



Observatory 2024

Op-ed

In 2023, onshore and offshore wind installations generated over 50 TWh of electricity, accounting for more than 10% of France's annual electricity consumption. Wind power confirms its position as France's third-largest source of electricity generation behind nuclear and hydropower. It is now on course to take second place, which is expected to happen between 2025 and 2026.

Early trends for 2024 confirm the strong performance of the previous year, with wind power generation in the first half of 2024 up 16% compared to the same period in 2023.

This substantial growth is driven by the gradual commissioning of the offshore wind farms of Saint-Nazaire, Saint-Brieuc and, more recently, Fécamp, which have collectively produced around 1.5 TWh of electricity in 2023. Additionally, the improved output of new wind turbine models has played a key role, as they can now generate power at wind speeds as low as 4 m/s, compared to the 6 m/s minimum required less than a decade ago.

As a result, more households and businesses in France can take advantage of the quality and competitiveness of this source of renewable, carbon-free electricity, which stands as the most efficient and cost-effective renewable energy options, alongside photovoltaic solar power.

As the recent British example has shown, the moratorium on onshore wind power implemented about ten years ago by the Conservative Party, along with the withdrawal from the European electricity market, have deprived the British public of one of the most competitive sources of electricity generation. In France, wind power has demonstrated over the past two years to be an effective way to reduce electricity prices, contributing over 50% to the funding of the *bouclier tarifaire* price cap on energy prices. Accordingly, the new British government is committed to the great comeback of onshore wind in the United Kingdom, aiming to double installed capacity to 30 GW by 2030.

Reading these lines, one might mistakenly conclude that the usefulness and performance of wind power are now sufficiently established to allow a focus solely on achieving the targets of 45 GW of onshore wind and 18 GW of offshore wind by 2035, particularly by securing the government's multiannual energy plans (PPE).

Op-ed

However, the recent European Parliament and legislative elections in France serve as a reminder that various political forces of national relevance are advocating for moratoria on offshore wind power and/or onshore wind power at both the French and European levels. This amounts to promoting a political agenda that would lock both our country and our continent into a deadly dependence on fossil fuels.

These are the same fossil fuels that are entirely imported from sometimes hostile countries. The very same fossil fuels whose prices are controlled by cartels of producing countries, undermining both France's sovereignty and its economic and social stability. And the same fossil fuels whose devastating impact on our common good — the climate — is no longer in doubt.

We have taken the full measure of this phenomenon in recent weeks – the struggle to uphold wind power is, in fact, nothing short of a fight to defend our sovereignty, purchasing power and competitiveness. So let us look straight ahead and fight back against any pro-fossil fuel energy policies that would deepen France's energy dependence and undercut its standing.



Anne-Catherine de Tourtier – President of France Renouvelables

Executive summary

The industry has reached a new level in 2023 and continues to pursue steady growth in both onshore and offshore wind



5 Capgemini invent Com FRANCE

Key figures for wind power in 2023



Over **9,500 wind turbines in France, spread across almost 2,391 wind farms** (including 7 offshore wind farms) at the end of 2023

Wind power is France's 2nd largest source of renewable electricity after hydropower, and the 3rd largest source of electricity overall.

France is Europe's 4th largest producer of wind-generated electricity, accounting for over 10% of the continent's total production.

Around 124 MW of wind power capacity has been repowered in France in recent years.

Sources: French Ministry of Ecological Transition, Agence ORE, RTE, Engie

* A distinction is made between grid-connected capacity and commissioned capacity. Several tranches of offshore farms (amounting to 0.4 GW) were connected to the grid in 2023 but commissioned only in May 2024.

Key figures

)

The place of wind power in the French energy mix

Electricity accounts for 27% of France's energy use. In 2023, wind power accounted for 10% of France's electricity production for the first time.



494.7 TWh... Total production of wind-generated

...including 50.6 TWh

electricity in France in 2023 (+12 TWh compared to 2022)

Sources: RTE 2023 electricity report, SDES's Annual energy report

France is improving its momentum, but it remains insufficient to achieve the objectives of the 2028 PPE



* Projects for which there has been a proposal for queuing or an accepted technical and financial proposal. **This corresponds to the "high" scenario of 2028 PPE *** This figure is only valid for onshore wind power.

Source: Agence ORE (the consortium of France's electricity and gas distributors)

 \bigcirc

Achieving the objectives of the 2028 PPE will require doubling the rate installation of new, aridconnected wind power capacity with an additional 12 GW and to expedite the allocation of projects. At the current rate, the country will be deprived of 7 GW of onshore wind power.

The multiple benefits of the wind market

The development of wind power in France brings about benefits at all scales and for all stakeholders.

SOCIETY AND ECONOMY

Wind power is a renewable, low-carbon energy source. It is a competitive technology in terms of costs and speed of deployment. The expansion of the industry also creates jobs and drives economic activity and contributes to France's industrial sovereignty.

A production cost of €82 per MWh and a deployment time of 7 years for onshore wind power.

BUSINESSES

Corporate Power Purchase Agreements (CPPAs) allow wind developers and companies to enter direct contracts for the purchase of renewable electricity at prearranged, fixed prices over the long term. The price of electricity can therefore be decorrelated from market prices, and thus help companies obtain low-carbon electricity at a competitive and secure price over the long term in a context of highly volatile energy prices.

Almost 500 GWh of contracts were announced for 2023, i.e., 2.6 times the cumulative amount of CPPAs in France at the end of 2022.

FRENCH STATE

Wind power is becoming a major source of revenue for the state. Through the "additional remuneration")CR mechanism, the wind industry as a whole has contributed several billion euros to the French state's general budget in 2022 and 2023.

More than €5.79 billion were returned to the state budget for 2022 and 2023 through the CR ("additional remuneration") mechanism.

LOCAL GOVERNMENT

The combination of the flat tax on network infrastructure (IFER) for onshore wind power and the tax on offshore wind turbines will enable the industry to contribute several billion euros to local government budgets over the long term. Local authorities will then be able to reinvest these proceeds to reduce local taxes and/or finance public interest projects within their jurisdictions.

The has contributed around €184 million towards local government budgets and around €10 million for onshore wind.

Over a two-year period, the industry has already repaid 50% of the sums invested by the French government between 2003 and 2021

Thanks to the additional remuneration mechanism, the wind industry has generated several billion euros in revenues for the French state since 2022.



Source: 2024 Evaluation of the CSPE tax to be offset, French Energy Regulatory Commission (CRE) deliberation No. 2024-139

Employment in the wind industry has sustained double-digit growth for 5 years and is projected to exceed 40,000 jobs by 2030



Employment growth is supported by the "Planning & development" link in the value chain, which represents one third of jobs in France and has experienced a 15% increase between 2022 and 2023.

Sources: Analysis by France Renouvelables; Invent

A French offshore wind industry that is present across the entire value chain and across the whole country



From design to recycling: France's wind industry is present at all links in the value chain

Industrial activities in offshore wind are primarily concentrated in the north-west and south-east.

SIEMENS Gamesa



*Source: ADEME "Marchés et emplois dans le secteur des énergies renouvelables et de récupération" [Markets and jobs in the renewable energy and energy recovery industries]

** Source: 2023 Observatory for marine energies

¹Domestic investment = value of wind assets installed on French territory



The industry is entering a repowering dynamic that is beneficial for all stakeholders



To date, more than **124 MW have been dismantled for repowering** since 2018. The repowering momentum is expected to further accelerate in the coming years. What a "repowered" wind turbine really means

+52% in single-unit capacity per wind turbine

+52% in IFER tax revenues for the local government

+250%

electricity generated

- **I** :

A more competitive electricity price

 \sim

2× as many people powered by wind-generated electricity

As a result of this momentum, France has become a key driver of the development of the wind industry in Europe



Wind power generation

Although wind energy only represents 11% of France's energy consumption, the country remains the 4th largest producer of wind electricity in Europe. Installed onshore and offshore wind power capacity by country in Europe at the end of 2023





The European target (excluding the UK) for 2030 is to reach 425 GW, requiring an increase of 200 GW over the next 6 years, or 30 GW per year.

In 2023, **16.2 GW of new wind capacity** were installed across the EU, bringing the total wind capacity to 218 GW. With 1.3 GW connected to the grid in 2023, France accounted for approximately 10% of the new capacity installed in Europe that year.

Table of contents

1. France's wind power market and economy

A. Society and economy	p. 17
B. French state	p. 22
C. Businesses	p. 28
D. Local government	p. 32
E. Our convictions	p. 38

2. Jobs in wind power in 2023

A. Current situation and dynamics	p. 40
B. Onshore and offshore wind	p. 48
C. Projections	p. 57
D. Wind energy training programs	p. 61

3. Overview and prospects

A. Key figures	p. 65
B. Onshore and offshore wind	p. 68
C. Wind industry	p. 85
D. Wind power in Europe	p. 96

France's wind power market and economy

French stat

The multiple benefits of the wind market

The development of wind power in France brings about benefits at all scales and for all stakeholders.



SOCIETY AND ECONOMY

Wind power is a renewable, low-carbon energy source. It is a competitive technology in terms of costs and speed of deployment. The expansion of the industry also creates jobs and drives economic activity and contributes to France's industrial sovereignty.



Wind power is becoming a major source of revenue for the state. Through the "additional remuneration" (CR) mechanism, the wind industry as a whole has contributed more than \in 5.8 billion to the French state's general budget in for the tax years 2022 and 2023.



Corporate Power Purchase Agreements (CPPAs) allow wind developers and companies to enter direct contracts for the purchase of renewable electricity at prearranged, fixed prices over the long term. The price of electricity can therefore be decorrelated from market prices, and thus help companies obtain low-carbon electricity at a competitive and secure price over the long term in a context of high volatility of energy prices.



The combination of the flat tax on network infrastructure companies (IFER) for onshore wind power and the tax on offshore wind turbines will enable the industry to contribute several billion euros to local government budgets over the long term. Local authorities will then be able to reinvest these proceeds to reduce local taxes and/or finance public interest projects within their jurisdictions.

An energy source that is beneficial to society

Wind power is a highly economically competitive technology.



Estimation of electricity production costs by technology in France

NB:

- For wind costs (onshore and offshore) and solar PV, weighted average prices of offers selected over the PPE2 periods of CRE's tenders
- For bottom-fixed offshore wind, grid connection costs (as estimated by France Renouvelables) have been added to CRE's tender price
- The cost of new nuclear plants as estimated in the case of Flamanville 3 by France's Court of Audit (Cour des Comptes)
- Combined cycle gas turbines (CCGT), data processing of LCOE data by ADEME Assumptions: carbon price at €60 per tCO2 low range with a wholesale gas price at €50 per MWh high range with a gas price at €300 per MWh (matching the summer 2022 price peak)

Sources: French Energy Regulatory Commission (CRE), SFEN, ADEME

French state

An energy source that is beneficial to society

Wind power is critical in the fight against climate disruption.

Greenhouse gas emissions by electricity production technology in France





In 2023, wind power has helped prevent emissions of >20 million tonnes of CO2e.*

Wind turbines emit minimal greenhouse gases over their full life cycle, and the development of wind power is necessary to achieve climate goals.

