



Photo: Greenpeace/Jeremy Sutton-Hibbert

## Climate Change: The Impetus Behind Wind

With the Kyoto Protocol now officially ratified, and the effects of climate change being experienced around the world, *Wind Directions* looks at the current agenda on an issue which, according to EU Environment Commissioner Stavros Dimas, "is a threat not only to the environment, but also to our economies, and in the end our security."

Anyone monitoring the international media over the past twelve months could be in little doubt that the issue of climate change continues to move up the political and public agenda. Scarcely a week goes by without a new study revealing that glaciers in Antarctica are sliding into the sea or that wildlife from temperate zones is gravitating towards the Arctic.

Although sceptics still hover on the fringes, few analysts now seriously challenge that this global environmental phenomenon is happening. Recent scientific reports confirm that it is occurring at an even faster rate than had previously been envisaged. According to the Millennium Ecosystem Assessment, endorsed by the United Nations and over 1,000 scientists from 95 countries, climate change is set to take over from habitat change and

over-exploitation as the single biggest global cause of ecosystem disruption.

Disagreements continue, however, about what action should be taken in response. These mostly revolve around conflicts between economic and environmental objectives, around the nature and equity of international participation, and around the menu of technological and policy options available. For wind energy these debates are fundamental for the future development of the industry.

### The greatest environmental threat

The science of climate change makes depressing if compulsive reading. Over the 20th century the average temperature of the world had already risen by

about 0.6°C. By the end of the present century it is expected to have increased again by up to 5.8°C. Globally, the ten warmest years on record have all occurred since 1991. The result has not just been a warmer climate but a series of catastrophic environmental impacts, from the melting of the polar ice caps to volatile weather patterns to multiple threats to global fauna and flora on an unprecedented scale (see box "Climate Change – Cause and Effects").

The overwhelming scientific consensus now is that the cause of climate change is the increasing emission of greenhouse gases into the atmosphere from human activity. Greenhouse gas concentrations are currently higher than at any time in the past 450,000 years, and projected to keep rising.



Fossil fuel and flooding – cause and effect of climate change

Photo: © 2003 Greenpeace / Matthieu Barret

Responsibility lies with a range of human activities, from the burning of fossil fuels to deforestation, all contributing to an increase in gas emissions, with the largest proportion coming from carbon dioxide. Within the European Union, CO<sub>2</sub> accounted in the year 2000 for over 80% of greenhouse gas emissions.

Most analyses of the phenomenon agree that if its worst side-effects are to be avoided, then the rise in average global surface temperature must be kept to below 2°C. Above that level, according to one recent report (1), the risks to human societies and ecosystems grow significantly, with the potential for substantial agricultural losses, greatly increased numbers of people experiencing water shortages and widespread health impacts. The world's coral reefs and the Amazon rainforest could also suffer irreversible damage.

Quite apart from the environmental effects, the economic damage resulting

from climate change is expected to be enormous. A report presented to the Organisation for Economic Cooperation and Development (OECD) this April (2), for instance, estimated that delaying serious efforts to abate greenhouse gases by 20 years could cost the global economy more than €17.7 billion annually.

So if climate change is one of the greatest environmental, economic and social threats facing the planet and likely to be the dominant environmental issue of the 21st century, what has been the response of the international community?

### Kyoto ratified

At its heart has been the United Nations Framework Convention on Climate Change (UNFCCC), the international treaty whose most concrete outcome was the 1997 Kyoto Protocol. This legally binding agreement was the first time that the industrialised nations of the world, responsible

for the majority of greenhouse gas emissions, had collectively agreed to reduce them. The target is for an average of a 5.2% reduction from their 1990 levels during the period 2008-2012.

It eventually took until February of this year for the Kyoto Protocol to reach its critical mass of ratification by at least 55% of the industrialised nations and accounting for at least 55% of global carbon emissions. But whilst Kyoto has finally entered into force, the European Union - itself responsible for almost a quarter of the industrialised countries' emissions - had already been working towards its own target for an 8% reduction in greenhouse gas levels by 2008-12. Individual targets were set in 1998 for each of the 15 original member states (see chart page 18). Eight of the accession countries joining in 2004 have also now been given targets ranging from a 6% to 8% reduction.

