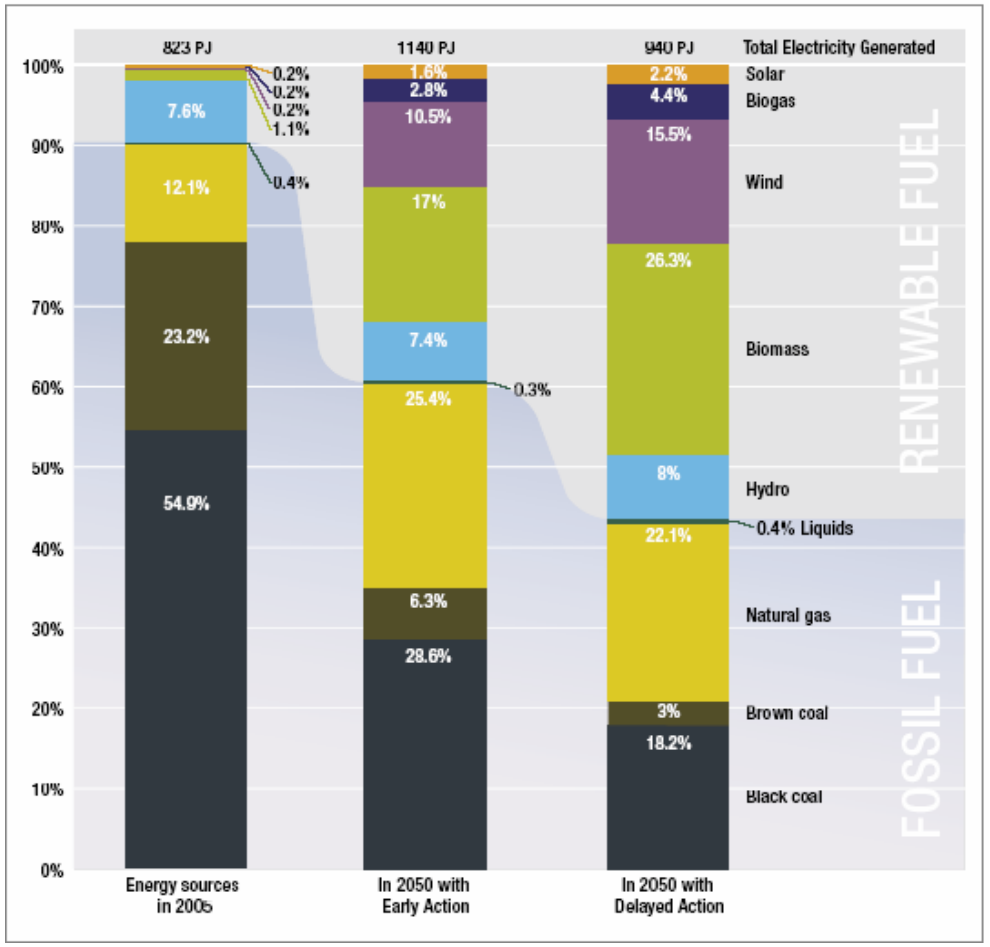
Key findings of the report:

- Possible to achieve 60% reduction in GHGs while maintaining strong economic growth.
- Delaying action to 2022 will result in lower real GDP growth by an average of 0.2% p.a. through to 2050, compared to early action.
- Delaying action will result in disruptive shocks being concentrated over a shorter period.
- An additional 3.5 million jobs will be created over the period 2013-2050 under an early action scenario.

Recommendations

- Carbon price signal & Emissions Trading scheme
- Encourage innovation & investment in emerging and breakthrough technologies
- Build national resilience to the impacts of climate change

Roundtable: Projected Composition of Electricity Generation 2005 - 2050



Where to now: an insurance perspective

Climate change presents risks for insurers…

Physical & regulatory risks

- Building resilience
- Emergency services adequacy
- Higher underwriting and risk assessment costs

Changing claims patterns

- Weather events: scope for both higher frequency/lower impact **and** lower frequency/higher impact events
- Increased damage and capital requirements, especially if multiple events arise simultaneously
- Additional remediation costs to settle claims on buildings & infrastructure

Investment perspective

- Carbon impact on value of shares held

Reputation

- “Bearers of bad news”
- Withdrawal of insurers from Florida

Climate change also presents opportunities

Changing customer needs

- New risk transfer products & lines; new asset classes
- Review D&O and PI lines for changing liabilities

