



## EVOLUTION AND FUTURE OF WIND ENERGY IN EUROPE

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### 1 ABSTRACT

This paper deals with evolution and potention of wind energy in Europe. Europe is today in the centre of an energy revolution that will impact the way we think about electricity as fundamentally as did the emergence of coal in the past. It is driven by the desire of European peoples to have cleaner, safer, more secure power to supply their needs, in contrast to the constrained fossil fuels of yesterday.

### 2 WIND ENERGY TODAY

Wind energy has come a long way in the last two decades. At a given site, a single modern wind turbine annually produces 180 times more electricity and at less than half the cost per kilowatthour (kWh) than its equivalent of 20 years ago. Today, Europe leads the world in terms of manufacturing and development of wind farms. In 1994, there were 1,683 megawatts (MW) of wind energy installed across the EU. By the end of 2005, installed capacity had increased 24 times and some 40 gigawatts (GW) of cumulative installed capacity were providing about 2.8% of European electricity consumption. Still, the potential of wind energy is far greater. European companies are world champions in the manufacturing of wind turbines and their components. Seven of the top ten turbine manufacturing companies are based in Europe. In 2004 they accounted for 82% of the global market, supplying the turbines that established growing markets in India and USA for example [1]. In turn, European developers also go ahead in setting up wind farms and are responsible for building 69% of them worldwide.

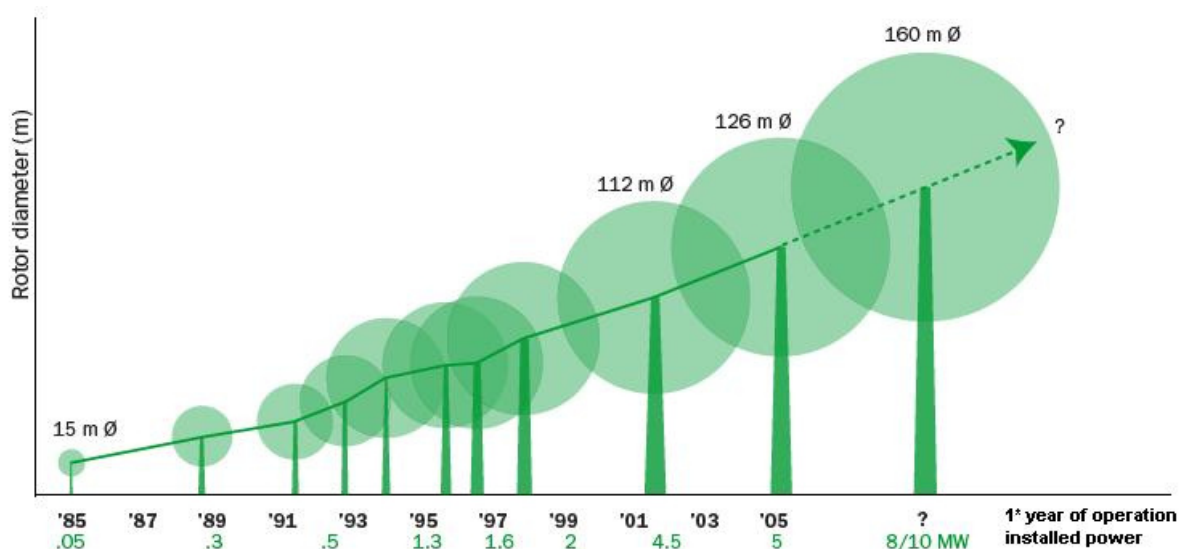


Figure 1: The size of wind turbines at market introduction [2].

The size of commercially available grid connected horizontal axis wind turbines has evolved from about 0.022 MW in the early nineteen eighties to about 6 MW today. These larger machines are being developed principally, though not solely, through the drive to take the technology offshore.

### 3 WIND ENERGY IN 2030

#### 3.1 European electricity consumption 2005 - 2030

A wind-powered future would mean reduced risks associated with fossil and nuclear fuels. Wind power entails no geo-political risk, reduces external energy dependence, reduces the need for energy imports, has no fuel costs, no fuel price risk, no resource constraints, no CO<sub>2</sub> and other harmful emissions and no radioactive waste. Reliable, clean power for European domestic consumers and reduced power costs for increasingly high energy use industries can be obtained, and more cheaply than today. Energy is fundamental to any economy; wind energy can be a driver for European growth. With the right kind of collaboration and investment, electricity production from wind and its contribution to meeting European electricity consumption could raise from 83 TWh in 2005 to 965 TWh by 2030, supplying 23% of European electricity. This projection takes into account that consumption is expected to increase by half over the same period [2].



Figure 2: Contribution of wind energy to European electricity consumption 2005 -2030 [2].

#### 3.2 Twice the Turbines and Twelve Times the Power

And yet this does not mean covering Europe in wind turbines. At the end of 2005, an estimated 47,000 wind turbines were installed in Europe. The average size of turbines delivered to the European market in 2004 was about 1.3 MW onshore and 2.1 MW offshore. Under the assumption that by 2030 the average size of a wind turbine will be 2 MW onshore and 10 MW offshore, only 90,000 turbines (75,000 onshore and 15,000 offshore) would be needed to fulfil the 300 GW target [3]. Almost no existing wind turbine will be operational in 2030, the technical lifetime for a turbine being twenty years onshore and twenty-five years offshore. In their place, integrated into the landscape, silent sentinels will gently spin – just twice the number of today, and yet generating twelve times as much power. The industry is optimistic about the potential for wind energy, more than it has ever been. Past targets set by the industry, and indeed by the European Commission in its 1997 White Paper on Renewable Energy, have been successively surpassed and upgraded. But this must not be taken to mean that the “job is done”. This is not the case. It is instead that even the wind industry itself in the past has underestimated the sheer scale of power that could potentially be brought online by 2030 if sufficient resources are brought to bear.

