Wind energy and EU climate policy

Achieving 30% lower emissions by 2020

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1 EXECUTIVE SUMMARY

In 2010 the total installed wind power capacity in the EU stood at 84 gigawatts (GW). In a normal wind year this would produce 181 terawatt hours (TWh) of electricity.

Wind energy production does not emit any greenhouse gases (GHG), unlike coal, gas and oil. Because of the way the electricity market operates – using marginal costs rather than full investment and operation costs – wind energy replaces a mix of gas, coal and oil generation. The European Commission estimates that these three technologies emit on average 696g CO_2/kWh in 2010. 181 TWh of wind energy production would therefore have avoided a total of 126 million tonnes of CO_2 ($MtCO_2$) in 2010.

As party to the Kyoto Protocol, the EU-27 committed to reduce emissions by 7.8% compared to 1990 levels with at least 50% of these reductions to be made inside the EU – so called *domestic reductions* – while the rest can be achieved by purchasing credits from projects outside the EU via the Clean Development Mechanism or Joint Implementation (CDM/JI),[1] otherwise called *offsets*.

Wind and other renewable energy emissions reductions are domestic reductions, made in the EU. Comparing the Kyoto Protocol targets with CO_2 avoided by wind energy, we find that in 2010, EU wind energy avoided as much as:

- 28% of the EU's Kyoto reduction target (or 56% of the EU's domestic reductions target)

The EU's current overall GHG reduction target is set at 20% for 2020 and allows for about 60% of total emissions reductions to come from offsets. Hence the EU's domestic reduction target is only 40% of the overall 2020 target. It represents a decrease in emissions of about 1,113 Mt compared to 1990.

EWEA's baseline scenario for wind power development to 2020 forecasts 230 GW of installed capacity, producing 581 TWh of electricity and avoiding 342 $MtCO_2$.

As a proportion of the EU's emissions reduction target, EU wind energy production should avoid as much as:

- 31% of the EU's 20% emissions reduction target (77% of EU *domestic* reductions)
- 20% of a potential 30% emissions reduction target (51% of EU *domestic* reductions)

Adding avoided emissions from other renewables[2] makes the picture even clearer, even without taking energy efficiency into account: by 2020 renewable power generation as forecast by the 27 national governments of the EU should avoid 530 $MtCO_2$, equivalent to:

- 48% of the EU's 20% reduction target (119% of EU domestic reductions)
- 32% of a potential 30% emissions reduction target (79% of EU domestic reductions)

The figures above compare wind power avoided emissions with the entire EU reduction targets, across all economic sectors. While the EU has no target for the power sector alone, the ETS sets a cap for power sector and heavy industry together – a 21% reduction from 2005 levels, allowing a 50% use of offsets. Comparing the CO_2 avoided from wind turbines installed in the timeframe covered by the ETS targets (2005-2010/2020), we find that turbines installed since 2005 avoided:

- In 2010 - 78 $MtCO_2$, equivalent to 83% of ETS required reductions
- By 2020 - 301 $MtCO_2$, equivalent to
  64% of ETS target (20% overall EU target)
  53% of ETS target (30% overall EU target)
  107% of ETS domestic effort (30% EU target)

Based on these findings, EWEA makes the following policy recommendations for 2020.

1 The CDM and JI allow industrialised ("Annex I") countries to invest in emission reducing projects respectively in developing ("non-Annex I") countries or in some eastern European countries, and to count the emissions reductions towards their own target.
2 Excluding large hydro generation.

EU climate policy recommendations to 2020

- **Moving to a 30% domestic reduction target – an achievable goal, beneficial to the EU economy**

The figures above make very clear that wind power will account for a significant part of the EU effort to reduce emissions. So significant, that even with a 30% target, and with the current rules on access to offsets, wind power alone can meet over 100% of the domestic ETS reduction effort. Renewable electricity generation[3] (based on the 27 Member States' submitted National Renewable Energy Action Plans, NREAPs) can achieve above 100% of the domestic EU-wide reduction effort with a 20% reduction target and 79% with a 30% target.

This would leave just 21% of the domestic effort to be met by other sectors/technologies, given constant production output, and potentially less if the national renewable energy targets are exceeded, as foreseen by the renewable industry – a very achievable objective.

Reducing emissions stimulates the EU renewable economy. There is now a widespread consensus that the development of resource-efficient and green technologies will be a major driver of growth (EU Commission, 2010). The EU has been the cradle of renewable energy innovation, particularly wind power, and the European wind industry represents a growing number of jobs (188,000 in 2010), significant and growing export opportunities, as well as increased energy security and competitiveness. But this advantage is being challenged, and climate targets are key to keep EU investors on the renewables track.

- **Tightening the Emissions Trading System to avoid oversupply and a low CO_2 price**

The economic crisis has undermined the effectiveness of the ETS as a tool to shift Europe away from fossil fuels towards a renewable, zero-carbon power sector. Reduced demand during the crisis meant reduced production which in turn also meant reduced real emissions. Because real emissions were well below the amount of freely allocated allowances heavy industry sectors received, it generated a surplus that could be sold or kept for later use. This created vast windfall profits for heavy industry and cheap business-as-usual solutions for the power sector, which didn't make the necessary investments in renewable technologies. To avoid oversupply on the carbon market and change investment patterns in the power sector, the EU must raise the current GHG target to 30% domestic reductions by 2020, or at minimum increase scarcity on the carbon market by setting aside a certain number of allowances to be cancelled at a later stage.

- **Committing 100% of ETS auctioning revenue to finance a shift in production**

With auctioning in the power sector, additional yearly revenues worth up to €50bn will accrue to Member States' budgets. It is essential that 100% of these new funds are directed toward mitigating climate change through, for example, the development and deployment of renewable energy technologies and modern electricity infrastructure, and that existing budget lines cannot be counted towards achievement of this objective.

3 Excluding large hydro generation.


Photo: Flamee

2 INTRODUCTION


Photo: Thinkstock

Since 1995, wind energy has played an increasing and accelerating role in the evolution of the power sector. Most of the 84 GW of wind energy installed in the EU by the end of 2010 were added in the last 10 years.

This significant deployment of wind energy has been instrumental in reducing greenhouse gas emissions from the power sector, with more wind power capacity being installed in the EU than any other power generating technology in the last 10 years, except for gas.

This report proposes a methodology for calculating wind-avoided CO_2 at EU level and looks at the impact the deployment of the technology is having, and will have, on emissions reductions. In order to make the results more visual, wind-avoided CO_2 is compared with the emissions reduction objectives the EU and the world have set themselves in order to avoid a 2°C temperature increase, as recommended by scientists in order to have a 50% chance of avoiding catastrophic climate change.

Based on these calculations and comparisons, the report proposes a set of policy recommendations which aim to increase emission reduction potential through the development of more renewable energy sources.

Photo: Getty Images

3 WIND ENERGY REPLACES COAL, GAS AND OIL GENERATION

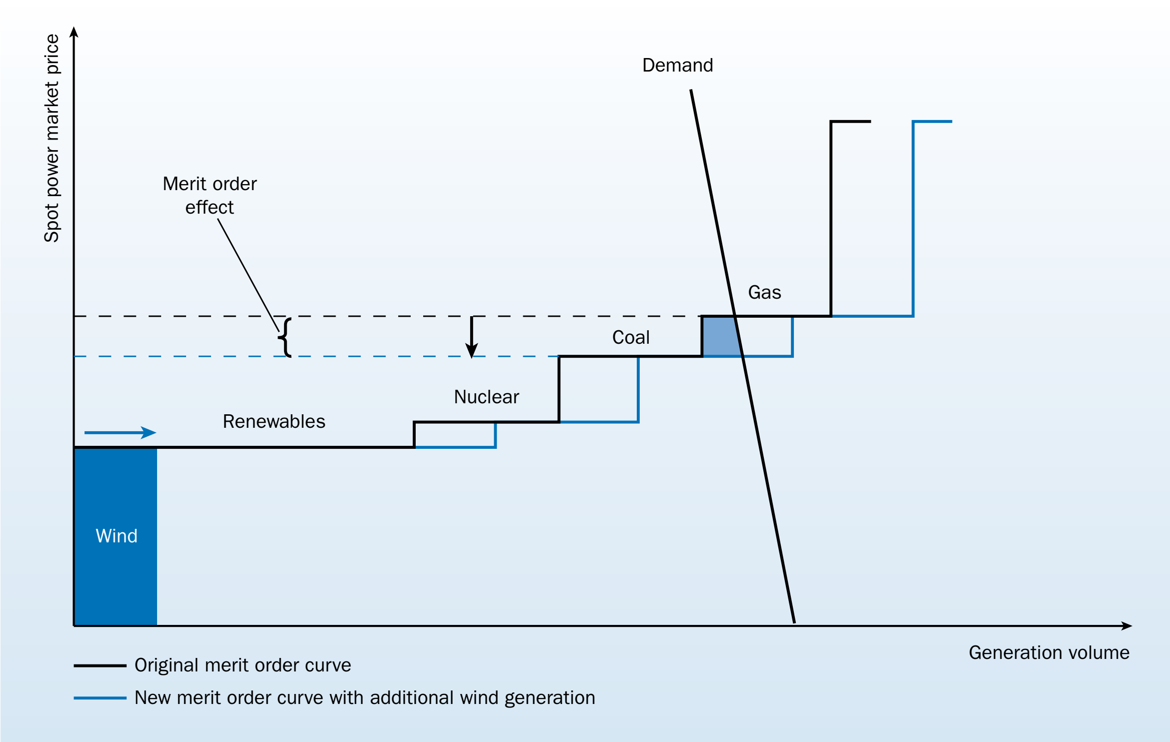
- **The "merit order effect" and its impact on CO_2 emissions**
- **Estimating avoided CO_2 – merit order rather than grid carbon intensity**

