

# Wind Energy

**Wind power** is the conversion of wind energy into a useful form of energy, such as using wind turbines to make electrical power, windmills for mechanical power, wind pumps for water pumping or drainage, or sails to propel ships.

Large wind farms consist of hundreds of individual wind turbines which are connected to the electric power transmission network. Offshore wind is steadier and stronger than on land, and offshore farms have less visual impact, but construction and maintenance costs are considerably higher. Small onshore wind farms provide electricity to isolated locations. Utility companies increasingly buy surplus electricity produced by small domestic wind turbines.<sup>[1]</sup>

Wind power, as an alternative to fossil fuels, is plentiful, renewable, widely distributed, clean, produces no greenhouse gas emissions during operation and uses little land.<sup>[2]</sup> The effects on the environment are generally less problematic than those from other power sources. As of 2011, Denmark is generating more than a quarter of its electricity from wind and 83 countries around the world are using wind power on a commercial basis.<sup>[3]</sup> In 2010 wind energy production was over 2.5% of total worldwide electricity usage, and growing rapidly at more than 25% per annum. The monetary cost per unit of energy produced is similar to the cost for new coal and natural gas installations.<sup>[4]</sup>

Wind power is very consistent from year to year but has significant variation over shorter time scales. The intermittency of wind seldom creates problems when used to supply up to 20% of total electricity demand,<sup>[5]</sup> but as the proportion increases, a need to upgrade the grid, and a lowered ability to supplant conventional production can occur.<sup>[6]</sup> Power management techniques such as having excess capacity storage, geographically distributed turbines, dispatchable backing sources, storage such as pumped-storage hydroelectricity, exporting and importing power to neighboring areas or reducing demand when wind production is low, can greatly mitigate these problems.<sup>[7]</sup> In addition, weather forecasting permits the electricity network to be readied for the predictable variations in production that occur.<sup>1</sup>