FRANCE

FRANCE

In 2020, over 1.1 GW new onshore wind was built in France. This number shows a third consecutive year of decrease, well below the average of 1.5 GW over the previous years. It should in the future increase to 2 GW per year to reach the newly set targets for 2023.

DANIEL AVERBUCH,
IFPEN Energies nouvelles, France.

This brings the total wind power capacity to 17.6 GW. Wind and solar now jointly represent 50% of France renewable installed power capacity, while wind alone represented 30% of the total renewable electricity production and 8.8 % of the national electricity demand in 2020. Total annual electrical energy output from wind was 39.7 TWh, a significant increase from 2019. This increase is the result of higher installed power capacity, in conjunction with a capacity factor of 26.5 %, substantially higher than the year before.

TABLE 1. KEY NATIONAL STATISTICS 2020: FRANCE

Total (net) installed wind power capacity*	17.6 GW
Total offshore capacity	0 GW
New wind power capacity installed	1.1 GW
Decommissioned capacity (in 2020)	GW
Total electrical energy output from wind	39.7 TWh
Wind-generated electricity as percent of national electricity demand	8.8 %
Average national capacity factor**	26.5 %
Target	26.5 GW in 2023
National wind energy R&D budget	6 M€ (2019)

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

**Average National Capacity Calculation. Only include turbines in operation the whole year: (MWh production/8,760 hrs) / MW installed capacity MWh total electrical production from wind turbines operating January 1 through December 31 divided by 8,760 hrs divided by the total installed wind capacity (in MW) at the beginning of the year. [You can also use an estimate based on the average installed capacity during the year: (installed 1st Jan + installed 31st Dec)/2. But in that case, state that it is how the estimate is calculated.]

During 2020, new official objectives for renewables were defined in the decree adopted in April, that gives the energy trajectory for the country. New targets are given for onshore and offshore wind.

Most awarded offshore projects started their construction, while a new tender for 1 GW of offshore wind in Normandy was launched.

In 2020, wind energy became the third electricity source in France, after nuclear and hydro power. Wind generated electricity covered 8.8 % of the national electricity demand.

Market Development

Targets and Policy

Along with the Paris Agreement during COP21, France defined new trajectories for renewables after adopting the Energy Transition for Green Growth Act in 2015. After that, the law related to Energy and Climate was enacted November 8th, 2019 and set new targets for energy, namely:

- 23 % of renewable energy share in 2020
- 33 % of renewable energy share in 2030 (40% in electricity), with a decrease of 40% of GHG emission (with respect to 2012)
- A decrease for nuclear to 50% share of electricity

To practically reach these targets, the Pluriannual Energy Program (Programmation Pluriannuelle de l'Energie, PPE) defines renewable energy target trajectories between 2018 and 2023. New trajectories for each renewable energy source are defined in the PPE.

The decree enacting the PPE was published April 21st, 2020 with updated targets for 2023 and 2028. For 2023, targets are:

- 24.1 GW land-based wind power capacity
- 2.4 GW fixed bottom offshore wind
- 20.1 GW solar energy
- 25.7 GW hydro power

The PPE sets also targets for 2028 of between 33.2 and 34.7 GW of land-based wind power capacity and between 5.2 and 6.2 GW of offshore wind power capacity.

The PPE also includes a schedule and target prices for coming offshore wind tenders. Floating wind tenders are included, as explained in the following table

Progress and Operational Details

During 2020, France reached a quantity of 1.1 GW [2,3] of new wind-power capacity, which is the third consecutive decrease of yearly installation (see figure 1).