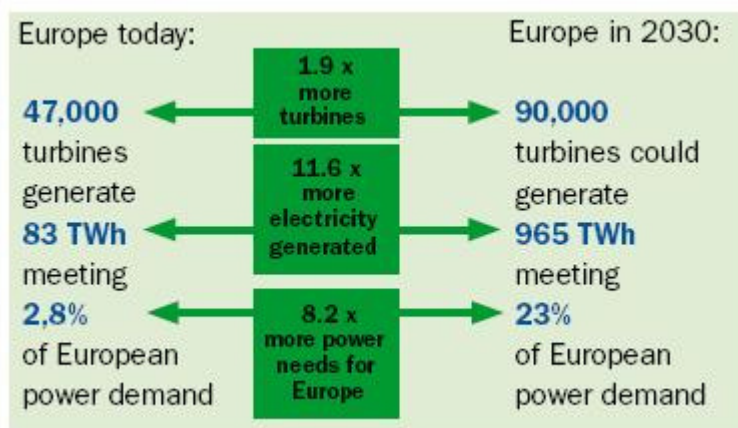


Figure 3: More power from less turbines in Europe [2].

## 4 WHAT WILL THIS MEAN FOR EUROPE?

### 4.1 More Secure Electricity Supply

On 8 March 2006, the European Commission released its Green paper “*A European Strategy for Sustainable, Competitive and Secure Energy.*” Energy is one of the most important raw materials of any economy, and will continue to be unless it is decoupled from economic growth. Its secure supply to meet European needs is one of the greatest challenges of the 21st Century. Conventional fossil and nuclear fuels are increasingly in short or constricted supply, sourced in just a few countries, many of them subject to unstable regimes, or hindered in export terms by their geography. The oil price has peaked above USD 70 per barrel, and will continue to rise dragging gas prices with it. The IEA predicts that by 2030 Europe will rely on foreign imports for 70% of its energy needs, making reliance on such sources even less desirable. Crystallisation of research efforts to maximise the use of Europe’s own, indigenous wind energy source will strengthen the foundations of the European economy [3].

### 4.2 A Healthy Environment

According to the conclusions of “*Energy and Environment in the European Union – Tracking Progress Towards Integration*”, a new report from the European Environment Agency, more action is required to reduce energy consumption and to encourage the introduction of Technologies with low environmental impacts. In particular, it recommends greater use of renewable energy sources and reiterates the need for long term targets (beyond 2010), to provide a clear direction for EU energy policy. The publication highlights the need for governments around the world to encourage investment in renewable energy technologies. The successful meeting of wind energy targets for 2020 and 2030 will be instrumental in a large proportion of the drive to decouple economic growth from environmental degradation. A dedicated Working Group on environment and public opinion will assess what needs to be done to effectively address potential single and cumulative impacts on avian, terrestrial and marine ecosystems [3]. TPWind objectives are closely aligned with those of the Environmental Technologies Action Plan (ETAP): “*Getting from Research to Markets; Improving Market Conditions*” and “*Acting Globally.*” The Environment and Public Support Working Group will place emphasis on environmental impacts of wind energy development, maintaining close links with environmental NGOs.

### 4.3 Slowing Climate Change

Environmental pollution and the emission of CO<sub>2</sub> from the use of fossil fuels constitute a threat to health, the environment and sustainable economic growth. The use of fossil fuels is responsible for 70% of greenhouse gas emissions. The climate change challenge must include a shift in the way we produce and consume energy. Many solutions and approaches are being developed to reduce emissions, e.g. emissions trading and the flexible mechanisms under the Kyoto Protocol. However, it is important to acknowledge that the cheapest solution in the short run is not necessarily the cheapest long term solution. In the long term, Europe must accelerate its transition to non-conventional sources of energy. Wind power can make a substantial contribution to the EU emission reduction targets under the Kyoto Protocol. With sufficient emphasis on technological R&D and market development, wind could meet 30% of the Union's obligation by 2010 [2].

## 5 CONCLUSION

Wind energy has the potential to be the cheapest power source in Europe, but like any emerging technology, it faces significant barriers. The existing market has developed around heavily subsidized and monopolistically-managed energy sources with very different characteristics: if wind energy is to penetrate European supply to a significant degree, its development must be viewed strategically. A strong wind energy sector does not only mean reduced CO<sub>2</sub>, cleaner air, and secure biodiversity. Sustainable economic growth, reduced energy import dependence, high quality jobs, technology development, global competitiveness, and European industrial and research leadership – wind is in the rare position of being able to satisfy all these requirements. Indeed wind energy can help significantly across the whole range of goals in the Lisbon Strategy to make Europe the world's most dynamic and competitive knowledge based economy.

## REFERENCES

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- [3] Future prospects for wind power markets. Prepared by The European Wind Energy Association, [http://www.ewea.org/fileadmin/ewea\\_documents/documents/press\\_releases/factsheet\\_future2.pdf](http://www.ewea.org/fileadmin/ewea_documents/documents/press_releases/factsheet_future2.pdf)

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