The "merit order effect" and its impact on CO_2 emissions

The "merit order" principle is a cost optimisation principle, which means that plants with the lowest short-run marginal costs[4] (SRMC) are used first to meet demand, with more costly plants being brought on-line later if needed. The merit order principle is the guiding principle of an electricity spot market in which the lowest bids will be served first. In case of increased wind power generation, the most expensive conventional power plants might no longer be needed to meet demand. If the short-run marginal costs of wind power are lower than the price of the most expensive conventional plants, the spot market price of electricity goes down. This is called the 'merit order effect' (MOE) and refers to the day-ahead or spot power price.

Figure 1 shows a supply and demand curve for a power exchange[5]. Because of its zero fuel and carbon costs and low operations and maintenance (O&M) costs, bids from wind power enter the supply curve at the lowest price level (blue block on the left of the supply curve). In Figure 1, wind is therefore part of the renewable technology step on the left side of the curve, which also includes hydro technologies. Renewable technologies will usually enter the merit order curve first, before other conventional technologies come in; the only exception is hydro reservoir power, which could be kept aside when power prices are very low. In the general merit order curve, renewable technologies are followed by nuclear, coal and combined heat and power plants, while gas-fired plants are on the upper side of the supply curve because they have the highest marginal costs of power production.

FIG 1: **MERIT ORDER EFFECT OF WIND ELECTRICITY GENERATION**



Source: EWEA, 2010, Powering Europe: wind energy and the electricity grid

4 These exclude investment costs, so only operation and maintenance cost are accounted for.
5 It is assumed that the electricity demand is very inelastic in the short-term perspective of a spot market.

With an increased share of wind power the supply curve is shifted to the right (becoming the blue "New merit order curve"), resulting in a lower power price. The merit order effect means that the technologies with higher marginal costs are pushed out of the market by wind energy and other renewables. These technologies also happen to be the ones that emit the most CO_2 – oil, gas and coal. This means that wind avoids CO_2 emissions from these three technologies, in differing combinations depending on each market's specificities. This principle will be the base of all calculations to follow.

Wind and hydro power - displacement and storage rather than replacement

Hydro power is very flexible, and can be turned on and off or regulated at very low costs, unlike technologies such as nuclear and coal. While it is true that hydro will be often used as storage technology in times of high wind production, hydro power is displaced rather than replaced: the water level in reservoirs goes up when production is reduced to make up for changes in output from other plants and this "stored" energy can be used at a later stage[6].

Curtailment should be minimised

While curtailment – the mandatory stopping of wind turbines – occurs for different reasons in certain systems, it should be seen as an exception and as such should not have much impact on the total EU production of wind energy particularly in a well run electricity system. Curtailing a relatively capital intensive power technology such as wind energy would be the most expensive option for the consumers since no fuel or carbon costs can be saved by curtailing wind power. Indeed, the EU's Renewable Energy Directive specifies that curtailments must be minimised. As such, it is not considered in the following calculations.

Estimating avoided CO_2 – merit order rather than grid carbon intensity

The Merit Order Effect as presented above is the basis for the methodology for calculating avoided CO_2 in this report. The Clean Development Mechanisms (CDM) use a different approach, looking at the average carbon intensity of the existing electrical generation capacity and using it as a benchmark to issue an equivalent quantity of Certified Emissions Reductions (CERs) for electricity production from a wind farm or other renewable CDM projects.

The CDM methodology was validated in the Marrakesh Accord, in 2001, when experience with renewable energy technologies was low and market liberalisation almost non-existent, even at EU level. It was therefore difficult to foresee how a more – if far from fully – integrated grid system would operate, and which technologies would be pushed out of the system when more renewables with low marginal costs would come online. Were the CDM created today, there is a chance that the methodology would be different.

As Yvo de Boer, former Secretary General of the United Nations Framework Convention for Climate Change (UNFCCC) pointed out during a meeting with Civil Society in Copenhagen in December 2009, "the CDM was designed with the aim to make it as complicated and useless as possible, so that companies would be deterred from using it". This could also be an additional reason for the choice of methodology, since basing the calculations on the carbon intensity of a generation mix will generally give a lower figure for avoided CO_2, since this mix could potentially include other renewable technologies (mainly existing wind, hydro and solar), or nuclear.

6 Many future plans for EU electricity grids and systems are looking at Nordic and Alpine hydro as storage – or batteries – to accommodate increased generation by variable renewable energy technologies.


Photo: Dave Walsh

4 AVOIDED EMISSIONS FROM WIND POWER IN THE EU

- **Wind production and avoided emissions today and up to 2020**
- **Wind power vs. EU climate targets – more ambitious action is possible**
- **Emissions reductions from wind power are domestic**
- **Renewable energies – meeting 100% of domestic reductions?**
- **Transport – wind energy, avoided CO_2 and the EU car fleet**
- **Conclusions – wind energy and renewables make a move to 30% possible**

Wind production and avoided emissions today and up to 2020

A sound production estimate – EWEA statistics and scenarios

Calculating the CO_2 avoided by wind energy requires a sound estimate of the quantity of electricity produced by the currently installed capacity. EWEA has been monitoring wind energy installations and production since 1985 and is producing scenarios on the sector's likely evolution to 2020, 2030 and 2050 based on its knowledge of the industry and EU or national level policy frameworks.

EWEA has a "baseline" scenario and a "high" scenario[7]. The "baseline" scenario is based on EWEA's traditionally conservative approach to setting targets for wind energy. It assumes a total installed capacity of wind power in the EU of 230 GW, producing 581 TWh of electricity, meeting 15.7% of electricity consumption in 2020.

The "high" scenario acknowledges that wind power – as the most affordable of the renewable electricity technologies – is likely to meet a higher share of the EU's Renewable Energy Directive target than the 14% of electricity demand by 2020 indicated by the NREAPs or the 14.2% calculated by the European Commission in its PRIMES energy model. In the "high" scenario, total installed wind power capacity will reach 265 GW by 2020, producing 682 TWh of electricity, meeting 18.5% of electricity consumption.

In 2010, the EU Member States submitted National Renewable Energy Action Plans (NREAPs) as required by the Renewable Energy Directive[8]. Taken together, the Action Plans show that the EU-27 will meet 34% of its electricity demand with renewables in 2020. Wind energy is forecast to generate 14% of Europe's total electricity demand in 2020 – 495 TWh – from 213 GW of installed capacity. This forecast is comparable to EWEA's. Given the weaknesses identified in the national action plans concerning potential wind power installations, in particular onshore, EWEA maintains its baseline scenario of 230 GW[9].

We base the calculations in this report on our baseline scenario.

Avoided CO_2 from wind energy – history and projections

According to the European Commission[10], electricity from gas, coal and oil emits on average 696g CO_2/kWh. Based on the scenarios presented in previous chapters and this figure on avoided CO_2, we get the following table for wind energy avoided CO_2 in past and future years across the EU:

TABLE 1: HISTORICAL AND PROJECTED WIND POWER CAPACITY, PRODUCTION AND AVOIDED EMISSIONS

	2008	2009	2010	2012	2020
Installed capacity (GW)	65	75	84	103	230
Production (TWh)	136	159	181	229	581
Avoided CO_2 emissions (Mt)	97	112	126	156	342

Note: *For comparability of verified figures versus projections, and because Eurostat wind production data is only available until 2008, we use the EWEA methodology for electricity produced in all calculations*[11].

To illustrate these avoided emissions figures, we then compare them with the different emissions reduction targets the EU has set itself, or will do in the future.