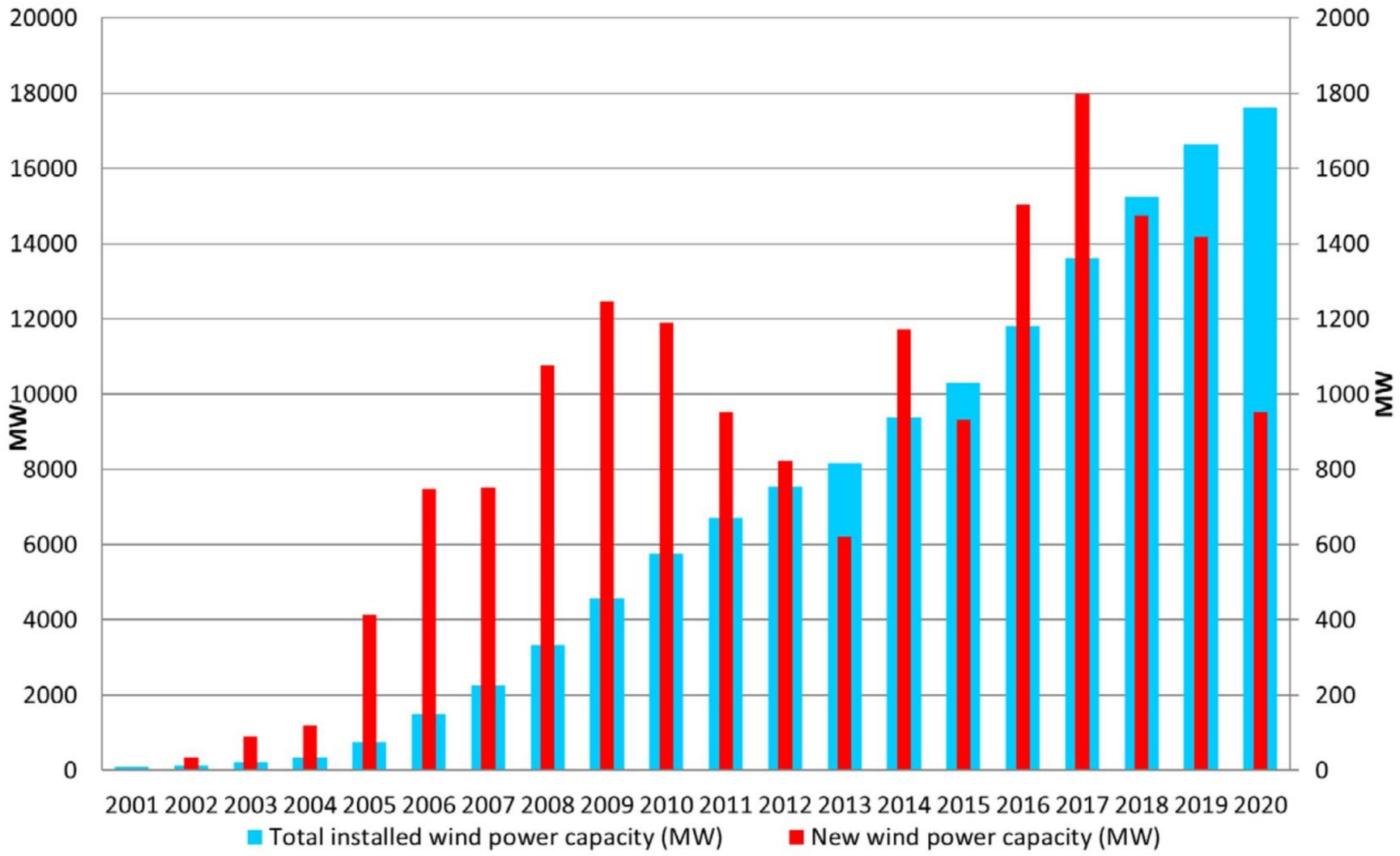

FIGURE 1. NEW AND TOTAL INSTALLED WIND POWER CAPACITY

This deployment rate will require a step increase above 2 GW per year to reach the newly set targets of the PPE, for 2023. This leads to a total of 17.6 GW of installed capacity, with installed capacity concentrated in the North and East of the country (see figure 2).

