Report 2021

European Union / European Commission

Photo: Christian Lue/Unsplash

Author *Matthijs Soede, European Commission, Belgium - Thomas Telsnig, European Commission, Joint Research Centre, the Netherlands - Ivan Komusanac, WindEurope, Belgium - Ivan Pineda, WindEurope, Belgium*

Wind installations in the European Union have seen moderate growth on 2020 as permitting and global supply chain issues slowed down the estimated growth.

AFTER INSTALLING 11 GW in 2021, the EU-27 is expected to install 18 GW per year over the next five years. However, this will need to be further increased in order to reach the EU's energy and climate goals.

Electrification of industry, transport, and buildings sectors is creating demand for additional renewable power capacity. Government-backed revenue stabilization mechanisms are still the preferred support scheme by the industry, while Power Purchase Agreements in some countries are having a larger role in securing financing of wind energy projects.

The European Commission continued to support wind energy research and development via their funding programs like Horizon 2020, its successor, Horizon Europe, and the European Regional Development Fund.

Table 1. Key National Statistics 2021: EU-27

Total (net) installed wind power capacity*	189 GW
Total offshore capacity	16 GW
New wind power capacity installed	11 GW
Decommissioned capacity (in 2021)	0.4 GW
Total electrical energy output from wind	375 TWh
Wind-generated electricity as percent of national electricity demand	14%
Average national capacity factor**	22% onshore / 34% offshore
Target	40% RES in final energy demand by 2030
National wind energy R&D budget	

*Installed wind power capacity: Calculated using nameplate power ratings of the installed wind turbines

Highlight(s)

- The EU-27 installed 11 GW in the EU-27 of new wind capacity in 2021, reaching a total cumulative capacity of 189 GW, of which 173 are installed onshore, and 11 GW are offshore.
- 90% of the new wind installation in Europe in 2021 were onshore wind. Sweden, Germany, and the Netherlands built the most onshore wind, while Denmark built most of the offshore wind.
- The European Commission launched the new Horizon Europe program for research and innovation.

Market Development

National Targets and Policies Supporting Development

The European Commission proposed the so-called "Fit-for-55" package, a series of legislative proposals to deliver the EU's increased climate target of 55% emissions reduction by 2030. The package includes a higher renewables target and new rules to support the expansion of renewables. It also further strengthens the Emissions Trading System to drive the electrification of the whole energy system.

The Fit-for-55 package comprises changes to over 10 pieces of legislation, including the Renewable Energy Directive, the Energy Tax Directive, the Alternative Fuels Infrastructure Directive, and the EU Emissions Trading System, among others.

Crucially, the European Commission proposed to raise the EU's renewable energy target from 32% to 40% by 2030.

The revision of the EU Renewable Energy Directive included improvements on cross border renewable energy projects, the planning of offshore wind per sea basin, the consideration for combining offshore wind with interconnectors across borders, and the facilitation of corporate Power Purchase Agreements (PPAs).

The entire legislative package must go through negotiations between the European Commission, Member States, and the European Parliament during 2022 and possibly 2023.

Progress and Operational Details

In 2021 new wind installations in the EU-27 amounted to 11 GW (10 GW onshore and 1 GW offshore). The EU-27 has a total of 189 GW of wind power capacity installed (173 GW onshore and 16 GW offshore)[1].