Managing risks

- Advocacy for prevention measures e.g. building standards, planning, engineering works
- Working with clients to reduce their risk
- Claim time: an opportunity to enhance resilience

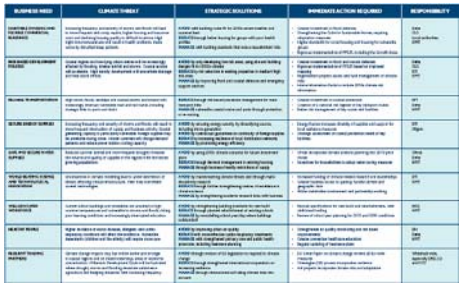
Operational

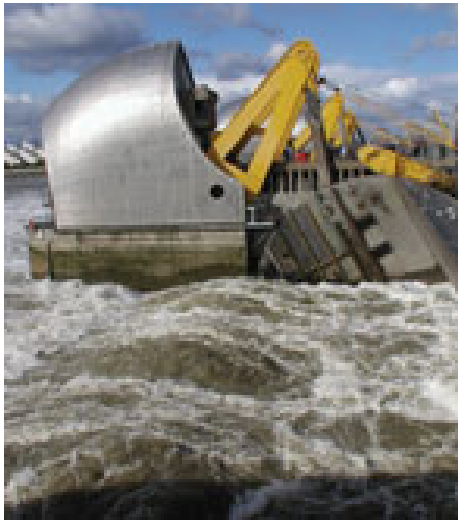
- Consistent contracts; transparency
- Understand & reduce our own environmental footprint & operating costs

Reputation

- Improved customer relationship: education, meeting needs & expectations
- Consistency between operating standards and public statements

Association of British Insurers climate change adaptation manifesto

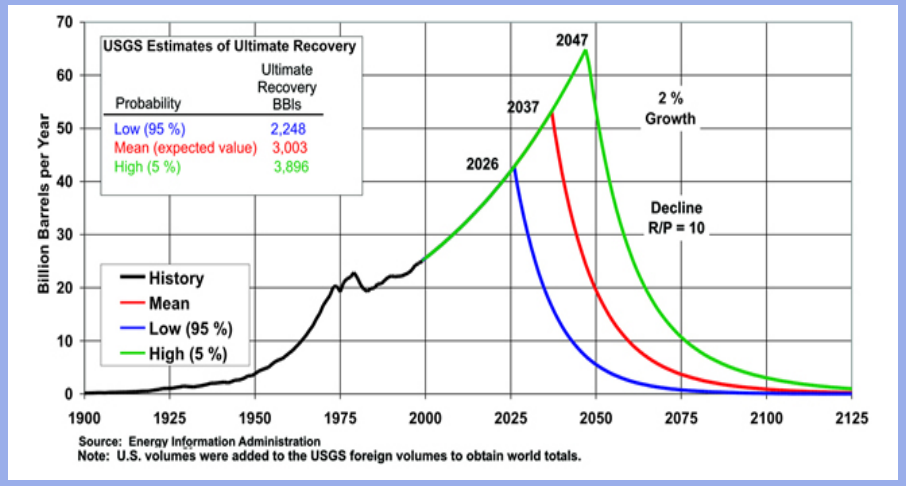




- Identifies key threats, eg maintaining habitable housing, reliable transport, safe water supplies
- Sets out strategic solutions, govt dept responsibilities, and immediate action needed to manage threats
- Outlines measures that need to be in place by 2011 for Britain to be prepared for climate change, including more spending on flood defences.

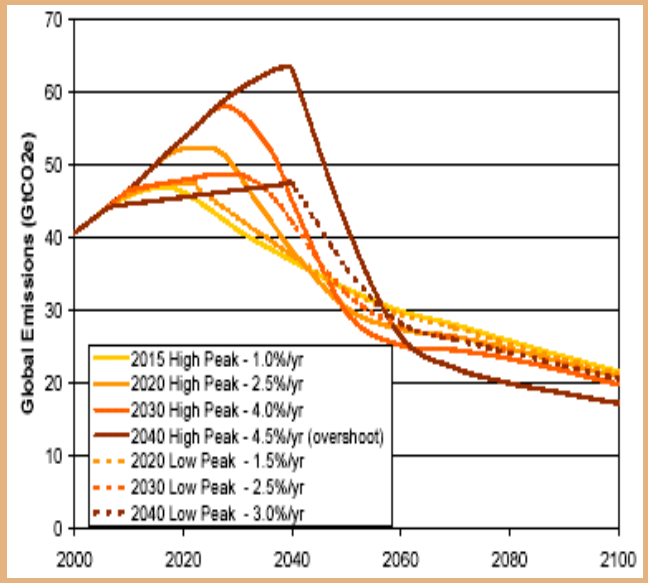
Looking wider: parallel emerging risks of energy security & climate change

