

WIND POWER



CASES

FACT SHEET

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What is Wind Power?

Wind is one of the most ancient forms of energy humans have harnessed to power technologies that have aided their labour, economies and way of life. Over two thousand years ago, windmills were used in agriculture in Asia and the Middle East to pump water and to grind grain. In the Netherlands, water-pumping windmills were a vital technology in their constant struggle to keep their low-lying lands arable and livable. Today, the windmills that rise above the flat Dutch countryside are an iconic symbol of the nation's ingenuity.

Just as windmills played an important role in ancient societies' agriculture-based economies, they have gained importance in today's electricity-dependent economy. Since the invention of the electric motor, windmills have been used to create electricity thanks to the development of the wind turbine. When the kinetic energy of wind turns the blades of the wind turbine, a rotor connected to the blades spins a generator and produces electricity.

What is Wind Power Used For?

In the century following its development, electricity generating wind turbines did not achieve wide-scale deployment and were used primarily on individual farms.

This situation has changed rapidly, however, over the past thirty years due to increasing awareness of the negative impacts of fossil fuels and the political and economic vulnerabilities of global oil and gas markets. Over this time period, wind power has gained an important role in the utility-scale production of electricity.


As wind energy's role has shifted from providing electricity to remote individual consumers to supplying power to national grids, the industry has experienced several important advancements. These include greater economies-of-scale in the manufacturing of windmills, greater knowledge about optimal locations for strong, consistent wind power, and technological improvements to generate greater amounts of electricity from a single wind turbine.

The growth and improvements in the wind sector have helped lead to a rapid decrease in the cost of electricity per kWh of 68% in the decade since 2010.[1] This drop in the cost of wind power has coincided with a similar drop in the cost of solar power and the two technologies rival each other as the lowest cost energy source. One area where wind power outpaces solar, however, is deployment. Wind power has experienced rapid uptake in China and Europe during the twenty-first century and currently produces one-tenth of global electricity supplies.

Wind Power and Renewable Energy

Wind power, like solar, is considered an intermittent energy source. Wind does not blow constantly and, unlike solar, it is difficult to predict. This can lead to windmills not generating electricity when there is high demand or producing abundant electricity during periods of low demand. The latter situation causes energy curtailment—when the energy produced at a wind farm is disconnected from the grid to avoid grid stress from too much electricity supply.

[1] IRENA (2022), Renewable Power Generation Costs in 2021, International Renewable Energy Agency, Abu Dhabi, 31.



One of the solutions to addressing the intermittent nature of wind power is to locate wind farms offshore where wind is more consistent and wind speeds are higher. Offshore wind farms currently constitute a small portion of global wind turbine deployment since the installation of wind turbines in the ocean is much more complex and costlier than on land. However, the development of larger wind turbines that generate more electricity, the decreasing costs of manufacturing windmills, and greater knowledge and economies-of-scale for offshore installation have made offshore wind much more attractive.[2]

A more consistent and efficient supply of wind power would likely lead to greater energy curtailment. Energy utilities are increasingly turning to energy storage systems to divert excess power that cannot be sent to the grid as electricity. The cost of the most common form of energy storage—lithium-ion batteries—has fallen at an even greater rate than wind power in the past decade. This makes hybrid energy plants, which combine renewable energy production with energy storage systems, financially viable. The combination of wind and energy storage addresses the issues of curtailment and intermittency as the excess power can be stored and dispatched when the wind is not blowing.

[2] IRENA (2022), Renewable Power Generation Costs in 2021, International Renewable Energy Agency, Abu Dhabi, 102.