In pursuit of these targets a series of policies and measures have been intro-

## Wind Energy and the Kyoto Mechanisms

*Wind power still has some ground to make up if it is to benefit fully from the project-based "flexible mechanisms" established under the Kyoto Protocol. This is despite the large potential for increased use of the global wind resource and the rapid growth in electricity demand in many host countries.*

*The two project-based mechanisms are the Clean Development Mechanism (CDM) and Joint Implementation (JI). Both allow industrialised countries to offset their domestic emissions of greenhouse gases through mitigation activities undertaken in another country. They also provide flexibility as to where these mitigation activities can take place and which gases, not just carbon dioxide, are involved. Apart from the benefits to both the host nation and the industrialised state, the underlying attraction of these mechanisms is that they help the latter to achieve their commitments more cost-effectively.*

*CDM projects involve investment by an industrialised country in a developing country, whilst JI projects involve transactions between industrialised countries. Credits are generated on the basis of the greenhouse gas emissions avoided. All projects have to show that the reductions they generate are in addition to any that would occur in the absence of the certified activity.*

*Although work on preparing the ground rules for these mechanisms has been ongoing for some time, and a number of projects have been initiated, the first CDM project was not officially registered until November 2004.*

*According to an analysis by the Organisation for Economic Co-operation and Development (OECD)\*, 800 MW of wind capacity has been developed under the mechanisms so far. This has involved plans for 21 separate wind farms.*

*One problem identified by the OECD report is that larger scale projects involving the capture of other greenhouse gases, for example reducing nitrous oxide emissions from industrial processes, are being preferred for cost reasons over carbon dioxide-saving renewables. Whilst the number of wind projects appears relatively high, OECD estimates they account for only 2.9% of the emissions credits generated to date.*

*The report says that clarification of the way in which the CDM and JI operate should reduce the costs and risks associated with the mechanisms, resulting in an increased take-up of renewables projects, including wind.*

\* "Can the Kyoto Protocol's flexibility mechanisms help increase the use of wind energy?", Jane Ellis, OECD, presentation at 2004 EWEC.

duced by the EU, the most recent of which has been the emissions trading scheme which came into effect at the beginning of 2005 (see “Emissions Trading and Wind Power – EWEA’s View”). Other existing policies and measures include improvements in the energy efficiency of large industrial installations and buildings, the promotion of energy efficient appliances, encouraging the use of biofuels in transport, reducing the emissions from new passenger cars, the promotion of combined heat and power, the recovery of methane from landfill sites, and the promotion of electricity from renewable energy.

How successful have these policies been? According to the most recent analysis by the European Environment Agency (3), at the end of 2002 the EU-15 had reduced the overall level of greenhouse gases to 2.9% below their 1990 level - just over a third of the way towards the Kyoto target. Emissions had fallen across most sectors, including energy supply, but not for transport, where they had increased by nearly 22%.

Looking forward, however, the EEA projects that existing national policies and measures will not be sufficient for the EU-15 to reach their combined 2010 goal. Only if additional domestic measures currently planned by the member states are taken into account could an emissions reduction of 7.7% be achieved. This would depend on six countries – Finland, France, Greece, Ireland, Sweden and the UK – cutting their emissions by more than is required to meet their national targets, an outcome which the EEA says “cannot be taken for granted”. If the plans by a number of member states to use credits achieved through the Kyoto Protocol’s flexible mechanisms (see box “Wind Energy and the Kyoto Mechanisms”) are also taken into account, then the reduction level would reach 8.8%. That would be above the EU’s Kyoto obligation for 2010.

