



IPCC chief warns: vast, rapid climate change: 50 million future refugees, famines from more weather catastrophes

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According to R. K. Pachauri, director general TERI (the Tata Energy Research Institute) and chair, IPCC (Intergovernmental Panel on Climate Change), speaking 1 February at the *Avoiding Dangerous Climate Change* conference in Sussex, UK, to a community of global

scientists – sea level rise and agricultural changes due to climate change may result in:

- 50 million environmental refugees by 2050;
- where total flood zone refugees in India alone could be anywhere between 20 million and 60 million, with 30 million taken here as a conservative working figure;
- 17 per cent of Bangladesh could be permanently lost to sea level rise coupled with land subsidence; while
- even with engineering works, an estimated 15 million would be displaced and Egypt would lose between 12-15pc of its arable land.

**Even after CO2 cuts:** He said the problem was – even after the world cut back its emissions spike, CO2 concentrations and sea levels would continue to rise long after the cuts. (see p. 5: "Millions at Risk: impact of floods, water shortages, and famine at various temps for parts per million (ppm) CO2e rises), and, "losses from catastrophic weather events" p. 6.)

**Reference:** R K Pachauri Director General TERI and Chairman, IPCC A Scientific Symposium on Stabilization of Greenhouse Gases - Exeter, UK, 1st February, 2005 <http://www.stabilisation2005.com/programme.html>

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## Round Up



CDM, JI, CER update 28 Jan - 2 Feb

**2 Feb: credits from wood rubbish:** TimberCAM, a carbon accounting model, found it was possible to earn greenhouse credits from wood products dumped in landfill.

**2 Feb: proposed CDM project:** The "Graneros Plant Fuel Switching Project" was up for review. It is under consideration for review because three requests for review have been received from members of the Board. The consideration of a review will be included in the proposed agenda of the 18th meeting of the Executive Board (to be held in Bonn, Germany, 23 to 25 February 2005. Information on this request for review and related documents are available on the UNFCCC CDM web site <http://cdm.unfccc.int/Projects/review.html>

**1 Feb: life hard for high-cost small-scale CDM projects:** CDM Executive Board (EB) members say so-called unilateral projects are not in the spirit of the CDM. The non-Annex I-based NGO and project facilitator, SouthSouthNorth (SSN), thinks they are, and that making the participation of an Annex I party in a CDM project mandatory will make life hard for high-cost small-scale projects.

**1 Feb: CDM MoU for Brazil and Spain:** In connection with the Spanish Prime Minister's official visit to Brazil earlier this week, a memorandum of understanding (MoU) to co-operate on

the CDM was signed between the two countries.

**2 Feb: Indian CER group forms:** An Indian Carbon Market Group (InCMG) is to be launched shortly that aims at coordinating CER suppliers across India. InCMG would meet on 17 February with developers of all 54 projects approved by the Indian DNA.

**2 Feb: India calls for expanded CDM:** At the Delhi GHG Forum in New Delhi, an Indian DNA representative called for expansion of the Clean Development Mechanism (CDM) to cover entire sectors and policies.

**1 Feb:** The approved methodologies page for small-scale CDM project activities has been revised and updated and is now available under the following link of the UNFCCC CDM web site: <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved>.

**26 Jan: World Bank to buy JI and CDM credits:** Energi E2, Elsam and the Danish Ministries of Foreign Affairs and Environment has launched its long-planned carbon fund. The fund will be administered by the World Bank, and aims to purchase 5-6 million tonnes of CO2e (MtCO2e) through JI and CDM projects by 2012.

**26 Jan: CDM and JI valid says European Environment Agency:** The European Environment Agency (EEA) hit back at NGOs criticizing the use of credits from CDM and JI projects in the EU emissions trading scheme, arguing that the environmental gains from projects are the same as from domestic

reductions.

**18 Jan: South Africa prepares to sell CDMs:** South Africa has established its Designated National Authority (DNA), the entity needed to approve Clean Development Mechanism (CDM) projects in the country.

**18 Jan: World Bank may buy Nicaragua forest sink:** The World Bank's BioCarbon Fund is considering purchasing temporary Certified Emission Reductions (CERs) from a reforestation project in Nicaragua.

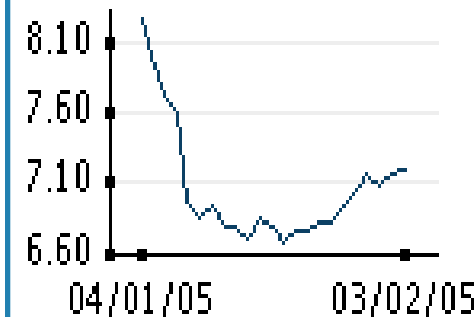
### CDM methodologies submissions:

- The ninth round of submissions for proposed new baseline and monitoring methodologies for CDM project activities is open until 14 February 2005.
- The third round of submissions for proposed new baseline and monitoring methodologies for afforestation and reforestation project activities is open until 17 February 2005. For more information please visit the UNFCCC CDM web site (<http://unfccc.int/cdm>)

**21 Jan: Japan to buy CDMs from China:** Large buyers of CDM credits - the Italian Government, the World Bank and a host of Japanese companies are gathering for a workshop on large-scale CDM projects to be held in Beijing next week.

EUROPE EU-ETS PRICE 28 Jan - 2 Feb

## EUA price last 30 days



**2 Feb: carbon prices find new range of 7.05-7.20:** European carbon prices for delivery for 2005 were slightly firmer on Wednesday, albeit on thin volume as an industry event in Norway took some players out of the market.

**2 Feb: NordPool all set to launch next week:** Oslo-based energy exchange NordPool today said it was ready to launch a forwards exchange for the European Union allowance market, once it has received clarification from the Norwegian Government on some legal issues, according to sources.

**2 Feb: 143 institutional investors prepare to buy:** The Carbon Disclosure Project (CDP), a secretariat for 143 institutional investors, announced it has requested information from 500 of the worlds largest companies regarding investment relevant information on their

greenhouse gas emissions, in a bid to facilitate investment in GHG reduction projects.

**1 Feb: EU ETS down 7 cents:**

European carbon prices weakened throughout the day on Tuesday with Point Carbons EU ETS volume-weighted assessment for 2005 dropping 7 cents over the course of the day.

**31 Jan: EU-ETS price up:** European carbon value continued Friday's upward price movement with a sizeable volume trading over the course of the day despite static fuel prices.

**26 Jan: wee rise in EU-ETS:** The sharp turn of weather felt across Europe has given support to fuel and power prices, while buoying European carbon values with carbon prices firming in early trade Thursday, on the back of healthy volumes, according to sources.

**26 Jan: EU-ETS climbing back towards E\$7.00:** European carbon prices for delivery in December 2005 moved north in early trading on Thursday with E\$7.00 on the back of healthy volume, traders said.

**26 Jan: carbon prices firm to over 7.05:** European carbon allowance prices firmed to over 7.00 in afternoon trading Friday on the back of healthy volume.

**26 Jan: EU-ETS price 6.80-6.84 for Dec 2005:** European carbon prices for delivery in December were static in trading Wednesday, with volume

changing hands in a narrow spread of 6.80-6.84.

**21 Jan: EU-ETS trades at 10 cent spread:** European Union allowances for delivery in 2005 traded across a 10 cent spread throughout the day on Friday and closed 6 cents up on Thursday's level at 6.76.

**21 Jan: EU CO2 price as temps fall:** After a mild start to the year, temperatures are expected to drop significantly across Europe over the next ten days. Combined with the recent fall in coal prices, this may trigger a rise in the CO2 price to the extent that the market responds to short-term changes in fundamentals

**21 Jan: EU-ETS price 6.75 1 December 2005:** European Union carbon allowance prices firmed 5 Euro cents in early morning trade Friday, taking the price up to 6.75 for allowances for delivery on 1 December 2005.

**18 Jan:** Carbon prices closed the day slightly firmer compared to Monday's levels with Point Carbon's Carbon Market Indicator rising 8.5 cents to 6.835 for 2005 delivery.

**EUROPE MECHANISMS AND MARKETS NEWS 28 Jan - 2 Feb**

**2 Feb:** German company 3C offered a portfolio of six German emission reduction projects for its German clients International.

**26 Jan: new forward contract on EUAs:** NordPool aimed to launch a

forward contract on EUAs on 7 February if all details fall into place.

**26 Jan: EkoFund trades bike paths in Poland:** EkoFund is ready to fund investments in Poland which will result in limiting greenhouse gas emissions in big cities. According to Maciej Nowicki, the president of EkoFund, projects targeted are bus innovations (i.e. changing the fuel source from diesel oil to gas), bike paths and car parks building.

**26 Jan: new spot market for European Union emission allowance:** The European Climate Exchange is to launch an electronically executed spot contract on the International Petroleum Exchange for the trading of European Union emission allowances (EUAs) for the first compliant period 2005-2007.

**EUROPE CORPORATE 28 Jan - 2 Feb**

**2 Feb:** Shell boss warned of global climate disaster if action not taken to reduce fossil fuel use, but insists it's up to governments to lead the way. The outgoing Shell chief took up a post with a climate change charity.

**1 Feb: German copper producer plans coal plant:** Electrabel Deutschland and German copper producer Norddeutsche Affinerie will build a coal-fired plant that will be up and running in 2010.

**2 Feb: ABN Amro hires emissions markets expert:** Dutch-based bank ABN Amro today announced the hiring

of an emissions markets expert as vice president Sustainable Development as a first step to launch new environmental financial products related to the EU Emissions Trading Scheme and the climate markets related to the Kyoto Protocol.

