WIND ENERGY STATISTICS AND TARGETS

DONE
2012 106 GW of wind power installed = **total electricity consumption** Sweden, Ireland, Slovenia and Slovakia

2020 230 GW EWEA estimate (including 40 GW of offshore wind power)

2050 735 GW EWEA estimate

This growth has been driven by the EU's binding target of 20% renewable energy by 2020.

DONE
7% 2012 of the EU's electricity demand

15-17% EWEA estimate of the EU's electricity demand

50% EWEA estimate **32-49%** EC estimate of the EU's electricity demand

EC = European Commission

26% Denmark, 16% Spain Portugal, 12% Ireland, 11% Germany

% of electricity generated by wind power **2011**

powering **60.8 million households** per year

106 GW OF WIND ENERGY =

COAL emitting 233.1 Mt CO_2
76 Mt mined transported burned
costing **€5,290 mn** for fuel

=

GAS emitting 103.8 Mt CO_2
45 mn m³ extracted transported burned
costing **€8,001 mn** for fuel

"Every time we spend $1 subsidising renewable (energy sources), we spend $6 on subsidising fossil fuels."

Connie Hedegaard, *Commissioner for Climate Action, December 2012*

TECHNOLOGY

15 m Ø **1985** < 1 MW

100 m Ø **today** average: 2.5 MW largest: 7.5 MW (120 m Ø)

future planned: 15 MW possible: 20 MW

3 experimental floating turbines

taking offshore wind energy to deeper waters which could include Atlantic and Mediterranean sea basins

2011 in Europe

Wind turbine manufacturers are also developing **longer blades** and **lighter rotors** in order to optimise and increase energy production.

FINANCE

2012 **up to €17.2bn** worth of investments in EU wind farms

Investors include power producers, international finance institutions, private equity and pension funds.

The **lack of EU renewable energy targets after 2020** and the **instability of national support mechanisms** for renewables increase the perception of risk and make financing more expensive.

Offshore wind is a **developing sector:** relatively new with new entrants, and cost reductions expected through technology innovation.

Wind energy:

capital intensive

low operation & maintenance costs

no fuel costs

COSTS, ENERGY SUBSIDIES AND ELECTRICITY PRICES

- **Onshore Wind energy** is becoming **competitive** with **fossil fuels.** Taking into account the fuel and CO_2 costs, **wind energy costs less** than the energy generated by **coal and gas** and is considerably cheaper than nuclear.

With a higher carbon price and the right market design, onshore wind could compete with those technologies.

wind, coal, gas, nuclear

EU R&D money

€353 mn FOR WIND ENERGY

1983 2011

€12 bn FOR NUCLEAR

EWEA
THE EUROPEAN WIND ENERGY ASSOCIATION

EWEA is the voice of the wind industry, actively promoting wind power in Europe and worldwide. It has over 700 members from almost 60 countries making EWEA the world's largest and most powerful wind energy network.

www.ewea.org

- In **2012, wind energy avoided €9.6 bn of fossil fuel costs.** Wind energy **will avoid €22-27 bn of fuel costs a year by 2020,** increasing to €47-51 bn by 2030.
- **Wind power can drive down wholesale electricity prices.** This is already happening, according to credit agency Moody's and financial analysts UBS.
- The **EU's oil and gas import bill** in **2012** is estimated at **€470 billion** – 3.4% of the EU's GDP. This bill **has increased by €200 billion** over the past three years.

JOBS AND GREEN GROWTH

- Wind energy contributed **€32 billion to the EU economy in 2010.** Between 2007 and 2010 the wind energy sector increased its contribution to GDP by 33%.
- The **EU wind energy sector was a net exporter of €5.7 billion** worth of products and services in 2010.
- The **EU** accounted for **37.5% of the global wind energy** market in 2012.

jobs in wind +30%

EU unemployment +9.6%

2007- 2010

people employed in EU wind energy

249,000 people — 2012 DONE

520,000 people — 2020 EWEA estimate

"Strong renewables growth to 2030 could generate over 3 million jobs, including in small and medium sized enterprises."

European Commission, *Communication – Renewable energy: a major player in the European energy market, June 2012*

EUROPE'S ELECTRICITY SUPPLY

Grid operators can integrate large amounts of wind power:

electricity demand met by wind power **IN DENMARK** 2011 **26%**

by 2025 the government aims for **50%**

electricity demand met by wind power **IN SPAIN** 2011 **16%**

at times it reaches **50%**

- The **power grid** needs to be **reinforced** and **better interconnected to** improve **security of supply**– regardless of the source of energy – and in order to improve **competition** in the electricity market, which would **bring down prices.**
- For an efficient integration of wind and other renewables, **intraday** and **balancing power markets are needed,** with demand-side management.
- **Reinforcing** key parts of the **grid** will provide **massive savings** of **€1-2 billion per year.**

"Variability and uncertainty are familiar aspects of all power systems."

International Energy Agency, *2011*

WIND ENERGY & NATURE

- Birdlife, WWF, Greenpeace, Friends of the Earth and others **support wind energy**. Birdlife recently stated that **climate change** was the single **largest threat to birds** and wind and renewables were a **clear solution to climate change**.
- The potential environmental effects of a wind farm are assessed before construction is allowed to start.

NO fuel
NO greenhouse gases
NO air pollution
NO toxic substances
NO water pollution
MINIMAL water use

"Climate change poses the single greatest long-term threat to birds and other wildlife. Wind power is the most advanced renewable technology, available at a large scale, over this time period. The RSPB supports a significant growth in offshore and onshore wind power generation in the UK."

