AUSTRALIAN CONSERVATION FOUNDATION

POLICY BRIEF 2.1

September 2008

Cut carbon pollution – set effective targets

To play our part in the global effort to keep global warming as far below 2°C as possible, the Australian Government must make the following commitments.

1) Australia must commit to a 2020 target to reduce carbon pollution by at least 30 per cent.
2) Australia must commit to increase the 2020 target to reduce carbon pollution by at least 40 per cent, if other developed countries do the same.
3) Over and above this, Australia must commit to funding carbon pollution reductions in developing countries. This would include funding to reduce emissions from deforestation.
4) Australia must work towards becoming carbon neutral before 2050.

Climate change is already affecting Australia's economy, society and environment. To avoid the worst impacts of climate change, Australia must legislate the above carbon pollution reduction caps, and encourage other countries to do the same.

The government-commissioned Garnaut report argues convincingly that it is firmly in Australia's national interest to act strongly and to lead for an effective global agreement.

> ***"Australia's interest lies in the world adopting a strong and effective position on climate change mitigation. This interest is driven by two realities of Australia's position relative to other developed countries: our exceptional sensitivity to climate change: and our exceptional opportunity to do well in a world of effective global mitigation."*** [1]

The most effective way for Australia to encourage other countries to reduce their greenhouse gas emissions is for us to lead by example and reduce our own emissions. The two key tests for our targets, or the emission caps, to be set for the Australian Carbon Pollution Reduction Scheme are:

1. **environmentally effective** – guided by the most recent science so as to avoid costly impacts;

2. **internationally credible** – given that Australia, along with other developed countries, have created more than 75 per cent of global carbon pollution to date and continue to create much higher carbon pollution, per person, than in developing countries.

[1] [1] Garnaut Climate Change Review (2008) 'Interim Report to the Commonwealth State and Territory Governments of Australia; Executive Summary' page 2

Credible Australian targets will need to be consistent with the following global objectives:

1. Avoiding the worst impacts of climate change
A global agreement that keeps warming as far below 2°C as possible is in Australia's national interest. Beyond 2°C, climate impacts become severe and irreversible.[2]

2. Setting a global target
The Fourth Assessment Report of Intergovernmental Panel on Climate Change (IPCC) found that to limit warming to 2.0 – 2.4°C[3], global emissions need to peak by 2015 and fall to 50 – 85 percent below 2000 levels by 2050. Any credible global effort to keep warming below 2 degrees must require global emission reductions of at least 85 per cent below 2000 levels by 2050.

3. Setting a target for the group of developed countries
For countries to support a global agreement, it needs to be a fair agreement. Any country that fails to commit to its share of the global effort threatens the viability of a successful global deal.

The IPCC scenario that limits warming to 2.0 – 2.4°C requires developed countries as a group to reduce their emissions by 25 – 40 percent below 1990 levels by 2020 then 80 – 95 percent by 2050. In order to keep warming below 2.0°C, developed countries need to reduce emissions by at least 50% below 1990 levels by 2020, then achieving carbon neutrality before 2050.

4. Setting Australian targets with other developed countries
If the Australian Government proposes a range of 2020 targets that falls outside the IPCC 25-40 percent range, we won't have any credibility with the Australian public or with other countries negotiating through the UNFCCC.

To encourage other developed countries to do more as part of global agreement to keep warming below 2.0°C, Australia must commit unconditionally to a target of at least 30 percent by 2020, with the offer to increase this to at least 40 percent if other developed countries agree to do the same. Funding and assisting in reducing emissions from deforestation in developing countries is necessary, but needs to be above and beyond our domestic commitments. Australia then needs to achieve carbon neutrality before 2050.

Emissions targets in the context of emerging climate science
While these targets draw on the work of the IPCC fourth assessment report published using 2006 science, more recent climate science is suggesting that more may be required, leading the PEW centre to conclude that:

> *". . . risks from future climate change are likely greater than scientists have generally believed, and existing climate change projections might best be viewed as the minimum changes that humanity should expect."* [20]

The policy decisions being made now by the Australian government need to allow future governments to tighten our targets should the growing body of climate science require it, and the Australian public demand it.