**26 Jan: firms to struggle to account for assets:** The EU's greenhouse gas trading scheme, launched earlier this month, could disrupt companies' annual financial reporting, according to the European federation of accountants (Fee). Participating firms "may face difficulties in measuring assets and liabilities and the effects on the profit and loss account", Fee said in a review of climate trading's likely impacts on accounting and auditing practices.

**EUROPE LAW POLICY AND REGULATION 28 Jan - 2 Feb**

**1 Feb: Spain's elec demand up 3.7pc in 2004:** Energy demand in Spain increased by 3.7 per cent in 2004 compared to the previous year, but if January is anything to go by, this year could be dramatically bigger with a 14 per cent increase in demand seen compared to January 2004.

**1 Feb: Portuguese companies apply for allowances:** Portuguese companies covered by the EU ETS will spend the next two weeks applying for emissions allowances from the government. The final installation-level allocation plan is expected to be ready in the third week of February.

**18 Jan: European Commission sues States for NAP failures:** In the European Commission's round of launching legal action against Member States, it was now Italy's turn. Rome's failure to transpose the emissions trading Directive into national law and submit a complete national allocation plan (NAP) has made the EC initiate infringement procedures.

**18 Jan: Germany's Economy Minister says ET trading unfair:** Germany's Economy Minister, Wolfgang Clement, has criticized the European Union's carbon emissions trading scheme, claiming that German utilities are at a disadvantage to their European peers in the first trading period.

**18 Jan: EU binding CO2 limits, new vehicles:** The European Parliament has added its voice to a growing chorus of demands for legislation to cut carbon dioxide emissions from new cars. A resolution adopted by MPs at their Strasbourg plenary session last week called on the European Commission "urgently to put forward proposals for binding CO2 limits for new vehicles".

**21 Jan: Spain allows more coal pollution:** The Spanish Government today gave in to pressure from two of its largest coal generators and increased its allocation of carbon emission allowances to coal-fired generation facilities by some 4.5 million tonnes, after first ordering coal plants to cut CO2e 21pc in 36 months.

**26 Jan: new records for France, Spain power demand:** Both France

and Spain recorded new records in power demand on Wednesday, as a cold spell hit Europe. The change in weather is influencing CO2 emissions across Europe.

**21 Jan: Italy plans nuclear:** Italian Premier, Silvio Berlusconi, has hinted that the government may reconsider its position on the utilization of nuclear power, according to Reuters reports.

**26 Jan: German offshore wind grows:** German Environment Minister foresaw a great future for the German offshore wind energy. He expects 45 billion to be invested in the sector by 2030.

**31 Jan: EU plans transport cap-and-trade:** The European Federation for Transport and Environment said in a recently released report that setting up a cap-and-trade scheme on CO2 emissions would be the most efficient way to reduce emissions from transport.

**31 Jan: EU allocations now balanced:** Although positions may vary significantly within sectors or Member States, the EU emissions trading market in total was more or less in balance before the Commission made its final decisions on the remaining allocation plans.

**31 Jan: Slovak nations have surplus to sell:** Amid loud protests from Slovak companies against the cuts in the Slovak NAP enforced by the European Commission in October, the country's Environment Minister said they would still have surplus allowances to sell to the market.

**31 Jan: big UK wave and tidal plans:** The UK's first large scale wave and tidal power generation farms could be feeding the national grid with power within three years, Energy Minister, Mike O'Brien, announced today in a press notice.

#### NORTH AMERICA LAW POLICY AND REGULATION 28 Jan - 2 Feb

**1 Feb: Canada - US\$2 billion in tax incentives and subsidies:** The Federal Government of Canada, finding itself stuck between the interests of industry and environmentalist, is planning to spend over CAD\$2.4 billion (US\$2 billion) in tax incentives and subsidies to meet its Kyoto target of 6 per cent below 1990 levels.

**31 Jan: Canada faces economic transformation:** Living up to Canada's commitment to Kyoto and at the same time ensuring continued growth - together with transition to a less emission-intensive economy - is the biggest single economic and political challenge for Canadian energy policy in the coming years, the IEA said in a report released today.

**26 Jan: Alberta, Canada, wants to trade:** Greg Melchin, Minister of Energy for the Province of Alberta, with three of the largest oil and gas reserves in the world, and one of the leading producers of greenhouse gases in Canada, feels left out of Ottawa's plans for Kyoto.

#### ASIA PACIFIC LAW, POLICY AND REGULATION 28 Jan - 2 Feb

**28 Jan: Japan to change transport rules:** Japan is to obligate

manufacturers that utilize the transport industry to formulate energy efficiency plans under a new law to be ratified in the current Japanese Parliamentary session, according to Yomiuri news service.

**2 Feb:** Japanese had a major problem with meeting their Kyoto target and had prepared a new fuel import tax at \$A30 per ton of carbon.

#### CLIMATE 28 Jan - 2 Feb

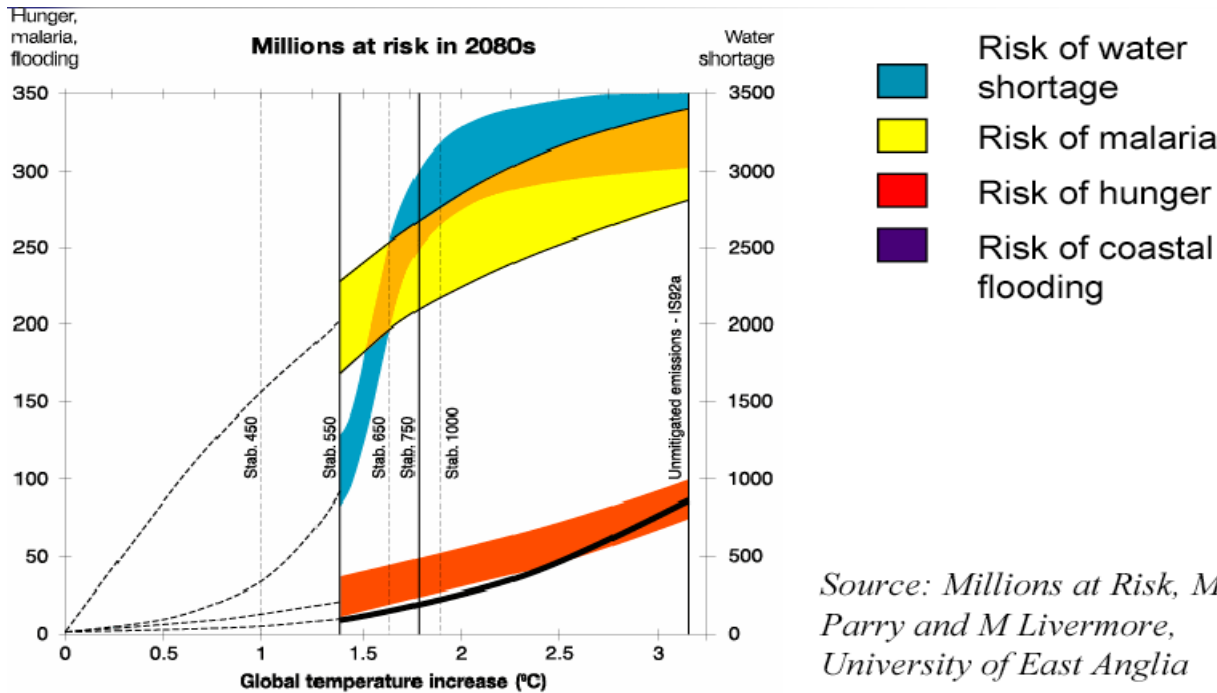
**2 Feb:** The IPCC chief warned of vast, rapid climate change: 50 million refugees, famines from weather catastrophes and see <http://www.stabilisation2005.com/programme.html>

**2 Feb:** Even after the world cuts back its emissions spike, CO2 concentrations and sea level would continue to rise long after the cuts; and rises in temperature do not start to decline until 2300, said the IPCC TAR and IPCC Syn report.

**2 Feb: NZ data supports CO2ppm rise:** Big annual increases in carbon dioxide levels were reported from Hawaii and also in NZ, where data showed 320 parts per million in 1973 to 374 ppm, 2004.

#### HYDROGEN ECONOMY 28 Jan - 2 Feb

**2 Feb:** The International Partnership for the Hydrogen Economy met four times in four countries in 2004. The International Partnership for the Hydrogen Economy, was an intergovernmental cooperation between Aus, US, EU and Japan.



Source: *Millions at Risk*, M L Parry and M Livermore, University of East Anglia

## Runaway carbon dynamics

R K Pachauri told delegates, “A breakdown of the thermohaline circulation and disintegration of the West Antarctic ice sheet, and a shift in mean climate towards an El Nino like state, may follow from runaway carbon dynamics – this would drive:

- reduced sink capacity...
- release of methane from hydrates; and
- carbon from permafrost, and a rearrangement of biome distribution.

“Such events can overwhelm our response strategies. Additional millions were at risk for increases in global temperature”, he said.

**What to do?:** Effective policies would:

- further sustainable development goals (economic, equity environmental) and
- maximize co-benefits of mitigation strategy;
- implement “no regret” options.

The key linkages between mitigation and development are many - macroeconomic impacts, employment creation, inflation”.