### Wind power’s contribution

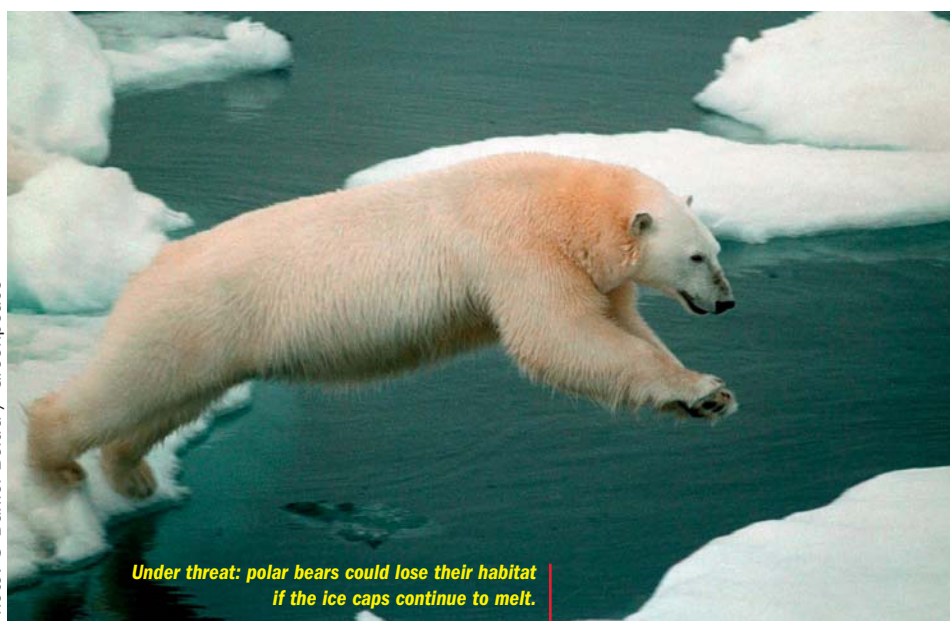
The EEA report states that “the largest emission savings for the EU-15 are projected to be from renewable energy policies, followed by the landfill directive”. However, with the share of renewables within the EU’s electricity consumption having increased from 13.4% to just 13.6% between 1990 and 2002, it is considered unlikely that the target for 22% by 2010, as laid down in the 2001 Renewables

Directive, will be met. “Large increases in renewable energy are therefore required,” the Agency concludes.

There is no doubt that wind power can make a substantial contribution to the EU’s emission reduction targets. According to EWEA calculations (4), wind is forecast to meet 30% of the Union’s Kyoto obligation by 2010. This is based on the assumption that one terawatt hour (TWh) of electricity produced by wind power will save 0.65 million tonnes of CO<sub>2</sub> in 2010, and that installed capacity increases from 34 GW by the end of 2004 to 75 GW in 2010.

But wind is not the only option on the table. According to the latest European Commission report (5), fifteen technology choices could each make a similar contribution to reducing carbon dioxide emissions. As well as wind power and other renewables, the list includes forest management, storage of carbon and nuclear fission. Quite apart from this report, nuclear power, hydrogen, carbon sequestration, clean coal and energy efficiency have all recently risen up the league table of proposed climate change solutions.

Photo: © Daniel Beltrá / Greenpeace



## Climate Refugees

- Sea level rise and agricultural changes due to climate change are estimated to result in 150 million environmental refugees by 2050.
- Flood zone refugees in India alone could range between 20 and 60 million.
- 17% of Bangladesh could be permanently lost to sea level rise coupled with land subsidence.
- Egypt would lose between 12 -15 % of its arable land.
- 50 million people globally could be displaced due to climate change-induced famine.

Source: Myers, N., “Environmental refugees in a globally warmed world” quoted by R K Pachauri, Director General, TERI and Chairman, IPCC at Scientific Symposium on Stabilisation of Greenhouse Gases, Exeter University, Feb 2005.



Devastation after Hurricane Charley hit the United States in 2004: extreme weather events will become more common

## Climate Change – Cause and Effects

Climate change is a direct result of the increasing greenhouse effect. This is the process by which concentrations of gases, including carbon dioxide, methane, nitrous oxide and CFCs, help trap the heat of the sun's rays within the earth's atmosphere. Recent and predicted effects of climate change, depending on the level of global temperature increase, include:

**Sea level rise:** Rising sea levels will cause flooding, land erosion and the loss of flat coastal regions. In the EU, an estimated 68 million people will be affected. In areas like the Maldives and Bangladesh, the loss of low-lying areas will result in mass migration.