7 For more information about the scenarios, please see the EWEA publication "Pure Power", 2011.
8 See Directive 2009/28/EC on the promotion of the use of energy from renewable sources.
9 For comparison of more scenarios from diverse sources, see EWEA 2011 Publication – "Energy Policy to 2050"
10 European Commission, 2010, "Trends to 2030".
11 Both datasets might differ slightly since Eurostat data takes into account actual production in a given year, while EWEA considers production in an average wind year - total installed capacity multiplied by the EU average capacity factor.

Wind power vs. EU climate targets – more ambitious action is possible

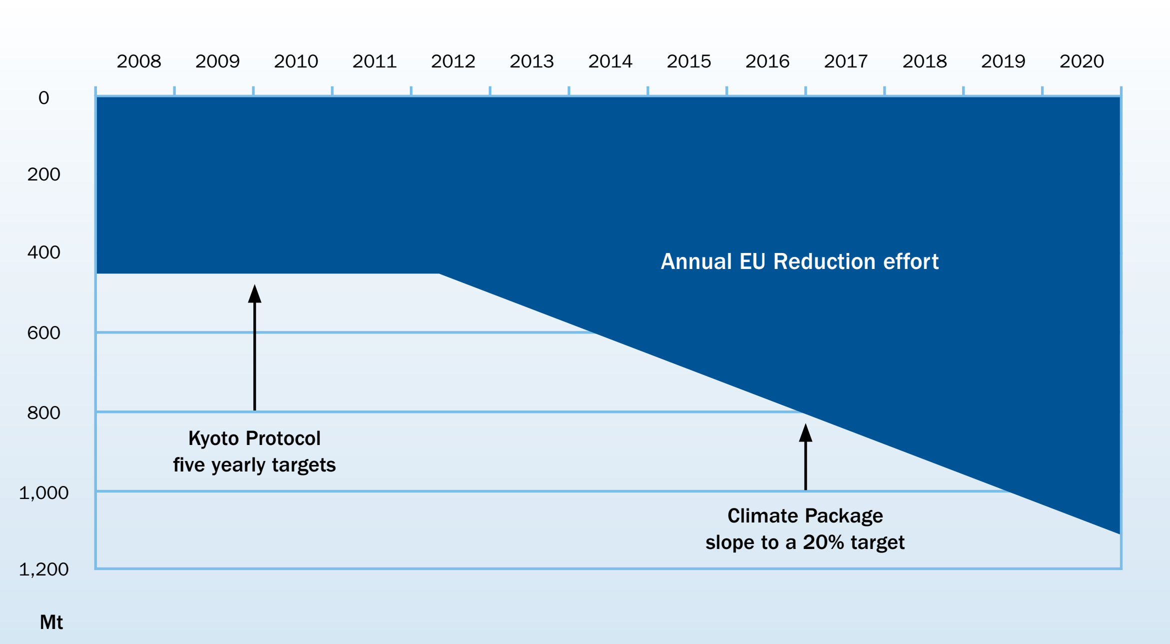
In February 2005 the Kyoto Protocol entered into force, and with it, the EU's commitment to reduce emissions by 8% for the EU-15 as a whole, and between 6% and 8% for the new Member States (EU-12) for an average of 7.8% from 1990 emission levels for the EU-27. The Kyoto commitment is the same each year so the reduction target is valid for the whole 2008-2012 period[12].

In 2009 the EU agreed the "climate and energy package" setting targets for production from renewables energies, energy efficiency, as well as a target for the EU to reduce emissions by 20% from 1990 levels by 2020. Unlike the Kyoto Protocol, this EU target for 2020 is reached by following a linear reduction path of increasing annual targets, reaching -20% in 2020 as displayed in Figure 2.

Comparing the reduction ambition from both the Kyoto Protocol ('KP' in Table 2) and the EU climate and energy package with CO_2 avoided by wind energy shows, as visible from Table 2, that CO_2 avoided by wind energy is already equivalent to 28% of the EU's Kyoto commitment in 2010. By 2012, EWEA estimates EU installed wind power capacity will avoid 35% of the Kyoto target. By 2020 wind should represent 31% of the EU's current target of 20% reductions[13].

While the contribution of wind energy to a 30% domestic target is still significant in EWEA's scenario, it is likely that a decision to move to 30% would trigger additional wind energy investments to those foreseen under the current 20% reduction target. Hence, while the wind energy development currently foreseen could cover 20% of the effort of a 30% domestic target, this number is likely to be higher in reality.

FIG 2: EU ANNUAL EMISSIONS REDUCTION TO 2020 – KYOTO AND 20% REDUCTION TARGETS



Source: UNFCCC, Kyoto Protocol & European Commission

12 See Section 6.1 on EU Kyoto Protocol targets. For 1990, the official figures used in the Kyoto Protocol for Annex I countries emissions differ slightly from the real emissions. In this report, official figures are used rather than real emissions since they result from the negotiation based on each country's perception of the reduction effort it was committing to. Real emissions are lower than official figures, so that comparing wind-avoided CO2 to real emissions would only result in a higher share of the effort met by wind energy.

13 EU Commission submissions to UNFCCC – 1990 emissions excluding LULUCF and international bunkers.

TABLE 2: PERCENTAGE OF REDUCTION EFFORT MET BY WIND ENERGY

	2010 (KP)	2012 (KP)	2020 (20%)	2020 (25%)	2020 (30%)
Yearly reduction effort (Mt)	446	446	1,113	1,392	1,670
Wind avoided CO_2 (Mt)	126	156	342	342	342
% of effort met by wind	28%	35%	31%	25%	20%

Emissions reductions from wind power are domestic

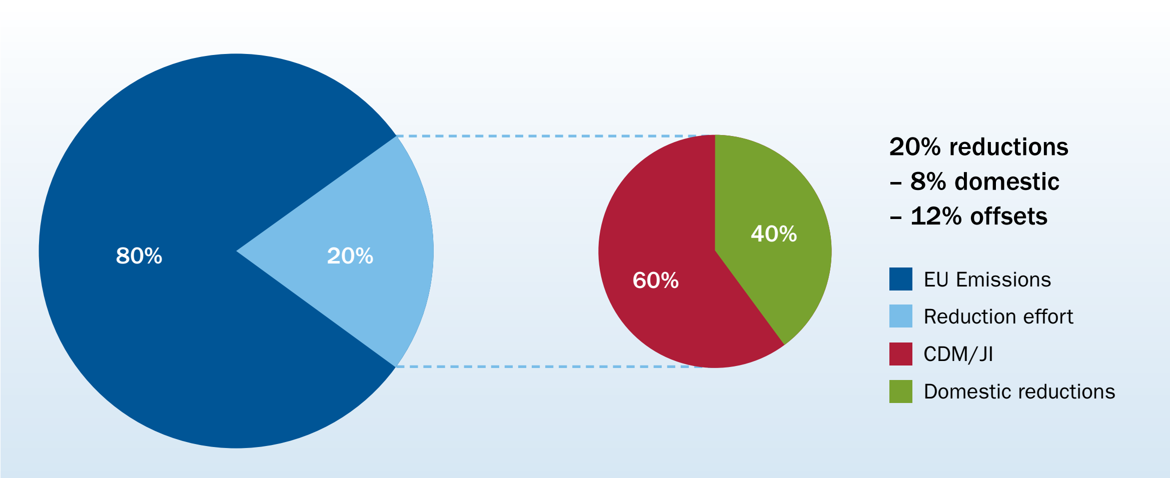
The above calculations represent domestic reductions, made within the EU. In the Kyoto Protocol, as in the EU climate and energy package, reductions targets can be met either by reducing emissions domestically, or by buying CO_2-credits from so-called offsets – projects reducing emissions abroad and registered under the Clean Development Mechanism (CDM) or under Joint Implementation (JI).

Wind avoided CO_2 as calculated above only takes into account turbines installed within the EU. As such, only emissions avoided domestically are taken into account, and not credits issued by wind CDM/JI projects built in developing countries.

In the Kyoto Protocol, the share of reductions to come from CDM/JI credits is not specified other than by stating that "the majority of reductions shall be made domestically"[14], which many interpret as a 49.99% access to offsets (CDM/JI). Table 3 shows that, leaving offsets out of the calculation, CO_2 avoided by wind turbines installed in the EU alone reaches the equivalent of 70% of the EU's domestic Kyoto target by 2012 – a significant achievement.

Similarly, the climate and energy package allows for a 50% access to offsets in ETS sectors[15] (mainly power sector and heavy industry), and about 66% in the effort sharing decision dealing with sectors outside the ETS (mainly agriculture, transport, buildings), for an average of 60% access across all EU sectors. Wind power by 2020 should avoid almost 77% of the entire EU domestic target across all sectors. Again, this is quite considerable.