Long-Term World Oil Supply Scenarios 2004: peak oil scenarios (Energy Information Administration)



- Oil production peak sometime between now-2040
- Timing is uncertain; Merrill Lynch estimates around 2015
- 80–95% of all transport currently fuelled by oil products
- Supply constraints will increase oil prices

Illustrative peak GHG scenarios (Stern Review)



- Emissions peak 2020-2040
- Loss of oil may complement GHG reduction efforts – but how will our region adapt?

Emissions trading – a reality check

We need multiple tools for transition to a low-carbon economy

- Fossil fuels are likely to remain the cheapest source of abundant energy for many years – even with significant investment to bring alternative technologies to large-scale commercialisation
- Without intervention, GHG stock could treble over next 100 years, giving at least a 50% risk of exceeding 5°C global average temperature increase (Stern)
- Government & stakeholders need to define and implement a combination of tools to lower emissions:
  - Subsidies, eg to promote R&D and investment in low emission energy
  - Regulatory frameworks, eg to mandate efficiency standards
  - Harnessing market forces, eg through emissions trading, to encourage least-cost abatement

Carbon trading - a $15 trillion market?

- In the next 43 years we need to prevent 600 billion tonnes of CO_2 globally that would otherwise accumulate in the atmosphere in order to stabilise atmospheric concentrations at or below 500 parts per million.
- Using a low average abatement cost of $25 a tonne therefore creates a capital market opportunity of **$15 trillion**.
- This would be the largest global financial market opportunity in history.

What proportion of this market will our region seize?

Source: Carbon Shift

- **In 2006, the carbon market grew to nearly US$30 billion, three times greater than the previous year**

Source: The World Bank and International Emissions Trading Association, State and Trends of the Carbon Market 2007, May 2007

Aust/NZ cooperation on emissions trading schemes

"It has been agreed to establish a working group of officials from the two countries to ensure that **as each of us moves towards the development of an emissions trading system in our two countries we achieve as much compatibility** and harmonisation and acceptance of common standards as might be possible."

Australian Prime Minister John Howard, June 2007

"We have agreed that **we should work hard on seeing if we can get the schemes we're designing to be compatible schemes**. … at this stage of design of systems we should certainly be closely comparing notes on verification systems, on forms of measurement and so on."

New Zealand Prime Minister Helen Clark, June 2007

ETS policy snapshot: Australian States vs Federal Government proposals

Australian states proposal	PM's proposal
Targets	
Up to 15% reduction by 2030 and 60% by 2050, both relative to 2000 levels. Targets set by science then cost	No targets nominated until 2008. Targets set by cost, rather than science or avoidance of dangerous climate change
Timeframes	
Scheme announced 2007 Legislation passed 2008 Scheme to commence 2010	Scheme announced 2007 Legislation passed 2009 Scheme to commence 2012
Sectors included	
Electricity to start with; Currently considering expansion to other sectors	Maximum 'practical' coverage of emissions except agriculture and land use

Crucial decisions on targets and compensation will be made in 2008, impacting Australian company values

ETS policy snapshot: New Zealand government

- Liability for Kyoto emissions commences January 2008
- Emissions trading now preferred over previous carbon tax proposal
- April 2007: cross-departmental Treasury-based GHG Emissions Trading Group began investigating how ETS could work in NZ
- As at mid-August 2007, Cabinet decision expected over next 1-2 months about proceeding further with ETS design
- Many issues are under consideration, including:
  - Coverage
  - Phased approach
  - Allocation of permits
  - Linking

Conclusion

- The scientific, economic and risk-management case for early action to address climate change is compelling
- Insurance & investment industry faces risks & opportunities in its response to climate change
- The detailed rules of the Emissions Trading Schemes will affect corporate values and scheme effectiveness
- What role will actuaries take?

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