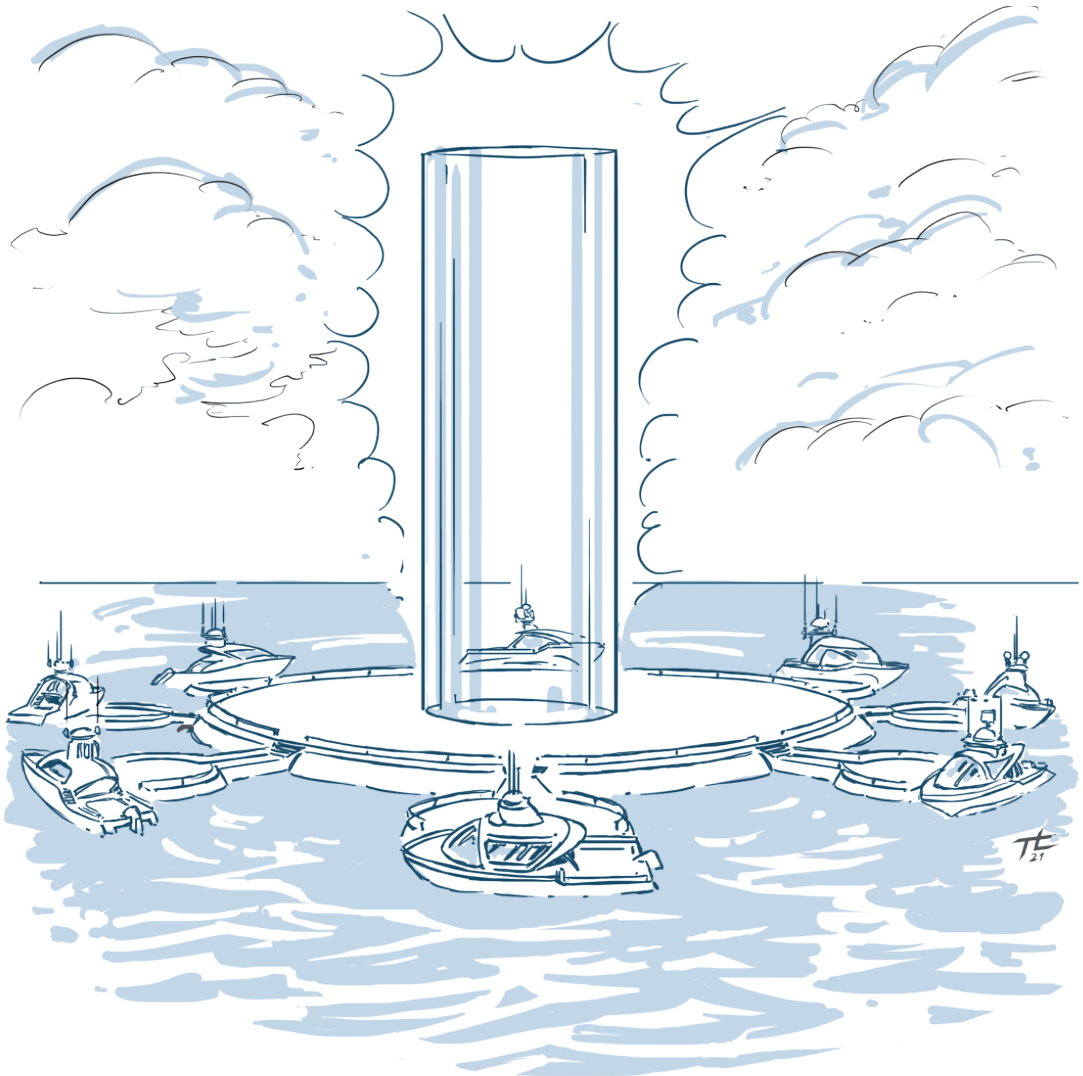
OFFSHORE & ONSHORE



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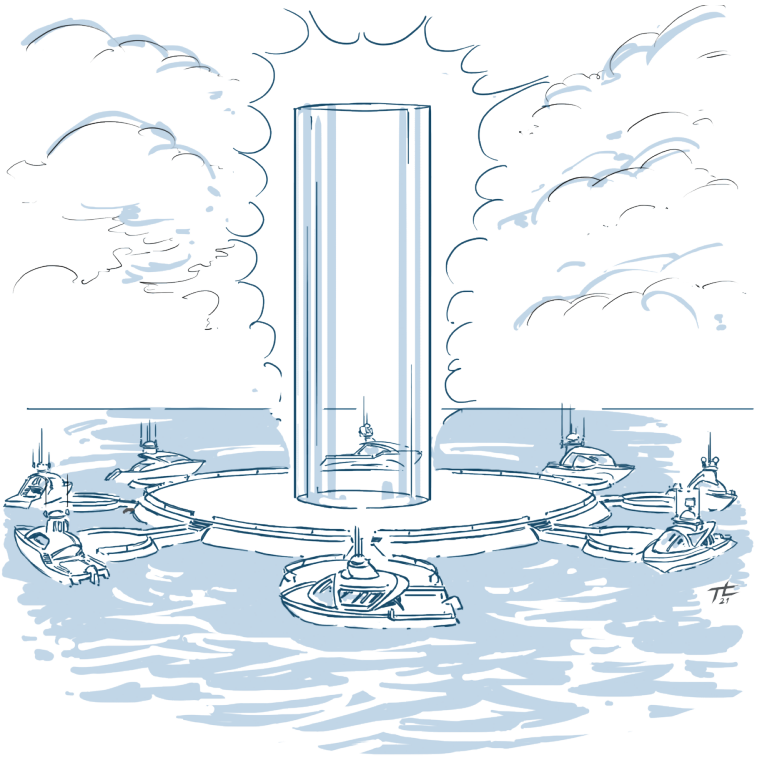
Fossil fuels continue to dominate the energy mix, despite the world facing a climate crisis and despite growing commitments by countries and business to net zero energy consumption.