**Where do we go from here?** R.K. Pachauri said nations needed to;

- develop frameworks and boundaries for decision making; and
- answer the question ‘dangerous for whom? and then;

Cont. from p. 1

## Av temps could rise 11 degrees even if CO2e cut

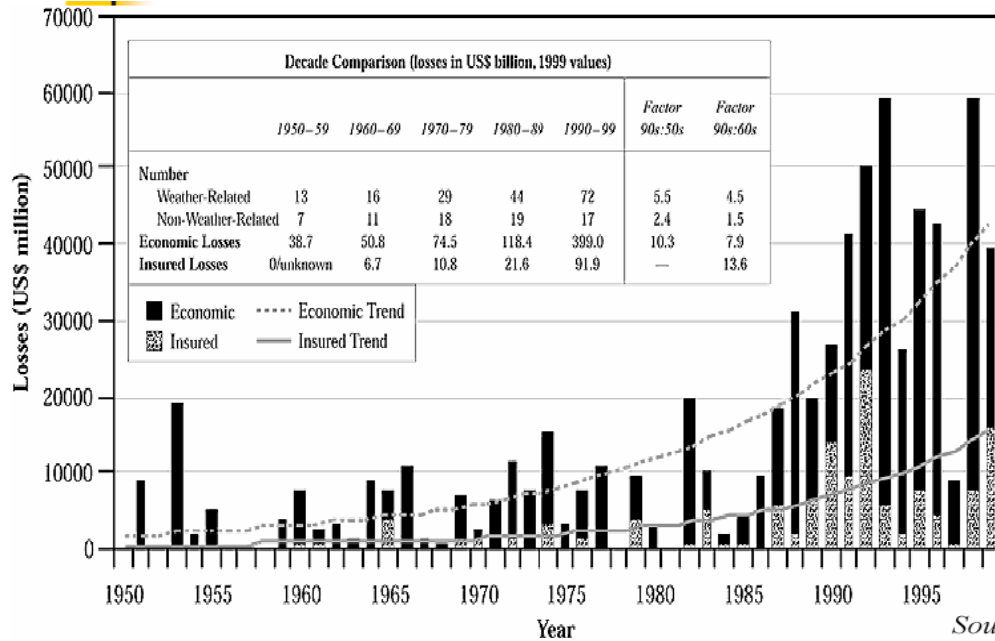
Another report, by British scientists, in the journal *Nature* showed that emissions of carbon dioxide (CO2) could have a more dramatic effect on climate than thought. They said the average temperature could rise 11 degrees even if atmospheric carbon dioxide were limited to the levels expected in 2050.

**Levels already dangerously high:** David Frame, who coordinated the climate prediction experiment, said: “If the real world response were anywhere near the upper end of our range, even today’s levels of greenhouse gases could already be dangerously high.”

**Emission limits hit oil firms:** Emission limits such as those in the Kyoto Protocol would hit oil firms because the bulk of greenhouse gases came from burning fossil fuel products.

# Trends in losses from catastrophic weather events

EWN Publishing



Most insured damages were in the north  
Most people were affected in the South

Source: IPCC TAR

**Trend of weather-extremes losses:** According to R K Pachauri Director General, TERI and Chairman, IPCC, 50 million people globally may be displaced due to climate change-induced famine, as the pattern shows

- disasters of hydro-meteorological origin had increased significantly; and
- an increase in precipitation in the mountains along with melting of glaciers had increased incidence of floods, mudslides and avalanches; and
- recurring incidence of floods and droughts was already apparent in temperate Asia.

**Three times faster:** Weather-related catastrophic events had risen three times faster than non-weather-related events, despite disaster planning.

**Multiple causes:** Part of this upward trend in weather-related losses over the past 50 years is linked to socio-economic factors (population growth, increased wealth, urbanization in vulnerable areas), and part is linked to regional climatic factors (eg., changes in precipitation, flooding events).

**Bangladesh and India at risk:** Large areas with high population densities were susceptible to floods, droughts and cyclones in Bangladesh and India. Vulnerability to extreme weather events were expected to increase in these areas. More extreme events would cause heavy losses of human life, property damage, and other environmental damages.

- define what is expected from science and lodge science rationally in the decision framework. "This would create value for value judgement," he said.

## Now up to the politicians

Conference chair, Dennis Tirpak, said on Wednesday 26 January the scientists from 30 nations meeting Tuesday, 1 February had aimed to define "dangerous levels of climate warming ... The purpose was to have a debate of the scientific facts. We will collect the best information we have to give to the politicians ... but don't expect to make any recommendations," he told reporters.

**Arctic Council study:** A separate eight-nation study by the Arctic Council last year warned:

- global warming was hitting the Arctic more than twice as fast as the rest of the planet;
- the North Pole could be ice-free by 2100; and
- the area in the Arctic covered by summer sea ice was decreasing by 9.2 per cent per decade. By 2026, the earth could be an average 2C warmer than it was in 1750.

**The state of the play today:** Preliminary indications suggest that some social and economic systems have been affected by recent increases in floods and droughts, with increases in economic losses for catastrophic weather events. Coral reef bleaching had shown an increased frequency in the 20th

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century, especially during El Nino events. The worldwide increase in coral bleaching in 1997-1998 was coincident with high water temperatures associated with El Nino.

**Icecover decreasing:** The frequency and severity of drought, had Increased summer drying and associated incidence of drought in a few areas. In parts of Asia and Africa, the frequency and intensity of droughts had been observed to increase in recent decades.

**Droughts increasing:** The duration of ice cover of rivers and lakes decreased by about 2 weeks over the 20th century in mid- and high latitudes of the Northern Hemisphere. Arctic sea-ice extent and thickness thinned by 40 per cent in recent decades in late summer to early autumn and decreased in extent by 10-15 per cent since the 1950s in spring and summer. Non- polar glaciers showed a widespread retreat during the 20th century.

**Reference:** R K Pachauri Director General TERI and Chairman, IPCC A Scientific Symposium on Stabilization of Greenhouse Gases - Exeter, UK 1st February, 2005 <http://www.stabilisation2005.com/programme.html>

## CO2 dumps planners propose they can sell 15 - 55pc of all world credits until 2100

**F**or the planned capture systems alone ( without storage need to earn 25 - 30 US\$/tCO<sub>2</sub>. The proponents argue under

different stabilization scenarios (between 450 and 750 ppmv CO<sub>2</sub>) and least cost deployment of mitigation options, their plan could contribute a cumulative amount of 220 - 2,200 GtCO<sub>2</sub> (60 - 600 tC) or 15 to 55 per cent to the total mitigation effort until 2100, averaged over a range of baseline scenarios. This determines the CCS economic potential for that particular scenario, which appears to be well within estimates for global CO<sub>2</sub> storage capacity in geological formations or oceans.

**Hydrogen economy connection:** An alternative way of avoiding emissions of CO<sub>2</sub> from these sources would be by use of energy carriers such as hydrogen or electricity produced in large fossil fuel based plants with CO<sub>2</sub> capture or by using renewable energy sources. In theory CO<sub>2</sub> could be captured from ambient air to offset emissions from distributed sources or to reduce the concentration of CO<sub>2</sub> in the atmosphere, if needed. However, the concentration of CO<sub>2</sub> in air is currently only 370 ppm, a factor 100 or more lower than in flue gas. This dilute concentration would make the separation of CO<sub>2</sub> from air by industrial processes a highly challenging engineering task which would be much more costly and energy intensive than capture from more concentrated sources given current technology concepts for the separation of CO<sub>2</sub> from air.

## IETA publishes Guidelines for the creation of a reference price index for EU emissions

**O**n January 12, 2005 The International Emissions Trading Association (IETA) published Guidelines for the creation of a reference price index for EU emissions allowance (EUA) Trading.

The Guidelines aim to:

- help build liquidity in the developing EUA market;
- enhance confidence in the reference price information available;
- standardise the new commodity; and
- create a reference price for use as a benchmark for OTC (Over The Counter) derivatives deals and for accounting purposes.

The Guidelines were developed during 2004 by IETA's *Price Index Working Group*, preceding the launch of the EU Emissions Trading Scheme on January 1, 2005.

The Working Group, which includes members from exchanges, market information providers, industrial companies, brokers, law firms, traders and merchant banks, recognised the pressing need for credible and reliable *Reference Price Indices*.

**Best practice benchmark:** The Guidelines developed by the Working Group offer a best

practice benchmark on how to collect, verify and report price information. The recommendations cover:

- Index composition;
- Calculation Methodology;
- The role of the Index Compiler; and
- The Publication and distribution of the index.

IETA encourages the use of the Guidelines by any party seeking to develop a Reference Price Index for the EUA market. The Guidelines have been specifically developed for the current stage of development of the EU emissions allowance markets and will be monitored by IETA and, following recommendations from the Price Index Working Group, will be updated from time-to-time to reflect market developments. "Financial trades are the next logical step for the EU Allowance market; these require a credible and reliable reference price index. The Guidelines developed by IETA will give a welcome boost to the establishment of indices and thus financial trades which will enhance the rapidly growing EU emissions market", says Louis Redshaw, Head of Environmental Markets at Barclays Capital.

[www.ieta.org](http://www.ieta.org)

## Industrialised countries must cut emissions 80pc by 2050, 40pc by 2020 to counter developing-nations' increase

Given the current scenarios of the Intergovernmental Panel on Climate Change (IPCC), the scientific advisory body of the international climate regime, emissions need to be drastically reduced below the current levels by mid-century, according to a policy paper released by the Wuppertal Institute for Environment, Climate and Energy.

**80pc reduction needed:** The paper said: "Since developing countries will need a certain increase of their emissions in order to cover their development needs, this means that industrialised countries will have to reduce their emissions by 80 per cent by mid-century, compared to the 1990 baseline. In order to achieve this target, emissions in industrialized countries need to be reduced by 40 per cent by 2020.

**Compensation needs consideration:** "Customers should therefore first of all examine the possibilities to bring down their own emissions, whereas compensation should only be considered as a complementary measure. In the same vein, the providers of compensation schemes should provide detailed information to raise the customers' general awareness of the climate change problem and point out options for reducing own emissions.