FIG 3: EU EMISSION REDUCTION TARGET – TOTAL PERCENTAGE AND ACCESS TO OFFSETS (CDM/JI)



14 UNFCCC, 1996, Kyoto Protocol.
15 2009 revision of ETS directive.

TABLE 3: PERCENTAGE OF DOMESTIC REDUCTION EFFORT MET BY WIND ENERGY

	2010 (KP)	2012 (KP)	2020 (20%)	2020 (25%)	2020 (30%)
Yearly Reduction Effort (Mt)	446	446	1,113	1,392	1,670
Wind avoided CO_2 (Mt)	126	156	342	342	342
Wind % of reductions	28%	35%	31%	25%	20%
Wind % of domestic reductions	56%	70%	77%	61%	51%

Renewable energies – meeting 100% of domestic reductions?

Like wind power, other renewable energies are set to develop significantly by 2020. The European Renewable Energy Council (EREC) has outlined them in *RE-thinking 2050*, published in 2010[16]. For 2020, RE-Thinking foresees figures as displayed in Table 4 for production from renewables (excluding large hydropower).

EU Member States have done a similar exercise for the Renewable Energy Directive's National Renewable Energy Action Plans (NREAPs). These production figures, multiplied by the forecast emissions from coal, gas and oil in 2020[17], give the following figures for avoided CO_2.

Figures from both scenarios exclude large hydropower production. The aim of this calculation is to analyse future renewables' CO_2 reduction potential. While large hydropower already is avoiding CO_2, the potential for expansion in Europe is limited.

Comparing the CO_2 avoided by renewables to the reduction effort needed to meet an EU-wide 20%, 25% or 30% domestic target for 2020 gives the figures displayed in Table 5 (next page).

According to EREC, electricity generation from renewables, excluding large hydropower, will avoid emissions equivalent to 61% of the EU's 20% reduction effort in 2020 or 41% of a 30% target should the EU decide to move beyond 20%.

TABLE 4: RENEWABLE ELECTRICITY PRODUCTION AND AVOIDED CO_2 BY 2020

	RE-THINKING 2050		NREAPS	
	TWh	$MtCO_2$	TWh	$MtCO_2$
Small Hydropower	65	38	55	33
Photovoltaics	180	106	83	49
Biomass	250	147	232	136
Geothermal	31	18	11	6
Solar Thermal	43	25	20	12
Ocean Energy	5	3	6	3
TOTAL non-wind RES[18]	574	338	407	239
Forecast Wind (EWEA/NREAP)	581	342	495	291
TOTAL RES-avoided CO_2	1,155	680	902	530

16 EREC, 2010, RE-Thinking 2050.
17 EU Commission, 2010, "Trends to 2030".
18 Excluding large hydro.

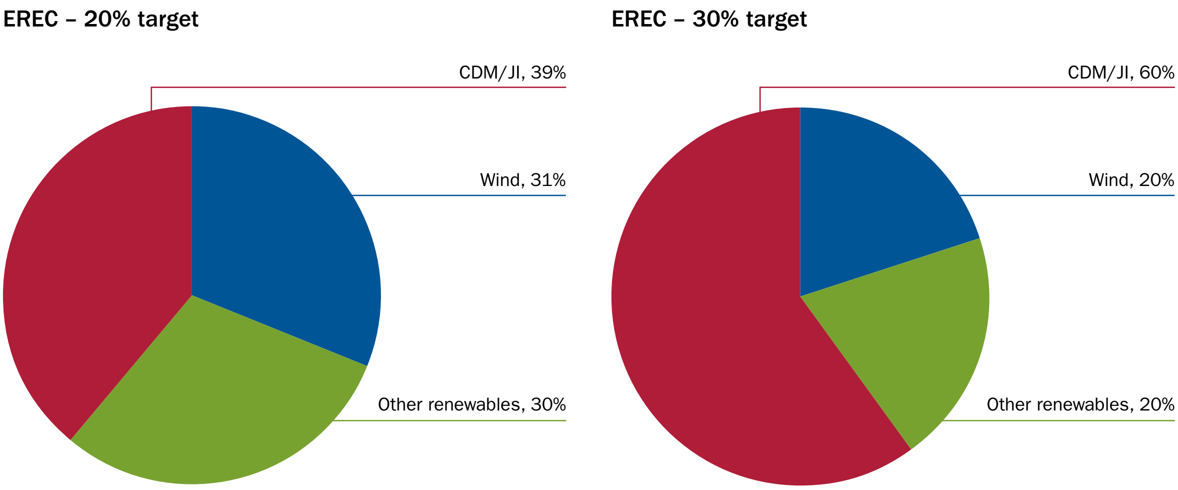
TABLE 5: EQUIVALENT SHARE OF THE REDUCTION EFFORT AVOIDED BY RENEWABLE ELECTRICITY IN 2020

	RE-THINKING 2050			NREAPS		
	20%	25%	30%	20%	25%	30%
Wind-avoided CO_2 (Mt)	342	342	342	291	291	291
Other RES-avoided CO_2 (Mt)	338	338	338	239	239	239
Yearly Reduction Effort (Mt)	1,113	1,392	1,670	1,113	1,392	1,670
% of effort met by wind	31%	25%	20%	26%	21%	17%
% of effort met by other RES	30%	24%	20%	22%	17%	14%
% of effort met by all RES	61%	49%	41%	48%	38%	32%
% of domestic effort met by RES	153%	122%	102%	119%	95%	79%

Again, these are domestic reductions, and taking into account the 60% access to international credits from CDM projects, renewables (excluding large hydropower) achieve over 100% of the 40% remaining domestic reductions required, both for a 20% and for a 30% target (153% of domestic reductions should the target remain at 20%).

Renewables as forecast in the NREAPs would avoid emissions equivalent to 48% of a 20% overall reduction target and 32% of a 30% target. According to the NREAPs, renewables will achieve the equivalent of over 100% of the domestic target in a 20% reduction scenario, while coming very close (95%) in a 25% scenario. Only if we move to 30% will additional reductions to renewable power plus offsets be necessary[19].

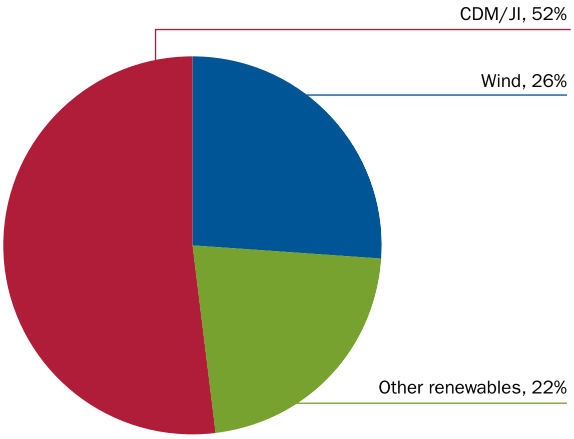
FIG 4: EREC - EQUIVALENT SHARE OF REDUCTIONS BY WIND ENERGY AND OTHER RENEWABLES IN 2020



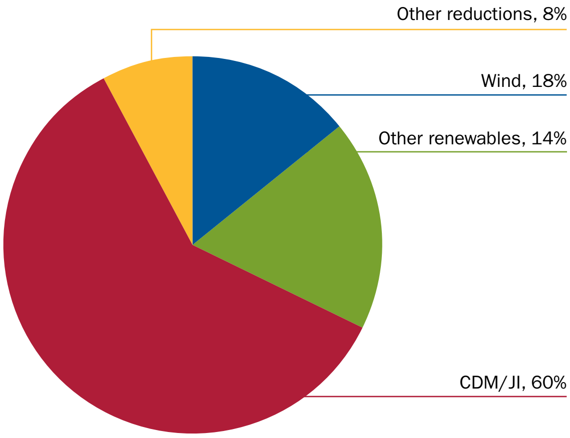
19 This is assuming constant demand in the EU. Increased industrial or power production could cancel out part of the displayed reductions.

FIG 5: NREAPS – EQUIVALENT SHARE OF REDUCTIONS BY WIND ENERGY AND OTHER RENEWABLES IN 2020

NREAPs – 20% target



NREAPs – 30% target



Transport – wind energy, avoided CO_2 and the EU car fleet

Transport emissions account for a very significant part of overall EU GHG emissions: 19.5%[20]. Road transport emitted about 920 $MtCO_2$ in 2007 with passenger cars representing about half of these emissions – 460 $MtCO_2$[21]. In 2008 the passenger car fleet in the EU was approximately 232 million cars. Based on these figures, one million cars emits about 1.98 Mt of CO_2.