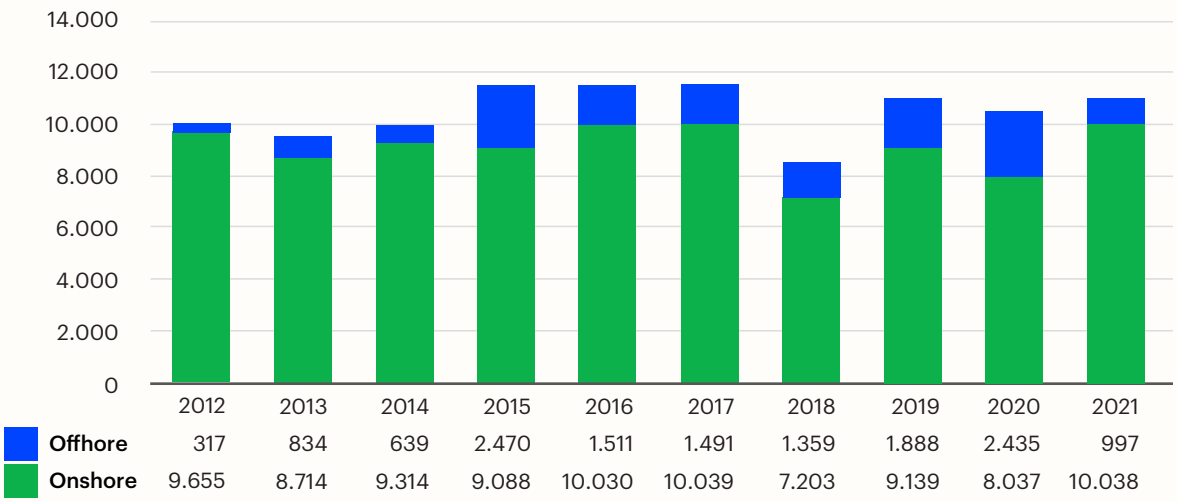
Sweden installed the most wind capacity in 2021, driven by a record year of onshore wind installations. Germany's onshore installations showed some recovery from the previous year. However, they are still well below the levels of 2012-17 and the volumes committed by its government for the rest of this decade. Denmark, Finland, and Croatia all installed what was for them, record amounts of new wind capacity in 2021.

The offshore wind made up 10% of new installations in the EU-27, with a total of 1 GW connected to the grid.

In 2021 there were 393 MW of decommissioned wind capacity in Europe, exclusively from onshore wind.

[1] WindEurope: Wind energy in Europe: 2021 Statistics and the outlook for 2022-2026: https://windeurope.org/intelligence-platform/product/wind-energy-in-europe-2021-statistics-and-the-outlook-for-2022-2026/

Annual new wind installations in the EU-27, 2012-21



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Offhore	317	834	639	2.470	1.511	1.491	1.359	1.888	2.435	997
Onshore	9.655	8.714	9.314	9.088	10.030	10.039	7.203	9.139	8.037	10.038

Wind energy produced 375 TWh in 2021, meeting 14% of demand across the EU-27. This is 1 p.p. lower than levels seen in 2020, and similar to the share of demand wind energy met in 2019. This is because power demand in 2021 returned to levels seen before the pandemic's economic slowdown, and there was lower wind energy generation in some of the large wind energy markets (Germany and France), which account for a large share of the generation across the continent.

Matters Affecting Growth and Work to Remove Barriers

The EU is aiming for higher rates of electrification of industry, transport, and building sectors, which will rely on a clean power supply. Wind energy installations over the next five years are expected to be 18 GW per year, which needs to significantly increase to 32 GW per year to reach the EU's 2030 energy and climate goals. However, permitting bottlenecks and global supply chain issues are affecting installations in the EU already for a few years.

To reach the energy and climate goals, EU Member States will need to significantly decrease permitting times, both in onshore and offshore wind. At the same time, Governments will need to support the competitiveness of the wind energy supply chain, which is facing inflationary pressures resulting from high energy prices and disruption of global supply chains.

This significant increase in wind capacity will need to be followed by a ramp-up of grid build-out, both onshore and offshore. In order to accommodate that, countries should allow wind turbines to participate in ancillary services, which would provide the needed flexibility to the power system.

RD&D Activities

RD&D Priorities and Budget

In June 2021, the European Commission launched the new research and innovation program called Horizon Europe with a funding budget of €95,5 billion EUR. It is tackling climate change and helps to achieve the UN's Sustainable Development Goals and boost the EU's competitiveness and growth. The program facilitates collaboration and strengthens the impact of research and innovation in developing, supporting, and implementing EU policies while tackling global challenges. It supports creating and better dispersing of excellent knowledge and technologies.