**But compo isn't a real solution:** "They should also convey the message that compensation is not a real solution but only a second-best option. In principle, almost every greenhouse gas emission can be subject to a compensation scheme and almost any entity – e.g. private households, communities, NGOs individuals – can be responsible for these emissions and consequently be a customer of compensation schemes.

**Two sorts of emissions:** "In the following, the range of possible customers was grouped into the two main customer groups of' individuals/ private household and companies/public administrations. Emissions to be compensated can generally be divided into emissions from individual sources on the one hand, and emissions resulting from services or products which entail emissions from a variety of sources on the other.

**Individual sources:** "The emissions from individual sources could be further divided into direct and indirect emissions, but most schemes offer the compensation of emissions from heating, electricity and transport in one package. The one exception is emissions from aviation, which are usually treated separately because of the high amount of emissions generated per level. Events are one example of products and services which entail emissions from a variety of sources, such as heating, transport (arrival, departure), accommodation, food supply (frozen food and instant meals require lots of energy).

**One type of compensation:** “This compensation service predominantly addresses companies, but private households can also be customers: conferences or workshops as well as birthday parties or weddings or any other event can be covered. It is mainly providers of the German-speaking region which offer this particular kind of compensation. It usually includes emission calculation, personal consulting and marketing support.”

**Reference: Policy Paper No. 3/2004, October 2004, “Voluntary Compensation of Greenhouse Gas Emissions” by Wolfgang Sterk and Maïke Bunse. Contact: Wolfgang Sterk, Maïke Bunse, Phone: +49 202 2492 149. Email: wolfgang.sterk@wupperinst.org & maïke.bunse@wupperinst.org. Wuppertal Institute for Climate, Environment and Energy GmbH. Doeppersbery 19 – 42103 Wuppertal - Germany. <http://www.wupperinst.org>**

## How to define dangerous climate change: ‘dangerous for whom, dangerous by when’

**D**efining dangerous is a value judgment, but some cardinal principles apply - for example, universal human rights and the needs of future generations and sustainable development apply – said R. K. Pachauri director general TERI (the Tata Energy Research Institute) and chair, IPCC (Intergovernmental Panel on Climate Change), speaking 1 February at the *Avoiding Dangerous Climate Change* conference in

Sussex, UK, he said a study of impacts and damage and the socio-economic dimensions was need study how the threshold depends on Initial conditions;

- marginal impacts and damage;
- costs or valuation of impacts
- irreversibility and adaptation; and
- mitigation options.

The study should ask the questions – as dangerous for whom – the equity dimensions, and dangerous by when, and then analyse the inertia in the system and the intergenerational issues.

**The next step:** Then, plausible adaptation scenarios and plausible mitigation scenarios were needed to define the actions required.

### Practical Questions:

- Can a temperature target capture the limits of what is dangerous?
- do we have the scientific rationale for setting this target?
- can a global target represent dangers at the local level?
- how do we determine a concentration level for GHGs? and
- what is the trajectory to achieve stabilization?

### Initial conditions of the investigation:

- An increase in global mean surface temperature by over 0.6C was highly likely;

- decrease in Arctic sea ice extent by 10-15 per cent and in thickness by 40 per cent was likely;
- a decrease in snow cover area by 10 per cent since observation started in 1960 was very likely;
- coral reef bleaching was reported; and
- 1990 was the warmest decade of the millennium, since records were maintained. This was therefore defined as likely.

**Reference: Avoiding Dangerous Climate Change. 2nd Keynote Address R K Pachauri Director General TERI and Chairman, IPCC. A Scientific Symposium on Stabilization of Greenhouse Gases - Exeter, UK 1st February, 2005 <http://www.stabilisation2005.com>**

## Shell boss warns of global climate disaster if action not taken to reduce fossil fuel use

**A** failure by governments to take immediate action to reduce the incentive to consume fossil fuels would result in an environmental disaster, Lord Oxburgh, chair of Shell’s United Kingdom arm, told the annual business lecture hosted by Greenpeace on Tuesday, 25 January.

**Former scientific adviser:** Lord Oxburgh, a former chief scientific adviser to the Ministry of Defence, and one of the two chairs of the Anglo-Dutch oil giant, said governments, not oil companies, must act now on global warming, reported *The Independent*.

**Living in a capitalist society:** He insisted that it was not up to the likes of Shell to reform their behaviour and reduce their supply of fossil fuels. "Whether you like it or not, we live in a capitalist society," he said.

**Demand must be met:** "If we at Shell ceased to find and extract and market fossil fuel products while there was demand for them, we would fail as a company. Shell would disappear as any kind of economic force.

**Job is to respond to reg environment:** "Our job is to respond in a positive way to a regulatory environment that has to be determined by government - given the urgency, we have to start now."

**Reference: Digest of latest news reported on website of Climate Change Secretariat of United Nations Framework on Climate Change Control (UNFCCC). 26 January. Address: PO Box 260 124, D-53153 Bonn, Germany. Phone: : (49-228) 815-1005, Fax: (49-228) 815-1999. Email: press@unfccc.int http://www.unfccc.int**

## Oil exec defection: outgoing Shell chief to take up post with climate change charity

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**T**he outgoing British chair oil giant Shell became the latest oil executive to defect to the enemy, reported *The Australian* (31/1/2005, p. 6).

**Charity case:** Lord Oxburgh announced that he wanted to take up a post with a climate-change charity when he left the Shell operation

later this year, saying he intended to devote more of his time to cutting greenhouse gas emissions and the use of fossil fuels.

## How to earn new green money with CO<sub>2</sub>-e cuts

**D**ebate was fierce over the legitimacy of credits awarded for carbon sequestration, according to a policy paper from German think-tank the Wuppertal Institute for Climate, Environment and Energy, but trades had begun – the first was made 18 November, 2004.

**How it works:** The basic principle was that countries or, the usual case, authorised private companies (the project developers), register emission avoidance/reduction or carbon sequestration projects as Clean Development Mechanism (CDM) or Joint Implementation (JI) projects. After the project has undergone a cycle that is laid out mainly in the so-called Marrakech Accords, emission certificates equivalent to the amount of the avoided/reduced emissions or carbon dioxide (CO<sub>2</sub>) removed from the atmosphere are issued to the project developer.

**Buying credits:** The Annex B countries can buy these certificates and count them towards the emissions target they committed to in the Kyoto Protocol.

**CDM/JI distinction:** One of the main distinctions between the CDM and JI is that CDM projects are carried out in non-Annex B

countries, whereas JI projects take place in Annex B countries. The certificates generated by CDM projects are called Certified Emission Reductions (CERs), whereas those from JI projects are called Emission Reduction Units (ERUs).

**Project Design preparation:** A CDM project must undergo a project cycle consisting of several steps.

**First step:** The first is preparation of the Project Design Document (PDD) by the project developer. For the purpose of calculating the emission avoidance or reduction achieved by the project, the PDD has to establish a so-called baseline. The PDD also has to contain a plan for monitoring the project's emissions. Baseline and Monitoring Plan either need to be designed according to methodologies that have already been approved by the CDM Executive Board, or you need to develop your own methodology and submit it to the CDM Executive Board for approval.

**The second step:** The second step is the validation of the PDD, an examination if the PDD meets all requirements, by a certification company accredited with the CDM Executive Board – a so-called Designated Operational Entity (DOE).

**Final steps:** The final steps were: registration of the project with the CDM Executive Board; implementation of the project and monitoring of all relevant emissions by the project developer; verification of the emission avoidance/reductions by another DOE.

certification of the emission avoidance/reductions by the DOE; and issuance of the CERs by the CDM Executive Board.

**Quality guarantee:** The quality guarantee of the CDM was yet further extended by the CDM Gold Standard, which aims to ensure that projects produce not only climate but also other sustainability benefits.

**Climate protection ace:** But from the climate protection point of view, Gold Standard CDM projects were definitely the best option. Once the CDM Gold Standard has been adapted for use with JI, JI Gold Standard projects would rate at the same level. The Gold Standard also lent itself well to marketing purposes.

**Reference: Policy Paper No. 3/2004. 'Voluntary Compensation of Greenhouse Gas Emissions', October 2004. Wolfgang Sterk and Maike Bunse. Wuppertal Institute for Climate, Environment and Energy. <http://www.wupperinst.org>**

## CDM Gold Standard: buyers willing to pay more for certs generated by high-quality projects: Wuppertal Institute

**T**he CDM Gold Standard, which was developed at the initiative of the World Wide Fund for Nature (WWF), is a high quality standard for CDM projects. According to the Wuppertal Institute for Climate, Environment and Energy GmbH Policy Paper No.3/2004, October 2004, titled "How to

manage voluntary compensation of greenhouse gas emissions", by Wolfgang Sterk and Maike Bunse, "The CDM Gold Standard aims to enhance the ecological and socio-economic integrity of the CDM".

**It worked this way:** It defined quality criteria to exceed those established within the Kyoto regime and created a premium product, on the market for emission certificates. It was based on the expectation that buyers will be willing to pay more for certificates generated by high-quality projects. The Gold Standard's criteria include:

- more detailed examination of the project's additionality;
- an assessment of the project's other ecological and social impacts; and
- minimum standards for stakeholder participation.