In 2010 wind energy avoided 126 Mt of CO_2. This was equivalent to emissions from 64 million cars, or 30% of the entire EU passenger car fleet.

By 2020 wind is forecast to avoid 342 Mt of CO_2, which will be equivalent to 173 million cars or 81% of the entire EU fleet.

TABLE 6: WIND AVOIDED CO_2 AND EQUIVALENT EMISSIONS FROM CARS

	2008	2009	2010	2012	2020
Installed capacity (GW)	65	75	84	103	230
Production (TWh)	136	159	181	229	582
Avoided CO_2 emissions (Mt)	97	112	126	156	342
Car equivalent in millions	49	57	64	79	173
Percentage of EU car fleet	23%	26%	30%	37%	81%

20 Source for all data in this paragraph: EU Commission – DG energy and transport – Statistical Pocketbook 2010.
21 Literature mentions from 50% to 66% depending on the definition of passenger cars. Vans, buses and motorbikes are not included here. See Papagiannaki & Diakoulaki, 2006, “Decomposition analysis of CO_2 emissions from passenger cars”, as well as CE Delft, 2009, “Are Trucks taking their toll”, among others.

Conclusions – wind energy and renewables make a move to 30% possible

The EU is currently considering moving beyond 20% GHG reductions, unilaterally or as part of an international agreement. In order to establish an effective post-2012 framework, EWEA recommends that the emissions reductions target be increased from the current 20% to a 30% domestic reduction by 2020. There are four reasons for this.

Firstly, the figures in this report make it very clear that wind power will account for a significant part of the EU effort to reduce emissions. So significant, that even with a 30% target, and taking the current rules on access to offsets into account, wind power alone would achieve the equivalent over 100% of the domestic ETS reduction effort. Renewable electricity generation (based on NREAPs) can achieve the equivalent of over 100% of the domestic EU-wide reduction effort of a 20% reduction target, and 79% of a 30% target.

This would leave just 21% of the domestic effort to be met by other sectors/technologies, given constant production output, and potentially less if the amounts of renewables forecast in the NREAPs are exceeded, as foreseen by the renewable industry – a very achievable objective. Taking the significant energy efficiency reduction potential into account would reduce this 21% even further.

Secondly, the IPCC stated that industrialised countries need to reduce emissions between 25-40% by 2020 to give the world a 50% chance of avoiding a 2°C temperature rise[22]. The current 20% target is not in line with this recommendation.

Thirdly, the financial crisis has undermined the effectiveness of the ETS as a tool to shift Europe away from fossil fuels towards a renewable, zero-carbon power sector. Reduced demand meant reduced production which in turn also meant reduced real emissions. Because real emissions were below the amount of freely allocated allowances companies received, it generated a surplus of allowances that could be sold or kept for later use, when auctioning will make emitting CO_2 more expensive. This has created vast windfall profits for heavy industry and cheap business-as-usual solutions for the power sector. To avoid oversupply on the carbon market and a low price of carbon before 2020, the EU must raise the current GHG target to 30% domestic reductions by 2020.

Fourthly, keeping within a 2°C temperature rise requires a 30% cut in emissions, since a 20% cut does not bring us on a path to an 80-95% economy-wide reduction, but merely to an 80% reduction in ETS sectors. Compared with other sectors (such as agriculture and transport) it is easier to reduce emissions in the ETS sectors, and particularly the power sector. Therefore these sectors need to be carbon-free by 2050, to allow for unavoidable emissions in other sectors. A 100% reduction by 2050 means the linear reduction used in the ETS (currently -1.74% per year) needs to be increased. A move to 30% domestic reductions by 2020 ensures the setting of a new linear factor for emission reductions that will bring us closer to 95% reduction by 2050.

Most of the legislative work has already been done by agreeing the 2009 Renewable Energy Directive. What is needed now is a strong emissions reduction target, so that investors' confidence is secured and maintained, and a clear signal is given and helps to take advantage of being the first on a promising new market. At some point in the future, all countries will be required to reduce emissions. To maintain and enhance its international competitiveness, the EU must start early.

More policy recommendations are made at the end of this report.

22 IPCC, 2007, 4th Assessment Report.

Photo: Dave Walsh

5 WIND ENERGY AVOIDED EMISSIONS VERSUS EU-ETS TARGETS

- **ETS over-allocations in phases I to III**
- **Wind energy's impact during ETS phases I and II – 2005-2012**
- **Wind energy's impact on ETS phase III targets – 2005-2020**
- **Moving to 30% and beyond by 2030**
- **Summary and conclusions**

We have so far compared wind-avoided CO_2 with reductions needed economy-wide in the EU. Since wind energy is a means of decarbonising the power sector, it would be interesting to compare its impact with targets in the power sector alone. While there is no target solely for electricity generation, the 2003 Emission Trading System Directive, and its 2009 revision, give a combined reduction target for the power sector and heavy industry together. With emissions from (mostly electrical) combustion installations totalling about 70%-75% of the total[23], it makes sense to look at how wind deployment in the EU and the resulting avoided CO_2 compare to ETS targets.

A logical way to look at wind-avoided CO_2 and ETS targets is to consider only those new wind turbines installed in the same timeframe of operation as the ETS: from 2005 to 2010, 2005 to 2012 and 2005 to 2020. The setting of emissions reduction targets ("the cap") is different in the first two phases (2005-2007 and 2008-2012) from the third phase, which follows the 2009 revision of the ETS, so they are considered separately in the following paragraph.

But first, a look at the current state of the ETS is necessary.

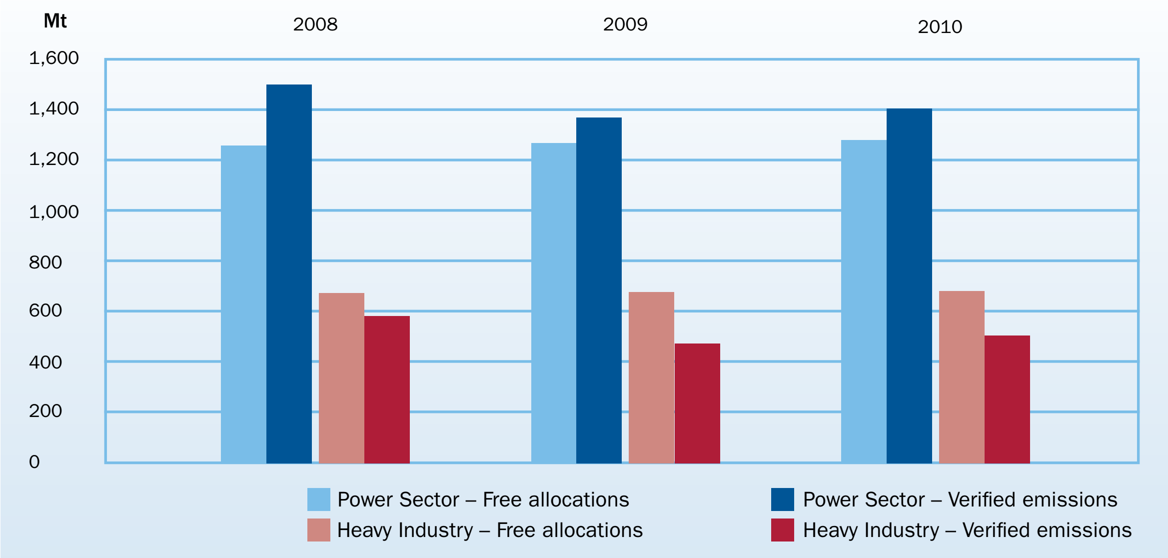
ETS over-allocations in phases I to III

In the first phase (2005-2007), the ETS was plagued by the over-allocation of emissions allowances. As soon as the publication of verified emission data for 2005, in mid-2006, made it apparent that the cap set by EU Member States was above real emissions, the price of carbon crashed to zero.

For the current period, allocations were supervised by the European Commission and set more consistently with actual emission levels. Yet the financial and economic crisis reduced industrial output severely and hence its emissions, as shown in Figure 6[24].

This data shows clearly that the combined industry sectors under the ETS received a massive amount of excess allowances in the last three years. These extra allowances can be kept for phase III or sold to the power sector, which can then continue to emit carbon cheaply.

FIG 6: ETS PHASE II - VERIFIED EMISSIONS COMPARED TO FREE ALLOCATIONS



Source: CITL (2010 estimates based on CITL, Point Carbon and Deutsche Bank)

23 Source: CITL, Verified emissions from 2005-2009.
24 Source: EEA ETS Data viewer - 2010 data is extrapolated based on provisional emissions released on 1st April 2011.