In 2021 the Horizon Europe launched a call for projects on the following topics:

- Wind energy in the natural and social environment.
- Physics and aerodynamics of atmospheric flow of wind for power production.
- Innovation on floating wind energy deployment optimized for deep waters and different sea basins.

More information can be found on the funding and tender portal of the European Commission: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/home.

Because new Horizon Europe projects are expected to start only in 2022, the number of projects decreased from

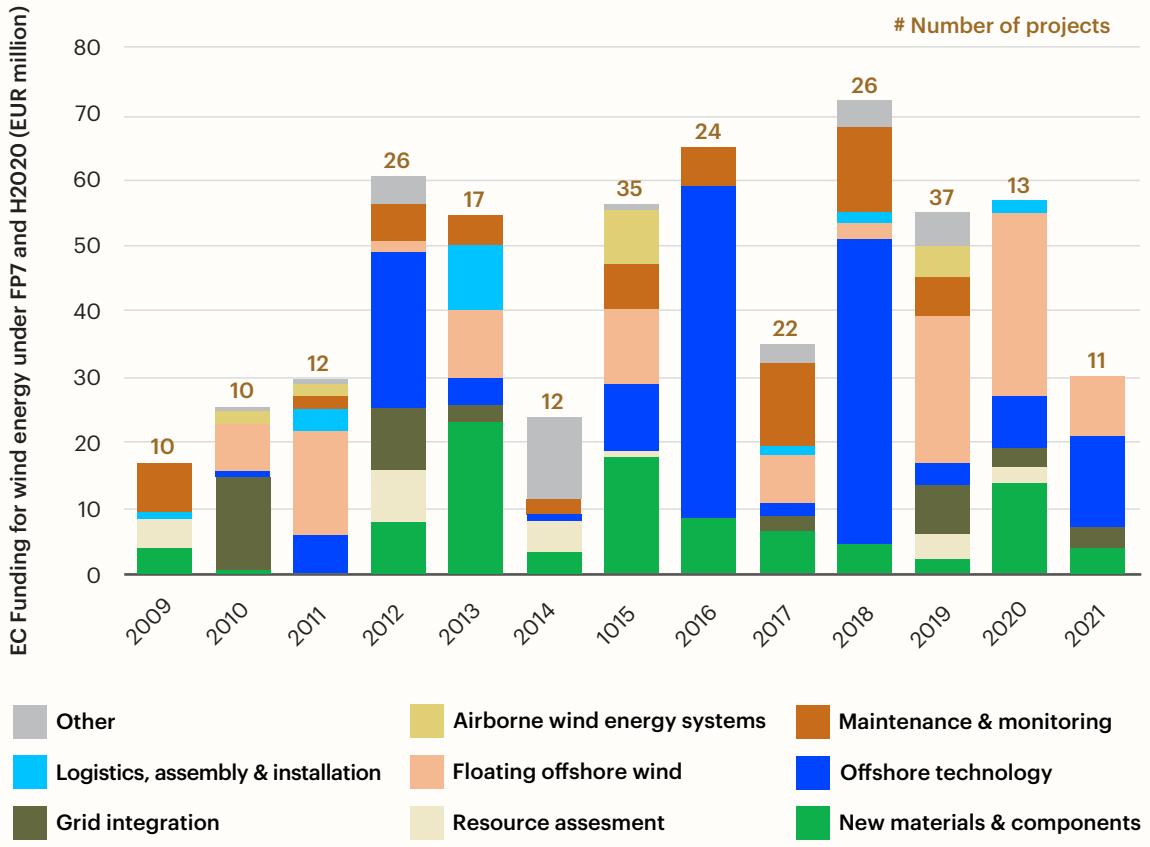


Figure 1: Evolution of EU R&I funding categorised by R&I priorities for wind energy under FP7 (2009-2013) and H2020 (2014-2021) programmes and the number of projects funded in 2009-2021. Project specifically on wind energy and those with a significant wind energy component are accounted for (see Table 1). Note: the item other includes some projects exploring emerging technologies such as social acceptance and critical rare earth elements, among others. Funds granted refer to the start year of the project. Source: [JRC 2022].