**Agriculture:** Although EU agricultural yields could increase with up to a 2°C average temperature rise, above that level they will decline. Bad harvests could become more common due to more extreme weather events, as well as pests and diseases.

**Health – heat stress:** More than 20,000 additional deaths attributable to heat occurred in western and southern Europe in summer 2003. Heat waves are projected to become more frequent and more intense. Globally, an average temperature rise of 1.2°C will cause an increase in premature mortality of several hundred thousands, not including heat waves.

**Health – infectious diseases:** A 2°C increase could result in 210 million more people being at risk of malaria.

**Ecosystems:** Protected areas of global importance are likely to suffer severe losses of both area and species. Arctic wildlife will be harmed. Coral reefs will suffer increased bleaching.

**Water:** Above a 2-2.5°C increase, up to 3 billion people will be at risk of water stress.

**Floods:** With a 1.4°C increase, coastal floods will place 10 million more people at risk; 3.2°C would place 80 million under threat.

**Extreme weather:** Cold spells, heat waves, drought, floods, storms and tropical cyclones are all likely to increase. The annual number of disastrous weather related events doubled in Europe over the 1990s. Economic losses from such events have increased from \$5 billion to \$11 billion in the last 20 years.

Source: "Winning the Battle Against Global Climate Change", European Commission, Feb 2005.

## Beyond Kyoto

Whilst debate continues about whether the current EU goals can be achieved, attention has now turned to what will happen at the end of the present 2008-2012 target period, already fast approaching. EU Environment Commissioner Stavros Dimas told an audience in Washington DC last month that post-2012 policy was "certainly the most burning issue in the current climate change debate".

In its latest strategy paper, "Winning the Battle Against Global Climate Change", published in February (5), the European Commission deliberately avoids recommending any specific target for EU greenhouse gas reductions after 2012. Instead it argues for a "participatory" approach which would encourage nations, such as the US, and developing countries, not so far included in the Kyoto process, to take part in international action to reduce emissions.

The Commission's specific recommendation is for the establishment of a "G7" type group of leading nations, whose members would include the EU, US, Canada, Russia, Japan, China and India - together responsible for about 75% of global greenhouse gas emissions - as a forum for future action. This would hopefully feed in to the ongoing UNFCCC negotiations. For the EU to set a new unilateral target for the post-2012 period would send the wrong message to this putative group, it argues.

Importantly, the report concludes that on the economics of climate change mitigation measures, the benefits clearly outweigh the costs involved in carrying them out.

In early March, however, the EU's Environment Ministers, called for all industrialised nations to look for much deeper cuts in emissions during the post-2012 period. Proposing specific ongoing targets, the ministers recommended that "reduction pathways... in the order of 15-30% by 2020 and 60-80% by 2050 should be considered". Justifying these new tougher targets, Denmark's Environment Minister Connie Hedegaard said that it was up to the EU to take a leading position on climate change. "There's no doubt that the industrialised countries, the rich part of the world, still have to lead with the biggest reductions after 2012," she said.

When it came to the European Spring Council meeting later in the month, the heads of government backed the Environment Ministers (see Brussels Briefing, p. 12). Although they avoided the more ambitious target for 2050, they did adopt the aim for a 15-30% cut by 2020. For the first time, they also backed the goal that global temperatures should not be allowed to rise to more than two degrees centigrade above pre-industrial levels.

### COP-11 in Canada

The stage now moves to the next meeting of the UNFCCC negotiations, the 11th COP (Conference of the Parties), scheduled to take place in Montreal, Canada this November. In advance of this, post-Kyoto targets are due to be discussed during a seminar of international government experts and a week of negotiations to be held in Bonn in May.

The International Climate Change Taskforce, a group set up by leading policy "think tanks" in the US, UK and Australia, recently recommended that the G8 governments establish national renew-

able portfolio standards to generate at least 25% of electricity from renewable energy sources by 2025, with higher targets needed for some countries.

UK Prime Minister Tony Blair has said that climate change will be one of the principle issues to be discussed at the summit of G8 leaders in Britain this July and for the UK's EU Presidency, which occupies the second half of 2005. Whether that will include more serious consideration of renewables as a means of limiting climate-induced damage remains to be seen.

