ENERGY

France Wind Farms
Praxis and Development / Technical View

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05 June 2018

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Introduction to DNV GL

Technical Due Diligence

Regulatory Framework

Wind Farm Projects in France

Market Developments

DNV GL: a quality assurance and risk management company

MARITIME | **OIL & GAS** | **ENERGY** | **BUSINESS ASSURANCE** | **DIGITAL SOLUTIONS**

150+ years

100+ countries

100,000 customers

12,500 employees

5% of revenue spent on R&D

What is 'Technical Due Diligence' ?

Due diligence is the term given to the broad, thorough and independent investigation of an "asset" to help ensure that a potential acquirer gets what they believe they are paying for. Typically this will consider tax, legal and technical aspects of the acquisition or investment.

Common themes in our reviews:

- ***Reliability:*** **Suitability of the turbine for the site specific conditions.**
- ***Productivity:*** **Accuracy of the energy yield prediction given site specific conditions.**
- ***Performance:*** **Adequate construction and operational performance warranties.**
- ***Interfaces:*** **Comprehensive and fully integrated scopes of works.**
- ***Compliance:*** **Fulfilment of specific technical requirements.**

Essentially, we look to spot / rectify omissions, errors, conflicts or trends which might either lead to increased capital cost or reduced operational income.

Who takes interest in a Technical Due Diligence?

Lenders

- Identification of loan risks
- Decision support on whether loan can be granted and,
- if yes, under which conditions

Investors

- Identification of technical chances and risks for the Client's overall investment strategy
- Verification and evaluation of information provided by the Seller

Vendors

- Technically viable presentation of the Project to potential investors
- Identification of potential threats from independent third party before start of selling process

General

- Potential strengths and weaknesses in the project identified by an independent third party
- Comparison to wind industry benchmarks

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Technical Due diligence objectives

- **Site Appreciation**
- **Energy**
- **Construction Contracts & Interfaces**
- **Balance of Plant Design**
- **Turbine**
- **Contractor Experience**
- **Schedule**
- **Operating Contracts**
- **Grid Connection**
- **Power Purchase Agreement**
- **Planning and Environment**
- **Financial Model**

- ✓ **Review and assess risks**
- ✓ **Minimise risk through design**
- ✓ **Allocate risk through contracts**
- ✓ **Cover risk through warranty**
- ✓ **Address risk through loan sizing**
- ✓ **Address risk through loan pricing**

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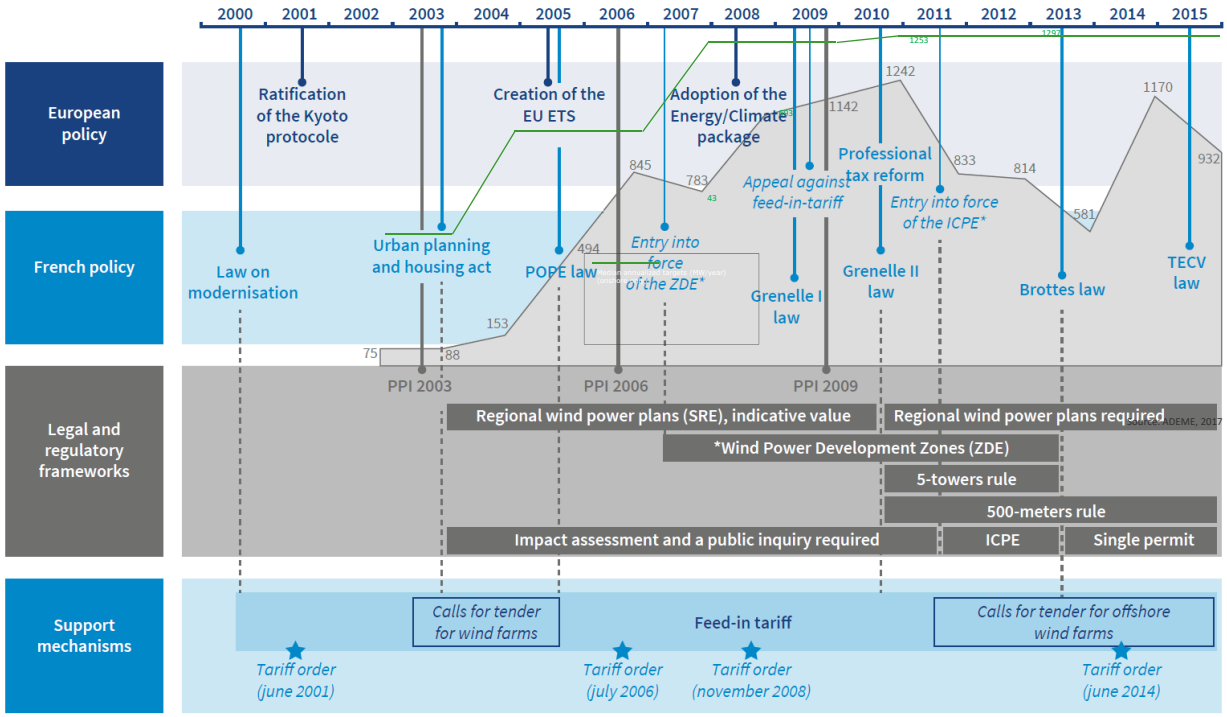
Regulatory Framework