More information on the CDM Gold Standard can be viewed at [http://www.panda.org/about\\_wwf/what\\_we\\_do/climate\\_change/what\\_we-do/business\\_industry/gold\\_standard.cf](http://www.panda.org/about_wwf/what_we_do/climate_change/what_we-do/business_industry/gold_standard.cf)

## Kyoto rule: if emission cuts credited to a project that would have happened anyway, cuts earn nothing

**I**f emission reductions are credited to a project that would have happened anyway, these reductions are fictitious and the

customer's emissions are in fact not compensated. The way the Kyoto rules worked was project standards assessing the other environmental and/or social impacts of a project – such as local pollution, employment generation – then to determine the project's emission avoidance/reduction or carbon sequestration, - the project developer sets "baseline" - a reference scenario of what would most likely have happened in the absence of the project.

**What it must demonstrate:** To earn Kyoto cash, the project demonstrate, that it would not have happened anyway. In the jargon - the project must be "additional". So, if the baseline emissions were 50,000 t CO<sub>2</sub>e per year, and the project's emissions 20,000 t CO<sub>2</sub>e; then the project has achieved an emission reduction of 30,000 t CO<sub>2</sub>e; that is then traded in an emissions market.

**High standards needed:** Since the establishment of the baseline and the assessment of the project's additionality are by definition hypothetical, the standards which have to be met in this respect are key to ensuring a project's environmental integrity.

**Reference: Policy Paper No.3/2004, October 2004, How to manage voluntary compensation of greenhouse gas emission by Wolfgang Sterk and Maike Bunse.**

## Three ways to earn Kyoto cash: CDM/JI standards, CDM Gold Standard and Verified Emission Reductions (VERs)

The three types of standards were self-developed standards, the official CDM/JI standards and "CDM Gold Standard", developed by the non-governmental organisations (NGOs). Some providers defined their own criteria and these were called Verified Emission Reductions (VERs).

**How the three fit in the Kyoto market:** These criteria are similar to those established by the Kyoto regime (see below) but are usually condensed and focused on certain project types.

**Who audits:** Auditing of projects is carried out either internally or with third-party involvement. The Clean Development Mechanism (CDM) and Joint Implementation (JI) are the project-based mechanisms established by the Kyoto Protocol with the aim of providing the countries which have adopted quantified emission limitation and reduction commitments – the so-called Annex B countries – with flexibility in achieving these targets.

**Reference: Policy Paper No.3/2004, October 2004, How to manage voluntary compensation of greenhouse gas emission by Wolfgang Sterk and Maike Bunse.**

## Solar kitchens in schools, hospitals and monasteries in India; a good example of application of Gold CDM

The German provider atmosfair (<http://www.atmosfair.com>) claims to be the first to use only Gold Standard projects for compensation. One of their supported projects is located in India ([http://www.atmosfair.com/2/projekt\\_indien.htm](http://www.atmosfair.com/2/projekt_indien.htm)).

**How they work:** So far, Indian community kitchens have usually used kerosene, diesel or firewood, which not only leads to GHG emissions but also to indoor air pollution and attendant health problems.

**Schools, hospitals and monasteries:** In this project, ten community kitchens in schools, hospitals and monasteries, that provide meals for 500 to 5,000 people every day, are going to be converted to solar thermal energy.

**How it works:** The technology implemented uses concentrated sunlight to generate steam for the cooking purposes. The solar kitchens also feature steam storage facilities so that they will remain fully functional after sunset; Co-firing by conventional means will only be necessary if the sky stays overcast for several days in a row. The project will thus save about 570 tonnes of CO<sub>2</sub> annually. Moreover, the project will reduce indoor air pollution, reduce firewood gathering in the surrounding forests and create up to 20 high-quality maintenance jobs.

**Reference: Policy Paper No.3/2004, October 2004, How to manage voluntary compensation of greenhouse gas emission at Wolfgang Sterk and Maike Bunse.**

## Warning: from 2008 on, projects in Annex B countries need to take care of the double counting problem

The Wuppertal Institute, an international think tank on environmental policies, expressed some misgivings over what they see as a potential downside to CO<sub>2</sub> trading under the Kyoto Protocol, and have initiated a discussion process.

**Assigned Amount Units (AAUs):** From the start of the first commitment period of the Kyoto Protocol in 2008 onwards, projects in Annex B countries entail a double counting problem. Based on emission targets at that time, these countries receive a budget of certificates called Assigned Amount Units (AAUs). For example, a country A with a Kyoto emission target of 1,000 Mt CO<sub>2</sub>e will receive 1,000 million AAUs. At the end of the Kyoto commitment period, each country will have to hand in an amount of AAUs plus other certificates that is equal to its actual emissions during the commitment period: i.e. if 1,100 Mt CO<sub>2</sub>e originated from country A, it would have to hand in 1,100 million certificates.

**Two bites of the apple:** Obviously, each emission reduction achieved in an Annex B country frees up the equivalent amount of AAUs, which the country can then sell to other countries or otherwise make use of. If the service provider also claims the emission reduction, it will in effect be counted twice. This problem could only be resolved if the corresponding amount of AAUs was cancelled. This is in fact what is going to happen in the case of JI projects, but in the case of non-JI projects the service provider would have to make similar arrangements with the host country.

**To sum up:** In principle one cannot draw a quality distinction between projects in Annex B and non-Annex B countries. But from 2008 on, projects in Annex B countries will need to take care of the double counting problem, otherwise there is no compensation effect. The Wuppertal Institute is currently conducting a discussion process on the potential of small scale CDM projects.

**If a Kyoto country's target is 1,000 Mt CO<sub>2</sub>e it will receive 1,000 million AAUs: how double dipping may happen**

**D**ue to the less developed infrastructure and local expertise, the risk that a claimed emission reduction did not actually take place was probably greater in

developing countries than in Annex B countries, according to a policy paper published by the Wuppertal Institute for Climate, Environment and Energy.

**Additional safe-guards needed:** The paper said, "and there is the problem that provisions for stakeholder participation are next to non-existent in many non-Annex B countries, so that additional safeguards are needed to prevent human rights violations and other negative effects. Customers should demand credible reassurance on this point, such as provided by the Clean Development Mechanism (CDM) Gold Standard. The European Climate Change Programme has in fact identified a massive reduction potential, especially in the area of energy efficiency.

**How AAUs work:** "However, there is a massive downside, since from the start of the first commitment period of the Kyoto Protocol in 2008 onwards, projects in Annex B countries entail a double counting problem. Based on their emission targets, these countries receive a budget of certificates called Assigned Amount Units (AAUs). For example, a country A with a Kyoto emission target of 1,000 Mt CO<sub>2</sub>e will receive 1,000 million AAUs. At the end of the Kyoto commitment period, each country will have to hand in an amount of AAUs plus other certificates that is equal to its actual emissions during the commitment period: i.e. if 1,100 Mt CO<sub>2</sub>e originated from country A, it would have to hand in 1,100 million certificates.

**Double dipping accounting:** "Obviously, each emission reduction achieved in an Annex B country frees up the equivalent amount of AAUs, which the country can then sell to other countries or otherwise make use of. If the service provider also claims the emission reduction, it will in effect be counted twice.

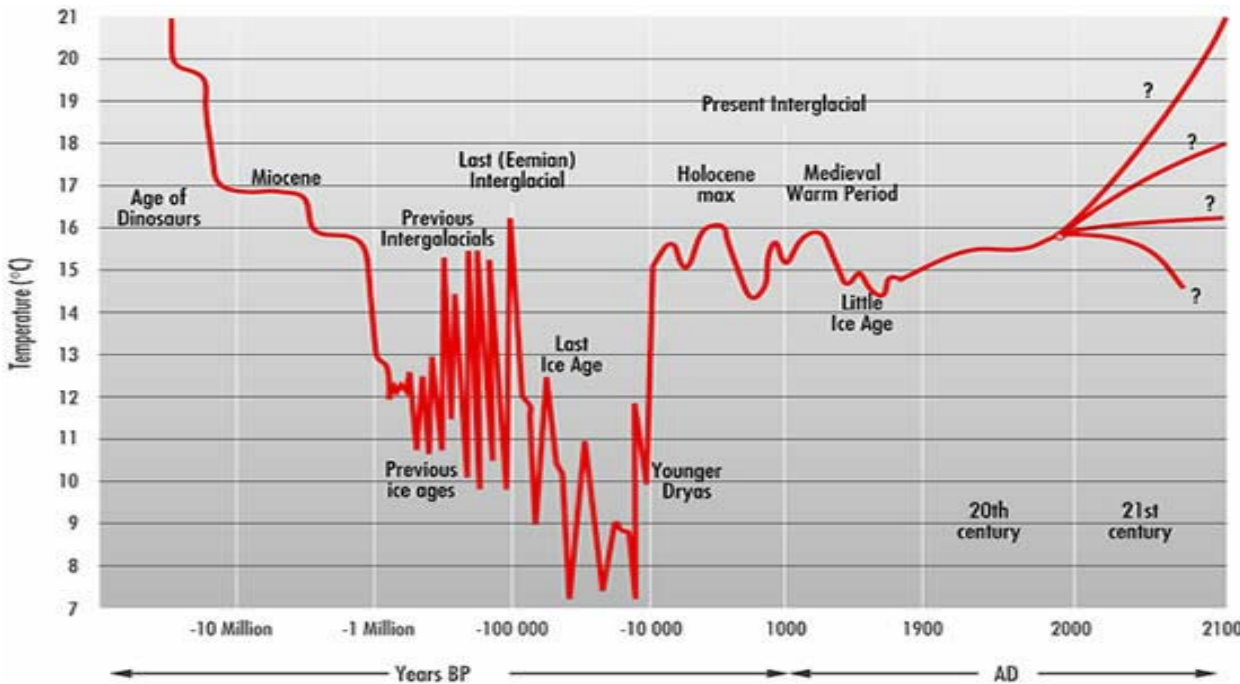
**The solution:** "This problem could only be resolved if the corresponding amount of AAUs was cancelled. This is in fact what is going to happen in the case of Joint Implementation (JI) projects, but in the case of non-JI projects the service provider would have to make similar arrangements with the host country.