#### References:

1. "Meeting the Climate Challenge", International Climate Change Taskforce, Jan 2005.
2. OECD Environment Policy Committee High-Level Special Session on the Costs of Inaction, 14 April 2005.
3. "Greenhouse gas emission trends and projections in Europe 2004", European Environment Agency, 2004.
4. "Wind Power Targets for Europe: 75,000 MW by 2010", EWEA Briefing, Oct 2003.
5. "Winning the Battle Against Global Climate Change", European Commission, Feb 2005.

## Emissions Trading and Wind Power - EWEA's View

"The entry into force of the Kyoto Protocol is indeed a historical event and the wind power sector is certainly supporting any measure that intends to put a price on pollution. We do not expect to see an immediate reaction in the market for wind power technology in the first commitment period. The low hanging fruit, predominantly in the form of efficiency measures, will be picked first. We will, in the short term, see governments include the CO<sub>2</sub> issue to a greater extent in energy policy, which could have a discernible impact on the market for wind power, say five years from now. But what will really make a difference is the level of ambition for reductions beyond 2012", says EWEA's Christian Kjaer.

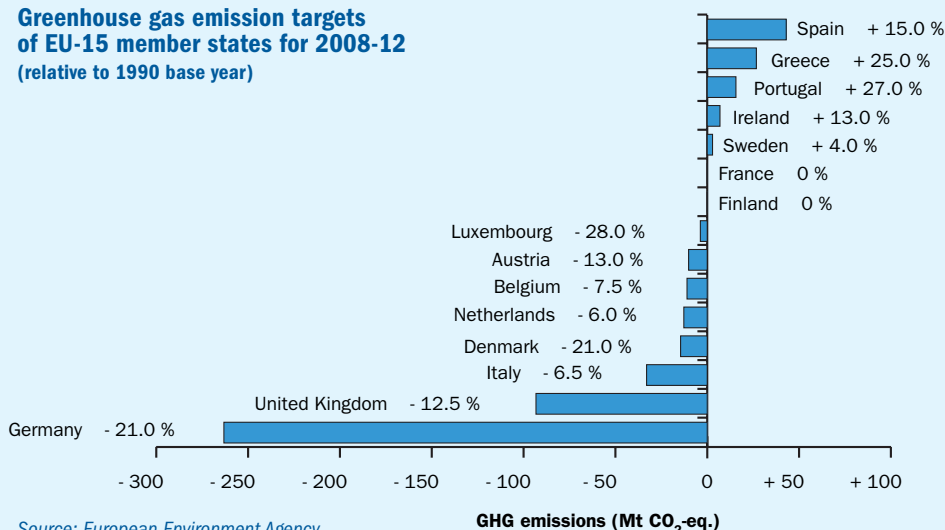
EWEA is generally supportive of the EU Emissions Trading Scheme, which it labels a potentially effective and powerful tool to meet targets for greenhouse gas emissions. However, it expresses some reservations about the design of the scheme. The Emissions Trading Directive states that for the period 2005-2007, Member States should allocate at least 95% of emission allowances for free. For the period 2008-2012, 90% of allowances will be allocated for free.

"It is clear that the scheme's impact on wind power and other renewables crucially depends on the method of allocation and, of course, the level of ambition for reductions beyond the first commitment period. We would certainly have liked to see a system based on pure auctioning rather than free allocation, but it became clear very early that auctioning was not politically possible to agree on," says Kjaer.

EWEA estimates that under free allocation, only some 5% of the power sector's external costs are internalised, so it will still be virtually free for power plants based on fossil fuels to pollute.

"The price of an emission allowance is unlikely to ever fully capture the external costs of power production. Only by mere coincidence will the

**Greenhouse gas emission targets of EU-15 member states for 2008-12 (relative to 1990 base year)**



price of a CO<sub>2</sub> allowance equal the environmental costs of producing electricity. That does not mean that we should not proceed with the scheme, but its limitations must be recognised. The emissions trading scheme is well designed for its main purpose of capping EU emissions. If we want to take the internalisation of external costs seriously, a completely different mechanism must be applied. However, auctioning would make a larger contribution towards internalising the power sector's external costs in accordance

with the Treaty's environmental articles and the polluter pays principle. It would be simpler and avoid most of the potential market distortions arising from Member States' determining the level of free allocation through National Allocation Plans," says Kjaer.