---

[2] Preston, B.L. and Jones, R.N., 2006: Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions, CSIRO, Aspendale, accessed at http://www.businessroundtable.com.au/pdf/BRT-on-CC_Climate_Impacts-CSIRO.pdf, March 2007.

[3] All temperature increase in this document are increases above the pre-industrial average.

1. Avoiding the worst impacts of climate change

The climate is changing

The global scientific community has demonstrated that the climate is already changing as a result of human activity.[4] Greenhouse gas emissions from human activities has already resulted in warming of 0.74°C since 1906.[5]

The Intergovernmental Panel on Climate Change[6] (IPCC) has identified evidence of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global sea level. They also found long term changes in precipitation and extreme weather, including droughts, heat waves and the intensity of tropical cyclones.

CSIRO research shows since 1950, the average temperature in Australia has increased by 0.9 °C, primarily due to carbon pollution from human activities.[7] The impact of this pollution is also having an effect on rainfall, which has substantially declined across most of eastern and south-western Australia.

Even more alarming signs of climate impacts are emerging, including rapid melting of Arctic sea ice. Coverage of sea ice shrank by 22 per cent in the last two summers, far more than IPCC models predicted for that time frame.[8]

There is a time lag between the release of greenhouse gases and temperature increase. This means even if we completely stopped emitting greenhouse gases tomorrow a further warming of 0.6 °C will still take place.[9] This would take warming to around 1.4 °C above pre-industrial levels.

Recent research shows even with warming of 1–2°C, Australian ecosystems are likely to be severely degraded. Impacts include 58–81 per cent of the Great Barrier Reef being bleached every year.[10] Other studies predict many threatened species in Australia's World Heritage Listed Wet Tropics may be pushed to extinction as a result of climate change of just 1°C.[11]

Avoiding dangerous climate change

Australia committed to work with other governments to avoid dangerous levels of climate change when it signed the United Nations Framework Convention on Climate Change in 1992.[12]

---

[4] IPCC, 2007: Climate Change 2007: Synthesis Report, November 2007.
[5] IPCC, 2007: Climate Change 2007: Synthesis Report, November 2007.
[6] The Intergovernmental Panel on Climate Change, all reports are available at www.ipcc.ch
[7] CSIRO, 2007: Climate Change in Australia, Accessed May 2008 at www.climatechangeinaustralia.gov.au
[8] Lenton M. L., Held H. et al , 2008: Tipping elements in the Earth's climate system, PNAS, accessed March 2008 at http://www.pnas.org/cgi/content/abstract/105/6/1786
[9] IPCC 2007: Climate Change 2007: The Physical Science Basis: Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, March 2007.
[10] Preston, B.L. and Jones, R.N., 2006: Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions, CSIRO, Aspendale, accessed at http://www.businessroundtable.com.au/pdf/BRT-on-CC_Climate_Impacts-CSIRO.pdf, March 2007.
[11] Krockenberger, A. K, Kitching, R. L. and Turton, S. M., 2003: Environmental Crisis: Climate Change and Terrestrial Biodiversity in Queensland. Cooperative Research Centre for Tropical Rainforest Ecology and Management. Rainforest CRC, Cairns.
[12] UNFCCC, Article 2.

There is no 'safe' level of climate change. However the more rapidly we can reduce our carbon pollution, the lesser the impact.

The IPCC predicts that if we do nothing, global temperature will increase to around 4 °C by 2100.[13] In Australia, the CSIRO found if we fail to reign in emissions, temperatures could increase by up to 5 °C above current levels by 2070. [14]

The global impacts of an average temperature increase of just 2–3°C include:[15]

- Melting glaciers increasing risks of flood during wet seasons and reducing water availability on dry seasons for one-sixth of the world's population
- Increased worldwide deaths from malnutrition and heat stress
- Vector-borne diseases such as malaria and dengue fever becoming more widespread if effective control measures are not instituted
- Population displacement due to rising sea levels, heavier floods and more intense droughts
- Increased vulnerability of ecosystems, with as many as 15–40 per cent of species facing extinction
- The drying out of the Amazon rainforest, which some climate models suggest could lead to dieback of the forest with the highest biodiversity on earth.