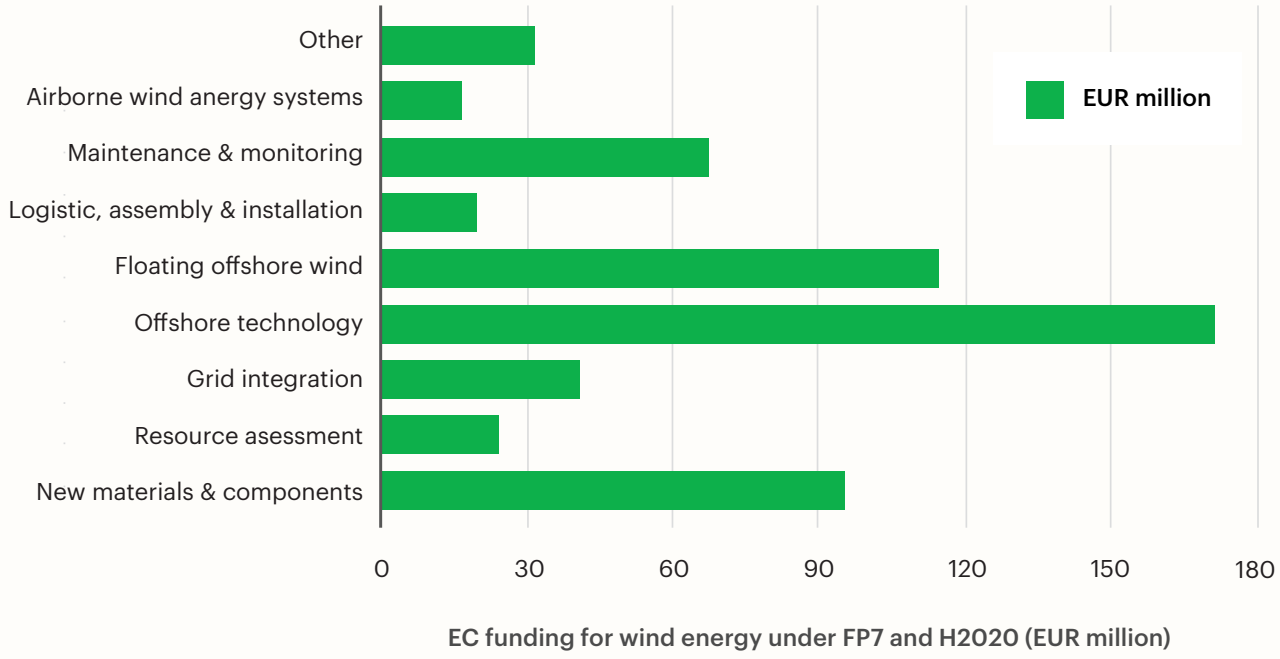


Figure 2: EC funding on wind energy R&I priorities in the period 2009 -2021 under FP7 and H2020. Source: [JRC 2022].

Table 2. Wind energy specific funding under Horizon 2020 is granted to projects starting in 2021

H2020-funded projects	Total project cost **Million EUR** (Million USD)	EU contribution **Million EUR** (Million USD)	Number of projects
Wind-specific projects	19.7 (22.1)	16.4 (18.3)	7
Non-wind specific projects[1]	17.4 (19.5)	13.6 (15.3)	4
Total funding for wind energy	37.1 (41.6)	30.0 (33.6)	11

[1] In 2021, non-wind specific projects include the following project with limited wind energy share: FIBREMACH, OYSTER, FIBREGY, EU-SCORES.

13 to 11 in 2021, and cumulated investment granted to European projects decreased by about 47% (30.0 million EUR) as compared to 2020 (57.0 million EUR) (see Table 2).

Figure 1 shows the development of R&I funding in the period 2009 – 2021 under the H2020 funding program and its predecessor FP7. With 46% of EC funding (13.9 million EUR (15.5 million USD)) granted to wind energy projects starting in 2021 focused on offshore wind technology research, followed by floating offshore (31%) and New materials & components (13%) [JRC 2022].

