SIEMENS

A macro-economic viewpoint

What is the real cost of offshore wind?

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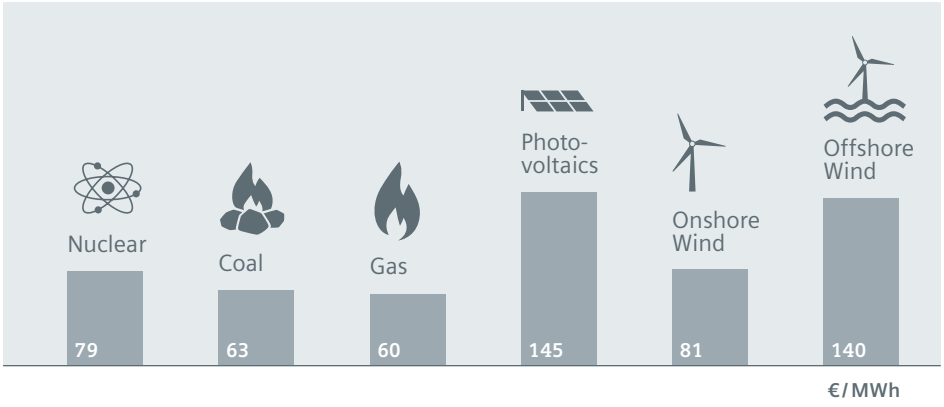
Wind in the cost debate

A broader view of the value of renewables.
Globally, installed power generation capacity currently totals about 6,500 gigawatts (GW). In-house calculations by Siemens suggest that this figure will almost double by 2030, to about 10,500 GW. The International Energy Agency (IEA) expects renewables by 2035 to generate more than 25 percent of the world's electricity consumption, with a quarter of this coming from wind.

The expansion of renewables must therefore be driven forward if these ambitious climate protection targets are to be achieved. Offshore wind is one of the world's most promising and climate-friendly energy-producing technologies. However critics continue to point out the higher costs, relative to more conventional power sources. Ongoing support of actions that will help the industry continue to lower costs associated with offshore wind energy is vital.

LCOE 2013



System costs (LCOE) for all primary energy sources in UK for 2013

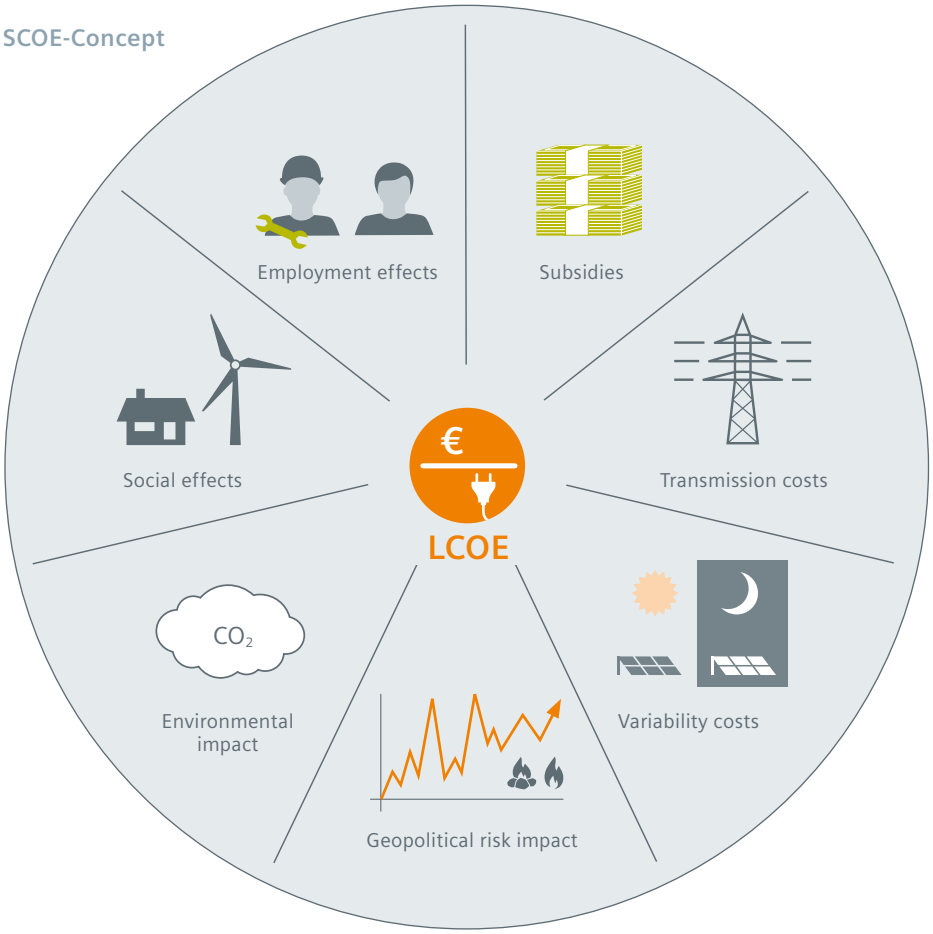
LCOE as a basis for calculation
But is the standard comparison based on LCOE (Levelized Cost of Energy) the right yardstick when it comes to deciding on the right energy mix? The LCOE represents only the system costs in terms of the expected lifetime of a power station. It is calculated as the ratio of the lifetime sum of discounted capital and operating costs, including fuel, divided by the lifetime sum of discounted electricity output.

$$\text{LCOE} = \frac{\text{Total costs over lifetime}}{\text{Electricity produced over lifetime}}$$

Benefit to society.
Cost to society.