For Australia, even a small sample of the predicted impacts[16] for warming of 2–3°C brings home the urgency of the situation:

- 97 per cent of the Great Barrier Reef bleached every year
- 40 per cent reduction in livestock carrying capacity of native pasture systems
- 5–10 per cent increase in tropical cyclone wind speeds
- 10 per cent increase in bushfire danger in many parts of the country.

Many of these impacts are irreversible and could not be adequately adapted to by human or ecological communities,[17] which is why the European Union sees keeping warming to 2°C as the climate change objective for governments around the world. Given the evidence that significant change occurs between 1-2C ACF advocates the need to go further, and to keep warming as far below 2C as possible.

Climate risks are underestimated

While climate science institutions such as the IPCC and CSIRO have identified many impacts of climate change, there are uncertainties that result in underestimation of climate risks. Tipping points are one aspect of climate science that tend to be excluded from assessments of climate risk.

Tipping points in the climate system

The term 'tipping point' commonly refers to a critical threshold at which a small change can affect the state of a whole system, resulting in a large change. In February 2008 the Proceedings of the

[13] IPCC, 2007: Climate Change 2007: Synthesis Report, November 2007.
[14] CSIRO, 2007: Climate Change in Australia, Accessed May 2008 at www.climatechangeinaustralia.gov.au
[15] IPCC 2007: Climate Change 2007: The Physical Science Basis: Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, March 2007.
[16] Preston, B.L. and Jones, R.N., 2006: Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions, CSIRO, Aspendale, accessed at http://www.businessroundtable.com.au/pdf/BRT-on-CC_Climate_Impacts-CSIRO.pdf, March 2007.
[17] The rate of climate change is also an important factor.

National Academy of the United States of America (PNAS) published an article[18] describing fifteen systems with tipping points. Some of these tipping points are:

Arctic sea ice loss
As sea ice melts, it exposes a much darker ocean surface which absorbs more radiation and amplifies warming. The report finds that a tipping point for summer ice loss may be very close, if it has not already passed.

Melting of the Greenland ice sheet
Warming at the periphery of this ice sheet lowers ice altitude, increasing surface temperature and causing a positive feedback loop. Existing ice sheet models are unable to explain the recent speed of changes in the ice sheet. Complete melting of this ice sheet would result in sea level rise of up to seven metres.

Instability of the west Antarctic ice sheet
Most of this ice sheet sits on land under the water line, so warming and rising waters can undercut the ice sheet and make it unstable. PNAS finds the tipping point for instability of this shelf could be reached this century.

New science is emerging

Recent work by NASA climate scientist James Hansen and others have included some of these tipping points in their climate modelling. Excluding most of these effects, the IPCC estimates climate sensitivity[19] at around 3°C.[20] Hansen finds when the surface albedo (or reflection) effects are included, equilibrium climate sensitivity is around 6°C.[21]

The Pew Centre on Global Climate Change has reviewed the latest climate science and concluded "existing climate change projections might best be viewed as the minimum changes that humanity should expect" (see Box 1).

While climate science has advanced dramatically, new climate change impacts continue to be discovered. These unknown climate impacts mean decisions should be made on the basis that the real risks will be significantly higher than the known risks, which are already very high. We don't know the full extent of climate impacts and risks and we must take a precautionary approach to setting targets.

[18] Lenton M. L., Held H. et al , 2008: Tipping elements in the Earth's climate system, PNAS, accessed March 2008 at http://www.pnas.org/cgi/content/abstract/105/6/1786
[19] Climate sensitivity is defined as the amount of warming that results from a doubling of greenhouse gas concentration in the atmosphere.
[20] Climate sensitivity is defined as the amount of average global warming that would result from a doubling in the concentration of carbon dioxide in the atmosphere.
[21] Hansen, Sato, Kharecha,et al. (2008), Target Atmospheric CO2: Where Should Humanity Aim? Columbia University Earth Institute, New York, USA. Accessed April 2008 at http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf

Box 1: The Pew Centre on Global Climate Change summary of new climate science:

"Recent observations indicate that climate models have underestimated ice loss from the Greenland and Antarctic ice sheets (Shepherd & Wingham, 2007), ice loss from mountain glaciers (Meier et al., 2007), the rate of global sea level rise (Rahmstorf et al., 2007), change in global precipitation (Wentz et al., 2007; Zhang et al., 2007), and response of northern forests to warming (Soja et al., 2007). All of these changes were predicted before they were detected, but they are occurring sooner or more rapidly than expected (Engelhaupt, 2007). Although there are probably multiple reasons for underestimating climate change and ecosystem responses to it, inadequately treated positive feedbacks (amplifying factors within the climate system itself) are probably involved (Pittock, 2006).