* Assumption: the electricity generated by wind turbines would be replaced by electricity generated by gas-fired Sources: ADEME, RTE 2023 electricity report power plants

An energy source that is beneficial to society

Thanks to its potential for rapid deployment throughout the country, wind power is strategic for reducing our dependence on fossil fuels as quickly as possible.



Development, planning, and authorizations Construction and connection to the grid

A deployment potential that must be unlocked to achieve our energy objectives

- + Accelerating the pace of construction and connection to the grid of renewable electricity production facilities will in turn step up our supply of low-carbon electricity. Furthermore, the first electrons from the initial wind turbines connected to the grid are transmitted even before all the turbines in a given wind farm are fully installed, accelerating the industry's deployment.
- + Wind power in France stands out with a significant margin for progress in the development phase, which lasts an average of 5 to 7 years – about twice as long as the European average. More flexible administrative procedures would help streamline authorization and public consultation processes, ultimately reducing the time needed to deploy new wind farms.
- + France's energy and climate strategy envisions a 10% increase in electricity generation by 2030 (+55% by 2050) to support the electrification of end uses and reduce dependence on fossil fuels. To achieve this ambition by 2030, and to ensure that the additional electricity production continues to come from low-carbon sources, renewable energies including wind power are the only viable solution in France. Given the lengthy development and construction timelines, no new nuclear power plants will be operational before 2035-2040, precluding them from addressing the medium-term need for increased low-carbon electricity generation.

* Learnings from the Hinkley Point C construction site ** Subject to government support of offshore wind

Sources: BBC, EDF, CRE, French Strategy for Energy and Climate

French state

An energy source that is beneficial to society

Wind power is a sector that creates jobs and is highly strategic for France's industrial sovereignty.

A booming wind industry ⁽¹⁾ ...

- A job pool that has been consistently growing for many years and with a promising long-term growth outlook in line with objectives set in the country's national energy strategy (PPE*).
 - 30,000+ FTEs at the end of 2023
 - 40,000+ FTEs projected by the end of 2030**



- Wind industry jobs are primarily generated by very small enterprises (VSEs) and small to medium-sized enterprises (SMEs) distributed across the country.
 - Almost 80% of winds jobs are created by VSEs/SMEs.
- A desire by companies in the industry to recruit both in the short and long term
 - 2/3 of companies in the industry express their intent to recruit more in the coming years

Æ

...which fuels France's reindustrialization⁽²⁾

- Investments in industrial equipment to manufacture components and ensure that turbine maintenance is carried out in France.
 - €3.8 billion invested in offshore wind power in 2023
 - 100+ maintenance bases deployed across the country to provide monitoring, maintenance and repair of wind turbines



- Large-scale projects that leverage cuttingedge technical expertise
 - Chantiers de l'Atlantique: **600,000+ hours** needed to build an offshore electrical substation
- An industrial expertise that is exported internationally
 - In offshore wind, 2 out of 3 French companies in the industry have sustained export activities in 2023

France's wind job pool and industrial expertise in wind power will continue to expand, establishing the industry as a strategic asset for the country.

* PPE: Programmation Pluriannuelle de l'Energie (Multiannual Energy Plan · France's official energy roadmap)

**France Renouvelables projections based on corporate hiring forecasts

Sources: ¹France Renouvelables 2024 study, 2 Observatory for marine energies 2024

21 Capgemini invent

MARKET AND ECONOMY

WIND JOBS

Wind power, a technology that contributes to funding the energy price caps

In 2023, wind power remained a significant source revenue for the French state through the "additional remuneration" mechanism established under CRE's calls for tenders.



23

Wind power, a technology that contributes to funding the energy price caps

Thanks to the additional remuneration (CR) mechanism, the wind industry has generated several billion euros in tax revenues for the French state since 2022.

Tax revenues generated by wind power for the state

Over the 2022-2023 period, prices on the electricity market were often well above the strike prices for wind power projects (corresponding to Scenario 2, see previous page). Onshore and offshore wind farm operators therefore paid back the difference to the French state for the tax 2022 and 2023. In 2024, CRE estimates that onshore wind power will bring in €250.8 million.



French state

The dynamics of CRE's calls for tenders

A record >3 GW of onshore wind was attributed in 2023 through CRE's 3 latest calls for tenders

Changes in announced vs. awarded tender capacity



A complicated start...

The undersubscription characterizing the first two PPE2 tender periods highlights the lack of attractiveness of the tenders in 2021 and 2022. For the P3 tender, in early 2023, the capacity awarded by CRE was well below the announced tender capacity: <70 MW awarded vs. >900 MW submitted (and 925 MW announced) – i.e. 7% of the announced target This situation arose from a procedural defect in the financial guarantees required from developers.

...followed by positive momentum.

Since the problem was resolved, the subscription rate for **each tender round has remained very high.** This positive momentum comes down to three factors: (1) the new indexation **mechanism**, (2) the **increase in ceiling prices**, and (3) the possibility for former tender winners to forgoing their win without relinquishing their tender bonds – thus enabling them to **reapply** to another tender round and benefit from indexation. The 2023 results must therefore be qualified since the sector is still catching up on the undersubscription recorded in 2021 and 2022.

The indexation mechanism upstream of the commissioning of wind farms came into force starting with the P3 tender (in January 2023). The reference price of electricity is indexed on the basis of a "K-index" which tracks changes in the **raw materials and financing costs** associated with wind projects.

24

The dynamics of CRE's calls for tenders

Winning bid prices have increased by more than 40% since the implementation of the PPE2 tenders, in response to the increase in raw material and financing costs induced by geopolitical events (+6% on average per tender round).

100 -€87 €87 €84 90 €76 80 €67 €65 70 €63 €62 €60 €60 E per MWh 60 50 +40%40 € per MWh 30 20 10 0 P5 P6 P7 P8 P1 P2 P3 P4 P5 P6 (01/20)(07/20)(11/20)(04/21)(11/21)(04/22)(01/23)(05/23)(09/23)(12/23)**CRE4** tender **PPE2 tender**

Changes in the weighted average price of the selected offers

Source: French Energy Regulatory Commission (CRE) (2024)

The dynamics of CRE's calls for tenders

The rise in wind prices between 2021 and 2023 is the result of increasing material and financing costs.

Factors driving increasing wind power costs

Between 2021 and 2023, raw material and financing costs have increased sharply (as interest rates tripled over the period). The *K-index* (which quantifies the changes in these two expenditure items) shows that these costs were up to 55% higher in 2023 compared to early 2021. The stretched energy market brought about by the war in Ukraine has had significant financial impacts on the raw materials market, both in Europe and globally.



Sources: ¹CRE, ²France Renouvelables

French state

ite

The dynamics of CRE's calls for tenders

The strike price of the bids accepted by the CRE for offshore wind power recorded a significant drop of almost 70% over the past 10 years.







Sources: CRE (2024), Eoliennesenmer.fr

The initial French offshore wind farm projects, along with their associated grid connections, cost between €1.4 and €2.2 billion per project for capacities ranging from 450 to 600 MW.

The strike price for the first 6 projects were renegotiated downwards (from €205 and €195 per MWh to €143 and €134 per MWh, respectively, for tenders 1 & 2) due to higher-than-expected turbine performance. This improvement was driven by advances in technology, the structuring of the industrial sectors, and to scale effects.

The price of the first 6 projects (2012-2014) included costs associated with the setting up of the industrial sites required for the manufacturing of offshore wind turbine components. This investment was a prerequisite for financial support from the French state. This is no longer the case since the third call for tenders (AO3) in 2019, which has led to a reduction in prices.

The costs associated with **floating offshore wind are currently higher** than those of bottom-fixed offshore wind, since the industry is not yet mature. The 2019-2028 PPE set differentiated target values for these two technologies:

- €50-60 per MWh for bottom-fixed offshore wind
- €110-120 per MWh for floating offshore wind

In the long term, the costs of floating wind power are expected to align more closely with those of bottomfixed wind power.

¥

Wind power also benefits French companies

Corporate Power Purchase Agreements: competitive renewable electricity purchase contracts allowing companies to commit over the long term.

A corporate PPA (or CPPA) is a direct purchase agreement for renewable electricity between a producer and an end user (or offtaker).

The price of electricity resulting from the contract is **prearranged**. It can therefore be decorrelated from market prices, in which case it usually is based on production costs. CPPAs are a hedging tool that allows companies **to secure a low-carbon electricity supply at a competitive price**, and to **have long-term visibility on their energy expenses**, in a context **of highly volatile energy prices**.

CPPAs are typically **classified into two types of contracts**: those that utilize existing wind farms and those that involve the development of new wind installations.



Brownfield

Mobilization of existing wind assets to produce renewable electricity delivered to the end user. The 1st wind CPPA was signed in 2019 and was a "brownfield" contract between Metro France and Eurowatt, to supply 25 GWh per year of renewable electricity for 3 years.

Duration: Short term (3–5 years)

Average volume announced by PPA:* 40 GWh per year



Development of new wind power installations not resorting to public subsidies. The first greenfield wind CPPA, signed in 2023 between Leroy Merlin and Voltalia, aims to cover the equivalent of 20% of the electricity consumption for the offtaker, a leading home improvement superstore operator.

Duration: Long term (20-25 years)

Average volume announced by PPA:* 77 GWh per year

*In France, between 2019 and 2023 (the year of the 1st Corporate PPA signed in France)

Sources: Capgemini Invent, Eurowatt

Society and economy

Corporate Power Purchase Agreements (CPPAs)

2023 was a record year for wind CPPAs in France, primarily due to the signing of the first "greenfield" wind projects.





- 2023 was a record year for wind CPPAs with 9 contracts announced, amounting to a total volume approaching 500 GWh per year where the combined volumes of the preceding years (2019 to 2022) was only 300 GWh per year.
- The year 2023 saw the signing of the first greenfield wind CPPA in France, initiating a strong momentum around this new type of agreement. A total of 5 such contracts were established over the course of the year, facilitating the development of 160 MW of new renewable electricity production capacity.

Source: Capgemini Invent

Society and economy

Corporate Power Purchase Agreements (CPPAs)

The development of electricity purchase contracts in the solar photovoltaic sector paves the way for the wind industry.



Sources: Capgemini Invent, SNCF, Bpifrance

Corporate Power Purchase Agreements (CPPAs)

As it matures, the French wind CPPA market is diversifying its economic models and accelerating its growth.



A deeper understanding of the market and the growing demand from electricity consumers have led to the emergence of innovative CPPA schemes, including the "rolling assets" mechanism and multi-buyer CPPAs. This diversification allows for a more precise response to the needs of producers and offtakers. To sustain this positive momentum, public authorities must simplify the requirements associated with the obligation for operators to obtain a supply certificate in order to sign a CPPA.

