

# Wind power is crucial for combating climate change.

There is an increasing awareness of the massive potential of wind power for significantly reducing CO<sub>2</sub> emissions in the energy sector, and wind turbines have now become a key symbol for the global fight against climate change.

However, the perception of quite how much wind power could contribute is still fairly vague. This paper aims to put some concrete numbers behind the claim that wind energy can and must play a key role in reducing CO<sub>2</sub> emissions, and to put these figures into the context of the climate pledges submitted by Annex I countries post-Copenhagen.

## **40% of global CO<sub>2</sub> emissions are produced by the power sector**

The power sector accounts for around 40% of global CO<sub>2</sub> emissions, and it is clear that we cannot win the fight against climate change without a dramatic shift in the way we produce and consume electricity. With dramatic increases in global power demand, renewable energy technologies must be rolled out quickly to provide emissions-free renewable electricity for industrialised and developing countries alike.

## **Wind farms can be deployed at large scale when we need them: now.**

Science leaves no doubt: Global emissions need to peak and begin to decline before 2020, and a dramatic increase in renewable energy deployment is urgently required to help make this happen. While building a conventional power plant can take 10 years or more, a large wind farm can be put up in a matter of months, and a half completed wind farm is just a smaller power plant, starting to generate power as soon as the first turbines are connected to the grid.

## **A wind turbine runs practically emissions-free for 20 years**

Wind energy is a viable alternative to burning polluting fossil fuels – it does not emit carbon dioxide or other air pollutants. Within three to six months of operation, a wind turbine has offset all emissions from its construction, to run virtually carbon free for the remainder of its 20 year lifetime.

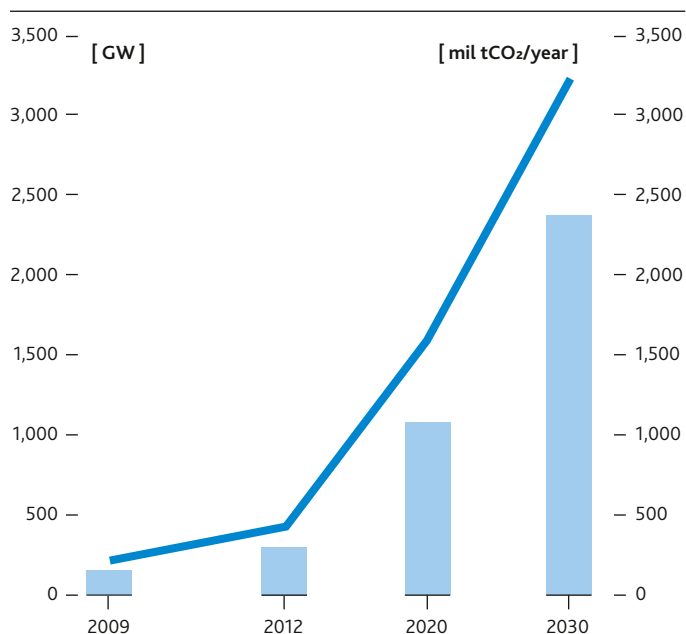
## **Wind energy can be deployed anywhere in the world**

About 160,000 wind turbines are now producing electricity in over 70 countries around the world. This includes sites in Europe, Africa, Asia North and Latin America and Australia, and many turbines operate in severe weather conditions, in deserts, in snow, at high altitudes, and of course at sea. Wind energy can be used at large scale nearly anywhere, and the total wind resource is sufficient to power the entire globe several times over.

## How much CO<sub>2</sub> can wind energy save?

Wind energy does not emit any greenhouse gases, and has an extremely good energy balance. The calculations on just how much CO<sub>2</sub> could be saved by wind energy is based on an assumption for the carbon intensity of the global electricity sector, i.e. the typical amount of CO<sub>2</sub> emitted by producing one kWh of power. Individual countries' emissions differ substantially, but here we use the IEA's estimate of 600g/kWh as an average value for the carbon dioxide reduction to be obtained from wind generation.

Global power capacity and avoided CO<sub>2</sub> emissions (2009-2030)



Source: GWEC

The most ambitious scenario by the Global Wind Energy Council (GWEC) shows that, with growth rates much lower than the 30% the wind sector has experienced over the past decade, global wind energy capacity could increase from 158.5GW at the end of 2009 to over 1,000GW by 2020 and 2,400 GW by 2030. This would result in annual CO<sub>2</sub> savings of more than 1.5 billion tons in 2020 and 3.2 billion tons in 2030.

## Climate targets for Annex I countries

Under the Kyoto Protocol, industrialised (Annex I) countries have committed to reducing an aggregate 5.2% of their greenhouse gas emissions, with different targets for individual countries.



The IPCC's 4th Assessment Report has clearly shown that if we are to stand a reasonable chance of keeping global temperature increase below 2°C, industrialised countries must reduce their emissions by at least 25-40% by 2020 (from 1990 levels).