Figure 6 shows this effect clearly – the power sector continued to have higher emissions than its cap, despite the crisis. This is the logical reaction of a market to a carbon price that is too low: it is cheaper to buy freely allocated allowances from industrial sectors than to invest in renewable technologies. This shows clearly the ETS remained largely inefficient in driving investments towards renewables. The current price of carbon, paid by consumers through their electricity bills, has become a subsidy for the heavy industry, without any of the market players having to reduce its emissions or change its production methods. Not quite the objective of climate legislation!

Even with higher emissions in the power sector, there is still an excess of allowances on the carbon market today. The yearly difference between free allocations and verified emissions in 2008, 2009 and 2010 is revealing: -162 Mt, +95 Mt and +32 Mt respectively. Adding the allowances that Member States chose to auction each year (68 Mt), we reach a total for excess allowances of 168 Mt. Claims that current climate targets are already a too stringent are hence absolutely not justified.

Nevertheless, and despite the lack of incentive from the ETS, the legislative framework for renewable energy at Member State and EU level provided strong investment security and boosted wind power development beyond what the already significant cost reductions could have done on a competitive market. This meant that significant emission reductions from wind installations have occurred since 2005.

Wind energy's impact during ETS phases I and II – 2005-2012

From 2005 to 2012, the cap was laid down in National Action Plans (NAPs) Member States had to submit to the Commission to implement the ETS directive. The Commission then had the right to ask for revisions to the cap level, mostly downwards. Put together, the NAPs reach a global EU cap across ETS sectors of 2,083 $MtCO_2$.

From the start of the EU ETS in 2005 up to 2010, 49,702 MW of new wind power capacity was installed, producing about 112 TWh of electricity annually, and avoiding 78 $MtCO_2$. In 2010, the ETS annual cap was 2,083 Mt, down from 2,177 $MtCO_2$ in 2005, or a reduction of 94 Mt.

Comparing these two figures, it is clear that newly installed wind power capacity was a major driver for emissions reductions in ETS sectors during this period – equivalent to 83% of the total reduction effort.

Looking at EWEA's scenarios for wind installed capacity to 2012, we estimate that emissions avoided by new wind power installed between 2005 and 2012 will be equivalent to 116% of the greenhouse gas reductions required by the ETS by 2012.

Obviously, this does not mean that emissions could not still increase as a result of increased demand in the power sector. Nor does it mean that fuel switching did not have an impact in reducing emissions from Business as Usual levels. In fact, according to analysts, both of these happened in the 2005-2010 timeframe: electricity demand rose, and coal to gas switching reduced emissions from Business as Usual levels. This is a very clear sign that the carbon price signal has been too low to have an impact on investment choices in the power sector. A higher price would have made development of high carbon assets uneconomical.

Wind energy's impact on ETS phase III targets – 2005-2020

In October 2010, the European Commission adopted a decision setting the cap for 2013 at 2,039.15 Mt[25]. This includes the new sectors which will be included in the ETS' scope from 2013. Determining the effort in ETS phase III requires a 2005 emissions figure for all ETS sectors which is not currently available. Since the 2020 target (1,777 Mt) is supposed to represent 21% below 2005 emissions, we can assume that 2005 ETS emissions were around 1,777/0.79 = 2,249.5 Mt. This in return gives an effort from 2005 to 2020 equal to 2,249.5 – 1,777 = 472 Mt.

Looking at EWEA's scenarios for wind installed capacity to 2020, we estimate that the emissions avoided by new wind power installed between 2005 and 2020 will be around 301 Mt per year. This is equivalent to 64% of the greenhouse gas reductions required by the ETS by 2020[26]. Given that these emissions are purely domestic, and given the 50% access to international credits, this represents 128% of the domestic ETS effort needed within the EU.

Moving to 30% and beyond by 2030

Given the current debate on moving beyond 20% reductions, it is interesting to look at what percentage of a 30% objective wind-avoided CO_2 could achieve. While the Commission has not yet calculated the 2020 cap in a 30% reduction scenario, the figure of 34% below 2005 emissions levels has been mentioned several times. This figure takes into account the higher burden that the ETS sectors are carrying compared to other sectors and corresponds to a reduction effort of 565 Mt.

Comparing this higher effort to the same wind avoided emissions for 2020 (301 Mt) we get a figure of 53% of the increased effort met by wind installed between 2005 and 2020, or 107% of domestic reductions (since in the ETS 50% of the effort can be met with offsets).

Again, looking at an overall 30% domestic target, it is difficult to evaluate how much additional wind growth such a signal, accompanied with implementing measures, could bring. What is clear is that the contribution of wind would still be considerable, and together with other renewables, would still represent the bulk of the domestic effort.

TABLE 7: SUMMARY OF ETS EFFORT AND WIND ENERGY AVOIDED CO_2 (INSTALLATIONS FROM 2005)

	2010	2012	2020 (20%)	2020 (30%)
Installed wind capacity since 2005 (GW)	49,702	68,899	195,628	195,628
Production from that capacity (TWh)	112	159	512	512
Yearly Reduction Effort (Mt)	94	94	472	565
Wind avoided CO_2 (Mt)	78	109	301	301
Percentage met by Wind	83%	116%	64%	53%
% of domestic effort met by Wind	–	–	128%	107%

25 2010/634/EU: Commission Decision of 22 October 2010 adjusting the Union-wide quantity of allowances to be issued under the Union Scheme for 2013 (second decision of the European Commission determining the cap for 2013).

26 The ETS requires a reduction of 21% compared to 2005 emissions.

Summary and conclusions

Because of the low average price of carbon, and its fluctuation, since the beginning of the ETS in 2005, analysts concur that the ETS mechanism has so far had close to no impact on the promotion of renewable energy technologies. On the other hand, it is clear from the calculations above that wind and renewables have had a major impact on the reductions in CO_2 achieved so far.

While the stated aim of the ETS is not specifically to promote renewable investments, but rather to reduce emissions - as pointed out regularly by heavy emitters - combustion installations represent over 70% of emissions covered. Because of this, there are three main solutions to achieve important emissions reductions by 2020: energy efficiency, renewables, and fuel switching from coal to gas.

While energy efficiency entails significant potential reductions, the lack of a binding framework linked with the fact that efficiency at customer level contradicts the interests of power producers means that the impact so far is unnecessarily low.

Gas is a lower carbon fossil source of electricity than coal, and is part of the short term solution as a transition technology to a 100% renewable electricity system. Yet in the longer term, the 350-450g CO_2/kWh it emits will be too high and gas will become part of the problem, particularly given the European Commission's modelling showing that the power sector will need to reduce its emissions by between 93–99% by 2050[27].

For these reasons, the argumentation around whether the objective of the ETS is to promote investments in renewables seems irrelevant: as we have shown, wind energy and other renewables have had a major impact on emissions reductions during the first ETS phases and will continue to do so. As such renewables, particularly wind power, are the best option within the ETS sectors to reduce emissions, up to 2020 and beyond.

27 European Commission COM 2011/112, "Roadmap for moving to a competitive low carbon economy in 2050".

Photo: IISD

6 WIND ENERGY AVOIDED EMISSIONS WORLDWIDE AND UNFCCC TARGETS

- **2012 – Global wind power versus industrialised countries' Kyoto targets**
- **2020 – Global wind power vs. COP16 pledges and scientific requirements**
- **2020 – Avoided emissions on other major wind markets**

At global level, the same exercise can be carried out. Every year, the Global Wind Energy Council (GWEC) publishes data for installed wind capacity around the world. It also has scenarios to 2020 and 2050: the Global Wind Energy Outlook (GWEO). The 2010 update states and forecasts following figures:

TABLE 8: GWEC ADVANCED SCENARIO HISTORICAL AND FORECASTED GLOBAL WIND DATA

	2008	2009	2010	2012
Global installed capacity (GW)	120	159	194	330
Global production in (TWh)	263	347	426	809
Global avoided CO_2 emissions (Mt)[28]	157	208	255	473

Up to 2009, global wind power installed capacity was following the path put forward by GWEC in its advanced scenario. The economic crisis, combined with regulatory issues in the US, has challenged this; yet current installations remain closer to the advanced scenario than to the moderate scenario to date. For this reason we will continue to use the advanced scenario in our calculations.

2012 – Global wind power versus industrialised countries' Kyoto targets

With the Kyoto Protocol, industrialised countries (Annex I countries in UNFCCC terminology) set themselves a 5.2% reduction target compared to 1990 levels between 2008 and 2012. Since 2008, wind power installations have continued to increase and avoid more and more CO_2.