Rolling assets

- The producer offers the offtaker a long-term brownfield CPPA thanks to a portfolio of wind assets that are outside of France's state support system and are set to reach the end of their service life over different time frames.
- Under this type of scheme, the various wind farms will successively ensure the annual delivery of renewable electricity to the offtaker over the duration of the contract – while also helping sell the output of wind farms towards the end of their service life.
- The signing of the first rolling assets partnership was announced in 2023 between Metro and Eurowatt and will ensure the delivery of 25 GWh per year over the course of 10 years.

Multi-buyer CPPA schemes

- A multi-buyer CPPA scheme enables multiple companies of varying sizes to jointly enter a CPPA with a structure tailored to the needs of its participants, facilitated by a bank that acts as guarantor for the payment of the electricity bills.
- The first multi-buyer CPPA in France was finalized by Voltalia whose offtakers are companies of all sizes (from Air France to the Laiterie de Saint-Denis de l'Hôtel). Its finances a 56 MW agricultural photovoltaic power plant commissioned at the end of 2023. Banque LCL organized the recruitment of the 10 subscribers and serves as the guarantor for the developer.
- By pooling risk and sharing the electricity generated by the power plant, this new business model aims to democratize CPPAs and make them accessible to new participants (such as *MSEs, SMEs and local authorities*).

Sources: Capgemini Invent, Eurowatt, Voltalia



MARKET AND ECONOMY

Wind power boosts local economic activity and attractiveness throughout the country...

Wind power acts as a catalyst for the energy transition in France's regions. Many local authorities (municipalities, EPCI* with own-source taxes, départments, regions) are actively engaging in supporting the development of this technology. Private stakeholders with strong regional roots, energy unions (SDE), local distribution companies and local elected officials are committed to ensuring the successful installation of wind farms and turn them into strong, modern and emblematic signals of local dynamism.

The development of a wind farm in a given area often leads to the emergence of forward-looking local projects such as wood-fired boilers, the rehabilitation of public buildings and tourist attractions, road repairs, continuity of public services, short food supply chains, and more.



*EPCI: public inter-municipal cooperation establishment, an administrative entity that brings together several municipalities.

Society and economy	French state	Businesses	Local government	Our convictions

...and with highly attractive associated tax revenues.



Sources: Economie.gouv.fr, DGEC, Eolise

Onshore wind contributes to local government budgets.

Like other economic activities, wind installations generate tax revenue:

- · IFER (the flat tax on network infrastructure companies),
- RODP (the public domain occupation fee),
- TFPB (the property tax on built-up properties),
- CFE (the corporate real estate tax),
- CVAE (the company value-added contribution).

Certain tax levies are no longer applicable, or will no longer be applicable in the medium run:

- The property tax and CFE will no longer apply to masts, though they still apply to wind turbine bases.
- CVAE will be eliminated in 2027.

The IFER tax is the predominant form of tax revenue from wind farms, with a rate set at €8,360 per MW of installed capacity for 2024. Wind power provides a better distribution of tax revenues across the country. Indeed, almost 1,400 (1,384) municipalities in the country benefit from the wind IFER, compared to only 18 municipalities receiving tax revenues from the nuclear IFER.



*Minimum proceeds in 2024, possibly along other sources of income (such as RODP, TFPB, CFE, CVAE)

- Tax revenues from wind power IFER by local authority (by type of taxation structure)

	Single municipality	EPCI with complementary taxation (FA)	EPCI with zonal business taxation (FPZ)	EPCI with single wind power taxation (FEU)	EPCI with single business taxation (FPU)
Tax components of IFER for wind turbines	80% for the département 20% for the host municipality	50% for the EPCI 30% for the départment 20% for the host municipality		Wind turbines inst 70% for the EPCI – 30 Wind turbines ins 50% for the EPCI – 30 – 20% for the ho	alled before 2019 % for the départment stalled after 2019 % for the département ost municipality

Sources: Economie.gouv.fr, National register of electricity production and storage installations

French state

Businesses

Our convictions

Economic and fiscal benefits for local authorities

Significant and long-term tax benefits, allowing municipalities to reduce local taxes, borrow money or fund new projects.

-Examples of tax revenues Number Tax revenues over Average tax Annual of wind the service life of revenues** distribution*** turbines the wind farm (20 years)** • EPCI: €62.700 €2.5 million €125,400 per year 5 Département: €37,620 Municipality: €25.080 • EPCI: €125,400 €250.800 per 1 10 €5.0 million Département: €75.240 year • Municipality: €50,160 EPCI: €188,100 前 15 €7.5 million €376,200 per year Département: €112.860 Municipality: €75,240 *** Distribution: 50% for the ** €8,360 per MW * for a 3 MW wind turbine EPCI, 30% for the according to the IFER département, 20% for the standard

Debunking a few misconceptions around the costs of wind power

Farmers can still grow crops in the fields after the wind turbines are installed. Only in the case of large wind turbines is the surface occupied by the turbines (approximately 1000 m² per wind turbine) lost to cultivation.

The responsibility for ensuring that the wind turbines are eventually dismantled doesn't rest upon the owner of the lands where they are located. Operators have a statutory obligation to handle the dismantling of production units and site reclamation at the end of their service life.

The tax revenues generated by the installation and operation of wind farms across the country will be long-lasting, averaging 20 to 25 years

host municipality

Sources: Economie.gouv.fr, Journal de l'éolien, MMA

Offshore wind power represents a very attractive financial opportunity for local governments.

Offshore wind farms are subject to a specific tax and an **annual fee for occupation of the Maritime Public Domain** (DPM). The distribution of these tax revenues between local authorities depends on whether the wind turbines are located in the public maritime domain (DPM) or in France's Exclusive Economic Zone (EEZ).

Specific tax on offshore wind	DPM occupation fee
The rate of the specific tax on offshore wind turbines has been set at €19,890 per MW of installed capacity for the year 2024.	 The occupation fee has 2 components: Fixed component: €1,000 per mast + €0.50 per meter of connection cable in the maritime public domain (DPM) + €1 per meter of connection cable in the terrestrial public domain (DPT) Variable component: €4,000 per MW in the DPM vs €6,000 per MW in the DPT

Tax revenues by location and by local authority

	Specific tax on offshore wind	DPM occupation fee*	
DPM (up to 22 km away from the coastline)	 50% to coastal municipalities within view of the turbines 35% to the Committee for marine fisheries and marine farming 10% to the French Office for Biodiversity (OFB) 5% to sea rescue and relief organizations 	100% to the general budget of the French state	
EEZ (between 22 and 370 km away from the coastline)	100% to the general budget of the French state * *	100% to the French Office for Biodiversity (OFB)	

*Due beyond the period covered by the additional remuneration contract, after approval by the French state **As of 5 June 2024

Sources: Economie.gouv.fr, Eoliennesenmer.fr
Economic and fiscal benefits for local authorities

Offshore wind farms will contribute billions of euros to local government budgets over the long run.

37

farms is estimated at 25 years

service life of offshore wind



Socie	ty and economy	French state	Businesses	Local government	Our convictions
Our	[•] beliefs				
1	Expedite the pe development of	rmit process and ensure onshore and offshore wi	adherence to timelines a nd.	aligned with the pace of i	ndustrial
2	Bolster value sh stakeholders.	naring by making econom	ic and social benefits a p	priority for all institutiona	l and private
3	Activate repower and competitive	ering by enabling an ambi eness.	itious renewal of wind fa	Irms in order to increase	electricity production
4	Ensure a stable dynamics of PP	and predictable economi As.	c framework for project	development and enhan	ce the growth

These 4 conditions are essential to successfully reduce the consumption of fossil fuels through the electrification of end uses.

Jobs in wind power in 2024



Projections

Snapshot of wind jobs in 2023



Training programs

Over the course of 5 years, the number of wind jobs has has increased by more than 50%

Employment trends in wind power from 2019 to 2023



The number of wind jobs continues to increase in both onshore and offshore wind



Strong recruitment dynamics across the entire value chain, particularly in "planning and development"

Employment trends in wind power across the value chain

Growth in wind jobs between 2019 and 2023 (rounded)



Strong growth in wind jobs in Normandy, Pays-de-la-Loire and Île-de-France



The Normandy, Pays-de-la-Loire, Occitanie, Hauts-de-France, Auvergne-Rhône-Alpes and Île-de-France regions are highly dynamic on the wind employment market and account for almost 65% of wind jobs in the country. Changes in wind jobs compared to 2022



The Normandy and Pays de la Loire regions are thriving due to the numerous offshore wind farms located there. Nationally, wind job growth has reached 11%.

The many wind turbine maintenance and prevention bases form a key driver of industrial activity



Distribution of the 107 maintenance bases across the country

Wind maintenance creates jobs throughout the country, particularly in regions where there are more installations (Hauts-de-France, Occitanie). There were 5,414 jobs related to operations and maintenance in France in 2023.

Focus - The state of work for women



Share of female employment by link in the value chain

Share of female employment by type of company in 2023



32%

Women make up nearly a third of the workforce in the wind industry, totalling 10,205 professionals, compared to just 20% in fossil fuels and 28.5% in the overall industrial sector. In order to attract more women into technical professions and increase the share of female students in technical, engineering and digital fields, significant initiatives are being implemented by industry leaders including RTE and Enedis:

- collaboration with schools and institutions to encourage girls to consider industrial careers from a young age
- `associated with these professions

Sources: France Renouvelables analysis, Capgemini Invent, Connaissance des Énergies

MARKET AND ECONOMY

The wind industry is recruiting massively, with more than 900 job vacancies available nationwide

Share of companies reporting the profession as facing staffing shortages and unfilled job openings ⁽¹⁾



Share of companies citing recruitment difficulties

Though the wind industry holds a lot of potential in terms of job creation, the sector is still experiencing **recruitment difficulties**. According to over 40% of the companies surveyed, current training programs **are insufficient to meet the demands of market growth**.

¹Job listings available on Indeed on 27 June 2024 ²France Travail

Onshore wind industry employment snapshot



Dynamics of employment in onshore wind between 2019 and 2023



On average, **17 new jobs are created for every wind farm with 15 MW of installed capacity**. This ratio is increasing slightly, mainly driven by the upstream segments of the value chain. Project developers are recruiting massively in anticipation of the **acceleration** in the pace of development of new capacities to be delivered in line with the PPE. This is particularly true of environmental engineers in particular, which represent 10% of jobs in the wind industry, and are required meet the increasing environmental regulations governing projects.

Wind jobs in operations and maintenance



On average, 3 new jobs dedicated to maintenance and operations are created for every wind farm with 15 MW of installed capacity. This ratio, which has been **stable for the past 5 years**, demonstrates **the balance achieved to ensure the effective operation of the** wind farms.