***Royal Society for the Protection of Birds** (RSPB)*

"At IKEA, we want to take a leading role in the transition to a low-carbon society by only using 100 percent renewable energy. By only using wind power in Sweden [..] we will not only be selfsufficient in electricity in Sweden, generating enough to supply all IKEA buildings and operations in the country, but it will give us opportunities to supply IKEA stores in other countries with wind power."

Steve Howard,
Chief Sustainability Officer, IKEA Group, June 2012

PUBLIC OPINION

Eurobarometer survey (2013)

EU citizens:

70% wind energy

A 2013 Eurobarometer study found that 70% of EU citizens **think renewable energy should be prioritised** as an energy option for the next 30 years.

GLOBAL **WIND DAY** 15 JUNE

- The growing participation in the annual Global Wind Day (15 June) shows **support for and interest in wind energy is increasing. www.globalwindday.org**
- The Global Consumer Wind Study 2012 by Vestas and TNS Gallup shows that **85% of consumers surveyed want more renewable energy.**

HEALTH

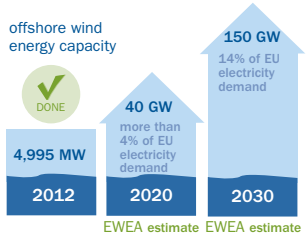
Noise levels from turbines meet **World Health Organisation** (WHO) recommendations for residential areas.

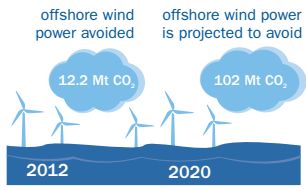
There is **no evidence** "that the audible or sub-audible sounds [including infrasound] emitted by wind turbines have **any direct adverse physiological effects**", concluded a study, 'Wind Turbine Sound and Health Effects', conducted in 2009 by a panel of medical professionals from the US, Canada, Denmark, and UK.

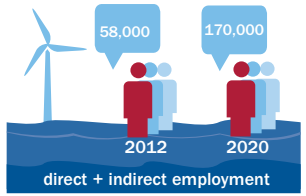
The most audible **sound** of wind turbines is a **light swishing** - and usually the wind itself is louder.

Wind energy emits **no particles**, unlike fossil fuels, which severely affect human health.

OFFSHORE







- In 2012, **Europe** was the **world's leader** in offshore wind energy with more than **90%** of the world's installed capacity.
- EWEA estimates that approximately **a quarter of Europe's wind energy** could be produced offshore in 2020.
- In 2012 the **average size** of offshore wind turbines installed and grid connected reached **up to 4.6 MW**, a 11% increase on 2011.
- In 2011 the average size of offshore wind projects was 199 MW. In 2012 it was 271 MW - a 36% increase.
- Offshore wind farms can provide **regeneration areas for fish and other sea creatures** because of reduced trawling activities and because the foundations act as an artificial reef, encouraging the creation of new habitats.

The average European **ONSHORE** wind turbine

Capacity: **2.2 MW**

Capacity factor: **24%**

Average annual energy production: **4,702 MWh**

This can power more than **1,202 households**

CO_2 emissions avoided: **3,202 t**

This can fuel **2,315 electric cars**

The average European **OFFSHORE** wind turbine

Capacity: **3.6 MW**

Capacity factor: **41%**

Average annual energy production: **12,961 MWh**

This can power more than **3,312 households**

CO_2 emissions avoided: **8,827 t**

This can fuel **6,481 electric cars**

Capacity (MW)

The ability to generate electricity is measured in watts. To describe the capacity of wind turbine or other power plants, the terms kilowatt (kW = 1,000 watts), megawatt (MW = 1 million watts), and gigawatt (GW = 1 billion watts) are most commonly used.

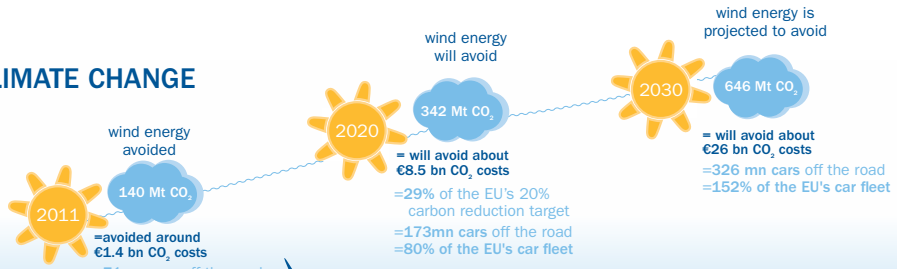
Electricity production (MWh)

Electricity production and consumption are measured in kilowatt (1,000 watts) hours per hour (kWh). One 50 watt light bulb left on for 20 hours consumes one kilowatt-hour of electricity.

Capacity factor

A modern wind turbine is available to produce electricity 80-98% of the time, but it generates different outputs depending on the wind speed. During one year, it will typically generate about 24% of the theoretical maximum output (41% offshore), which is the capacity factor (conventional power stations: 50-80%). More comparable with other sources of electricity is the overall efficiency, the relationship between the energy input (the wind) and the energy output (the electricity). The efficiency of a wind turbine has a theoretical limit of 59% (compared to coal with about 35% and gas with about 50%).

CLIMATE CHANGE



- For **every kWh of wind energy used,** approximately **696g of CO_2** will be **avoided.**
- Wind energy produces no greenhouse gas emissions during its operation. **A turbine** will **produce** up to **80 times more energy** than is used to **build, install, operate, maintain** and **decommission it.**

Annual investments in offshore wind farms are expected to increase

Average water depth and distance to shore of offshore wind farms