In the past, most of the world's installed wind power capacity was built in Annex I countries. Additionally, over 95% of wind turbines installed in developing countries have applied, or are in the process of applying, for Clean Development Mechanism support, so that the CO_2 they avoid will be counted towards the targets of developed countries for 2020. As such it is acceptable to compare the entirety of world wind avoided CO_2 to Kyoto Protocol targets and later to pledges made by Annex I countries at COP15 in Copenhagen and enshrined in the COP16 Cancun agreement.

As depicted in Table 9, in 2010 wind-avoided CO_2 accounted for up to 26% of the total effort required by the Kyoto Protocol (KP). By 2012 – the end of the first commitment period of the Protocol – GWEC expects global wind avoided emissions to be equivalent to 49% of the effort.

TABLE 9: GLOBAL WIND POWER CAPACITY, PRODUCTION AND AVOIDED CO_2 VERSUS KYOTO TARGETS

	2008	2009	2010	2012
Global installed capacity (GW)	120	159	194	330
Global production in (TWh)	263	347	426	809
Global avoided CO_2 emissions (Mt)	157	208	255	473
Annex I countries effort (Mt)[29]	974	974	974	974
% of effort met by global wind	16%	21%	26%	49%

2020 – Global wind power vs. COP16 pledges and scientific requirements

Since the Conference of Parties in Bali in December 2007, UNFCCC negotiations have been ongoing to find a framework for a second commitment period under the Kyoto Protocol, or a replacement agreement, with the aim of reducing emissions further. While discussions are still ongoing, a consensus on the length of the new commitment period is within reach. The option of a new eight-year period ending in 2020, as opposed to five year periods under the KP, is clearly gaining momentum, and so we will consider the pledges put on the table for that end year.

28 The avoided CO_2 methodology in the GWEO is slightly different: to avoid extensive modelling a standard figure of $600gCO_2e/kWh$ is used.
29 All data on world emissions from World Resource Institute – CAIT database.

These pledges were announced before COP15 in Copenhagen in December 2009 and formalised at COP16 in Cancun in December 2010. Estimates have been made of the aggregate (overall) level of all pledges for Annex I countries. This is necessary to compare them with what science considers necessary to keep a 50% chance of avoiding a temperature increase of above 2°C, and the dramatic consequences associated with it.

While science clearly states that reductions by 2020 should be in the 25% to 40% range for industrialised countries, so far, estimates of total aggregate pledges range from 12% to 18% of 1990 emissions levels, depending on whether one considers the low range or the high range of the pledges: i.e. if Europe keeps a 20% target, total pledges will be closer to 12% and if it moves to 30%, closer to an 18% reduction.

As Table 10 illustrates, wind energy in 2020 would be likely to provide the equivalent of between 46% and 69% of the (low/high) pledges on the table. If one goes by the more ambitious scientific recommendations, wind avoided CO_2 would still be equivalent to between 21% and 33% of the reductions needed.

2020 – Avoided emissions on other major wind energy markets

The three prime competitors to the EU on the path to a low-carbon economy are China, India and the US, with South Korea, Brazil and Mexico also now starting to implement aggressive policies to reduce emissions and promote wind power and renewable development. Looking at installed wind power capacity in these three countries yields equally significant figures on avoided CO_2.

USA – 17% target compared to 2005 emissions

A 17% reduction from 2005 emissions levels is the pledge that the US put forward in the Cancun agreement. While one of the US houses validated the target, the Senate blocked it as part of the legislation on the cap and trade system in 2010. The 17% target currently remains the pledge of the Obama administration, but its fate is unclear, which is one of the reasons why President Obama is reverting to a strategy based on renewable energy development, rather than emission reductions.

If such a target is adopted in the US, it should not be a problem to meet: by 2020, GWEC estimates that 253 GW of US installed wind power capacity will avoid 372 Mt of CO_2, an amount equivalent to 31% of the US reduction objective.

TABLE 10: WORLD WIND POWER-AVOIDED EMISSIONS VERSUS COP16 PLEDGES AND SCIENCE IN 2020

	2020	2020	2020	2020
	PLEDGES 12%	PLEDGES 18%	SCIENCE 25%	SCIENCE 40%
Global installed capacity (GW)	1,071	1,071	1,071	1,071
Global production (TWh)	2,628	2,628	2,628	2,628
Global avoided CO_2 emissions (Mt)	1,577	1,577	1,577	1,577
Annex I countries effort (Mt)	2,270	3,404	4,728	7,565
% of effort met by global wind	69%	46%	33%	21%

China and India – 15% deviation from BAU

As part of a solution to avoid a temperature rise of more than 2°C, science recommends – alongside the 25-40% reduction in industrialised countries – a reduction of 15-30% from Business-As-Usual (BAU) growth pathways in developing countries. So that it would be a meaningful comparison for both China and India, which are both considered to be "developing countries", to see what percentage of such an objective wind energy could avoid.

Estimating BAU emission growth in countries experiencing rapid development is difficult and relies to a great extent on assumptions made in the macroeconomic models. To avoid lengthy discussions about these assumptions, we looked at scenarios from three different bodies that estimate 2020 emissions in the energy sector, which represents above 80% of local emissions, to get a range of projections to 2020: the International Energy Agency (IEA), the US Energy Information Administration (EIA), and Strasbourg University (POLES model)[30].

TABLE 11: 2020 PROJECTIONS FOR CHINESE AND INDIAN ENERGY SECTOR EMISSIONS

	CHINA	INDIA
International Energy Agency (IEA)	9,475	1,818
Energy Info. Admin (EIA, US)	10,004	2,187
University of Grenoble (POLES)	7,551	2,926

The result depicted in Table 12 below show clearly that even in developing countries, and whichever scenario is considered, the pace at which wind energy is being deployed is fast enough to account for a significant share of the emissions reductions needed: between 26%-33% of the total for China and 22%-35% of the total for India.

TABLE 12: WIND ENERGY - AVOIDED CO_2 VERSUS 15% DEVIATION FROM BAU BY 2020

	INDIA	CHINA
Installed capacity (GW)	65	250
Production (TWh)	160	614
Wind-avoided CO_2 (Mt)	96	369
2020 Wind % of reduction effort - EIA	35%	26%
2020 Wind % of reduction effort - IEA 2006-2020	29%	25%
2020 Wind % of reduction effort - POLES	22%	33%

China now has a domestic production capacity of over 25 GW of wind energy, and the five-year plan released in early April 2011 includes a target of 70 GW of additional wind capacity by 2015. Again, given the size of the current market (16 GW in 2010) this target is likely to be surpassed.

Of course, these percentages cannot be added to the ones used in the calculations concerning Annex I countries, since we would be double-counting wind power avoided emissions which are happening in developing countries but which count towards Annex I countries' targets in the current framework. Figures in Table 12 show that wind is not a technology reserved for rich industrialised nations, and that it can constitute some of the "low-hanging fruit" in the emission reduction basket.

30 Source: World Resource Institute - CAIT database for world GHG emissions.

7 EU CLIMATE POLICY RECOMMENDATIONS TO 2020

- **Moving to a 30% domestic target is necessary and beneficial to the EU economy**
- **Tightening the ETS cap to improve the ETS's efficiency**
- **Financing renewable energy with 100% of auctioning revenue**

The different analyses above make it very clear that wind energy and renewables are key to reducing emissions rapidly and significantly in different parts of Europe and the world. Yet the signals to investors given by EU climate legislation are currently too weak to enable these technologies to reach their full emission reduction potential, and shift Europe away from locking itself into a high carbon emitting power system.

To strengthen these signals, EWEA recommends the following policy actions, to be taken during the mandate of the current European Commission and European Parliament.

Moving to a 30% domestic target is necessary and beneficial to the EU economy

As explained in Section 2.6 Conclusions – wind energy and renewables make a move to 30% possible, the amount of installed wind and renewable energy will greatly help us reach our climate targets, and a more ambitious target is backed up by science. Yet moving to 30% should not be regarded as a burden, but rather as an opportunity for the EU's economy and competitiveness.

There is now a widespread consensus that the development of resource-efficient and green technologies will be a major driver of growth (EU Commission, 2010). The EU has been the cradle of renewable energy innovation, particularly wind power, and the European wind industry represents a growing number of jobs (188,000 in 2010), significant and growing export opportunities, as well as increased energy security and competitiveness.

With a 10 year head start on other parts of the world and a proven track record in both onshore and offshore wind, the EU has a clear competitive advantage. But this advantage is being challenged: both China and the US are making very significant investments today in renewable energy, in particular wind power.

For Europe to keep this first mover advantage, strong signals are needed to keep investors on the renewable energy track, one of its most promising industries. A unilateral move to a 30% GHG domestic reductions target is such a signal.