The distribution of wind jobs remains stable across the different links in the value chain, while SMEs continue to expand on the market

Breakdown in onshore wind jobs by link in the value chain



Breakdown of wind jobs in onshore wind by type of company



Sources: Analysis by France Renouvelables, Capgemini Invent

Onshore wind

Projections



7,840 FTEs

Wind jobs in offshore wind

in offshore wind at the end of 2023

Employment trends in offshore wind between 2019 and 2023

58%

of jobs are dedicated to component manufacturing

Breakdown in wind jobs by link in the value chain





Sources: FEM & France Renewables data, France Renouvelables analysis, Capgemini Invent

Projections

Focus on the Observatory for marine energies

Key figures for offshore wind and MREs (marine renewable energies) in 2023

€3.5 billion turnover*

overall growth of the industry in 2023, forming a new record (+75% vs 2022), including €1.5 billion in exports

Full-time jobs (FTEs) in offshore wind

Breakdown between fixed-bottom and floating wind

€3.8 billion invested in 2023

in 2023, including 88 % by developer-operators related to the construction and connection of wind farms to the grid

Full-time jobs (FTEs) in MREs Gender distribution





*Turnover of all service providers and suppliers in the value chain (excluding energy sold)

Source: 2024 Observatory for marine energies

Current situation and dynamics | Onshore and offshore wind |

Projections

•

Training programs

Focus on the Observatory for marine energies

Industry, the main driver of employment.





- 82% of wind jobs
 (6,789 jobs) created by suppliers of project
 developers
- 3,807 wind jobs
 thanks to the 5 largest industrial companies
 - 2/3 of wind jobs in the Pays de la Loire and Normandy regions
- +150% wind job growth in Auvergne-Rhône-Alpes, and +40% in the

In Auvergne-Rhöne-Alpes, and +40% in the PACA region

 55% of companies have reported recruitment difficulties in 2023

Source: 2024 Observatory for marine energies

Focus on the Observatory for marine energies

The companies awarded the offshore wind power construction contracts showcase the development of a French value chain in the industry.



Situation of wind farms under construction as at 30 June 2024

	SAINT-NAZAIRE		SAINT-BRIEUC		FÉCAMP		COURSEULLES-SUR- MER			
Activities	Manufacturing	Installation	Manufacturing	Installation	Manufacturing	Installation	Manufacturing	Installation	Manufacturing	Installation
Onshore station	Hitachi, Siemens et GE	Eiffage Energies	Hitachi et Siemens	SPIE	Hitachi et Siemens	Omexom	Siemens	Omexom	NC	NC
Onshore connection	Prysmian	Omexom and Eiffage	Nexans	Omexom	Prysmian	SPIE, Bouygues, SPAC	Prysmian	Sadertelec		ADEME
Inter-array cabling	SILEC (Prysmian Group)	LD Travocéan	Prysmian	Prysmian	Prysmian	Prysmian / ASSO Divers	Prysmian	Prysmian / ASSO Divers	Prysmian	Louis Dreyfus Travocean /
Offshore connection	Prysmian	Prysmian	Nexans	Nexans	Prysmian	Prysmian	Prysmian	Prysmian		Prsymian
Substation foundation	Chantiers de l'Atlantique / Rosetti Mar <u>ino</u>	DEME	lemants (Smulders)	Saipem	Chantiers de l'Atlantique / Rosetti Mar <u>ino</u>	DEME	Chantiers de l'Atlantique / Rosetti Mar <u>ino</u>	DEME	Navantia Seasenergies	
Marine substation	Chantiers de l'Atlantique / GE Grid Solutions	DEME	Chantiers de l'Atlantique / GE Grid Solutions	DEME	Chantiers de l'Atlantique / GE Grid Solutions	DEME	Chantiers de l'Atlantique / GE Grid Solutions	DEME	Chantiers de l'Atlantique	Allseas / DEME
Wind turbine foundations	Eiffage	DEME	Navantia	Van Oord	Bouygues TP	Saipem Boskalis	EEW SPC and Bladt (subcontractin g from SAIPEM)	SAIPEM	Eiffage Smulders	DEME
Masts	GE Renewable Energy	SODRACO (Jan de Nul Group) /	Haizea Breizh / SPIE	Siemens Gamesa / Fred	GRI & Windar	Siemens	Tbd	Siemens	Haiza Breizh	lon do Nul
Wind turbines	GE Renewable Energy	newable ergy GE Renewable Energy	Siemens Gamesa	Olsen Windcarrier	Siemens Gamesa	DEME	Siemens Gamesa	Gamesa	Siemens Gamesa	Jan de Nul
				Réalisé	En cours	Non réa	lisé			

Sources: Observatory for marine energies 2024, France Renouvelables analysis

MARKET AND ECONOMY

Projections

Option

Focus on the Observatory for marine energies

The companies awarded the offshore wind power construction contracts showcase the development of a French value chain in the industry.



Situation of wind farms under construction as at 30 June 2024

	SAINT-N	NAZAIRE	SAINT-	BRIEUC	FÉC	AMP	COURSEUL MI	LES-SUR- Er	NOIRM	OUTIER
Activities	Manufacturing	Installation	Manufacturing	Installation	Manufacturing	Installation	Manufacturing	Installation	Manufacturing	Installation
Onshore station	Hitachi, Siemens et GE	Eiffage Energies	Hitachi et Siemens	SPIE	Hitachi et Siemens	Omexom	Siemens	Omexom	NC	NC
Onshore connection	Prysmian	Omexom and Eiffage	Nexans	Omexom	Prysmian	SPIE, Bouygues, SPAC	Prysmian	Sadertelec		ADEME
Inter-array cabling	SILEC (Prysmian Group)	LD Travocéan	Prysmian	Prysmian	Prysmian	Prysmian / ASSO Divers	Prysmian	Prysmian / ASSO Divers	 Prysmian	Louis Dreyfus Travocean / Prsymian
Offshore connection	Prysmian	Prysmian	Nexans	Nexans	Prysmian	Prysmian	Prysmian	Prysmian		
Substation foundation	Chantiers de l'Atlantique / Rosetti Marino	DEME	lemants (Smulders)	Saipem	Chantiers de l'Atlantique / Rosetti Marino	DEME	Chantiers de l'Atlantique / Rosetti Marino	DEME	Navantia Seasenergies	
Marine substation	Chantiers de l'Atlantique / GE Grid Solutions	DEME	Chantiers de l'Atlantique / GE Grid Solutions	DEME	Chantiers de l'Atlantique / GE Grid Solutions	DEME	Chantiers de l'Atlantique / GE Grid Solutions	DEME	Chantiers de l'Atlantique	Allseas / DEME
Wind turbine foundations	Eiffage	DEME	Navantia	Van Oord	Bouygues TP	Saipem Boskalis	EEW SPC and Bladt (subcontractin g from SAIPEM)	SAIPEM	Eiffage Smulders	DEME
Masts	GE Renewable Energy	SODRACO (Jan de Nul Group) /	Haizea Breizh / SPIE	Siemens Gamesa / Fred	GRI & Windar	Siemens	Tbd	Siemens	Haiza Breizh	lan da Nul
Wind turbines	GE Renewable Energy	GE Renewable Energy	Siemens Gamesa	Olsen Windcarrier	Siemens Gamesa	DEME	Siemens Gamesa	Gamesa	Siemens Gamesa	Jan de Nul
				Réalisé	En cours	Non réa	alisé			

Sources: Observatory for marine energies 2024, France Renouvelables analysis

Focus on the Observatory for marine energies

+1,100 new positions are planned across the industry in 2024 and a total of 67 training programs preparing for MRE careers have been identified across the country.

Breakdown of FTEs in MREs by job position*

Spatial distribution of MRE training programs



FRANCE renouvelobles

Employment in the wind industry has sustained double-digit growth for 5 years and is projected to exceed 40,000 jobs by 2030



Employment growth is supported by the "Planning & development" link in the value chain, which represents one third of jobs in France and has experienced a 15% increase between 2022 and 2023.

★ Objective set by the Offshore Wind Pact

57 Capgemini invent

A job growth trend primarily driven by the planning & development branch

Projections 50 000 45 000 +6% per 40 000 vear +3% per 35 000 vear 30 000 5% per +8% per 5% per 25 000 vear +14% per year year year 20 000 +8% per 1% per +7% per year 1% per vear year 15 000 year +12% per +9% per year 10 000 1% per year 11% per vear 5 0 0 0 +16% per +14% per year vear vear 2021 2022 2023 2030 2035 1. Planning & Design 2. Component manufacturing ■ 3. Engineering & Construction 4. Operations & Maintenance

Historical and projected growth of wind jobs in onshore and offshore wind

Growth projections for 2023-2030 **are primarily driven by project developers** benefiting from strong visibility; however, a slowdown is expected post-2030 due to **anticipated permitting constraints**, resulting in timeline issues. To sustain the momentum of acceleration, it is essential to enhance visibility on the industry's 2035-2040 objectives.

Companies in the sector are largely planning to recruit more in the short term, particularly SMEs and mid-sized companies.

Predicted recruitment needs on a one-year timeframe based on company size

	VSE <10 FTEs	SME 10-250 FTEs	MSE 250-5,000 FTEs	LE > 5,000 FTEs
Stabilize recruitment	50%	20%	30%	66%
Increase hiring	50%	80%	70%	34%

J.

Working in the wind industry carries many advantages:

- Decentralized jobs distributed across the country
- Stable jobs (mostly permanent contracts) that are required for the energy transition
- There are **many career opportunities**, whether internationally or through gateways between onshore and offshore wind, as well as jobs related to the environment and aeronautics.

2 out of 3 wind companies are planning to recruit more within the next year

Towards a more even distribution of jobs across the country



Top 3 regions with job creation potential by 2030



- Territorial coverage is set to expand, particularly in regions such as the Grand-Est, which could be on the verge of moving on to a new stage.
- The regions of Île-de-France, PACA, Bourgogne-Franche-Comté, Auvergne-Rhône-Alpes, Brittany, and Occitanie could also experience an acceleration in wind job creation with growth rates of over 40%.
- Only Centre-Val de Loire and Corsica could remain relatively isolated.
- As a result, seven out of thirteen regions are projected to end up with more than 2,500 wind jobs each, amounting to >75% of jobs in the industry in France.

Training programs

A wide range of training programs preparing for careers in wind power, spread throughout the country



Wind energy-related training is available at different levels, ranging from high school level (*baccalauréat professionnel*) to engineering schools . Wind jobs are distributed in a decentralized manner throughout the country. Current training programs are helping fill some operational positions, but it is necessary to strengthen engineering training in order to meet all the needs of the industry.

SIEMENS Gamesa

Building on the success of the training programs launched in 2022 and 2023 in the Normandy region and Brittany, Siemens Gamesa is pushing forward with a new session of its **training program for service technicians** in 2024.

61 Capgemini invent

MARKET AND ECONOMY

WIND JOBS

Projections

Training programs

Wind energy training programs

Sample training itineraries



Projections

Training programs

Wind energy training programs

Focus on a selection of training programs in wind power



Lycée Raoul Mortier Post-secondary training programs

12 students per year in BTS MSE wind energy post-secondary technical ed.

12 BZEE NetWork trainees per year

Accreditations:

- 4 GWO BST modules for both students and trainees
- Electricity: B2V, BR, BC, H0V and H1V





UIMM Brittany training centre Post-secondary training

Training programs:

- Bachelor in Advanced Maintenance, with a Wind Power specialization (3 years of post-secondary education)
- Maintenance Technician, with a Wind Power specialization (post-secondary training or 2 years of post-secondary education)
- Advanced Technician in Submarine Vehicle Maintenance (2 years of post-secondary ed.)