Since 2009 FP7 and H2020 have allocated substantial funding across all wind research R&I priorities with projects on offshore wind technology (172 million EUR), floating offshore wind (115 million EUR), and research on new materials & components (95 million EUR), accumulating most of the funds (see Figure 2).

Research Initiatives and Results

In 2021 17 collaborative projects ended in 2021 (with a cumulated EC investment of 24.7 million EUR (27.7 million USD)) with 34% of EC funding addressing Maintenance & monitoring, followed by Offshore technology (22%), New turbine materials & components (17%) and Grid integration (16%) (See Figure 3).

The following selected projects exemplify the research progress made:

- Exemplary for the 'Maintenance & monitoring category', the WindTR-Ro (DK) develops a robot performing all the phases of wind turbine blade leading edge maintenance and repair, which might be an economic alternative for manual repair. First customers of the first fleet of robots are the leading wind OEMs SiemensGamesa RE and Vestas [Rope Robotics, EC 2020]. As a result, the project lead Rope Robotics unveiled the BR-8 robot capable to document and repair blade damage by performing repair processes such as sanding, cleaning, and applying a new coating [EC 2022a].

- The SATH project is the demonstration in real conditions of a floating structure for offshore wind, which will allow a reduction in LCOE over the current floating technology. Within this project, the SATH (Swinging Around Twin Hull) 1:6-scale prototype of a 10 MW wind turbine will be built and deployed for a 24-month offshore testing programme to de-risk a 2 MW demonstrator, known as DemoSATH/BlueSATH. The prototype, constructed in Santander (Spain), will be installed on the Basque Marine Energy Platform (BIMEP) in 2022. The SATH design is based

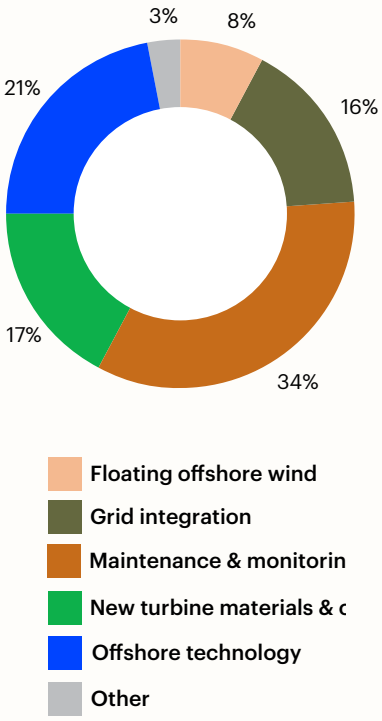


Figure 3.
Share of wind energy funding under H2020 granted to projects completed in 2021 categorised by research area for wind energy. Source: [JRC 2022].

Photo: Feri & Tasos/Unsplash

on a joined pair of cylindrical pre-stressed concrete hulls anchored to the seabed via a single-point mooring system that allows the unit to swing like a weathervane to face the wind. The concept has previously been put through an extensive part-scale testing campaign in wave tanks at the University of Cantabria's Instituto de Hidráulica Ambiental, and lately the manufacturing and handling operation of the floater prototype [Saitec 2019a, Saitec 2019b, EC 2022b, Saitec 2022].

- The NBTECH project develops an innovative, cost-competitive steel frame tower using its patented self-erecting system based on a hydraulic lifting mechanism. The technology allows transporting parts separately and assembling on-site. At the end of 2021, Nabrawind (ES) received the Design certification by DNV for its self-erecting tower, followed by the installation of a 144m high wind tower in Morocco [EC 2021a, NABRAWIND 2021, NABRAWIND 2022].

Other projects ending in 2021 focus on new turbine materials and components, such as the FiberE-Use project aiming for large scale demonstration of new circular economy value-chains based on the reuse of end-of-life fibre reinforced composites, the Eologix project introducing a wireless wind turbine blade sensor for automatic, real-time condition-based monitoring, and the FloatMastBlue project developing an innovative floating met mast platform.