Following the Copenhagen Accord, which came out of the COP15 climate negotiations in Copenhagen in December 2009, Annex I countries submitted the following pledges:

Country	2020 pledge	Reference year
Australia	-5% up to -15% or -25%	2000
Belarus	-5% to -10%	1990
Canada	-17%	2005
Croatia	-5%	1990
EU-27, Liechtenstein, Switzerland	-20% or 30%	1990
Iceland	-30%	1990
Japan	-25%	1990
Kazakhstan	-15%	1992
Monaco	-30%	1990
New Zealand	-10% to -20%	1990
Norway	-30% to -40%	1990
Russian Federation	-15% to -25%	1990
United States	-17%	2005

Source: UNFCCC

These Annex I pledges would add up to an aggregate 12-19% reduction of emissions from 1990 levels.

# How can wind energy contribute to meeting the 2012 and 2020 commitments?

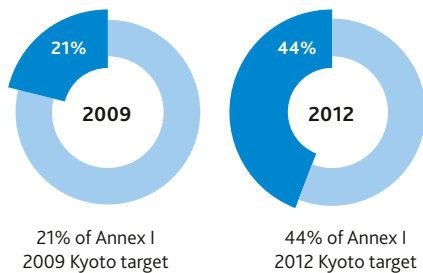
In 2009, wind energy saved 209 million tons of CO<sub>2</sub>, which corresponds to around 21% of the 2008 Kyoto target of Annex I countries.

Wind energy is expected to produce 716TWh of electricity in 2012, thereby saving 430 million tons of CO<sub>2</sub>. This would translate to around 44% of Annex I commitments under the first commitment period of the Kyoto Protocol.

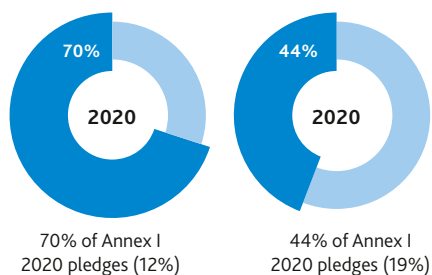
In terms of the targets already stated by Annex I countries for the period up to 2020, global wind energy could contribute 70% (for a reduction of 12%) to 44% (19% reduction) of the total emissions reductions, i.e. 1.5 billion tons of CO<sub>2</sub> every year. Of course these emissions reductions are nowhere near what the science tells us is required, but even for a range of 25%-40% of reductions, wind power could still achieve 34% - 21% of these.

This means that even under the most stringent climate regime, one fifth of all emissions reductions of Annex I countries could be met by wind energy alone.

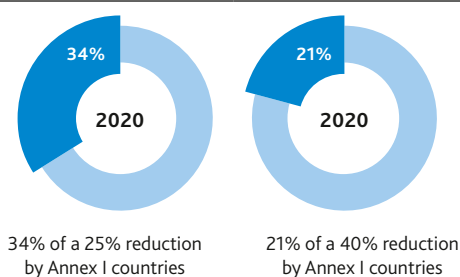
In terms of Annex I Kyoto 2008-2012 targets, global wind power can avoid...



In terms of Annex I pledges for 2020, global wind power can avoid...



In terms of a 25% - 40% reduction by 2020, wind power can avoid...



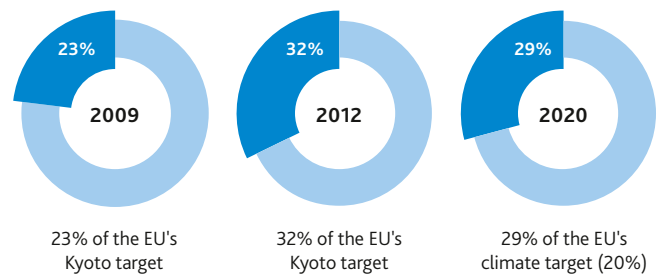
## Annex I Countries

### EUROPE

Europe is the region with the highest installed capacity of wind energy, and can therefore rely on wind power to substantially reduce CO<sub>2</sub> emissions and to reach both its 2012 Kyoto target and its pledge to reduce emissions by 20-30% by 2020.

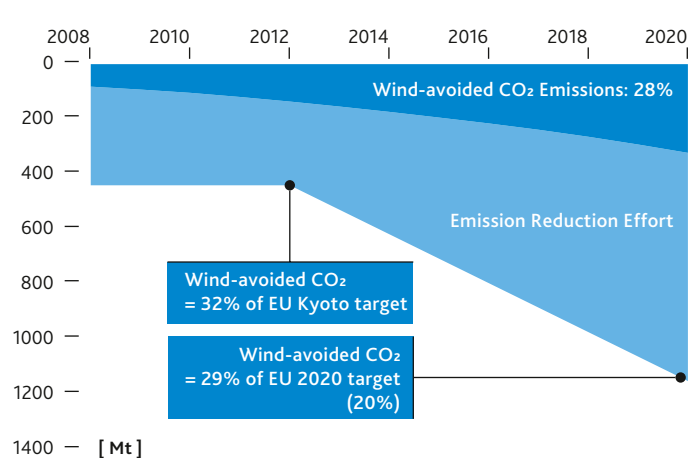
In the European Union, wind power in 2009 avoided 106 tons of CO<sub>2</sub>, or 23% of the EU's target for that year. In 2012, wind energy is forecast to save 183 tons of CO<sub>2</sub>, which represents 32% of the EU's Kyoto target. In 2020, 29% of the EU's promised emissions reduction of 20% can be achieved by wind power.