**No distinction between Annex B or not:** "To sum up, in principle one cannot draw a quality distinction between projects in Annex B and non-Annex B countries. But from 2008 on, projects in Annex B countries will need to take care of the double counting problem, otherwise there is no compensation effect."

**Reference: Policy Paper No.3/2004, October 2004, How to manage voluntary compensation of greenhouse gas emission at Wolfgang Sterk and Maïke Bunse.**

**ICCT wants the world's top 8 industrialised nations to set temp rise limit of 2C and 25pc renewables by 2025**

**I**n releasing its latest findings on Tuesday, 25 January – the eve of the five-day World Economic Forum in Davos, Switzerland -



-The Greenhouse Effect and Climate Change - a new booklet (PDF, 5.6MB)<http://www.bom.gov.au/climate/change/>

**Germany, UK, Sweden face problems:**

Carlen said: "This circumstance implies, among other things, that if Germany, Sweden and, UK stick to their announced climate policies they would either fail to comply or the 'over comply' with the burden-sharing agreement, depending on whether the aggregate net sale of allowances by these countries' trading sectors is positive or negative.

**EU may fail to comply:** "As a consequence, the European Union would either fail to comply or over comply with the Kyoto Protocol".

Reference: "EU's Emissions Trading System in the Presence of National Emission Targets" Paper No. 2004:16 by Bjorn Carlen in 'Research Papers in Economics' November 2004. Contact: Bjorn Carlen, Department of Economics, Stockholm University, Stockholm, S-106 91 Stockholm, Sweden. Phone: +46 8 16 20 00. Fax: +46 8 16 14 25. Email: bc@ne.su.se <http://www.ne.su.se/>

the ICCT (International Climate Change Taskforce) also called for mandatory caps and trade schemes for emissions, reported *The Guardian* (25/1/2005).

**Other parts of wish list:** The ICCT wants a limit set of a 2 per cent rise in average global temperatures, establishing a Group of Eight (G8) climate-change group, and a global protocol that built on Kyoto. The ICCT is jointly chaired by former British Minister, Stephen Byers, and US Republican Senator, Olympic Snowe.

**Germany, Sweden and UK face Kyoto compliance failure if current policies not changed, warns Swedish economist**

**T**he EU's greenhouse-gas emissions would be an increasing function of the aggregate net sales of allowances by trading sectors in countries with national emission targets, according to a paper by Swedish economist, Bjorn Carlen.

**Report urges G8 to form G8+ group, including Australia, to form post-Kyoto trading bloc with China and India**

**A** new report on climate change has argued that the G8 group of nations could play a vital role in preventing global average temperatures rising more than 2 degrees by creating a new international climate body - the G8+ - which would include Australia and other key developing nations

such as China and India, reported *The Age* (25/1/2005, p. 8). The report aimed to break the impasse on climate change by bringing the US and Australia - the only industrialised countries that have not ratified the Kyoto Protocol - back to the fold. The protocol came into effect next month.

**G8+ group:** The report urged all nations to act to prevent global average temperatures rising more than 2 degrees above pre-industrial revolution, or 1750, levels. It warned of irreversible environmental, health and economic consequences if they did not. It suggested the G8 could play a vital role by developing a G8+ climate group that would include other major economies, including Australia, and key developing countries such as China and India.

## Climate policies announced by Germany, Sweden and the UK inconsistent with European Union rules and also Kyoto

The climate policies announced by Germany, Sweden and the UK were inconsistent with the European Union's (EU's) burden-sharing agreement (BSA), and thereby also with the Kyoto Protocol (KP), according to a paper by Bjorn Carlen from the Department of Economics at Stockholm University.

**Germany, UK, Sweden other trading:** Carlen said: "Of course, countries' as well as firms' emission levels will be closely monitored whereby any tendencies toward non-compliance or over-compliance would likely be detected. The policies of Germany, Sweden and the UK would then be adjusted, perhaps long before 2012. So, the outcome that EU would over-comply or fail to comply with the KP should not necessarily be interpreted as a prediction. The point is that such policy adjustments would imply that Germany, Sweden and the UK conduct other greenhouse trading policies than those they have announced.

**Altered policies:** "To design policies consistent with the BSA, Germany, Sweden and the UK might:

- (a) abandon their national emission targets;
- (b) change their banking/retirement behavior as compared to the announced one;
- (c) engage in International Emissions Trading/Joint Implementation/Clean Development Mechanism in a way that differs from the announced behavior; or
- (d) undertake some combination thereof".

**Reference:** "EU's Emissions Trading System in the Presence of National Emission Targets" Paper No. 2004:16 by Bjorn Carlen in 'Research Papers in Economics' November 2004. Contact: Bjorn Carlen, Department of Economics, Stockholm University, Stockholm, S-106 91 Stockholm, Sweden. Phone: +46 8 16 20 00. Fax: +46 8 16 14 25. Email: bc@ne.su.se <http://www.ne.su.se>

## ExxonMobil funding lobby groups like Scientific Alliance to play down climate threat

The US oil industry was funding lobby groups to play down the threat of climate change and derail British action to cut greenhouse gas emissions, Professor Bob May, president of the Royal Society, wrote in *The Guardian* (27/1/2005). He cited the government's decision to make global warming a focus of its Group of Eight (G8) presidency and the high profile of its chief scientific adviser, David King, who described climate change as a bigger threat than terrorism.

**Links to ExxonMobil:** May's warning coincides with a meeting of climate change sceptics at the Royal Institution in London organised by a British group, the Scientific Alliance. David Adam, science correspondent of *The Guardian* said the Alliance had links to US oil company ExxonMobil through collaboration with a US institute.

**Report claims to undermine climate change:** The Scientific Alliance published a joint report last month with the George C. Marshall Institute in Washington that claimed to "undermine" climate change claims. The Marshall institute received donations from ExxonMobil for its "global climate change program" in 2003 and an undisclosed sum this month. May wrote that, during the 1990s, parts of the US oil industry funded sceptics who opposed action to tackle climate change.

**Sponsorship conceded:** A Scientific Alliance spokesman said the current British meeting was sponsored person, but funders did not influence policies. ExxonMobil said it was not involved.

**CO2 good for planet, says one adviser:** One adviser was Dr Sallie Baliunas, an astrophysicist at the Harvard Smithsonian Centre, who was linked to the Marshall Institute. In 1998, Baliunas co-wrote an article that argued for the release of more CO2. The article was mass-mailed to US scientists with a petition asking them to reject Kyoto.

**Reference:** Digest of latest news reported on website of Climate Change Secretariat of United Nations Framework on Climate Change Control (UNFCCC). 27 January. Address: PO Box 260 124, D-53153 Bonn, Germany. Phone: : (49-228) 815-1005, Fax: (49-228) 815-1999. Email: [press@unfccc.int](mailto:press@unfccc.int) <http://www.unfccc.int>

## Fight against global warming will fail if economic growth threatened, Blair tells WEF

**E**fforts to deal with global warming would not mean drastic cuts in living standards, but they would fail if they demanded actions that would seriously threaten economic growth, the British Prime Minister, Tony Blair, said, in his keynote speech to the World Economic Forum (WEF) in Davos, Switzerland, reported *BBC News*.

**Emerging consensus on key issues:** On the first day of the five-day meeting of business and political leaders, Blair said there was an "emerging consensus" on key issues such as climate change and poverty, but he also noted that the evidence for global warming was "disputed", an acknowledgement of the US refusal to sign up to the Kyoto climate change deal.

**Danger of deficits:** Jacob Frenkel, former Israeli central banker and current vice-chair of insurer American International Group (AIG), said deficits both in the public purse and the overall economy in the US were a particular danger.

## TimberCAM, a carbon accounting model, finds it's possible to earn greenhouse credits from wood in landfill

**W**ood products in landfill could be a significant "carbon sink" in Australia and some other countries, according to a statement from the Cooperative Research Centre (CRC) for Greenhouse Accounting (23/12/2004).

**New accounting model:** The research has underpinned the development of TimberCAM, a carbon accounting model that accounts for the fate of carbon sequestered in trees through their harvesting, conversion to wood products, use and end-of-life options.

## Wood accounts for 2m t of Aust landfill:

The research findings were presented by two researchers from the CRC Greenhouse Accounting to the 3rd Intercontinental Landfill Research Symposium in Japan. While organic waste in Japan and Europe was often burnt rather than committed to landfill, large quantities of wood and paper were consigned to landfill in both Australia and the US. In Australia, about two million tonnes of wood and wood products are placed in landfill each year, and it was previously assumed that this wood decomposed relatively quickly, becoming a source of greenhouse gases.

**Little decomposition after 50yrs:** However, in excavating landfill sites in Sydney, CRC researchers found very little decomposition had occurred in wood and paper products after 20 to 50 years. Carbon loss from wood products retrieved from landfill ranged from 1.4 per cent to 3.5 per cent after up to 50 years in landfill.

**Life-cycle analysis undertaken:** A life-cycle-analysis approach was taken to determine the post-harvest storage of carbon in wood, tracked from the harvest of the trees through to the ultimate disposal of the wood products. Components of the research included carbon recovery both in the harvesting of trees and in the conversion of logs to round, sawn and panel products, studies of the carbon content and density of forest products, a survey of service life, and waste audits.

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## Anyone using sink projects risks a huge public relations fallout: Wuppertal Institute

Anyone using sink projects for compensation purposes risks a huge public relations fallout. Wolfgang Sterk and Maïke Bunse from the Wuppertal Institute for Climate, Environment and Energy They argued the coupling of emission avoidance/reduction and CO<sub>2</sub> sequestration in the Kyoto Protocol and afterwards is "very unfortunate".