The LCOE calculation does not include the total actual economic costs of individual primary energy sources. However, to arrive at a better estimate of which generation technologies benefit our societies the most, many more additional factors need to be considered. This is why we have created a new calculation model that represents the real cost/benefit ratio as a macro-economic yardstick – Society's Cost of Electricity (SCOE).

SCOE-Concept



SCOE: total of LCOE and all cost factors relevant to society as a whole

Subsidies
When talking about renewables often involves a call for them to “grow up and become independent of subsidies.” However, it is often overlooked that conventional technologies also receive substantial levels of subsidies, although these are not included in the LCOE calculation.

Transmission costs
As the share of renewables in the energy mix grows, grids often need to be reinforced on both the transmission and distribution levels, since renewable sources are either not centrally located (photovoltaics, biomass, onshore wind) or are remote and installed at sea (offshore wind). For offshore wind, grid optimization costs amount to around 2.0 €/MWh, for onshore wind we assume 2.0 €/MWh, and for photovoltaics, 6.6 €/MWh.

Variability costs
Because large-scale storage technologies are not yet available at an industrial scale, the variability of wind power plants must be offset using regulated conventional power stations. This incurs additional costs for renewables in the order of 13-15 €/MWh.

Geopolitical risk impact
Wind energy is an inexhaustible renewable energy source available for free. It is ideally suited to reduce dependency on oil and gas importers and the risk of future fuel price increases. To estimate the geopolitical cost of conventional energy sources, we have applied the price adder required to pay for hedging of fossil fuel prices for a period of only two years. In UK, the cost effect for coal is 1.7 €/MWh; for gas it is 5.4 €/MWh. This is a conservative estimate when viewed against the usual lifetime of fossil power stations of more than 30 years.

Environmental impact
The cost of CO_2 certificates is included in the LCOE, but at a CO_2 price of well below 10 €/ton, this level does not provide a reasonable reflection of the immediate and long-tem negative impacts of greenhouse gas emissions. We assumed a price of 81 €/ton for CO_2 as this is the lifetime value of CO_2 for a power plant starting operations in 2025, given by the carbon price floor. This gives us an additional cost of 45 €/MWh for greenhouse gas damage in the case of coal power plants, for example.

Social effects
Social effects are the impact on property value close to power stations. These are relatively moderate for all technologies and amount to 5.0 €/MWh for onshore wind, for example.

Employment effects
Offshore wind has more potential to create local employment and a positive GDP impact than all other energy sources. According to the latest Offshore Wind Industrial Strategy Report published by the UK government and industry the offshore sector has the potential to create 30,000 jobs and contribute more than EUR 8 billion to the economy in the UK alone by 2020. The value of the economic impact ranges from 21 €/MWh for gas to 71 €/MWh for offshore wind. These are gross effects; we account only for the positive difference to the lowest value (i.e. vs. 21 €/MWh).

Comparison of LCOE and SCOE for all primary energy sources in UK

Offshore wind – an investment that pays off.

When broadening the scope of electricity cost calculation from LCOE to SCOE – Society's Costs of Electricity – we account for (partially hidden) subsidies, grid access costs, variability costs, social costs, economic benefits and geopolitical impact. Using SCOE enables us to compare the different technologies for the first time based on actual social impact factors and benefits. The cost of wind power in general, but offshore wind in particular, declines considerably from the simpler calculation represented by the LCOE.

Based on the SCOE, offshore wind should be a main pillar of tomorrow's energy supply. It generates clean and climate-friendly electricity, creates jobs and reduces risks on several levels, such as exposure to particulate matter and security of supply through to susceptibility to the price volatility of imported fuel. Jobs related to the installation and long-term maintenance of wind turbines can be localized. Additional jobs will be created for offshore wind in turbine assembly and embarkation ports. These jobs will provide significant economic impact to the regions with additional local consumption of goods and services.

The SCOE calculation also shows that gas is the most efficient and lowest-cost backup solution for all renewables, as a means of achieving a reliable, low-emission energy supply system.

The sample calculation for UK in 2025 demonstrates the paradigm shift that applying the SCOE concept could involve – which we hope will ensure a redefined, more balanced and fruitful cost debate for the benefit of society.

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