With a significantly superior capacity factor (26.5%) than previous year thanks to increased capacity and better wind conditions, wind-generated electricity production totaled 39.7 TWh, more than 17% increase with respect to 2019. The percentage of electricity demand (excluding overseas territories) met by wind energy increased to 8.8%.

Three instances of onshore wind tenders happened in 2020 for a total of 1380 MW, with average prices decreasing from 65,4 €/MWh in 2017 to 59.7€/MWh for the 6th period ending in July 2020 [4]. The average name plate capacity for this last period is 3.1 MW, significantly above the average of the wind turbines currently installed (2.4 MW per wind turbine installed in 2019). It is worth noting that the maximum tip height exceeds 150 m for 72% of the selected projects [4].

The development of offshore wind progressed in 2020, with the start-up of the construction of 3 (Saint-Nazaire, Fécamp, Saint-Brieuc) of the 6 awarded wind parks from round 1 and 2 tenders. After the award of the Dunkerque project in 2019, a project of 1 GW is being tendered in 2020 in Normandy. It will enter a phase of competitive dialogue in 2021, along with the first floating wind tender for 250 MW in South Brittany

Matters Affecting Growth and Work to Remove Barriers

Since 2017, several measures have been adopted to foster the development of wind in France and improve the consenting.

Following this trend, on December 8th, 2020 the counsel for ecologic defense announced several measures to favor a harmonious development of wind energy. It features, propositions for reducing lighting and signaling of wind turbines, improving the recycling of wind turbines (with targets for 2022 and 2024) and generalizing the removal of concrete foundations during dismantlement. Other measures focus on improving the consenting process and favoring the implication of local communities and citizen in wind related projects.

R,D&D Activities

National R,D&D Priorities and Budget

- The development of offshore wind and large wind turbine technology has been a priority in the recent years. The French Environment and Energy Management Agency (ADEME) is the driving funding agency for applied R,D&D projects in this area. ADEME funds and administers three kinds of projects: PhD theses; R&D projects for intermediate technology readiness levels (TRL); and the Programme des Investissements d'Avenir (PIA), which is dedicated to industrial projects, and funded by subsidies, reimbursable aids, and possibly equity.