Career opportunities:

 Design engineer for the design of offshore wind turbines or components, project director for offshore wind farm design...

98% of graduates are hired on completing their training

Master's degree delivered with

Partners:





ENSTA & École nationale des Ponts et Chaussées

Master's degree in floating wind power*

ENTSA Brittany, which is based in Brest (Finistère) and is currently merging with ENSTA Paris, has joined forces with the École nationale des Ponts et Chaussées to respond to a call for expressions of interest from the French state, operated by the National Research Agency (ANR) and aimed at creating a high-level course in floating wind power.

Features:

- 1st cohort scheduled for 2025
- Approx. 50 students
- The only training program of its kind in France

*The official name of the training program has not been revealed yet.

Sources: Lycée Raoul Mortier high school, UIMM Brittany training centre, École Centrale Méditerranée, ENSTA

SeaTech

Overview and prospects

3

The place of wind power in the French energy mix

Electricity accounts for 27% of France's energy use. In 2023, wind power accounted for 10% of France's electricity production for the first time.



494.7 TWh... Total production of wind-generated

...including 50.6 TWh

electricity in France in 2023 (+12 TWh compared to 2022)

Sources: RTE 2023 electricity report, SDES's Annual energy report

MARKET AND ECONOMY

Production has almost doubled in 5 years and now amounts to 10% of France's electricity production in 2023



50.6 TWh

Over the past 5 years, annual wind electricity production has increased by more than 80%, with an increase of more than 30% between 2022 and 2023, representing an increase in electricity production by onshore wind of 9 TWh compared to 2022.

Onshore and offshore wind

Wind industry

Public buy-in on wind power in France

Grassroots renewable power generation projects are proliferating in France.

Grassroots renewable energy projects





351 grassroots renewable energy projects (+15% vs 2022) including 36 in wind power generation (2nd place after solar)

5,574 MW financed in 2023 through crowdfunding initiatives including 990 MW in wind power (80%+ of new capacity installed in 2023)

>€368 million collected through crowdfunding for renewables including €50 million for wind power (+12% vs 2022)



79%⁽¹⁾ of French people want to see renewables expand in the country

This civic energy, where decision-making, financing and initiatives stem from the **grassroots**, leverages the local natural resources of the territories involved through the generation of renewable energy. It also results in **direct citizen involvement** in renewable energy projects and the transformational challenges of the energy transition.

The strong growth of crowdfunding in the field of renewable energies is continuing. For project developers in this space, crowdfunding is becoming a key financing tool that further **improves public buy-in**. Citizens, in addition to their commitment to the environment, are **drawn to the low-risk nature of this type of investment**.

Sources: Baromètre du crowdfunding en France [Crowdfunding barometer in France], 1France Renouvelables survey

Onshore and offshore wind

Wind industry

Wind power in Europe

Vestas.

Key figures for onshore wind power



A wind farm called into existence by local residents: Andilly-les-Marais



Charente-Maritime



Commissioned in 2024

3 Vestas 162 wind turbines, with a unit capacity of 5.6 MW each



376 backers contributed to funding the project



France's record total height: 200 m



Electricity consumption of 10,000 households



68 Capgemini invent (FRANCE - FRANCE - FRANCE

A positive trend that enable us to approach the objectives set for onshore wind power

The national targets for 2023 (PPE) have been achieved at a rate of 90%.

Changes in grid-connected power (in MW) and electricity generation (in TWh) Growth in grid-connected onshore wind power capacity (in MW)



* Projects for which there has been a proposal for queuing or an accepted technical and financial proposal. **This corresponds to the "high" scenario of 2028 PPE *** This figure is only valid for onshore wind power.

Source: Agence ORE (the consortium of France's electricity and gas distributors)

Achieving the objectives of the 2028 PPE will require doubling the rate installation of new, grid-connected wind power capacity with an additional 12 GW and to expedite the allocation of projects. At the current rate, the country will be deprived of 7 GW of onshore wind power.

Overview of installed wind power capacity

Top 20 onshore and offshore wind farm operators in France as at 30 June 2024



In 2023, wind power will cover more than 10% of French electricity consumption, i.e., as much as hydroelectricity.

Growth in electricity consumption coverage

Energy consumption coverage by onshore wind by region in 2023



Monthly consumption coverage for the year 2023



The coverage of electricity consumption by wind power has experienced constant growth over the last 3 years. In 2023, wind power covered more than **11% of electricity consumption in France**. Wind power generation is **particularly efficient during peak consumption periods during the winter**.



Onshore wind production covers almost **30% of the electricity consumption** of the Hauts-de-France and Grand-Est regions, which are among the four largest consumers of electricity in France.

Capgerwini invent () FRANCE

Sources: : Agence ORE, Enedis, RTE

The Hauts-de-France and Grand Est regions represent almost 50% of installed capacity, while other regions are accelerating project development

Grid-connected capacity (in MW) as at 30 April 2024



* Projects for which there has been a proposal for queuing or an accepted technical and financial proposal.

Source: Agence ORE (the consortium of France's electricity and gas distributors)

72 Capgenvini invent

MARKET AND ECONOMY
Wind-generated electricity production is primarily concentrated in the northern and eastern regions of France.

Onshore wind power production (in GWh) by region in 2023 Grid-connected capacity (in MW) by region as at 31 December 2023



Grid-connected capacity is mainly concentrated in the north-eastern regions of the country. As a result, wind-generated electricity is significant in these regions.

Sources: Agence ORE, Enedis, RTE

73 Capgemini invent

MARKET AND ECONOMY

WIND JOBS

Onshore wind

The average unit capacity of installed turbines has increased from 1.6 MW in 2005 to 2.9 MW in 2023. However, a significant lag is observed in France compared to the European average, which stands at above 4 MW.

Average unit capacity of installed turbines (MW) in France





and a

Over the past 20 years, the unit capacity of turbines in France has **tripled**, though it still falls below the European average, which is currently **4.1 MW**.

These turbines, with their typically lower unit capacity, underscore the potential for improvement and modernization of wind power installations in France.

Sources: WindEurope, France Renouvelables analysis

75

Repowering makes it possible to significantly increase electricity generation for an unchanged number of wind turbines installed.

Repowering a wind turbine



OVERVIEW AND PROSPECTS.

In 2023, the turbine construction market is primarily dominated by European manufacturers

In France, turbine manufacturers have installed 1,299 MW of wind power capacity in 2023, with European manufacturers accounting for 95% of the installed capacity in onshore wind.

MW connected to the grid by the 6 main manufacturers from 1 January to 31 December 2023



Source: France Renouvelables analysis

In 2023, a large majority of installed turbines will have unit capacities ranging from 2 to 4 MW

60% of the installed turbines have a unit capacity greater than 3 MW, and 35% have a unit capacity of 2 to 3 MW.

	Model	Manufacturer	Unit capacity (MW)	Mast height (France)	Installed capacity (MW)
1	V110	Vestas	2 to 2.2	80-120 m	210
2	V126	Vestas	3 to 3.6	87-117m	184
3	N117 DELTA	CNORDEX Gacciona	3 to 3.6	84-106m	154
4	V117	Vestas	3 to 4	91-105m	140
5	N131 DELTA	CNORDEX Gacciona	3 to 3.7	84-120m	135
6	V136	Vestas	3 to 4.2	82-112m	89
7	V100	Vestas	2.2 to 3.75	75-100m	82
8	V150	Vestas	3 to 4.2	105m	52
9	V112	Vestas	3	94 m	28
10	SG132		3.6	97 m	27

Top 10 most installed turbines in 2023

Sources: WindEurope, France Renouvelables analysis

European turbine manufacturers account for 96% of France's wind turbine fleet

The 5 largest manufacturers in France account for 94% of the turbine fleet.

MW in service by manufacturer (rounded to the nearest MW)



Onshore wind

The unit capacity of turbines in French wind farms is increasing

While turbines in French wind farms currently have an average unit capacity of 2.2 MW, those installed in 2023 average 2.9 MW. This increase allows for greater installed capacity for the same number of turbines.

Most installed turbines as at 31 December 2023 (cumulative)

	Model	Manufacturer	Unit capacity (MW)	Rotor size / height	Cumulative capacity (MW)	Number of units
1	V100	Vestas	1.8 to 3.8	75-150m	1,804	848
2	E-82		1.5 to 3	59-108m	1,700	779
3	V90	Vestas	2 to 3	78-145m	1,688	796
4	E-70		2 to 2.35	54-99m	1,500	670
5	MM-92	SENVION wind energy solutions	2	59-100m	1,500	737
6	N117		2.4 to 3.7	91-120 m	1,200	419
7	V110	Vestas	2 to 2.2	80-125m	983	462
8	N90		2.3 to 2.5	125-145m	840	444
9	V112	Vestas	2 to 3.6	69-119m	800	2452

France is lagging behind its European neighbours but is **nevertheless moving towards turbines with increasingly higher unit capacities.**

Sources: WindEurope, France Renouvelables analysis

Onshore and offshore wind

Wind industry

Wind power in Europe

Key figures for offshore wind power



The very first French industrial offshore wind farm

Parc éolien

e S^t-Nazaire



Saint-Nazaire

ee-

Commissioned in 2022



80 6 MW GE wind turbines manufactured in Montoir-de-Bretagne (bottom-fixed monopile turbines)



Electricity consumption of 700,000 people



€4.7 million in annual revenues (amounting to 50% of the proceeds from the offshore wind tax) for the host municipalities

Sources: Agence ORE, Enedis, RTE

*Turnover of all service providers and suppliers in the value chain (excluding energy sold)

Offshore wind

Bottom-fixed and floating offshore wind: two technologies that are developing in French waters

Examples of offshore wind installations:



Bottom-fixed offshore wind

These fixed turbines are intended for seabeds of depths of up to 50 to-60m. They can harness strong coastal sea winds:

- 3 wind farms are in operation (1.5 GW)
- 6 wind farms are currently under construction (1.7 GW)
- 3 other calls for tenders are in progress (3.5 GW)

Bottom-fixed wind power is the **most mature** and competitive technology among MREs. Bottom-fixed wind power accounts for 90% of the turnover of the wind industry.

Floating offshore wind

Floating wind turbines are connected to the seabed by anchor lines and can be located further offshore starting at depths of 30 to 50 m.