Selected examples of new R&I projects:

- With about 6.5 million EUR (7.3 million USD), the FIBREGY project addressing the 'New turbine materials & components category' received the highest EU funding. It aims for the extensive use of Fibre Reinforced Polymers (FRP) materials in the structure of the next generation of large Renewable Energy Offshore Platforms in order

to replace steel which is more prone to degradation in offshore environments [EC 2021b]. The project includes testing different prototypes and the building of a real scale demonstrator. With respect to offshore wind, FIBREGY's activities are focused on the Enerocean's W2Power twin wind turbine platform [FIBREGY 2022].

- The OYSTER project aims for the development and demonstration of a compact electrolyser solution designed for the integration of offshore wind turbines. PEM electrolyser manufacturers, ITM Power, offshore wind developer Ørsted and turbine manufacturer Siemens Gamesa Renewable Energy will develop and test a shore-side pilot MW-scale electrolyser at Grimsby (UK). Project partners aim for hydrogen to be produced from offshore wind at a cost that is competitive with natural gas (with a realistic carbon tax), thus unlocking bulk markets for green hydrogen [EC 2021c, OYSTER 2022]. EU support: 5.0 million EUR (5.6 million USD).

- FLOATECH aims to increase the technical maturity and the cost competitiveness of floating offshore wind energy. The project will develop a fully-coupled, aero-hydro-servo-elastic design and simulation environment (named QBlade-Ocean) in order to reduce the uncertainties in the design process and improved cost competitiveness. Moreover, the project will develop innovative control techniques, namely the Active Wave-based feed-forward Control and the Active Wake Mixing, which will lead to an increase in the actual energy yield of floating wind farms [EC 2021d]. EU support: 4.1 million EUR (4.6 million USD).

Impact of Wind Energy

In its Offshore Renewable energy strategy, the EC aims for an installed capacity of at least 60 GW of offshore wind by 2030, with a view to reach it by 2050 300 GW. This is in line with the CTP-MIX scenario from the Impact Assessment accompanying the 2030 climate target plan, which reduces greenhouse gas emissions by 55% in 2030 compared to 1990, thus providing a more accelerated pathway to climate neutrality by 2050 [European Commission 2020]. Following this scenario foresees 35% of the electricity generation in 2030 stemming from wind energy, with onshore and offshore wind generating about 850TWh and 230TWh, respectively. This will significantly contribute to GHG emission reduction already in 2030 as sectoral GHG emissions of the power sector will decline by 71% as compared to 2015-levels (total emission reduction of the energy sector in 2030 in the CTP-MIX scenario will decrease by about 40%). Looking further ahead toward a zero carbon economy in 2050, this share will further increase to about 50% making wind energy together with solar PV the main pillar of EU electricity generation.

These targets are further strengthened by the EC's REPowerEU Plan, proposing a diversification of EU gas supplies and the elimination of dependence on Russian fossil fuels. Moreover, the REPowerEU Plan proposes to boost the Fit for 55 proposals with higher or earlier targets for renewable energy and energy efficiency. Concerning wind energy this pathway would foresee 480GW (onshore and offshore) deployed by 2030 (and the production of 5.6Mt of Green Hydrogen)[EC 2022c].

Next Term

The European Commission has presented the REPowerEU Plan [EC2022c], its response to the hardships and global energy market disruption caused by Russia's invasion of Ukraine. There is a double urgency to transform Europe's energy system: **ending the EU's dependence on Russian fossil fuels.** The REPowerEU Plan responds to this through **energy savings, diversification of energy supplies, and accelerated roll-out of renewable energy** to replace fossil fuels in homes, industry, and power generation.

The Commission proposes to **increase the headline 2030 target for renewables from 40% to 45%** under the Fit for 55 packages. Setting this overall increased ambition will create the framework for other initiatives, including a Commission Recommendation to tackle slow and complex permitting for major renewable projects.