### Benefit to renewables?

In EWEA's view, two major misconceptions about the effects of the emissions trading

scheme have developed: that the scheme places additional cost burdens on power production from fossil fuel plants and that emissions trading will definitely benefit renewables.

EWEA argues that fossil fuel power plants stand to gain enormous windfall profits from the scheme. The reason is that price-fixing in the electricity markets is based on the marginal cost of production, i.e. the cost of the last produced kWh. The cost of an emission allowance will therefore apply to the marginal unit of electricity that sets the price on the market, raising the market price for all kWh produced. Fossil power producers will receive the higher price for each kWh they produce, but the cost of buying CO<sub>2</sub> emission allowances will only apply to the very small share of total kWh's produced that are not allocated for free.

The same argument has been made by the International Federation of Industrial Energy Consumers, which estimates that in Germany alone, the power sector will earn windfall profits of €3.2 billion. The cost of the emissions trading scheme should add €0.25 per MWh to electricity at an allowance price of €10. Due to the nature of the price setting mechanism and the lack of real competition in the wholesale electricity market, the cost will be €7 per MWh.

"The emissions trading scheme's effect on the relative competitiveness between the various power technologies, specifically its relative effects on renewables and non-renewables, are not very well understood. In a conventional power market characterised by limited competition, as pointed out in the Commission's four benchmarking reports, a conventional power plant operator stands to gain considerable windfall profits from the EU emissions trading scheme. Consumers have to pay a high price for all the kWh they purchase, although the extra production costs for the power plant only apply to a very small share of total power produced", says Kjaer.

### Emissions Trading – How It Works

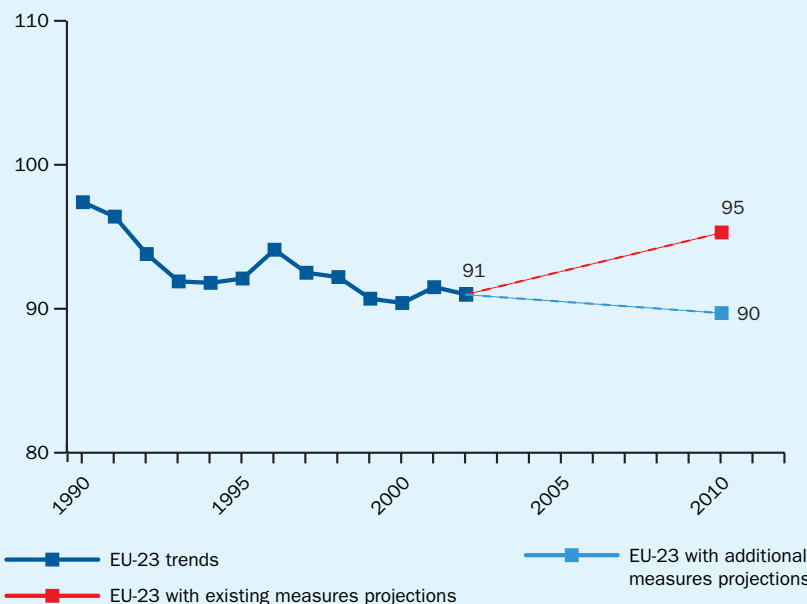
The EU Emissions Trading Scheme, which commenced operation on 1 January 2005, is based on Directive 2003/87/EC. The scheme is aimed at reducing greenhouse gas emissions within the 25 member states by a fixed amount, but at least cost to the participants. It consists of a pilot phase that runs from 2005-2007 and a second phase from 2008-2012, which is the first obligation period of the Kyoto Protocol.

The Directive is based on the EU's Kyoto obligation to reduce, by 2010, the emission of greenhouse gases by 8% compared to 1990, and covers 46% of EU emissions. Within the Directive carbon dioxide caps on emissions from numerous industrial sectors, for example electricity generation, are included in a European framework.