Sources: France Renouvelables analysis, Eoliennesenmer.fr

Onshore wind: accelerating coverage

AVANCEMENT DES PROJETS

3 wind farms in operation

as at 30 June 2024 (Saint-Nazaire, Fécamp and Saint-Brieuc)

3 wind farms under construction (1.5 GW)

that will be commissioned in no later than 2026

3 wind farms allocated (1.85 GW)

currently in the planning phase with commissioning slated for 2031

3 pilot wind farms

floating wind turbines to ensure the viability of the technology



FRANCE



Wind power in Europe

An insufficient number of ongoing projects jeopardizes the achievement of the 6.1 GW target

2023 national targets have been achieved at 61%

Changes in grid-connected capacity in MW



Sources: France Renouvelables analysis, Eoliennesenmer.fr

*Awarded projects with milestones that are not yet known

83

ent (FRANCE renouvelobles

MARKET AND ECONOMY

The Channel and Atlantic coasts are favored for offshore wind projects

9 GW of offshore wind are planned, of which 2.75 GW are already in development.

Grid-connected capacity and projects as at 31 December 2023 (in MW)



Existing grid-connected capacity
Upcoming tenders

Ongoing developments

Sources: France Renouvelables analysis, Eoliennesenmer.fr

84

MARKET AND ECONOMY

France has a leading position in the wind industry on a European scale



Source: WindEurope

Regulatory measures are being implemented to promote the development of the wind industry

Europe and France are streamlining their regulatory frameworks in order to bolster the development of the wind industry.

Net Zero Industry Act (NZIA), a European framework for low-carbon industry

Regulatory measures to support the wind industry across the entire value chain have proliferated. These measures address various aspects, from planning and development to the production, installation, and management of wind farms. The European Union promotes the localization of wind component production by providing incentives for companies to establish factories that manufacture turbines, blades and other components within the EU.

The Net-Zero Industry Act (NZIA) is an EC regulation aimed at strengthening Europe's low-carbon technology industry, in line with its net-zero carbon strategy for 2050. Its primary objective is to enhance local production of net-zero technologies and reduce Europe's reliance on imported key technologies for the energy transition, including wind turbines.

Law for the acceleration of renewable energy production (APER)

The APER law aims to accelerate the development and territorial planning of renewable energies. It allows municipalities to define "acceleration zones" for renewable energies. **Critical Materials Act**

The CMA aims to ensure a stable and secure supply of the critical materials that are crucial for the production of green technologies. It fosters innovation, promotes recycling and material reuse, establishes strategic reserves, and develops contingency plans to address potential supply disruptions.

Green Industry Act

The 2024 finance bill introduces a "green industry investment" tax credit (C3IV) to foster investment in green technology. The administrative authorization procedure has been streamlined in order to expedite the installation of new renewable energy farms, reducing the administrative process from 17 down to 9 months.

Wind Energy Package

The European Commission launched the "Accele-RES" initiative to ensure swift implementation of the revised EU renewable energy rules. To boost investment in wind power equipment manufacturing in Europe, the European Commission will facilitate access to funding through the Innovation Fund.

Source: French Ministry for Ecological Transition

From design to repowering: the key stages in the wind power value chain

The wind power value chain encompasses the design, manufacturing, installation, maintenance, dismantling and repowering of wind turbines, integrating activities ranging from the component manufacturing (blades, nacelles, masts, foundations) to wind farm management and the recycling of materials.



Source: France Renouvelables analysis

French manufacturers are positioned at all levels of the industrial value chain

The wind power value chain is organized around traditional industrial players that develop expertise across various links through dedicated subsidiaries, as well as specialized industrial players focused on the production of specific infrastructure components.



An industrial success story – the installation of the substation of the Yeu and Noirmoutier offshore wind farms





Key figures:

Project details

After the foundations, at the end of May, the substation of the offshore wind farm of Yeu and Noirmoutier **was installed on 12 June 2024**. This piece of industrial infrastructure, which is crucial for wind farms, converts the electricity generated by wind turbines before it is injected into the electricity grid.

The module installed at the Yeu-Noirmoutier wind farm was built at Chantiers de l'Atlantique and is based on the same model as the substations that equip the three other French offshore wind farms, including that of Saint-Nazaire.

Updates

The development outlook for Chantiers de l'Atlantique is positive, following the signing of a \in 4.5 billion contract on May 2, 2024 (together with RTE and Hitachi Energy) for the construction of three new direct current offshore platforms to support the offshore wind farms in the Normandy sea area (Centre Manche 1 & 2) and Oléron.

2,500 t

The installation of the electrical substation required the use of a crane ship towering as high as the Eiffel Tower.

600,000 hours

were needed for the construction of the substation in the industrial workshops.

300+ workers

were mobilized over the course of three days to ensure its installation at sea.

Lacq Recyclage

An industrial success story – the official launch of a rare earth recycling plant



Key figures:

€15 million.

As part of the post-Covid recovery plan, the government is providing support amounting to

Project details

Announced at the beginning of 2022, the Lyon-based company Carester should **commission its first plant specializing in the recycling of rare earth elements**, located in the Lacq basin, towards the end of the year. Aiming to support France's independence from rare earth imports, Carester helps secure raw material supply chains.

Updates

For this project, the Lyon-based startup has partnered with the chemical company Solvay to advance its activities. Through this strategic partnership, Solvay will leverage its industrial expertise and technology, while Carester will bring its knowledge of end-of-life equipment recycling and insights into the upstream market and related activities.

will decrease by 80%.

Thanks to this innovation, water use, which is required in the industrial production process,

320 t of rare-earth elements per year

Production at the plant is expected to begin in July 2024 with a capacity of 320 t per year.

La Turballe

An industrial success story – Louis Dreyfus Armateurs is continuing to expand its expertise activities in offshore wind power



Updates

Louis Dreyfus Armateurs has announced the order of two new Crew Transfer Vessels (CTV) on 6 July 2024, bringing its fleet to a total of 7 vessels. The new CTVs will be based on the StratCat model, with a capacity of 24 passengers, and should be delivered in the 1st quarter of 2025.

Key figures:

18 to 30 months

are necessary for the construction of industrial infrastructure, including Crew Transfer Vessels (CTVs) and Service Operations Vessels (SOVs).

Project details

Established in 1890, Louis Dreyfus Armateurs is a French company with a specialization in personnel transfer services for the O&M phases of wind farms, via the management and operation of dedicated nautical assets including Service Operation Vessels (SOVs) and Crew Transfer Vessels (CTVs) as well as the installation, burial and maintenance services for submarine power cables (through its subsidiary LDTravacean).

As part of its operations, Louis Dreyfus Armateurs develops innovative solutions that align technical offerings with the operational needs of its customers (developers and turbine manufacturers) while navigating a competitive environment. For example, LDA has developed, built and operates mechanical slicers (TMO5), CTVs designed with semi-swath hulls, as well as hybrid SOVs.

300+ FTEs

are secured through the company's industrial activities, in particular in operating dedicated fleets (CTVs and SOVs).

>€150 million

in investments in service activities related to offshore wind. .

La Ciotat

Onshore wind

Industrial production in wind power in France is driven by component manufacturing and project assembly

Changes in the value generated* in industrial activities related to wind power that are installed on French territory, by activity – excluding cost of energy sold (in current million €)



Project development and planning Technical studies Component manufacturing Assembly Civil engineering and transportation Connection to the grid

The value generated by the wind industry in France has decreased by **13% compared to the previous year**. The main value-add comes from **component manufacturing** activities, which represent around **41%** of the value generated by the French wind industry in 2023. The main components (masts, blades, rotors and turbines) represent only 13% of the value generated by component manufacturing. The other important segment is project assembly activities, which contribute 25% to the value creation of the French wind industry.

Source: ADEME "Marchés et emplois dans le secteur des énergies renouvelables et de récupération" [Markets and jobs in the renewable energy and energy recovery industries]

*Value generated = domestic investment + exports – imports Investments correspond to purchases of assets whose operation is located in France

92 Capgemini invent (FRANCE PENOUVElobles

MARKET AND ECONOMY.

WIND JOB

Component manufacturing is the largest segment for domestic investment and exports in France

Trends in domestic investment by activity – excluding energy sold (in current €M)

Changes in export volume by activity – excluding energy sold (in current €M)



Domestic investment has **contracted sharply by 28% between 2022 and 2023**. It is mainly driven by component manufacturing, which amounts to 72% of total value in 2023. **Exports are experiencing moderate and stable growth**, mainly driven by **component manufacturing and project assembly**, which contribute **63% and 23%** of total value respectively.

Source: ADEME "Marchés et emplois dans le secteur des énergies renouvelables et de récupération" [Markets and jobs in the renewable energy and energy recovery industries]

An upsurge in export activity for French companies present on the offshore wind market

2 out of 3 companies engaged in exports in 2023.





Source: 2024 Observatory for marine energies

Wind power in Europe

France ranks 4th in Europe for installed wind capacity

Installed onshore and offshore wind power capacity by country in Europe at the end of 2023

Installed over the course of the year





In 2023, **16.2 GW of new wind capacity** were installed across the EU, bringing the total wind capacity to 218 GW.

The European target (excluding the UK) for **2030 is to reach 425 GW**, requiring an increase of 200 GW over the next 6 years, or 30 GW per year. To get closer to this goal, it is necessary to **double the current pace** of installation.

France and the UK have load factors of 26% and 25%, respectively, which are **both higher** than those in Spain (24%) and Germany (23%), further confirming France's **significant wind power potential**.

Sources: WindEurope, Ember

Wind power generation has reached 477 TWh, surpassing the output of Europe's gas-fired power plants



Although wind energy accounts for only 11% of France's energy consumption, placing the country 17th in Europe, France remains the **4**th **largest producer of wind-generated electricity on the continent**.

	Source: WindEurope	
96	Capgemini invent	MARKET AND ECONOMY

*UK included

Europe has developed a strong wind industry capable of serving its domestic market

The top 10 turbine manufacturers represent 85% of the 120 GW installed in 2023. Among the top 10, 3 European turbine manufacturers have installed 27 GW, capturing a 23% market share.

Global distribution of installed capacity in 2023 among the Top 10 turbine manufacturers (in MW)



Distribution of production plants dedicated to onshore wind power in Europe



Sources: WindEurope, GWEC



The European wind industry is active across at all levels of the onshore wind industrial value chain, and the majority of industrial sites are concentrated in Western Europe.



MARKET AND ECONOMY

Europe is one of the leaders in the onshore wind market with more than 218 GW of installed capacity at the end of 2023, representing more than 20% of global installed capacity.

OVERVIEW AND PROSPECTS

Installed capacity by company in Europe (MW) as at

Offshore wind

98

Europe can rely on the strength of its industrial fabric to achieve its objectives

95%+ of turbines installed in Europe were designed by European manufacturers, and 80%+ of offshore wind turbine foundations in Europe were built by European companies.*



Foundations built by company in Europe (MW) as at the end of 2022

Appendixes

How wind turbines work

Wind turbines transform the kinetic energy of the wind into electrical power



Source: L'éolien en 10 questions [Wind power in 10 questions], ADEME

Selection criteria for the location of wind farms

Wind resource assessments are critical to confirm site suitability

Harnessing the wind

The efficiency of wind turbines depends on wind speed and frequency. A site with winds averaging 30 km/h will be approximately eight times more productive than another site with winds averaging 15 km/h. In France, a project is considered economically interesting when the annual average speed at the site is around 21 to 25 km/h.

Other criteria are also taken into account, such as the capacity of the soil to support the foundations and the connection to the power grid.



Wind turbines must aim for an optimal rotor size to be able to capture winds that are both strong and continuous. The larger the diameter of the rotor (5 and 6), the more energy is captured.