References

[1] IG Windkraft (2021)
Windkraftausbau 2021 und Vorschau 2022.
https://www.igwindkraft.at/?mdoc_id=1047387

[EC 2020] EC:
The first wireless wind turbine blade sensor for automatic, real-time condition-based monitoring. Accessed: 07/02/2020.
https://cordis.europa.eu/project/id/848747

[EC 2021a] EC:
INTEGRAL COST-EFFICIENT SYSTEM FOR WIND TURBINE TOWERS. Accessed: 04/22/2022.
https://cordis.europa.eu/project/id/880041

[EC 2021b] EC:
Development, engineering, production and life-cycle management of improved FIBRE-based material solutions for structure and functional components of large offshore wind enerGY and tidal power platform. Accessed: 04/25/2022.
https://cordis.europa.eu/project/id/952966

[EC 2021c] EC:
Offshore hydrogen from shoreside wind turbine integrated electrolyser. Accessed: 04/25/2022.
https://cordis.europa.eu/project/id/101007168

[EC 2021d] EC:
Optimization of floating wind turbines using innovative control techniques and fully coupled open source engineering tool. Accessed: 04/25/2022.
https://cordis.europa.eu/project/id/101007142

[EC 2022a] EC:
Meet the BR-8 robot that inspects and repairs wind turbine blades. Accessed: 04/22/2022.
https://cordis.europa.eu/article/id/435577-meet-the-br-8-robot-that-inspects-and-repairs-wind-turbine-blades

[EC 2022b] EC:
New twin floating platform for offshore wind turbines. Accessed: 04/22/2022.
https://cordis.europa.eu/article/id/435784-staying-afloat-with-offshore-wind-energy

[EC 2022c] EC:
COM(2022) 108 final - COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS REPowerEU: Joint European Action for more affordable, secure. Accessed: 04/10/2022.
https://eur-lex.europa.eu/resource.html?uri=cellar:71767319-9f0a-11ec-83e1-01aa75ed71a1.0001.02/DOC_1&format=PDF

[European Commission 2020]
European Commission: Impact Assessment accompanying the 2030 climate target plan - COM(2020) 562 final

[FIBREGY 2022] FIBREGY:
Fibregy - The project. Accessed: 04/25/2022.
https://fibregy.eu/the-project/

[JRC 2022] Telsnig T:
Wind Energy - Technology Development Report 2020, JRC123138, (data update 2022). EUR 30503 EN. Luxembourg.
https://ec.europa.eu/jrc/en/publication/wind-energy-technology-development-report-2020

[NABRAWIND 2021] NABRAWIND:
DNV awards Design Certification to the highest wind tower ever developed: Nabralift 2.0 HH190. Accessed: 04/22/2022.
https://www.nabrawind.com/dnv-awards-design-certification-to-the-highest-wind-tower-ever-developed-nabralift-2-0-hh190/

[NABRAWIND 2022] NABRAWIND:
Nabrawind and InnoVent install the tallest Africa's wind turbine in Morocco. Accessed: 04/22/2022.
http://www.nabrawind.com/nabrawind-and-innovent-install-the-tallest-africas-wind-turbine-in-morocco/

[OYSTER 2022] OYSTER:
EU OYSTER Consortium chooses Grimsby for innovative hydrogen project. Accessed: 04/25/2022.
https://oysterh2.eu/eu-oyster-consortium-chooses-grimsby-for-innovative-hydrogen-project/

[Rope Robotics] Rope Robotics:
Rope Robotics - Funding

[Saitec 2019a] Saitec:
Saitec lands EU funds for 10MW+ floating wind design. Accessed: 02/07/2020.
https://saitec-offshore.com/2019/04/15/saitec-lands-eu-funds-for-10mw-floating-wind-design/

[Saitec 2019b] Saitec:
BlueSATH: Saitec's first offshore wind deployment in Spain. Accessed: 02/07/2020.
https://saitec-offshore.com/2019/11/25/bluesath-saitecs-first-offshore-wind-deployment-in-spain/

[Saitec 2022] Saitec:
DemoSATH manufacturing moves forward. Accessed: 04/22/2022.
https://saitec-offshore.com/demosath-assembly-operation/