

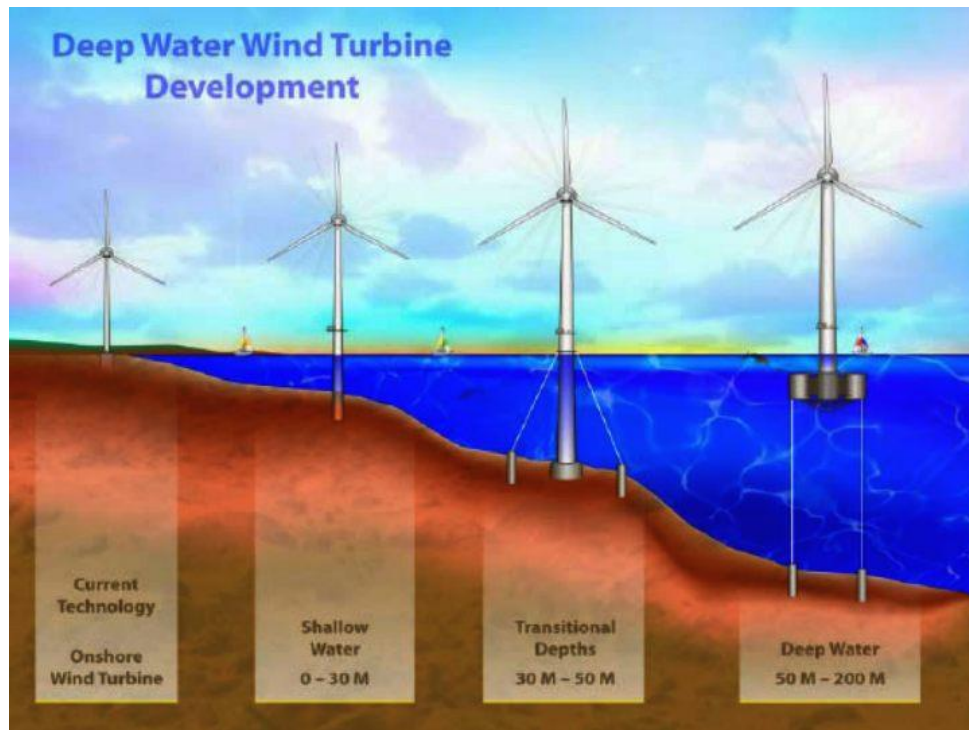
Offshore wind power or offshore wind energy is the use of wind farms constructed in bodies of water, usually in the ocean, to harvest wind energy to generate electricity. Higher wind speeds are available offshore compared to on land, so offshore wind power's electricity generation is higher per amount of capacity installed



Unlike the typical use of the term "offshore" in the marine industry, offshore wind power includes inshore water areas such as lakes, fjords and sheltered coastal areas as well as deeper-water areas. Most offshore wind farms employ fixed-foundation wind turbines in relatively shallow water.

Fixed foundation offshore wind turbines

Almost all currently operating offshore wind farms employ fixed foundation turbines, with the exception of a few pilot projects. Fixed foundation offshore wind turbines have fixed foundations underwater, and are installed in relatively shallow waters of up to 50–60 m



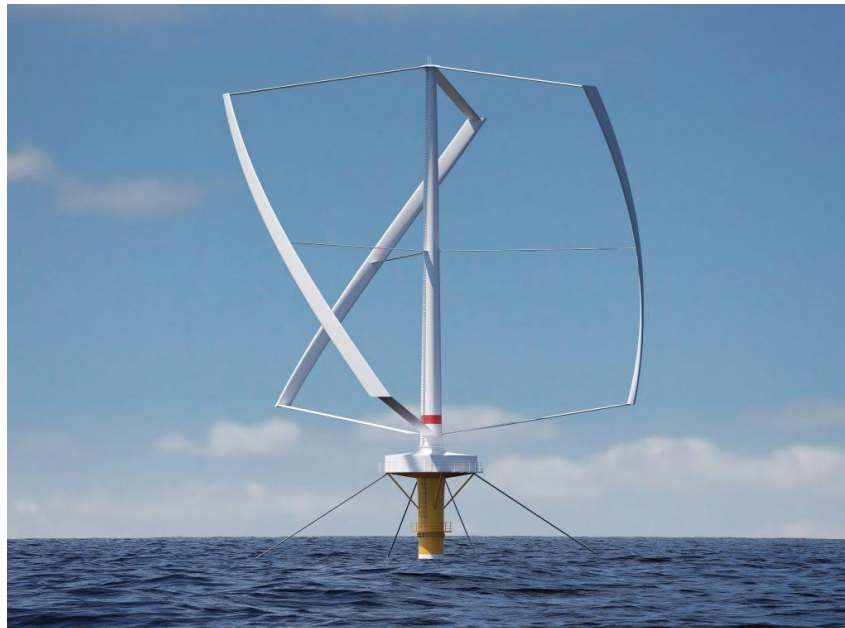
Floating offshore wind turbines

For locations with depths over about 60–80 m, fixed foundations are uneconomical or technically unfeasible, and floating wind turbine anchored to the ocean floor are needed. *Hywind* is the world's first full-scale floating wind turbine, installed in the North sea off Norway in 2009. Hywind Scotland, commissioned in October 2017, is the first operational floating wind farm, with a capacity of 30 MW. Other kinds of floating turbines have been deployed, and more projects are planned.