Source: Le parc et l'éolien [Wind power in the natural park], Parc naturel régional Loire-Anjou-Touraine

Corporate Power Purchase Agreements (CPPAs)

Electricity purchase contracts can take several different forms: physical or virtual.



"On-site" physical

The electricity is delivered directly and physically to the consumer.

"Off-site" physical

An end user (or offtaker) purchases electrical power from a producer and has it delivered by their utility (which may also fill any remaining need).

Virtual

The end user enters into an agreement with a producer of green energy to provide additional remuneration based on the market price. There is no concept of physical delivery involved.

APPENDIXES



Auvergne-Rhône-Alpes





The following companies have their headquarters in the Auvergne-Rhône-Alpes region:



* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard

Capgemini@invent FRANCE renouvelobles 104

Bourgogne-Franche-Comté



These companies have their headquarters in Bourgogne-Franche-Comté:



* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard

105 Capgemini invent

Brittany







* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard



Centre-Val de Loire



These companies have their headquarters in the Centre-Val de Loire region:



* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard

107 Capgemini invent

Grand Est



* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard
Hauts-de-France



* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard

Île-de-France



* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard

110 Capgemini invent

Top 5 wind operators

💙 VALEMO

CGN

NB: Figures as of June

2024

WPO

BayWa r.e.

Normandy

Key figures	То
4,225 jobs (+45% compared to 2021)	
Planning & Design Component manufacturing Engineering & Construction Operations & Maintenance 389 2934 480 422	
1,563 MW installed as at 30 June 2024 €34.1 million in tax revenues*	
152 companies	
Calvados159 MWEure126 MWManche142 MWOrne53 MWSeine-Maritime1082 MW	
These companies have their headquarters in the Normandy reg	gion:





* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard

Nouvelle-Aquitaine



* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard

APPENDIXES

renouvelables

WPO

Occitanie

Capgemini@invent

113





FRANCE renouvelobles



* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard

BOUYOUTS) valeco eDF engie 🔿 valeco res engie VALEMO M ENERCON edp \odot /:∕ BORALEX **AUGIZEAU apex**energies* EnBW NSB NB: Figures as of June 2024

Top 10 wind employers

Vestas.

APPENDIXES

Top 10 wind operators

edf.

Pays de la Loire



These companies have their headquarters in the Pays de la Loire region:



* Following the calculation: 1 MW = €8,360 in tax revenues (following the IFER standard)

**including the Saint-Nazaire offshore wind farm

CHANTIERS DE L'ATLANTIQUE

Rie

.

engie

CHARIER

BayWa r.e.

TEAM

Amos Atlantique Maritime Services

DEFONTAINE





NB: Figures as of June 2024

Capgemini@invent FRANCE 114

Provence-Alpes-Côte d'Azur



* Following the calculation: 1 MW = €8,360 in tax revenues per MW according to the IFER standard



Top 5 wind operators

BayWa r.e.

WPO

2

engie

NB: Figures as of June

2024

CNR

Wind energy training programs



Zoom on the Vestas Campus

The Vestas campus opened its doors in 2021 with the aim of providing students with training to become advanced technicians in **wind power maintenance**. The unique aspect of this co-op program is that it is **specifically designed for early school leavers and young adults seeking job retraining, drawing participants from across the country**. Vestas emphasizes human skills, teamwork, learning abilities, autonomy and initiative.



Prerequisites

=

- Training: Technical baccalaureate (maintenance, automotive mechanics, electrical engineering...) or CAP (vocational qualification) / BEP (occupational studies) with a few years of professional experience
- Driving licence
- Elementary English

Skill set developed

- Mechanics
- Electricity
- Hydropower
- 70% in the field
- 30% on campus
- GWO certification



Cohorts of 9-10 trainees

 \sim

•

- 2021 cohort: 6 hires
- 2022 cohort: 5 hires
- 2023 cohort (current)
 - 2024 cohort: Oct. 2024
- 2025 cohort: 1 session in Reims and 1 session in Le Mans

Location

٠

- Theoretical background: Reims (51)
 - Practical training: on the various wind farms of Troyes (10), Langres (52), Reims (51), Nancy (54), Saint-Quentin (02), Amiens (80) and Cambrai (59) – at the trainee's choice.

Permanent or professionalization contracts

- 12-month interim professional training contracts through temporary staffing company ADECCO
- 3-Week *ad hoc* training for job seekers under the POEC scheme with the support of the national employment agency, France Travail
- At the end of the training program, Vestas offers long-term employment contracts if the prerequisites are met

116 Capgenvini invent

Wind energy training programs



Focus on the Nordex Academy

The Nordex Academy is based in Laon (02) since 2022 and comes in addition to other Nordex Group training centres around the world.

The training provided at the Nordex Academy complements the general training programs already available in the region and allows Nordex France to ensure its maintenance technicians specialize in its products from the moment they are hired and then throughout their career (GWO training, electrical accreditations, technical training, OHS training). The in-service training of its teams is a core practice of Nordex Group. The Nordex Academy is equipped with the full range of converters used in France and replicates all the communication interfaces of wind turbines in order to achieve ever greater efficiency and a training environment that is as close as possible to real conditions.

The centre is open to all Nordex Group employees in the Mediterranean region and, since 2024, training opportunities are also open to the group's customers and partners. The team of GWO instructors has expanded to round off Nordex Academy's training portfolio and to train almost 500 people each year at the Nordex Academy.



Wind energy training programs



Focus on the Enercon Training Center

Since September 2017, the wind turbine manufacturer ENERCON has been operating a training centre for the whole country located in Le Meux (60). This 1,400 m² building accommodates **600 commissioning and maintenance technicians** (ENERCON staff and service providers) each year. A team of **6 instructors** is present on site to provide training in **electricity**, **mechanics and safety**.



A unique and comprehensive integration program

This is facilitated by nearly 30 days of training in the first year, beginning upon hiring.

Training in real conditions

With the help of ENERCON equipment, a 500 m² platform, a high-voltage room, and workshops for practical training.

Skills development

The instructors are specially-trained former technicians who continually update their professional expertise.

A focus on security

Via specialized equipment including mock platforms for turbine rescue exercises and evacuation drills, personnel lifts, etc.

Driving the industry forward

The industry is driven by a variety of stakeholders organized in competitiveness clusters and other collaborative structures.

Competitiveness clusters

Networks of companies, research and training units, and public bodies which come together around a field

Seven competitiveness clusters in wind power are currently active in France:

- PÔLE MER Bretagne Atlantique
- Technopole Brest-Iroise
- EMC2
- DERBI
- PÔLE MER Méditerranée
- Capenergies
- Tenerrdis



Innovation clusters

Groupings of public and private stakeholders facilitating knowledge transfers among participants. Eight active clusters in the wind power industry have been identified in the country:

- Cluster Maritime Français (the French Maritime Cluster)
- MEDEE
- Ouest Normandie Énergies
 Marines
- France Énergies Marines
- Neopolia
- Technocampus Ocean, West Atlantic Marine Energy Center
- Cluster Éolien Aquitain
- CEMATER

Other relevant actors

Professional unions and federations that, like France Renouvelables, bring together wind industry professionals:

- FNTP,
- FNTR,
- UFL,
- Cluster Maritime Français,
- · Gimélec,
- EVOLEN,
- SER...

France Renouvelables facilitates the wind industry in the various

regions thanks to its regional representatives (regional groups)

The regional groups, which are made up of members of France Renouvelables located throughout the country, ensure that the issues they encounter are communicated to the national team, and that France Renouvelables' actions are relayed at the local level. The regional groups are coordinated by regional representatives.





Focus on FOWT, the world's largest event in floating offshore wind, co-hosted by France Renouvelables

Since 2013, Pôle Mer Méditerranée and the Marseille-Provence Chamber of Commerce and Industry have co-hosted the Scientific and Technical Seminars of Floating Offshore Wind every year, with a view to fostering the growth and development of the industry. Since 2016, the conference has been renamed FOWT (Floating Offshore Wind Turbines), and it is co-hosted by France Renouvelables.

FOWT has three ambitions: to accelerate the increase in the share of floating wind power in the global energy mix; to support the structuring of an ecosystem and to promote interactions between participants of the FOW value chain; and to turn FOWT into a showcase for international expertise of the floating offshore wind industry.

The 2024 edition of FOWT was held from 24 to 26 April 2024 at the Palais du Pharo in Marseille (FOWT 2025 will be held from 23 to 25 April 2025 in Brest)

The best in science & the best in technology

and Industry

Financing, industrial issues, regulatory framework, environmental impacts, technological innovations, insurance, zoning; all these topics are covered during the 3 days of conferences to help reveal the key issues related to the emergence and the industrialization of floating offshore wind power in France and around the world. In order to ensure that the program is relevant and diverse during the whole three days, the event committee launches a call for abstracts every year.



Key data on the FOWT 2024 event

1,400+ participants 30+ nationalities represented

3 days of plenary conferences

60+ sponsors & industrial and institutional partners

Methodology

- Questionnaires were sent out to all identified corporations and companies (from April to June)
- Survey of jobs at the company ٠ level



Survey of installed capacity (MW)

Survey of turbine manufacturers active in France regarding newly installed capacity (between 1 July 2023 and 30 June 2024). The "Top operators and manufacturers" lists in the appendixes* are derived from this survey.

Survey of dismantling/repowering operations

Update of cumulative installed power

Mapping

How the companies appearing on each regional map are selected:

- Top 10 wind employers in the • region
- Headquarters of companies with more than 5 FTEs that responded to the census.

Estimated number of jobs

Breakdown of surveyed wind jobs by link in the value chain

- 1. Planning & Design
- 2. Component manufacturing
- 3. Engineering & Construction
- 4. Operations & Maintenance

For each link in the value chain, the total number of jobs is estimated based on the number of jobs surveyed and their growth compared to the previous year

- Companies that were not surveyed in 2023: estimated data
- Companies surveyed in 2023 and not in 2022: actual data

Companies surveyed in 2022 and 2023: actual data used to establish a growth rate for the estimated data



Photo credits

The credits below correspond to the photos provided by manufacturers for the Observatory. The other photos are royalty-free photos.