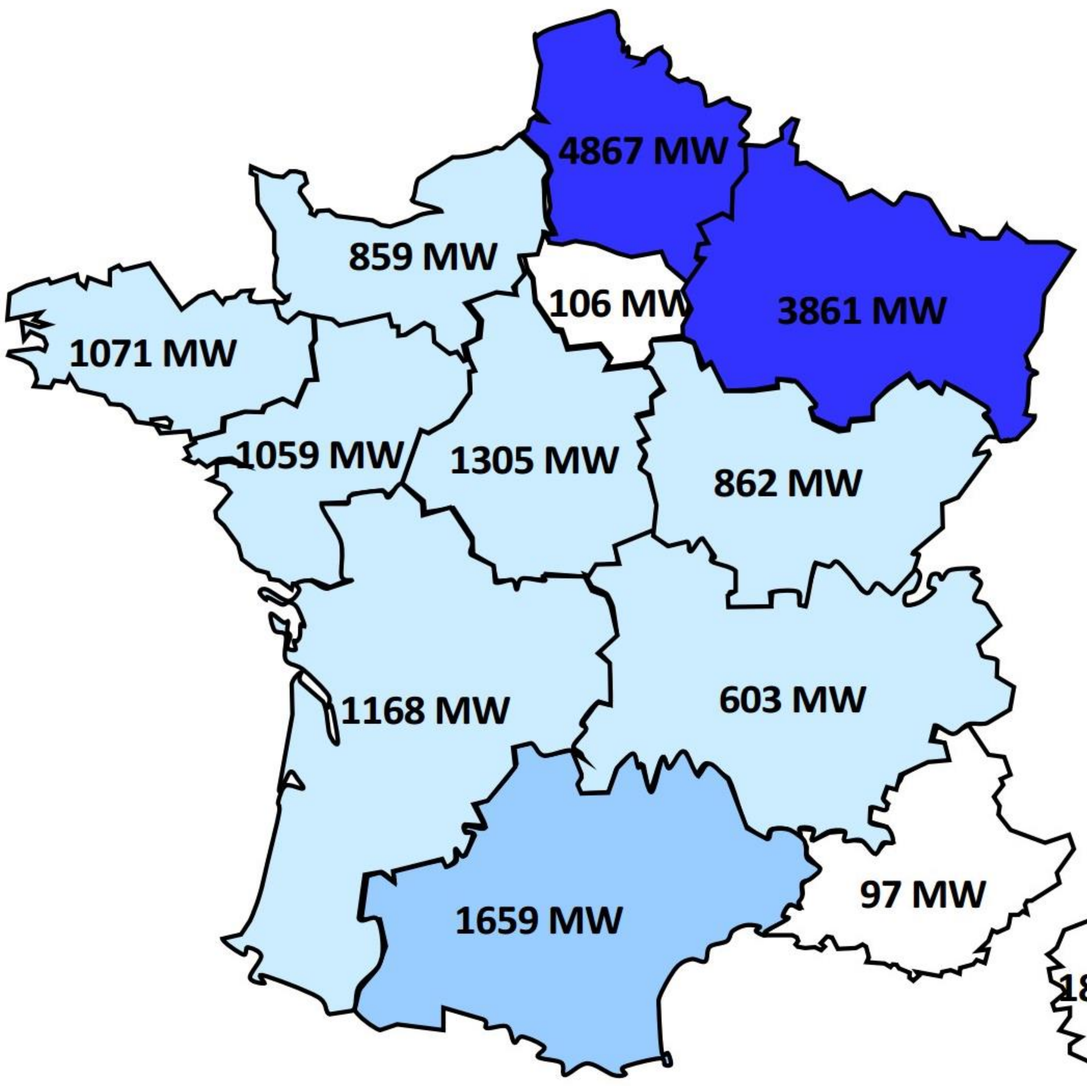

FIGURE 2. TOTAL INSTALLED WIND POWER CAPACITY IN THE DIFFERENT ADMINISTRATIVE REGIONS

- After a call for proposals in 2009 on ocean energies, which included floating wind technologies, another call was launched in 2013 and four industrial demonstration projects were awarded by ADEME (see the IEA Wind TCP 2015 Annual Report).

- Since the first calls in 2009, floating wind technology has been prioritized as a strategic area. France has a favorable situation for floating wind, local harbor facilities, and a local naval and offshore oil and gas industry capable of addressing this market. A dedicated call for tender for floating wind farm pilot projects highlighted the focus on floating wind.

- Though several national public organisms perform R&D on their own budget, the dedicated R&D budget for 2019 is 6 M€ [5], with 9.4 M€ in addition for the support of demonstration projects.

National Research Initiatives and Results

- The Momenta (farM rOtor ModEl accouNting aTmospheric wAke turbulence) project is ongoing after having been awarded funding by the ANR. Partners are the LA, LHEEA, PRISME labs, IFPEN and VALEMO which a French O&M company. The objective is to study atmospheric and wakes turbulence effects influence on wind turbine loads. Lidar and drones will be used to measure in-situ the wind conditions. Experimental work at small scale and modeling tasks will also be performed.

- The ePARADISE (Evaluation des Perturbations AéRodynamiques sur les pales pour l'Amélioration de la Durabilité et de l'Impact Sonore des Eoliennes) aims at developing a sensor to measure the air flow near wind turbine blades, to optimize their operations and minimize acoustic emission. It os operated by ECN/LHEEA, CSTB, Mer Agitée and VALEMO.

- Several floating wind demonstration projects are ongoing, including the EOLFLOAT project led by Dietswell, the AFLOAT project led by SAIPEM, the EFFICACE project led by Eolink.

- Within a call featuring the topic of Wind and Biodiversity, the projects SEMMACAP, OPRECH, ORNIT-EOF, ECOSYSM-EOF, EOLBIO and MAPE have been selected by the ADEME, and study the impact of wind turbines on mammals, bats and birds, in different situations, including the specifics of floating wind.