A May 2010 Commission Communication[31] highlights that the crisis reduced the amount of investments needed to reach 20% GHG reductions from €70bn to €48bn (due to the increased price of oil, the lower price of CO_2 and number of banked allowances). These investments are estimated to be €81bn, or just €11bn more than the initial estimation to reach 20%.

The March 2011 Commission "Roadmap for moving to a competitive low carbon economy in 2050"[32] furthers the analysis, showing that 25% domestic reductions by 2020 is the cost-effective way forward, and that a full decarbonisation of the power sector is possible by 2050 at a reasonable cost.

The benefits of moving to 30% outweigh the costs: the International Energy Agency estimates that "every year of delayed investment in more low-carbon sources adds €300-400 billion to the price tag" (IEA, 2010). In addition, remaining at 20% does not put us on a path to a 2°C temperature rise by 2050, and so would necessitate a much greater and more expensive effort post-2020, and mean significant risks of irreversible changes in emission trends.

Emission reductions from wind power have several macroeconomic benefits:

- Creates export opportunities for EU companies
- Lowers our 54% increasing energy dependency
- Avoids fuel costs (€40bn import costs at 88$/bbl), re-invested in the EU economy
- Creates jobs (188,000 in 2010 - 450,000 by 2020)
- Avoids fuel and CO_2 risk
- Avoids health and environmental impacts
- Lowers electricity prices on the market

31 European Commission COM 2010/265, "Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage".
32 European Commission, COM 2011/112, "Roadmap for moving to a competitive low carbon economy in 2050".

EWEA urges Member States and European Parliament to agree to a unilateral 30% domestic reduction, thereby putting the EU at the forefront of the world green economies, addressing both the employment, energy security, health and climate issues we are facing today, while reaping the commercial benefits and job creation from exporting modern energy technology. Wind energy will help on that path, but for investors to make the right decisions, the signals must be very clear. A binding and ambitious emissions reduction target is the longer term incentive needed to put us on a path to a maximum 2°C temperature increase.

Tightening the ETS cap to improve the ETS's efficiency

The Emissions Trading System (ETS) is the primary tool for driving emission reductions, and it should be the starting point for options for going beyond 20%[33]. The financial crisis has clearly undermined the effectiveness of the ETS as a tool to shift Europe away from fossil fuels towards a renewable power sector, and has instead created windfall profits for heavy industry and cheap Business-As-Usual solutions for the power sector. This is highly counterproductive, since with numerous renewable energy solutions to reach zero emissions, the greatest potential for emissions reductions comes from the electricity sector (European Commission, 2010).

To re-establish the effectiveness of the ETS, the emissions cap needs to be tightened further. Moving to 30% emissions reductions is the most effective way to tighten the emissions cap and establish the high and stable carbon price necessary to make the shift to a renewable energy economy. In the absence of a 30% target, the possibility of setting aside a number of allowances must be considered to compensate for the combined negative impact of the crisis and free allocation.

The CDM have provided for cost-effective reductions, through for example wind power projects in China or India. But after the economic crisis, and without a further reduced cap, a generous and prolonged stream of such low-cost reductions into the EU ETS slows down innovation in the EU (European Commission, 2010). Domestic targets are essential and international credits should only be used as part of an international agreement calling for a 40% target, in line with scientific requirements.

Financing renewable energy with 100% of auctioning revenue

The EU ETS is a fiscal burden aimed at solving a specific issue: climate change. A burden that is shouldered in the end by consumers, not by companies under the cap. Companies either get free allocations or can pass the cost down to consumer without loss of competitiveness, due to the many imperfections and market failures in Europe's power markets. As such, the revenue generated from ETS auctioning is expected by consumers to be deployed in the fight against climate change and should be used only for this purpose.

When agreeing the revised Emission Trading Scheme Directive[34] in 2009, European Heads of State made a voluntary commitment to earmark 50% of this auctioning revenue for climate change mitigation and adaptation. EWEA is calling for a new political agreement that would require 100% of the auctioning revenue to be used to finance the fight against climate change, including the move to a renewable energy economy, and the modernisation of Europe's ageing power infrastructure.

33 European Commission COM 2010/265, "Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage".

34 Directive 2003/87/EC "Establishing a scheme for greenhouse gas emission allowance trading […]", Article 10, as amended by Directive 2009/29/EC.

Furthermore, it is vital that existing budget lines which have an impact on climate change mitigation or adaptation are not counted towards this 100% commitment as they can be according to the current agreement, since the money from auctioning revenue is new and additional to the existing state budgets.

According to Commission estimates[35], revenue from auctioning could amount to around €50 billion annually by 2020, enough to finance a sharp increase in renewable generation, modern infrastructure and many other climate-friendly initiatives that will benefit Europe's economy and maintain its global lead in some of the most promising technologies of tomorrow.

35 European Commission COM 2010/265, "Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage" It is assumed that the electricity demand is very inelastic in the short-term perspective of a spot market.

Photo: Luis Marinho

8 ANNEXES

Kyoto Protocol

TABLE 13: **KYOTO PROTOCOL TARGETS AND EMISSIONS**

DATA IN $MTCO_2EQ$	1990 EMISSIONS BASE YEAR (OFFICIAL)	REDUCTION TARGETS IN %	REDUCTION EFFORT IN MT	1990 VERIFIED EMISSIONS IN MT
Australia	416	8.0%	-33	416
Austria	79	-13.0%	10	79
Belarus	127	-8.0%	10	127
Belgium	145	-7.5%	11	145
Bulgaria	133	-8.0%	11	117
Canada	592	-6.0%	36	592
Croatia	33	-5.0%	2	33
Czech Republic	194	-8.0%	16	194
Denmark	70	-21.0%	15	70
Estonia	42	-8.0%	3	42
EU-15	4,244	-8.0%	340	4,244
Finland	71	0%	0	71
France	566	0%	0	566
Germany	1,228	-21.0%	258	1,228
Greece	105	25.0%	-26	105
Hungary	116	-6.0%	7	98
Iceland	3	10.0%	0	3
Ireland	56	13.0%	-7	56
Italy	517	-6.5%	34	517
Japan	1,272	-6.0%	76	1,272
Latvia	26	-8.0%	2	26
Liechtenstein	0	-8.0%	0	0
Lithuania	49	-8.0%	4	49
Luxembourg	13	-28.0%	4	13
Monaco	0	-8.0%	0	0
Netherlands	212	-6.0%	13	212
New Zealand	62	0%	0	62
Norway	50	1.0%	0	50
Poland	563	-6.0%	34	454
Portugal	59	27.0%	-16	59
Romania	282	-8.0%	23	248
Russian Federation	3,326	0.0%	0	3,326
Slovakia	74	-8.0%	6	74
Slovenia	20	-8.0%	2	19
Spain	288	15.0%	-43	288
Sweden	72	4.0%	-3	72
Switzerland	53	-8.0%	4	53
Turkey	170		0	170
Ukraine	922	0.0%	0	922
United Kingdom	772	-12.5%	96	772
United States	6,135	-7.0%	429	6,135
TOTAL excl US	12,778		545	12,599
TOTAL incl US	18,914		974	18,734
EU27	5,743		446	5,564

Source: UNFCCC & Kyoto Protocol

Data from 'Trends to 2030'

TABLE 14: EU COMMISSION – 'TRENDS TO 2030' - 2010 EDITION

	ELECTRICITY GENERATION - THERMAL (GWh)	CO_2 EMISSIONS THERMAL GENERATION ($MtCO_2$)	KG CO_2 / KWH (Mt/TWh)
2000	1,666,574	1,321	0.793
2001	1,711,727	1,333	0.779
2002	1,756,880	1,345	0.766
2003	1,802,032	1,357	0.753
2004	1,847,185	1,369	0.741
2005	1,892,338	1,381	0.730
2006	1,888,116	1,365	0.723
2007	1,883,894	1,350	0.716
2008	1,879,673	1,334	0.710
2009	1,875,451	1,318	0.703
2010	1,871,229	1,303	0.696
2011	1,877,114	1,293	0.689
2012	1,882,998	1,284	0.682
2013	1,888,883	1,274	0.675
2014	1,894,767	1,265	0.668
2015	1,900,652	1,256	0.661
2016	1,895,838	1,225	0.646
2017	1,891,024	1,195	0.632
2018	1,886,210	1,164	0.617
2019	1,881,396	1,134	0.603
2020	1,876,582	1,104	0.588

EWEA
THE EUROPEAN WIND ENERGY ASSOCIATION

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About EWEA

EWEA is the voice of the wind industry, actively promoting the utilisation of wind power in Europe and worldwide. It now has over 700 members from almost 60 countries, including manufacturers with a 90% share of the world wind power market, plus component suppliers, research institutes, national wind and renewables associations, developers, electricity providers, finance and insurance companies, and consultants.

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