Large emitters of carbon dioxide are allocated emission allowances for free on the basis of national allocation schemes. If they reduce the emissions to a level which is below the quantity assigned to them, they can sell any surplus allowances to participants that do not fulfil their obligation, or keep them for later use. One quota equals the right to emit one tonne of CO<sub>2</sub> equivalents in a given period. If a plant exceeds its emissions allowance it has to trade for further allowances, or pay a penalty.

Currently, allowances are allocated for free to the polluters, such as fossil fuel based power plants. Nuclear power plants and renewables are not allocated free allowances. However, a country has the possibility to auction up to 5% of its allowance allocation.

GHG emissions (base year = 100) **Greenhouse gas emission trends and projections for EU-23**



Source: European Environment Agency

What is more, the higher electricity price is unlikely to have any significant short-term effect for wind power plants and other renewables – at least in those markets where payments to wind farm operators are decoupled from the power market. In the longer term, as the quotas are tightened (and/or free allocation is replaced by auctioning of allowances), wind power and other renewable energy sources could benefit from a higher emissions allowance price and higher alternative abatement costs.

“Emissions trading can – if designed correctly - be a splendid tool to reduce greenhouse gas emissions but it does not serve the same purposes as policies to promote the development of renewable energy sources and policies aimed at fully internalising external costs. In its current form, it is clear that the scheme benefits conventional fuels rather than renewables. These impacts must be better understood and communicated. But it is still early days and hopefully these concerns will be addressed when deciding on a framework beyond the first compliance period,” says Kjaer

## Climate Change: The NGO View

### Steve Sawyer, Greenpeace International

“Both the International Climate Change Task Force convened by Tony Blair for his G8 Presidency and now the European Council have confirmed that responsible climate policy means aiming to keep global mean temperature rise below 2°C. To do that requires urgent action to achieve deep cuts in emissions beyond the Kyoto Protocol’s initial round for the period 2008-2012. ‘Negotiations about negotiations’ are already underway informally, and the Kyoto parties must get down to work as soon as possible.

Greenpeace’s calculations show that to keep the option of remaining below 2°C temperature rise means cuts in industrialised country emissions of at least 30% by 2020. But while that might seem difficult, it pales in comparison with the task of both convincing and enabling the booming economies in China and India to take the urgent and necessary steps to decarbonise their economies to the point where they can talk about absolute emissions caps and eventually, reductions - and to do this without sacrificing the economic growth and development their populations rightly demand. Despite China’s booming economic growth, for example, their GDP

per capita has only just passed \$1,000, an order of magnitude less than in the industrialised west.

One part of both convincing and enabling these countries to participate in the task of saving the climate will be to establish financial and technology transfer mechanisms which will allow the inevitably massive investment in their energy sectors to be primarily in renewable energies. Wind energy can and should play a major role in that.

The fact is, the wind industry in both China and India is growing rapidly, with ‘business as usual’ growth of around 30%. The challenge is to ensure that this growth is faster than business as usual. To do this we have to put our money where our mouth is – to show that for new power production and job creation, wind is faster and better than coal or nuclear. We now have the opportunity to prove it on a very large scale.”

### Stephan Singer, Worldwide Fund for Nature

“By agreeing that industrialised countries should reduce their greenhouse gas emissions by up to 30% by 2020, the EU’s leaders have set a new benchmark for international efforts to combat climate change. This sets the



“Vote to Stop Climate Chaos” message projected on the UK parliament building in London.

Photo: WWF-UK

stage for global negotiations starting later this year about how to reduce climate pollution in the longer term.

The leaders now need to follow up in their own countries. If such reductions were implemented across Europe, they would help the EU combat climate change, increase the EU’s energy security and create a lean and efficient economy. According to a recent economic assessment by the European Commission, the benefits of additional action in the EU to fight against climate change outweigh the perceived costs, while the cost of non-action will be much higher.

Key decisions to be made within Europe in the next few months include an agreement on stronger energy efficiency legislation, a decision to increase the share of renewable energy sources such as wind and biomass to 25% by 2020, and a strengthening of the EU’s Emissions Trading Scheme so that dirty coal power plants are taken out of business. These are all crucial to the battle against climate change.”