- **High political renewable ambitions and goals**, between 21.8 and 26.0 GW by 2023, which is almost a doubling of the installed capacity in 2017 of 13.8 GW, reinforcing the role of wind energy in the energy transition strategy of the French government.
- Historically **lengthy concession process with high probability for appeals**. May take up to ten years or more. However, measures are underway for easing this process.
- **The greenfield potential in France is potentially high**, with large areas currently blocked for development. This might change in the future with the current government in favour of renewable energy.
- The grid connection cost is borne by the developer. Final costs may be up to 15% higher than foreseen in the financial proposal in the connection agreement proposed by ENEDIS.



Source: ADEME, 2017

Different tariff mechanisms over time

- **Pre 2016:** PPA-FiT (~82€/MWh adjusted after year 10, for 15 years)
- **In 2016:** Market premium (transitional regime with similar characteristics as previous FiT)
- **2017 and after:** A market premium system (74 - 72 €/MWh up to cap depending on rotor diameter, then 40€/MWh; for 20 years) for smaller wind farms and a competitive tender process for larger wind farms.

Description of grid connection process onshore wind

Request
- Based on standardized data collection sheets ("fiches de collecte"), part of the technical application file.
- Contain key information of the project (power, number of turbines, location, etc.). Additional studies might be required.

Proposal (PTF)
- The DSO (Enedis) will issue an initial technical and financial proposal (PTF) for the grid connection of the project, containing details of the technical solution (voltage, connection point) as well as provisional costs and planning.

Connection agreement
- If the PTF is accepted, the DSO will later propose a grid connection agreement (CR) containing final costs and planning.
- The final CR costs might be up to 15% higher than foreseen in PTF

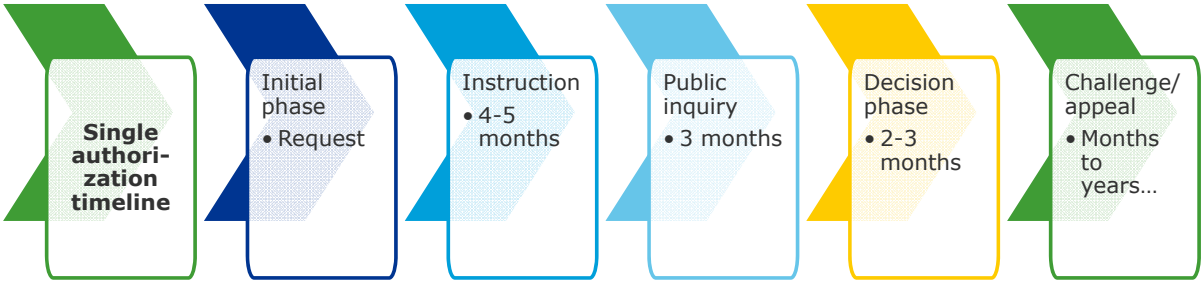
Connection works
- Once the CR is accepted, the DSO will perform the grid connection works until the wind farm substation or the agreed connection point.
- Once the mandatory electrical inspections have been performed, the DSO will allow the energization of the cable
- wind farm has 2 years time for connection

Access agreement
- Prior to COD, the DSO will sign an access agreement (CARD) with the project, to allow the injection of energy to the grid.
- Initial run tests and configurations must be performed jointly between the TSO and the project before first power.