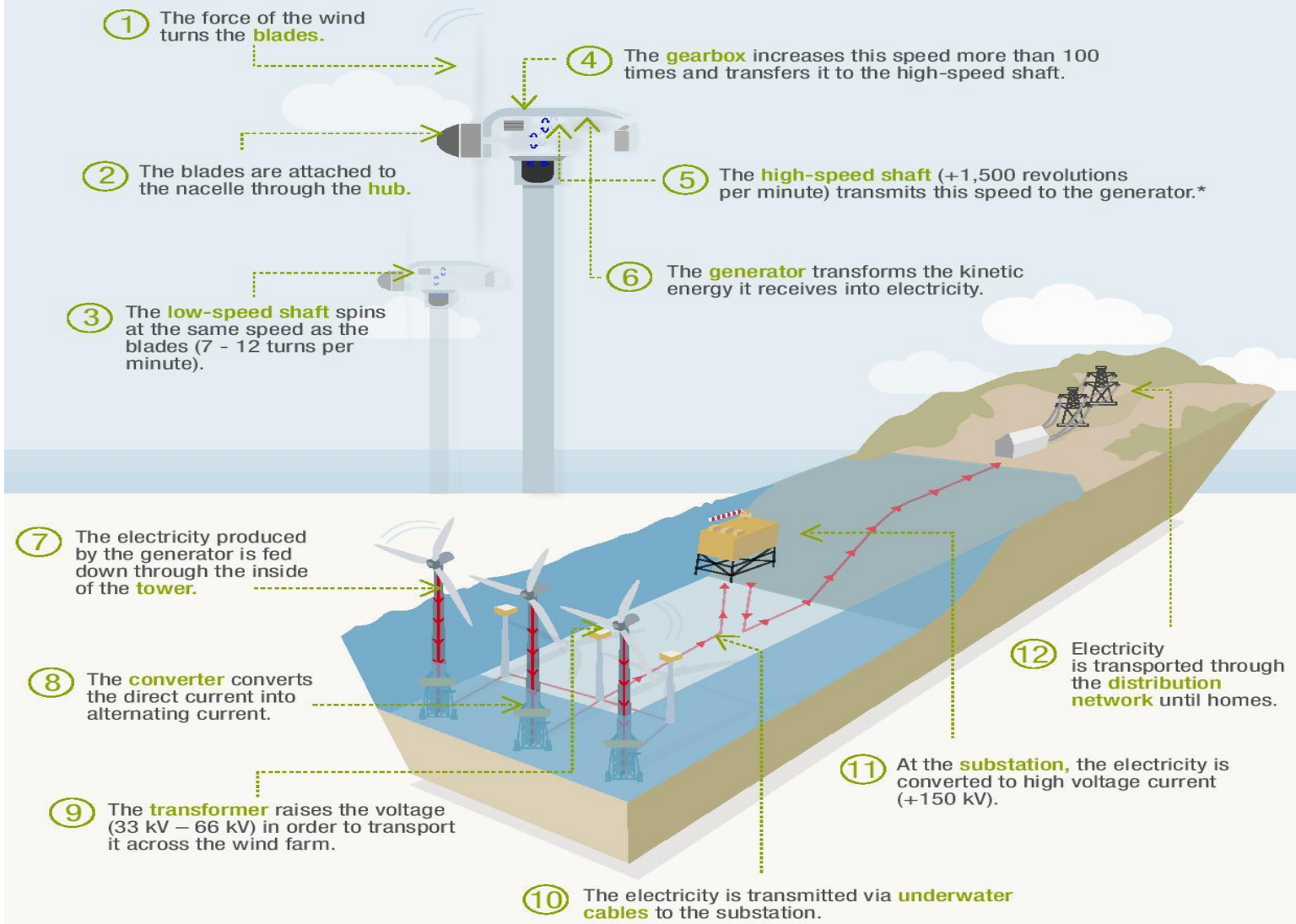


Vertical axis offshore wind turbines

Although the great majority of onshore and all large-scale offshore wind turbines currently installed are horizontal axis, vertical axis wind turbines have been proposed for use in offshore installations. Thanks to the installation offshore and their lower centre of gravity, these turbines can in principle be built bigger than horizontal axis turbines, with proposed designs of up to 20 MW capacity per turbine. This could improve the economy of scale of offshore wind farms. However, there are no current large-scale demonstrations of this technology.



How does an offshore wind farm work?



(*) Some technologies use low-speed generators coupled directly to the low-speed shaft.

Offshore wind power by country

Most of offshore wind farms are currently in northern Europe. The United Kingdom and Germany alone accounted for roughly two thirds of the total offshore wind power capacity installed worldwide in 2016. Other countries, such as China, are rapidly expanding their offshore wind power capacity.

Rank	Country	2016 (MW)	2017(MW)	2018 (MW)
1	United Kingdom	5,156	6,651	7,963
2	Germany	4,108	5,411	6,380
3	China	1,627	2,788	4,588
4	Denmark	1,271	1,268	1,329
5	Belgium	712	877	1,186
6	Netherlands	1,118	1,118	1,118
7	Sweden	202	202	192
8	Vietnam	99	99	99
9	South Korea	35	38	73
10	Finland	32	92	87
11	Japan	60	65	65
12	United States	30	30	30
13	Ireland	25	25	25
14	Taiwan	0	8	8
15	Spain	5	5	5
16	Norway	2	2	2
17	France	0	2	2
	World total	14,482	18,658	23,14