**Sequestration risky and unreliable:** The two argued in a paper, "How to manage voluntary compensation of greenhouse gas emission", that "In the future, they (emission avoidance/reduction and CO<sub>2</sub> sequestration) should be decoupled by dealing with them in two distinct legal instruments, as has been proposed by the German Advisory Council on Global Change (WBGU 2003b).

**Ignores cause of climate change:** "Supporters argue that deforestation is major source of emissions and that sink projects can also bring about many other ecological and socio-economic benefits. But while their opponents would agree that there is a case for good forestry projects, or CO<sub>2</sub> dumps, they do not at all agree that they should be used to compensate emissions."

**The reason why:** First, it was feared that this could draw attention away from the cause of climate change; i.e. fossil-based energy systems and infrastructures. Second, the sequestration of carbon was not equivalent to the avoidance or reduction of emissions, since a tonne of emissions avoided will never enter the atmosphere, whereas carbon stored in biomass might at any time be re-released into the atmosphere.

**Just a temporary measure:** Sinks therefore offer only a temporary respite whereas what's needed is lasting emission reductions. There are also technical problems with quantifying the sequestration of carbon.

**Politically charged:** The debate is politically charged because many forestry projects such as large-scale monoculture plantations have in the past led to grave ecological and socio-economic effects such as a loss of biodiversity or the displacement of the local population.

**Allows genetically modified plants:** "This controversy has been further stoked by the decision of the parties to the Kyoto Protocol oil modalities for sink projects which allows the use of genetically modified plants and invasive species (UNFCCC 2003). Anyone using sink projects for compensation purposes therefore risks a huge public relations fallout.

**Better to cut back pollution source:** "The obvious advantage of climate protection projects dealing with sources is that they keep GHGs out of the atmosphere once and for all and that they contribute to the technological

change that is necessary to prevent dangerous climate change", argued the paper.

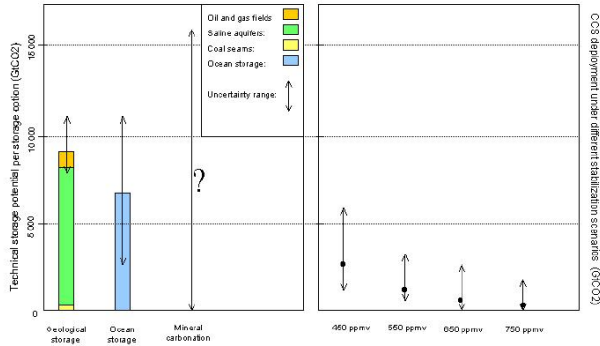
**Reference:** Policy Paper No.3/2004, October 2004, How to manage voluntary compensation of greenhouse gas emission by Wolfgang Sterk and Maïke Bunse.

## Big plans to make tradeable CO<sub>2</sub> from capture systems on fossil fuel power, refineries and manufacture of iron, steel, cement and chemicals

A paper written by the Australian, Japanese and US proponent of CO<sub>2</sub> dumps says "Technological innovations will be one of the key factors which determines our future path. Most of the CO<sub>2</sub> emissions to the atmosphere are currently in the form of flue gas from combustion, in which the CO<sub>2</sub> concentration is typically 4-15pc by volume, although CO<sub>2</sub> at higher concentrations is also emitted by a few industrial processes. Flue gas could be stored, to avoid emissions to the atmosphere but it would have to be compressed to a pressure of more than 7 MPa and such a compression process would consume an excessive amount of energy .

**CO<sub>2</sub> capture:** Also, the high volume of flue gas would mean that large storage volumes would be required. For these reasons it is preferable to produce a relatively high purity stream of CO<sub>2</sub> for transport and storage; this

process is called CO2 capture. The main application of CO2 capture is likely to be at large point sources: fossil fuel power plants, oil refineries, and industrial plants, particularly for the manufacture of iron, steel, cement and chemicals.



Technically available storage capacity (or technical potential) for various storage options (left panel) compared to the cumulative CCS deployment (or economical potential) in the period 2000-2100 for different baseline (SRES) and stabilization (450 - 750 ppmv) scenarios (right)

## Four basic systems for capturing CO2 from use of fossil fuels or biomass

- Capture from industrial process streams;
- Post-combustion capture;
- Oxy-fuel combustion capture; and
- Pre-combustion capture.

**No incentive or requirement to store CO2:** CO2 has been captured from industrial process streams for 80 years, although most of the CO2 that is currently captured is vented to the atmosphere because there is no incentive or requirement to store it. Current examples of CO2 capture from process streams are;

- purification of natural gas; and
- production of hydrogen-containing synthesis gas for the manufacture of ammonia, alcohols and synthetic liquid fuels.

Most of the techniques employed for CO2 capture in the examples mentioned are also similar to those used in pre-combustion capture.

**Cement and steel:** Other industrial process streams which are a source of CO2 that is currently not captured, include cement production and steel manufacturing. CO2 could be captured from these streams using techniques that are common to either post-combustion capture or pre-combustion capture

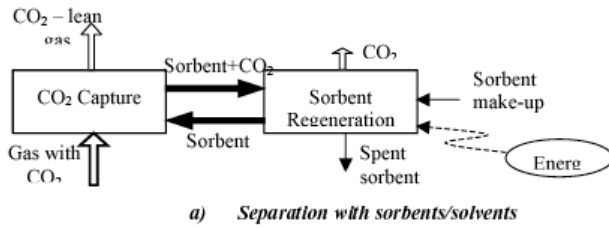
**How to do it:** Capture of CO2 from flue gases produced by combustion of fossil fuels and biomass in air is referred to as post-combustion capture. Instead of being discharged directly to the atmosphere;

- flue gas is passed through a device which separates most of the CO2;
- the CO2 is fed to a storage reservoir;

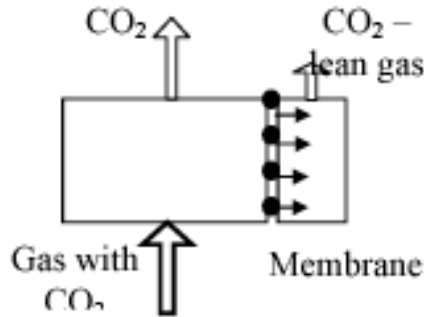
- remaining flue gas is discharged to the atmosphere;
- a chemical sorbent process as described in section would normally be used for CO2 separation. Other techniques are also being considered but they are not at such an advanced stage of development

**Oxy-fuel combustion capture:** The main component of conventional flue gas is nitrogen, which is the main component of the air used for combustion. In oxy-fuel combustion, nearly pure oxygen is used for combustion instead of air, resulting in a flue gas that is mainly CO2 and H2O. If fuel is burnt in pure oxygen, the flame temperature is excessively high, but CO2 and/or H2O rich flue gas can be recycled to the combustor to make the flame temperature similar to that in a normal air-blown combustor. Oxygen is usually produced by low temperature (cryogenic) air separation and novel techniques with potentially lower energy consumption and cost are being developed. An alternative type of oxy-fuel combustion is chemical looping combustion, in which the oxygen required for combustion is provided by decomposition of a metal oxide.

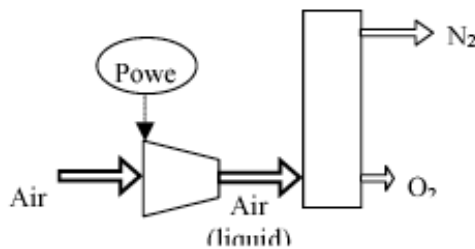
**Pre-combustion capture:** Pre-combustion capture involves reacting a fuel with oxygen or air, and/or steam to give mainly a synthesis gas or fuel gas composed of carbon monoxide and hydrogen. The carbon monoxide is reacted with steam in a catalytic reactor, called a shift converter, to give CO2 and more



a) Separation with sorbents/solvents



b) Separation with a membrane



c) Separation by cryogenic distillation

The above graphs describe general schemes of the main separation processes relevant for CO2 capture. The gas removed in the separation may be CO2, H2 or O2.

hydrogen. CO2 is then separated, usually by a physical or chemical absorption process, resulting in a hydrogen-rich fuel which can be used in many applications, such as boilers, furnaces, gas turbines and fuel cells.

**Types of CO2 capture technologies;** CO2 capture systems use many of the known technologies for gas separation which are integrated into the basic systems for CO2 capture identified in the last section.

**Separation with sorbents:** The separation is achieved by putting in intimate contact in a vessel the gas containing the CO2 with a liquid or solid sorbent that is capable of capturing the CO2. The sorbent resulting after the regeneration step is sent back to capture more CO2 in a cyclic process. In some variants of this scheme the sorbent is a solid and does not circulate between vessels because the sorption and regeneration are achieved by cyclic changes (in pressure or temperature) in the vessel where the sorbent is contained. A makeup flow of fresh sorbent is always required to compensate for the natural decay of activity and/or sorbent losses. In some situations, the sorbent may be a solid oxide which reacts in a vessel with fossil fuel or biomass producing heat and mainly CO2. The spent sorbent is then circulated to a second vessel where it is re-oxidised in air for reuse with some loss and make up of fresh sorbent

**Huge demand for sorbents:** The above model governs many important CO2 capture systems, including leading commercial options

like chemical absorption system and physical absorption and adsorption. Other emerging processes based on new liquid sorbents, or new solid regenerable sorbents are being developed aimed to overcome the limitations of the existing systems. One common problem of these CO2 capture systems is that the flow of sorbent between the vessels of is large because it has to match the huge flow of CO2 being processed in the power plant. Therefore, the energy required for sorbent regeneration is very large and tends to translate into an important efficiency penalty and added cost. Also, in systems using expensive sorbent materials there is always a danger of escalating cost related to the purchase of the sorbent and the disposal of sorbent residues. Good sorbent performance in many repetitive cycles is obviously a necessary condition in these CO2 capture systems.