Page		Enercon
Page	17	Enercon
Page	36	Fruges onshore wind farm
Page	38	Saint-Nazaire offshore wind farm
Page	40	Vestas
Page	64	Enercon
Page	100	Enercon
Page	104	Enercon

France Renouvelables' members

2W RH **3D ENERGIES** 3E 8.2 FRANCE ARELENERGY FRANCE ABO WIND ACACIA ADI-NA (AGENCE DE DEVELOPPEMENT ET D'INNOVATION NOUVELLE-AQUITAINE) AFNCO AEOLIA AUDIT ET CONSEIL AGREGIO ALAIA ADVISORY ALEXIS ASSURANCES AL PIC ALPIQ ENERGIE FRANCE ALTERRIC SARL AM'EOLE GMBH AMARENCO FRANCE AMUNDI TRANSITION ENERGETIQUE APAI MW ARHYZE ARKOLIA ENERGIES SAS ARTELIA ATLANTIQUE MARITIME SERVICES ATLAS SUD AUDDICE ENVIRONEMENT AXPO SOLUTIONS AG BAYWA R.E FRANCE BCTG AVOCATS BDO IDF BENTAM BILLAS AVENIR ENERGIE BIODIV-WIND SAS BIOSECO SA BIOTOPE **BIRD & BIRD AARPI BKW ENERGIE AG** BLACKEAGLES GREEN ADVISORS BI UF BROKER BLUEFLOAT ENERGY HOLDINGS FRANCE SAS BLUESIGN BMEOL SARL BMH AVOCATS BORALEX BPCE LEASE - BPCE ENERGECO BPI FRANCE FINANCEMENT BRETAGNE POLE NAVAL BRITTANY AVIATION BUREAU VERITAS SERVICE FRANCE BW IDEOL BWTS FRANCE CABINET BRUN CESSAC CABINET RAVETTO ASSOCIES CAISSE DES DEPOTS ET CONSIGNATIONS CALYCE DEVELOPPEMENT CARBON CAREMAG CATHIE ASSOCIATES SARL CEGELEC RENEWABLE ENERGIES CEMATER

CEPS CEZ FRANCE SAS CFAI BRETAGNE CGN EUROPE ENERGY CGR AVOCATS CINAV COBRA INSTALACIONES Y SERVICIOS COLAS FRANCE COPENHAGEN OFESHORE PARTNERS A/S CORIO GENERATION LIMITED COVERWIND SOLUTIONS FRANCE CREDIT AGRICOLE CIB CREDIT AGRICOLE LEASING ET FACTORING CREDIT INDUSTRIEL ET COMMERCIAL CUBE GREEN ENERGY SAS DAVID PROJECT SNC DEKRA INDUSTRIAL SAS DEMINETEC DEMOPOLIS CONCERTATION SAS DERASP DERBI DEUTSCHE WINDTECHNIK S.A.R.L DHL DGF DIADES MARINE SAS DI A PIPER FRANCE LI P DIGA DNV FRANCE SARL DS AVOCATS E3 IDENTIFLIGHT FRANCE ECO DELTA FCOSPHERE EDPR FRANCE HOLDING EES ENERGIE EOLIENNE SOLIDAIRE SAS ELATOS FLEMENTS SAS ELICIO FRANCE ELYS EMERGYA WIND TECHNOLOGIES B.V. EMERSON PROCESS MANAGEMENT SAS ENBW FRANCE ENCAVIS ASSET MANAGEMENT ENCIS WIND ENDIPREV FRANCE ENERCON GMBH ENERCOOP SCIC - SA ENERGIE EOLIENNE FRANCE ENERGIE FONCIERE ENERGIE PARTAGEE ASSOCIATION ENERGIEQUELLE SAS FNFRGIFS CITOYENNES EN PAYS DE VILAINE ENERGIETEAM ENERGITER ENERGREEN PRODUCTION ENERGY CONSULT FRANCE SAS ENERTRAG SE ENESI SARL ENGIE GREEN FRANCE ENI PLENITUDE RENEWABLES FRANCE ENRSUR ENVINERGY TRANSACTIONS ENVOL ENVIRONNEMENT

EO (EX SITE A WATTS DEVELOPPEMENT) EOL-C SAS EOLE CONSTRUCTING FOLEC. FOL FL EOLICA EDILIZIACROBATICA FRANCE EOLISE SAS EOLISSUN FOI TECH FOS WIND FRANCE FPSILINE EQOS ENERGIE LUXEMBOURG SARL EQUINOR WIND POWER AS EREA INGENIERIE SARL FRG FRANCE ERSG FRANCE ESA ENERGIES SAS ESCOFI ENERGIES NOUVELLES ESG ENERGY SERVICE GROUP FTCHART GCM EUROPEAN ENERGY FRANCE EUROWATT DEVELOPPEMENT EUROWATT SERVICES EVEROZE EWZ EXEN EXPLAIN - LMP EXUS FRANCE SAS FEECRM FIDAL FILHET-ALLARD ET COMPAGNIE FIPELEC FLYING FOR YOU FMTC SAFETY FONDATION OPEN-C FONDEOLE FRANCE CIMENT GAIA ENERGY SYSTEMS GAZEL ENERGIE SOLUTIONS GDES WIND SAS GEG ENR GIDE LOYRETTE NOUEL AARPI GIE QUALITE ENTREPRISES GOTHAER GOWLING WLG FRANCE **GP-JOULE FRANCE SARL** GREENSOLVER GREENVOLT POWER FRANCE S.A.S. GREENWITS GRETA-CFA DU MAINE GRID SOLUTIONS SAS H2AIR HELIANTIS ENERGIES HELIOPALES HENSOLDT FRANCE SAS HK LEGAL HYDRODIESOL SAS HYDRONEXT IBERDROLA FRANCE SAS IEL DEVELOPPEMENT IFOPSE IFP ENERGIES NOUVELLES IMAGIN'FRF INDDIGO

INFRSYS - SYSCOM INNERGEX FRANCE SAS INTHY SERVICES IQONY WIND FRANCE S.A.S. IRIDA A L TECHNOLOGIES JEANTET JIGRID IOHN COCKERILI JOHN COCKERILL SERVICES FRANCE SUD JONES DAY JP ENERGIE ENVIRONNEMENT KALLIOPE KJM CONSEIL SAS KLUBER LUBRIFICATION FRANCE SAS L'ETINCELLE LANTHAN SAFE SKY LHOTELLIER TP LIGHT GUARD GMBH LINKLATERS LOCOGEN SAS LOUIS DREYFUS ARMATEURS I OXAM LYCEE DHUODA LYCEE SAINT FRANCOIS D'ASSISE M WIND MAGREE SOURCE MASER ENGINEERING MD WIND MENARD METROL MIROVA MW ENERGIES NATURAL FORCES FRANCE NATURAL POWER FRANCE NATURGY RENOUVELABLES FRANCE SAS NCA ENVIRONNEMENT NEOPOLIA NEOTEK SAS NFT WIND NILEA ENERGY NORDEX FRANCE NORIA NORMANDIE ENERGIES NORMANDIE MARITIME NORTON ROSE FULBRIGHT LLP NOTUS ENERGIE FRANCE SERVICES NOUVERGIES NTR WIND MANAGEMENT DAC OBSTA OCEAN WINDS OFATE (OFFICE FRANCO-ALLEMAND POUR LA TRANSITION ÉNERGÉTIQUE) OIM FRANCE OMEXOM RENEWABLE ENERGIES OFFSHORE GMBH OMNES CAPITAL OPALE DEVELOPPEMENT OSTWIND INTERNATIONAL OVP SOLUTIONS SAS OX2 FRANCE OXAN ENERGY PHOENIX OFFSHORE SOLUTIONS

PHOTOSOL DEVELOPPEMENT PINSENT MASONS FRANCE LLP PLANETA FRANCE SAS PLASTEOL POLEMER MEDITERRANEE POLE S2E2 POMA LEITWIND POWEEND SAS PRINCIPLE POWER FRANCE PRUD'HOMME & BAUM Q ENERGY FRANCE QAIR FRANCE QANNT SAS QUALICONSULT EXPLOITATION QUENEA CH RAZEL-BEC RBA REGION OCCITANIE REMAP SERVICES RENANTIS RENNER ENERGIES FRANCE RES SERVICES ROBUR WIND FRANCE RP GLOBAL FRANCE RUAVEL RWE RENOUVELABLES FRANCE SAB ENERGIES RENOUVELABLES SAS SAEML 3D ENERGIES SAFETYPACK SAFIER INGENIERIE SAINT-LAURENT ENERGIE SAMFI ENERGIE SARI HTC TRAINING (HTC TECHNIQUES VERTICALES) SAS SODEREC FER ET METAUX SBM INC. SCANDOL SCP LACOURTE RAQUIN TATAR SELARL PAWLIK SIMEREY SEM ENR CITOYENNE SEML COTE D'OR ENERGIES SENS OF LIFE SEPALE SHEFFIELD GREEN SIEMENS ENERGY SAS SIEMENS GAMESA RENEWABLE ENERGY FRANCE SAS SIENNA AM FRANCE SINGULAIR SIRMET SK & PARTNER SKYBORN RENEWABLES SKYWORK SOCIETE D'EOLIENNE CARIBEENNE SOCIETE GENERALE SOFIVA ENERGIE SOLATERRA SOLEIL DU MIDI SOLVEO ENERGIES SOMME NATURE ETUDES ET TRAVAUX SOREGIES SPARKSIS - INVESTER TECHNOLOGIES SPOOR AS SSE RENEWABLES FRANCE

SUBSEA 7 (UK SERVICE COMPANY) LIMITED SUEZ RV DEFF SUPAIR VISION SUPPLY GRAPH SYADEN SYNERDEV SYNERIA SAS SYNOPS CONSEIL TCO WIND LORRAINE SAS TECHNOSTROBE INC. TENERGIE SOLUTIONS TENERRDIS TENSAR INTERNATIONAL TERAPOLIS TERR.A TES TOTAL ENERGIES TOTALENERGIES RENEWABLES TSE TTR ENERGY UL SOLUTION UNION DES PRODUCTEURS LOCAUX D'ELECTRICITE UNIPER RENEWABLES FRANCE URBASOLAR VAISALA FRANCE SAS VALECO SAS VALOREM ENERGIE VATTENFALL EOLIEN SAS VENDEE ENERGIE VENSOLAIR VENTELYS VENTIENT ENERGY VENTIS VENTS DU NORD VERSPIEREN VESTAS FRANCE VINCI CONSTRUCTION SERVICES PARTAGES VIRIDI ENERGIES RENOUVELABLES VOLKSWIND FRANCE SAS VOLTA AVOCATS VOLTA DEVELOPPEMENT (EOL PROD 1) VOLTALIA VOLTAN ENERGIES VOLTERRES VSB ENERGIES NOUVELLES VULCAIN WATSON, FARLEY & WILLIAMS LLP WATTABASE SAS WATTS.GREEN SARL WEB ENERGIE DU VENT WHITE AND CASE LLP WINDFAN CONSULTING WINDSTROM FRANCE WKN FRANCE WPD ONSHORF FRANCE WPD WINDMANAGER FRANCE SAS WPO ZEPHYR

APPENDIXES

STATKRAFT RENOLIVELABLES

Capgemini invent (Capgemini Pinouvelobles

124

The team behind the 2024 Observatory



Rachel RUAMPS "Economy and Industry" Project Officer

Antoine FAU Wind Industry project manager

Benoît GILBERT Chair of the Industry Committee

Matthieu Monnier Deputy CEO

In collaboration with:





Alexandra BONANNI Head of the Energy Strategy Lab

Arnaud BUZENET Managing Consultant – Sustainability & Energy Transition

Édouard GUIRAO Consultant – Sustainability & Energy Transition

Sylvain MAKENGO Consultant – Sustainability & Energy Transition

Mathieu GAZQUEZ Consultant – Sustainability & Energy Transition

Wind Observatory 2024