The unexpectedly rapid change in Arctic sea ice and other climate processes suggests that the climate reacts more strongly to a given amount of global warming than scientists have calculated. As a result, risks from future climate change are likely greater than scientists have generally believed, and existing climate change projections might best be viewed as the minimum changes that humanity should expect."[22]

2. Setting a global greenhouse gas reduction target

A global agreement is needed to avoid the worst impacts of climate change identified by the IPCC and the CSIRO, and reduce the risk of reaching climate tipping points. The Australian Government has highlighted that:

> *"In considering what constitutes dangerous anthropogenic interference with the climate system, Parties should agree on cooperative approaches that minimise the impacts of climate change at the lowest achievable stabilisation goal."*[23]

Greenhouse gas emissions are rising rapidly. The level of carbon dioxide in the atmosphere has risen from 280 parts per million (ppm) in preindustrial times to 379ppm in 2005.[24] When other greenhouse gases, such as methane and nitrous oxide, are included, the overall level is 455ppm of carbon dioxide equivalent (CO_2e). Current levels far exceed the natural range of greenhouse gases over the last 650,000 years.[25] Levels are rising at more than 2ppm a year and global emissions are still going up.[26] If we do nothing to put the brakes on, greenhouse gas levels could exceed 1000 ppm by the end of the century.[27]

In order for the level to fall, global emissions will need to fall well below the level of emissions in 1990. The IPCC found that to keep warming to between 2.0 and 2.4°C higher than pre-industrial levels global emissions will need to peak by 2015 and fall to 50–85 per cent below 2000 levels by

[22] Pew Centre on Global Climate Change, 2007: The science behind the shrinking ice caps, accessed May 2008 at: http://www.pewclimate.org/impacts/icecap
[23] Government of Australia, 2008: Views on the work programme for the Ad Hoc Working Group on Long Term Cooperative Action, in Views regarding the work programme of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention Submissions from Parties, Addendum FCCC/AWGLCA/2008/MISC.1/Add.2, UNFCCC, Bonn, Germany.
[24] IPCC, 2007: Climate Change 2007: Synthesis Report, November 2007.
[25] IPCC, 2007: Climate Change 2007: Synthesis Report, November 2007.
[26] Stern Review, 2006: The Economics of Climate Change, HM Treasury, London, accessed March 2007 at http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm.
[27] IPCC, 2007: Climate Change 2007: Synthesis Report, November 2007.

2050.[28] [29] However, as noted earlier, the latest science reveals impacts and risks that are not included in the 2007 IPCC analysis. The climate may be more sensitive to greenhouse gas emissions than the IPCC calculated,[30] tipping points could be reached more quickly and there remain unknown impacts.

To keep warming below 2 °C and avoid climate tipping points, we need to aim for global emissions reductions of more than 85 per cent below 2000 levels by 2050.

Sharing the task

In meeting the global target, different countries will have different responsibilities, because they have made different contributions to the problem. Developed countries have created more than 75 per cent of emissions to date and have much higher pollution per person than developing countries.[31] Countries with stronger economies are best placed to reduce emissions and are better able to adapt to climate change impacts.

Four major factors should be considered when calculating particular countries' individual targets:

1) **Contribution to the problem.** Developed countries have contributed more emissions over past decades, therefore using cumulative emissions is a more equitable measure than annual emissions.
2) **Emissions per person.** Using per capita emissions is fairer than national emissions, but it does not address all equity issues.
3) **Wealth**. Richer countries have the resources to make the biggest reductions. Some rapidly developing countries should adopt commitments consistent with their level of development, but the poorest developing countries cannot be expected to pay for adaptation to or mitigation of a problem they didn't create.
4) **Abatement costs.** Different countries have different opportunities to reduce emissions at different costs to their economies.