- Finally, the H2-Ouest led by LHYFE was awarded funding by the ADEME to look at the production of Hydrogen from wind generated electricity.

Test Facilities and Demonstration Projects

- The four pilot projects awarded in 2016 for floating wind farms have progressed on permitting and engineering work. As a reminder, the Groix and Belle-Ile project is located on the Atlantic coast, while the EoldMed project, Eoliennes Flottantes du Golfe du Lion project, and the Provence Grand Large project the Mediterranean. These projects are now targeting installation in 2022/2023.

- Along the SEMREV test site on the Atlantic Coast, the Mistral floating wind test site on the Mediterranean will be developed by Valeco/EnBW, in cooperation with France Energies Marines. It targets a first demonstrator with the HexaFloat technology from SAIPEM in 2023.

Collaborative Research

- Since joining IEA Wind TCP in 2014, nearly 15 French organizations, including private companies, Regional Transmission Organizations (RTOs), Small to Medium Enterprises (SMEs), and laboratories, have expressed interest in collaborative research. France has contributed to the following IEA Wind TCP Tasks with positive results:

- Task 25 Design and Operation of Power Systems with Large Amounts of Wind Power

- Task 29 Analysis of Wind Tunnel Measurements and Improvement of Aerodynamic Models

- Task 30 Offshore Code Comparison Collaboration, Continued, with Correlation (OC5)
- Task 31 WAKEBENCH: Benchmarking of Wind Farm Flow Models
- Task 32 Lidar Systems for Wind Energy Deployment
- Task 33 Reliability Data: Standardizing Data Collection for Wind Turbine Reliability, Operation, and Maintenance Analyses
- Task 34 Working Together to Resolve Environmental Effects of Wind Energy (WREN)

Several other tasks including Task 36 Forecasting for Wind Energy, Task 44 Farm flow control, and Task 45 Recycling of wind turbines blades, are also being considered.

Impact of Wind Energy

Environmental Impact

- While total renewable power capacity reached 55.9 GW at the end of 2020, of which wind energy contributed to provided approximately 31% of the overall installed renewable power capacity in France. Wind and solar now represent jointly 50% of the total capacity, wind being the second largest source after hydroelectricity.
- Renewable electricity represented 26.9 % of the total consumption in 2020, in terms of electricity production, wind contributed to 30% of the total renewable energy production, equaling to 8.8% of the total electricity consumption, which is a record high number.

Economic Benefits and Industry Development

- According to [1], wind energy represented a total of 20,200 full time equivalent jobs at the end of 2019, with a steady growth over the last two years. Studies and development represented 6,300 employees, while manufacturing of wind turbines and components account for an estimated 4,600 employees. Engineering and construction represented 5,400 employees while Operations and Maintenance provided 3,900 jobs.
- It is worth mentioning that several industrial players such as Vergnet, and, more recently, Poma Leitwind, contribute to the French wind industry, along with facilities from several large wind turbine suppliers such as GE, Siemens- Gamesa, and an LM Windpower blade factory.
- A variety of suppliers already exist, such as Atlantique Offshore Energy (formerly STX) for offshore substations and foundations, Nexans for the electric cables, Leroy-Somer for generators, and Rollix for blade and yaw bearings. Several SMEs are also providing advanced technologies; for example, LeoSphere is a leading lidar provider, while METEODYN and METEOPOLE provide service and software for wind resource assessment. This situation is currently evolving quickly, along with the development of a local offshore industry.
- In addition, important infrastructures are being carried out in the Brest harbor for bottom-fixed and floating projects, and the Port-la-nouvelle harbor for floating wind. These new infrastructures will foster the development of offshore wind in France.

Next Term

In 2021, the development of offshore wind will reach new milestones, including the start-up of the construction of additional offshore projects and the progress of the bottom-fixed Normandy project and South Brittany floating wind project tendering processes.

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