According to the latest REN21 (2022) study, the share of fossil fuels in the global energy mix was 78.5 per cent in 2020, up from 80.7 per cent in 2009, while the share of renewables was 12.6 per cent in 2020, up from 8.7 per cent in 2009.

Both wind and solar power costs have fallen over the past decade, and renewable energy is the cheapest form of electricity generation. Almost three quarters of wind energy (~700 GW globally) comes from wind farms in five countries: China, the United States, Germany, India and Spain.

The European Parliament voted in September 2022 in favour of a 45 per cent target for renewable energy in the EU energy mix by 2030, paving the way for negotiations with the 27 Member States.



WHAT WILL BE THE FUTURE OF ONSHORE AND OFFSHORE WIND?

WHAT ROLE CAN OFFSHORE WIND ENERGY PLAY IN EUROPE AND WORLDWIDE?

WHAT CONDITIONS MUST BE MET IF SUCH AMBITIOUS ENERGY TRANSFORMATION GOALS ARE TO BE ACHIEVED?

PROGRESS

Worldwide

Total global wind power capacity now stands at 837 GW, helping the world avoid more than 1.2 billion tonnes of CO2 per year - equivalent to South America's annual carbon dioxide emissions.

In 2021, almost 94 GW of wind power capacity was added globally, incl. 21.1 GW of offshore wind capacity. Its share of the global new installations market increased to 22.5 per cent in 2021. China accounted for 80 per cent of the offshore wind capacity added globally in 2021, increasing its cumulative offshore wind installations to 27.7 GW. This is an astonishing level of growth, as it took Europe three decades to bring its total offshore wind capacity to a similar level.

By the end of 2022, Asia will be the largest offshore market in the world; it could take until 2031 for Europe to regain this position.

Over the next five years, 557 GW of new capacity is expected to be built under the current policy. This means more than 110 GW of new installations per year by 2026. However, this growth needs to quadruple by the end of the decade if the world is to stay on a 1.5°C path and net zero emissions by 2050.

„Floating wind" has moved from demonstration to pre-commercial phase, with 57 MW of new installations worldwide.

Europe

Europe has installed 17.4 GW of new wind power capacity in 2021, including 14 GW onshore and 3.4 GW offshore. Bottlenecks in the approval process and global supply chain issues continue to delay the commissioning of new wind farms.

The UK, Sweden, Germany, Turkey and the Netherlands had the highest amount of new capacity installed. Sweden had installed the most new onshore wind power (2.1 GW) and the UK new offshore wind power (2.3 GW).

Poland

The installed capacity of wind farms is more than 7.2 GW.

Sources: Polityka Energetyczna Polski 2040 (PEP 2040), The Global Wind Energy Council, Wind Europe, U.S. Department of Energy, International Renewable Energy Agency, European Commission, REN21, UN Environment Programme, IEA

CHALLENGES

Demand

The market needs huge amounts of clean, green and reliable energy at affordable prices.

Changes to processes and procedures

Changes are needed to build more wind power capacity that will contribute to energy and climate goals, modifications are needed to planning processes, permitting procedures, granting grid access and subsidy schemes. The process of obtaining new permits is lengthy and developers are discouraged from pursuing new projects because of the risks and costs involved.

Wind strength and patterns

A significant challenge for offshore wind turbine designers is the variability of wind power - turbines must be adapted to both low and high winds. In addition, climate change is resulting in more frequent abnormal weather events, including potential changes in wind strength and patterns.

Onshore wind energy is much cheaper than offshore

It needs shorter cables, installation is quicker, maintenance is easier. In addition, it contributes to the creation of local jobs. However, compared to offshore wind farms, its disadvantages are: variable wind speeds or lack of wind, interruptions in power generation and the need to replace it with another source, environmental impact, smaller scale of production than offshore farms.

Environmental impact of wind farms

Concrete in wind turbine foundations and fibreglass in blades present challenges in the context of coal use and waste issues.

Offshore wind farms are more efficient

Offshore wind farms produce more energy, have less environmental impact, and the sea offers more space for construction. On the other hand, they cost much more, require more frequent and longer maintenance and repairs, create noise and spoil the landscape, and provide fewer jobs locally.