The political viability of an effective international agreement will need more than an equitable method for allocating national commitments. Issues such as adaptation funding and technology transfer will also need to be included in the UNFCCC negotiation of a post-2012 agreement.

Developing countries have made less contribution to the problem, have less wealth and typically have much lower emissions per person. In order to achieve global emissions reductions of at least 85 per cent by 2050 in an equitable way, developed countries must fund effective emissions reduction in developing countries. There are opportunities for Australia to take a leadership role in brokering an international agreement to achieve this.

[28] The relationship between CO2e levels and temperature rise is complex and there are uncertainties, so scientists have calculated a range of temperature increases for greenhouse gas levels.
[29] IPCC, 2007: Climate Change 2007: Synthesis Report, November 2007.
[30] Hansen, Sato, Kharecha,et al. 2008: Target Atmospheric CO2: Where Should Humanity Aim? Columbia University Earth Institute, New York, USA. Accessed April 2008 at http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf
[31] World Resources Institute, 2008: Climate Analysis Indicators Tool (CAIT) Version 5.0. Washington, D.C., USA.

3. Setting a developed country target

The IPCC Fourth Assessment Report assessed what contribution developed and developing countries should make towards the global effort, using the criteria above. It found that to keep warming between 2.0–2.4 °C, developed countries would need to reduce emissions by 25–40 per cent below 1990 levels by 2020 and 80–95 per cent by 2050.

As noted above, evidence released since the IPCC Fourth Assessment report has found the climate may be more sensitive to greenhouse gases than previously thought.[32] Also, greenhouse gas emissions are rising more rapidly than projected in worst case IPCC scenarios, implying developed countries will need to make a greater contribution to solving the problem.[33] Therefore the IPCC targets now appear too low.

If emerging climate science is taken into account, and the goal is keep warming below 2 °C rather than between 2.0 - 2.4 °C developed countries as a group should take on a reduction target in the order of at least 50 per cent below 1990 levels by 2020 and become carbon neutral well before 2050.

In order to achieve a developed country target of at least 50 per cent levels by 2020 initiatives will need to be funded in developing countries. This would include funding to reduce emissions from deforestation in developing countries.

4. Setting Australian targets

Australia's emissions reduction target will decide what role we will play in seeing developed country emissions reach the overall reduction target. The Garnaut Climate Change Review has identified Australia as potentially the biggest loser among developed countries from unmitigated climate change. As a country with so much to lose, we need to become a leader when it comes to deciding what national targets to set.

On a per person basis, Australia has made a major contribution to creating the climate change problem compared to both developing and other developed countries. We also have the national wealth and ability to achieve a strong reduction target. And we have many opportunities to reduce our pollution at a lower cost than other countries.[34] [35]

Commit to increasing this target with the involvement of other developed, wealthy countries

One way Australia can encourage a better global agreement is to commit to making more effort for mitigation if other developed countries do the same. This creates a reward for cooperation. The European Union has committed to a 2020 emission reduction target of 20 per cent below 1990 levels as a unilateral action and is prepared to increase this to 30 per cent with the involvement of

[32] Hansen, Sato, Kharecha,et al. 2008: Target Atmospheric CO2: Where Should Humanity Aim? Columbia University Earth Institute, New York, USA. Accessed August 2008 at http://arxiv.org/abs/0804.1126
[33] Garnaut, R., Howes, S., Jotzo, F. and Sheehan, P., 2008: Emissions in the Platinum Age: The implications of rapid development for climate change mitigation. Accessed May 2008 at: http://www.garnautreview.org.au/CA25734E0016A131/WebObj/OXREP_paper_2-05-08/$File/OXREP_paper_2-05-08.pdf
[34] The Climate Institute 2008: Submission to the Garnaut Climate Change Review. April 2008. Accessed May 2008 at: http://www.climateinstitute.org.au/index.php?option=com_content&task=view&id=173&Itemid=1
[35] McKinsey & Company 2008: An Australian Cost Curve for Greenhouse Gas Reduction. Accessed May 2008 at: http://www.mckinsey.com/clientservice/ccsi/pdf/Australian_Cost_Curve_for_GHG_Reduction.pdf

other developed countries. This target provides a benchmark but is too low to avoid the worst climate impacts.