In the EU, wind power will avoid as much CO<sub>2</sub> as...



From 2008-2020, wind energy will avoid 28% of the EU's reduction efforts as outlined in the 'Climate Package'. This figure is based on the Kyoto 2012 commitment and an EU 2020 target of 20%.

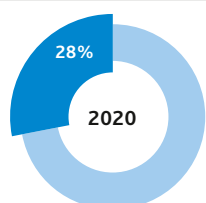
From 2008 - 2020, wind will avoid 28% of the EU cumulative reduction efforts from Kyoto until 2012 and the climate package up to 2020



## UNITED STATES

In the US, wind power would produce 554 TWh of electricity in 2020, avoiding 332 million tons of CO<sub>2</sub>. Based on the 17% reduction from 2005 levels under discussion in the US Congress in 2009 (which would translate into a mere 4% reduction from 1990 levels), wind energy would account for 28% of the required emissions reductions between 2005 and 2020.

In the US, wind power will, in 2020, avoid as much CO<sub>2</sub> as...



28% of a 17% reduction from 2005 levels

## Developing Countries

A large number of developing countries have also submitted emissions reduction pledges under the Copenhagen Accord, including China, India, South Africa, Brazil and Mexico<sup>1</sup>.

To keep us within range of the 2°C target, developing countries need to 'deviate' from Business-as-Usual in the range of 15-30%. There are different models resulting in different visions of 2020 emissions for China and India (in Mt) in the energy sector.

### Energy Sector Emissions (in Mt)

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

Since these estimations differ considerably, we use all three models in the figures below.

<sup>1</sup> UNFCCC: Appendix I – Nationally appropriate mitigation actions of developing country Parties; <http://unfccc.int/home/items/5265.php>

## Raise your pledges!

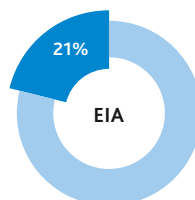
The Copenhagen climate negotiations failed to deliver the robust and binding international agreement that is needed to avert climate change. Industrialised need to increase their level of ambition towards the upper end of the range of 25-40% below 1990 levels to give us a fighting chance of keeping below the 2°C limit that all parties in Copenhagen agreed to.

Wind energy is already making a significant contribution to reduce emissions in both industrialised and developing countries, and by 2020, substantial savings of CO<sub>2</sub> can be achieved.

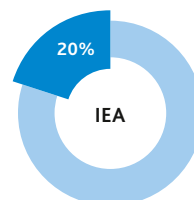
## CHINA

In China, wind energy could produce up to 493 TWh of electricity in 2020, saving 296 million tons of CO<sub>2</sub>. If China were to reduce emissions by 15% from the business-as-usual scenario by 2020, wind power would contribute 20-26% of the emissions reductions required in the energy sector (depending on the model used).

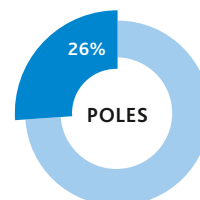
If China were to reduce emissions by 15% from BAU by 2020, wind power in China would avoid



21% of China's emissions reductions in the energy sector



20% of China's emissions reductions in the energy sector



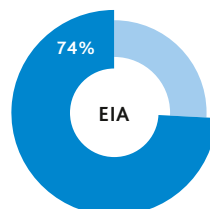
26% of China's emissions reductions in the energy sector

Source: CAIT

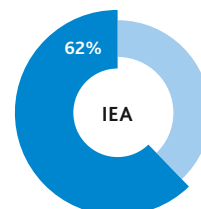
## INDIA

In India, wind energy is expected to generate up to 338 TWh of electricity in 2020, which would reduce CO<sub>2</sub> emissions by 203 tons. Again based on a reduction of 15% from the business-as-usual scenario by 2020, India could achieve 46-74% of the emissions reductions required in the energy sector by wind energy only (depending on model).

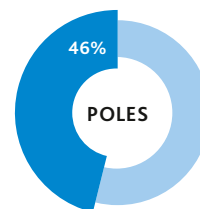
If India were to reduce emissions by 15% from BAU by 2020, wind power in India would avoid



74% of India's emissions reductions in the energy sector



62% of India's emissions reductions in the energy sector



46% of India's emissions reductions in the energy sector

Source: CAIT