**Huge demand for membranes:** Membranes are specially manufactured solid materials that allow the selective permeation of a gas through their mass. The selectivity of the membrane to different gases is intimately related to the nature of the material, but the flow of gas through the membrane is usually driven by the pressure difference across the membrane. Therefore, high pressure streams are usually preferred for membrane separation. There are many different types of membrane materials (polymeric, metallic, ceramic) that may find application in CO2 capture systems to preferentially;

- separate H2 from a fuel gas stream;

Summary of CO2 Capture Costs for New Plants Based on Current Technology

Cost and Performance Measures	New NGCC Plant			New PC Plant			New IGCC Plant			New Hydrogen Plant			(Units for H2 Plant)
	Range		Rep.	Range		Rep.	Range		Rep.	Range		Rep.	
	low	high	Value	low	high	Value	low	high	Value	low	high	Value	
Emission rate w/o capture (kg CO2/MWh)	344	379	367	736	811	762	682	846	785	78	174	137	kg CO2/GJ (w/o capture)
Emission rate with capture (kg CO2/MWh)	40	66	52	92	145	112	87	152	117	7	28	17	kg CO2/GJ (with capture)
Percent CO2 reduction per kWh (%)	83	88	86	81	88	85	81	88	85	72	96	86	% reduction/unit of product
COE w/o capture (US\$/MWh)	31	50	37	43	52	45	41	61	47	6.5	10.0	7.8	H2 cost w/o capture (US\$/GJ)
COE with capture (US\$/MWh)	43	72	54	62	86	73	54	79	63	7.5	13.3	9.1	H2 cost w/ capture (US\$/GJ)
Increase in COE w/ capture (US\$/MWh)	12	24	17	18	36	27	9	22	15	0.3	3.3	1.3	Increase in H2 cost (US\$/GJ)
Percent increase in COE w/ capture (%)	37	69	46	42	84	60	20	55	33	5	33	15	% increase in H2 cost
Cost of CO2 avoided (US\$/t CO2)	37	74	53	29	55	42	13	37	23	2	56	15	US\$/t CO2 avoided
Cost of CO2 captured (US\$/t CO2)	33	57	44	23	44	31	11	32	19	2	39	12	US\$/t CO2 captured
Capture plant efficiency, LHV basis (%)	47	50	48	30	35	33	31	40	34	52	68	60	Capture plant efficiency (% LHV)
Capture energy reqmt. (% more input/MWh)	11	22	16	24	40	31	16	25	19	4	22	8	% more energy input/GJ product
Cost Confidence Level (see Table 3.8)	moderate			moderate			moderate			high to moderate			

Definitions: NGCC=natural gas combined cycle; PC=pulverized coal combustion; IGCC=integrated coal gasification combined cycle; Rep.=Representative value; COE=cost of electricity (levelized); MWh=megawatt-hours; LHV=lower heating value; See Section 3.6.1 for definition of energy requirement for capture plants.

Notes: [a] Ranges and representative values are based on data from Tables 3.9, 3.11, 3.12 and 3.13. [b] Cost years are in constant US dollars (approx. 2002 basis year); all costs include CO2 compression but not additional CO2 transport and storage costs (see Chapter 8 for full CCS costs). [c] Cost of CO2 avoided is based on the given plant type with and without capture (also See Figure 3.22). [d] Power plant sizes range from approximately 400-800 MW without capture and 300-700 MW with capture. [e] Capacity factors vary from 65-85% for coal plants and 50-95% for gas plants (average for each=80%). [f] NGCC data based on natural gas prices of US\$2.8-4.4/GJ (LHV basis). [g] All PC and IGCC data are for bituminous coals at costs of US\$1.0-1.5/GJ (LHV); all PC plants are supercritical units. [h] Hydrogen plant feedstocks are natural gas (\$4.7-5.3/GJ) or coal (\$0.9-1.3/GJ). [i] Fixed charge factors vary from 11-16% for power plants and 13-20% for hydrogen plants. [j] See source tables for additional s

- CO2 from a range of process streams; or
- O2 from air with the separated O2 subsequently aiding the production of a highly concentrated CO2 stream.

Although membrane separation finds many commercial applications in industry today (some of a large scale, like CO2 separation from natural gas) they have not yet been applied for the large scale and the demanding conditions in terms of reliability and low cost required for CO2 capture systems. A large R & D effort worldwide is in progress aiming at the manufacture of more suitable membrane materials for CO2 capture applications.

**Distillation of a liquefied gas stream and refrigerated separation** : A gas can be made liquid by a series of compression, cooling and expansion steps. Once in liquid form, the components of the gas can be separated in a distillation column. For the case of air, this operation is carried out commercially today on a large scale. Oxygen can be separated from air and be used in a range of CO2 capture systems (oxy-fuel combustion and pre-combustion capture). The key issue for these systems is the large flow of oxygen required. Refrigerated separation can also be used to separate CO2 from other gases. It can be used to separate impurities from relatively high purity CO2 streams, for example from oxyfuel combustion, and for CO2 removal from natural gas or synthesis gas that has undergone a shift conversion of CO to CO2.

Separation task	Process streams*		Post-combustion decarbonisation		Oxy-fuel		Pre-combustion decarbonisation	
	CO2/CH4		CO2/N2		O2/N2		CO2/H2	
Capture Technologies	Current	Advanced	Current	Advanced	Current	Advanced	Current	Advanced
<b>Solvents (Absorption)</b>	<b>Physical solvents</b> <b>Chemical solvents</b>	Improved solvents Novel contacting equipment Improved design of processes	<b>Chemical solvents</b>	Improved solvents Novel contacting equipment Improved design of processes	n. a.	Biomimetic solvents, e.g. hemoglobine-derivatives	<b>Physical solvent</b> <b>Chemical solvents</b>	Improved chemical solvents Novel contacting equipment Improved design of processes
<b>Membranes</b>	Polymeric	Ceramic Facilitated transport Carbon Contactors	Polymeric	Ceramic Facilitated transport Carbon Contactors	Polymeric	Ion transport membranes Facilitated transport	Polymeric	Ceramic Palladium Reactors Contactors
<b>Solid sorbents</b>	Zeolites Activated carbon		Zeolites Activated carbon	Carbonates Carbon based sorbents	Zeolites Activated carbon	Adsorbents for O2/N2 separation, Perovskites Oxygen chemical looping	Zeolites Activated carbon Alumina	Carbonates Hydroxalicates Silicates
<b>Cryogenic</b>	Ryan-Holmes process		Liquefaction	Hybrid processes	<b>Distillation</b>	Improved distillation	Liquefaction	Hybrid processes

These leading commercial options are shown in bold. Unlike CO2 storage options, where many environmental and political issues are relevant, the choice of a technology to capture CO2 in a particular application will mainly be economy-driven. This means that only a few of these options will prove truly cost-effective in the medium to long term

## Case for CO<sub>2</sub> capture as a new service business: new equipment on a separate site

**C**O<sub>2</sub> capture can be installed in new energy utilisation plants or it can be retrofitted to existing plants. Energy utilisation plants often have very long lives, 50 years or more in the case of some power plants, so if CO<sub>2</sub> capture is to be introduced rapidly it will have to be retrofitted to some existing plants or these plants will have to be retired prematurely and replaced by new plants with capture. The disadvantages of retrofits are: There may be site constraints such as land or access to transport systems. A long remaining plant life is needed to justify the large expense of installing capture equipment. Old plants tend to have low energy efficiencies. Including CO<sub>2</sub> capture will have a proportionally greater impact on the net output than in high efficiency plants.

**New site:** The first barrier could be largely overcome by installing much of the new equipment required for CO<sub>2</sub> capture on a separate site. This would be possible for precombustion fuel processing and CO<sub>2</sub> capture, or oxygen production for oxyfuel combustion. The off-site equipment could continue to be used to supply other energy utilisation plants after the original plant reaches the end of its life, by building new connecting pipelines. Site constraints could also be avoided by making new energy utilisation plants capital.

**Make new energy utilisation plants capture-ready:** When the plants are built, sufficient space and facilities would be made available for simple installation of CO<sub>2</sub> capture at a later date. The last two of these barriers could be largely overcome by upgrading or substantially rebuilding the existing plant when capture is retrofitted. For example, old inefficient boilers and steam turbines could be replaced by modern high efficiency supercritical boilers and turbines or IGCC plants. In such cases it is possible that the efficiency of the retrofitted plant with CO<sub>2</sub> capture could be as high as that of the original plant without capture. For example, technologies are already being developed with the aim of increasing the efficiency of coal-fired boiler steam cycle plants to 50-55 per cent within 20 years, compared to the current global regional average of 27-40 per cent. A requirement to capture CO<sub>2</sub> could provide a further impetus to the development of such technologies and could accelerate the retrofitting or replacement of low efficiency plants with modern high efficiency equipment, because only high efficiency plants would be suitable for CO<sub>2</sub> capture. The overall economy-wide impact of large scale use of CO<sub>2</sub> capture on fuel consumption may therefore be less than that which is indicated by comparing the same type of plant with and without capture. The rebuilding of old inefficient power plant in combination with retrofit of CO<sub>2</sub> capture would have the added benefit of reducing the emissions to the environment of other substances such as sulphur and nitrogen oxides

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