Complicated production, transport and installation

All aspects must go together: research and development, costs, production and logistics.

Ageing of wind farms

In Europe, 38 GW of wind farms will reach their 20-year lifespan in the next five years and decisions will have to be made about their future: upgrading or replacing them with new ones (repowering), extending their lifespan or decommissioning.

TRENDS

- Wind power represents a small but fast-growing branch of electricity generation. Its share of global electricity production is 5 per cent.
- According to the International Renewable Energy Agency (IRENA), by 2050 wind energy could meet 35 per cent of global energy demand. However, for this to happen, current wind power capacity would need to increase tenfold to 6,000 GW, including 5,000 GW onshore and 1,000 GW offshore.
- According to the Global Wind Energy Council, offshore wind power will grow to more than 234 GW by 2030, with the Asia-Pacific region leading the way.
- WindEurope predicts that 116 GW of wind farms will be installed in Europe between 2022 and 2026. This means an average of 23 GW of capacity per year. 75 per cent of the new capacity will come from onshore wind farms. This is still far too little to reach the EU's new 40 per cent renewable energy target.
- Germany will be the largest wind power market in Europe thanks to the expected good performance of the onshore market over the next five years (19.7 GW) and a growing number of offshore installations (5.4 GW). Significant new capacity will be installed in the UK (15 GW in total), France (12 GW) and Spain (10 GW) and Sweden (7 GW). In Poland, installed wind power capacity is expected to reach around 11 GW in 2040.
- Despite higher annual installation rates, Europe will not install the amount of onshore and offshore wind power it needs to meet its energy and climate goals.
- Offshore wind power, which is more expensive and therefore much less common than onshore wind power, will see the largest cost and price reductions in the future. Significantly larger turbines will allow a threefold increase in capacity, creating economies of scale that will reduce the cost of energy per megawatt hour.
- Offshore wind farms on floating platforms, currently the rarest and most expensive, are expected to become significantly cheaper and could account for 25 per cent of all offshore investments by 2035.
- New strategies for turbine reuse and disposal are currently being designed. Work is also underway on recyclable plastic turbine blades and on a fully integrated system for converting wind energy into hydrogen at sea. Larger and larger offshore wind turbines are also being constructed. New ideas are also emerging, including: aerial wind turbines and ‚artificial trees that harvest the wind'.

ANTI TRENDS

- Reducing the costs and improving the efficiency of wind power.
- Changes in wind characteristics due to climate change.
- Cyber attacks on infrastructure.
- Progress on new technological developments in nuclear energy and cold fusion.
- Economic crisis limiting investment spending by companies and states, including government subsidies for wind energy.
- Changes in energy policy and a slowdown in green energy development due to armed conflicts and social unrest.
- The pace of growth may depend on disruptive innovation, as improving existing technologies may not be enough.

CONCLUSIONS

If wind energy, together with solar energy, is to lead the energy transition, a significant increase in investment in wind installations is needed over the coming decades. This also requires more conducive policies, new energy storage and improved technologies.

According to the experts, the mechanisms that are key to the development of wind power are: increasing the economies of scale of the generating unit, power plant and resources, the economies of value of the grid system and production efficiency. Experts predict that wind power will cost significantly less than it does today. Work to increase economies of scale through technological innovation, and new siting strategies, will lead to an increase in the height and diameter of wind turbines and to the siting of farms in less ‚wind-friendly' regions and further offshore, in deeper waters for offshore projects. New wind power projects should also improve grid service through hybridisation (batteries, hydrogen production, flexible photovoltaic elements).

Having achieved a decline in the averaged cost of wind power, the development of the industry will be increasingly influenced by power system (transmission), social (labour) and environmental (pollution) factors. Given the scale of the infrastructure needed, technology in wind power is expected to evolve significantly. However, it may also be that leapfrogging technological advances will be needed to support deep decarbonisation and a sustainable future for the energy sector.

It will also be necessary to find a balance point between standardisation and highly configurable solutions in order to create effective wind project implementation policies.

ABOUT US

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4CF is a strategic foresight and long-term strategy building consultancy. For almost two decades, 4CF has been helping its clients prepare for an uncertain tomorrow. The company has completed hundreds of projects for private companies, public and international institutions, including UNESCO, UNDP and WHO.

Using foresight, 4CF supports clients in uncovering future opportunities so that they can make important strategic decisions today and implement solutions to ensure a better future for their stakeholders. We care that our clients are always one step ahead of the competition. The company is the only Polish member of the Association of Professional Futurists, Foresight Educational and Research Network and founder of the Polish node of The Millennium Project.

4CF is at the forefront of global innovation and actively contributes to the development of cutting-edge foresight tools. The company's foresight experts have extensive interdisciplinary knowledge and experience. They are constantly refining the 4CF methodology and actively collaborate with leading international foresight centres.

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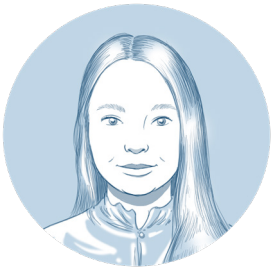

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