Australia can leverage deeper commitments from other countries by committing to a 30 percent reduction by 2020 unconditionally, and offering to increase that to at least 40 percent if other developed countries do the same. In the longer term, Australia must work towards becoming carbon neutral before 2050.

Fund developing countries to reduce emissions

Australia and other developed countries can have a greater impact than their individual reduction targets by funding emission reductions in developing countries. This would include helping neighbouring countries, such as Papua New Guinea, to reduce emissions from deforestation. Global emissions from deforestation and forestry account for around 17 per cent of global emissions.[36]

Over and above our domestic emission reduction commitments, Australia must commit to funding emission reductions in developing countries from activities such as avoided deforestation

5. Affordable and achievable

While these targets appear challenging, the IPPC and the Stern Review both found the costs of reducing emissions are low. The 2.0 – 2.4 °C mitigation scenario assessed by the IPCC was found to cost the global economy less than 0.12 per cent per year.[37] Stern estimated the damage caused by climate change without action to reduce emissions could rise to 20 per cent.[38] In the light of more recent science, Sir Nicholas Stern has recently said his review underestimated the magnitude of avoided damages.[39]

A report by consultants McKinsey & Co found Australia could reduce emissions by 30 per cent by 2020 and it would cost Australian families less than $1 a day ($290 per household per year).[40]

To put this in some context, the 2002-03 drought cost Australia $10 billion.[41] The total cost of a 30 per cent cut in emissions by 2020 is less than a third of this at $2.9 billion. The report identified opportunities to reduce Australia's carbon pollution even further and found Australia could reduce its pollution at a lower cost than the global average.

These studies find that for the globe and the world, the costs of achieving reducing emissions can be achieved while maintaining strong economic growth. The Australian Business Roundtable on Climate Change[42] found the costs of taking early action would be lower than if we delay.

---

[36] IPCC, 2007: Climate Change 2007: Synthesis Report, November 2007.
[37] IPCC, 2007: Climate Change 2007: Synthesis Report, November 2007.
[38] Stern Review, 2006: Stern Review: The Economics of Climate Change, Accessed May 2007 at: http://www.hm-treasury.gov.uk/media/8AC/F7/Executive_Summary.pdf
[39] Stern, N. 2008: Economics of Climate Change, Richard T. Ely Lecture, New Orleans, January 4th. Accessed May 2008 at: http://www.occ.gov.uk/activities/stern_papers/Ely%20lecture%2020.12.2007%20no%20notes.pdf
[40] McKinsey & Company 2008: An Australian Cost Curve for Greenhouse Gas Reduction. Accessed May 2008 at: http://www.mckinsey.com/clientservice/ccsi/pdf/Australian_Cost_Curve_for_GHG_Reduction.pdf
[41] CSIRO, 2007: Climate Change in Australia, Accessed May 2008 at www.climatechangeinaustralia.gov.au
[42] The Australian Business Roundtable on Climate Change, 2006: The Business Case for Early Action, accessed at http://www.businessroundtable.com.au/html/documents.html, April 2007

Recent science, along with Stern,[43] shows the costs of inaction have been underestimated. Meanwhile the costs of reducing emissions tend to be overestimated, simply because we are unable to imagine the technological and societal changes that could unfold over the next 50 years.

A world of zero emissions vehicles seems as impossible today as a world dominated by fossil fuel powered vehicles must have seemed in 1900. Yet within a few decades the impossible became possible. Avoiding dangerous climate change is a challenge we can meet and one we can be proud to tell our grandchildren we had the courage to face.

For more information, please contact
Tony Mohr **Phone:** 02 8270 9908 **Mobile:** 0437 242 950 **Email:** t.mohr@acfonline.org.au

[43] Stern, N. 2008: Economics of Climate Change, Richard T. Ely Lecture, New Orleans, January 4th. Accessed May 2008 at: http://www.occ.gov.uk/activities/stern_papers/Ely%20lecture%2020.12.2007%20no%20notes.pdf