



Photo: Geopower

Invest in the future: wind energy, finance and economics

Wind is an increasingly competitive power source

Wind power is developing rapidly at both the European and global level. Between 1992 and 2008, the global installed capacity of wind power increased from 2.5 GW to more than 120 GW, an average annual growth rate of more than 25%. Due to ongoing improvements in turbine efficiency, wind power is increasing in economic competitiveness against conventional power production.

Wind power costs

The key parameters governing wind power economics are: investment costs, operation and maintenance costs, electricity production, average wind speed, turbine lifetime and discount rate.

One of the most striking elements in terms of wind energy investments is the high share of costs paid upfront, compared with the total cost of the project over its whole lifetime (about 80%). This fact marks a fundamental difference with most conventional electricity production options, where the fluctuating and uncertain nature of fuel costs constitutes a key component.

The total investment cost of an average 2 MW wind turbine installed in Europe is about €1.23 million/MW.

A turbine's share of total costs averages about 76%, while grid connection accounts for 9% and the foundation for 7%.

Operation and maintenance (O&M) costs have an average share over the lifetime of the turbine of about 20% to 25% of total levelised cost per kWh produced.

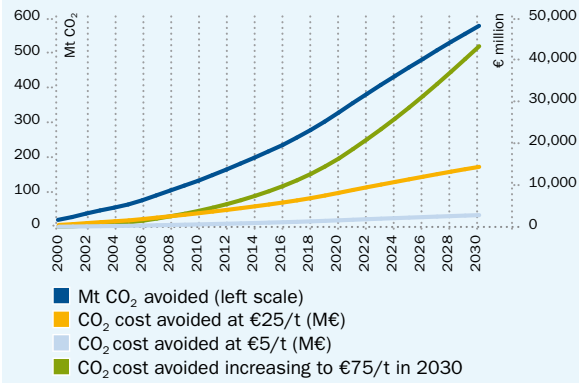
The wind regime at the chosen site, the turbine hub height and the efficiency of electricity production due to better equipment design determine the turbine's power production. Taking into account these aspects, the overall wind power production efficiency has increased by 2-3% annually over the last 15 years.

The economic consequences of this trend are clear. For a coastal position, for example, the average generation costs have decreased from around 9.2 c€/kWh for the 95 kW turbine (mid 1980s typical turbine) to about 5.3 c€/kWh for a new 2,000 kW machine, an improvement of more than 40% over 20 years.

Financing wind energy

While most commercial wind farms have been funded through project financing, which is a loan backed by the cash flow of a project, in the last few years new forms of financing have arisen using renewable energy funds, pension funds and even high net worth individuals seeking efficient investment vehicles. Although many small privately owned projects remain, there has been a substantial shift towards bigger utility-owned projects. These changes bring new money to the industry and decrease dependence on banks for initial funding.

Wind energy CO₂ savings and cost avoided for different CO₂ prices in the EU-27 (2000-2030).



Wind power reduces the price of electricity

Since wind power has zero fuel costs and a very low marginal cost, it not only reduces the uncertainty and the risk of the power system, it also contributes to the reduction of the overall price of electricity by displacing the most expensive generation options. A study carried out in Denmark shows that the price of power to consumers in 2004 to 2007 would have been 4-12 % higher if wind power had not contributed to power production. Studies in Germany and Spain have shown similar results.

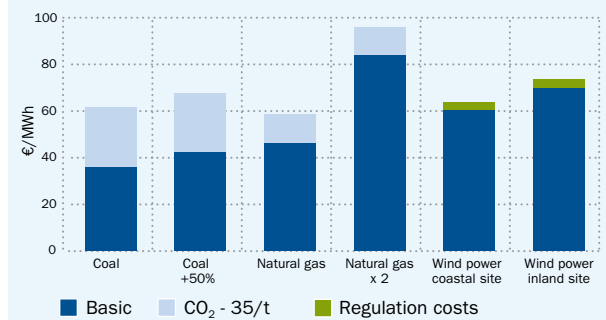
Wind power avoids fuel and CO₂ costs

An increased share of wind power capacity avoids the full fuel and CO₂ costs, as well as a considerable portion of the O&M costs, of the displaced conventional sources. Recent studies show that CO₂ costs avoided due to wind energy will increase from €2 billion in 2007 to €16 billion in 2020 and €43 billion in 2030. At the same time, wind energy production will be responsible for avoiding €4.4 billion of fuel costs in 2010, €12 billion in 2020 and €24 billion in 2030 (Pure Power – www.ewea.org).

Wind power compared to conventional power

Analyses have shown that at good sites wind power is competitive with new coal and gas-fired power plants. If the environmental and social costs of power generation were included in electricity prices, wind power would already be cheaper than any other electricity generating technology.

Sensitivity analysis of costs of generated power comparing conventional plants to wind power, assuming increasing fossil fuel and CO₂-prices, year 2010 (constant 2006-€).



This graph shows that when the natural gas price doubles (compared to the reference equivalent to an oil price of \$118/barrel in 2010), the coal price increases by 50% and the price of CO₂ increases to 35€/t from 25€/t in 2008. The competitiveness of wind-generated power increases significantly; costs at the inland site become lower than generation costs for the natural gas plant and only around 10% more expensive than the coal-fired plant. On coastal sites, wind power produces the cheapest electricity of the three.



Key objectives

- Keep reducing the cost per kWh of wind power through continued technology improvement, R&D and economies of scale.
- Establish stable regulatory frameworks, simple to implement and compatible with a liberalised electricity market.
- Promote a well-functioning electricity market to enable wind power's cost advantages to be passed onto the consumer.