Description of consenting and permitting process

The **single authorization** (or unique authorization) is one of the tangible results of the French Government's willingness to simplify administrative procedures. For WTGs and biomass systems, the single permit system represents a "merger" of administrative procedures, including building, environmental and operational permits. There will be a single decision of the prefect. It will bring together various decisions relating to the Water Act, Natura 2000 assessments, exemptions from the prohibition of infringement of protected species, ICPE authorizations, clearing authorizations, operating authorizations, approvals of transport works, electricity distribution and building permits.

Since November 2015, the "single authorization" was gradually extended to all wind farm projects in France. Before, multiple permissions were required for a single project. This constituted more administrative work on the part of the developer.



Permitting Process

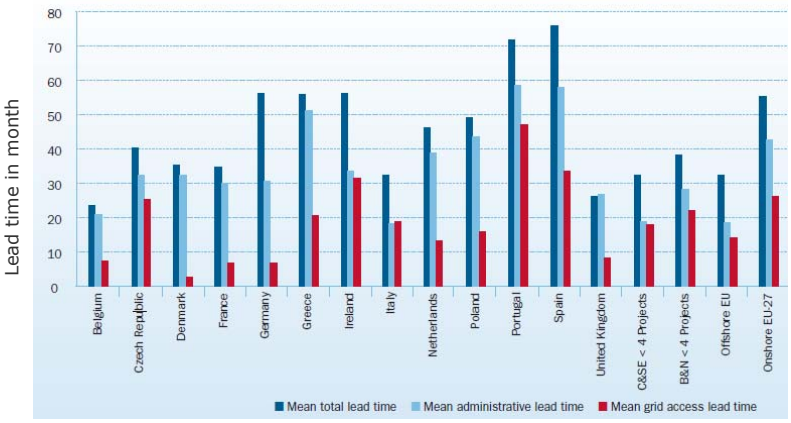
- PC - Building Permit
- ICPE – Operational Permit
  - since 2011
- Several other permits
- Unique authorization– Environmental Permit
- Complicated with Grid connection

ICPE slowly takes effect (Inspections, Post-Construction Noise / Environmental examination, understanding)

Consenting and permitting process

Typical period to obtain the required administrative authorizations

- 18 months for the building permit (for wind turbines longer than 12 meters)
- 14 months for the ICPE authorization
- 16 months for the grid connection agreement
- 4 months for the authorization of exploitation
- 3 months for the certificate giving right to the authorization of purchase
- 3 months to obtain the contract of purchase of electricity



Source: EWEA 2010, WindBarriers survey Administrative and grid access barriers to wind power.

Development times in France are long. In average, projects spend 5-7 years in the authorisation process, and can reach 10+ years due to legal challenges.

This is expected to improve in the future as the French government aims at implementing measures in this direction (e.g. unique permit)

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Turbine construction

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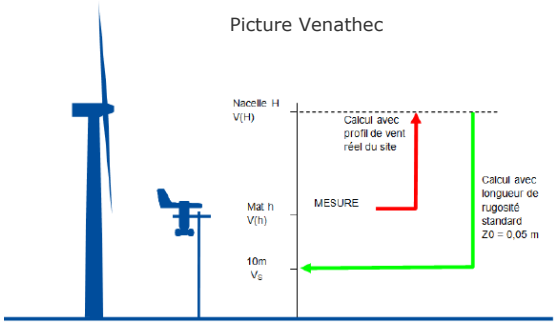
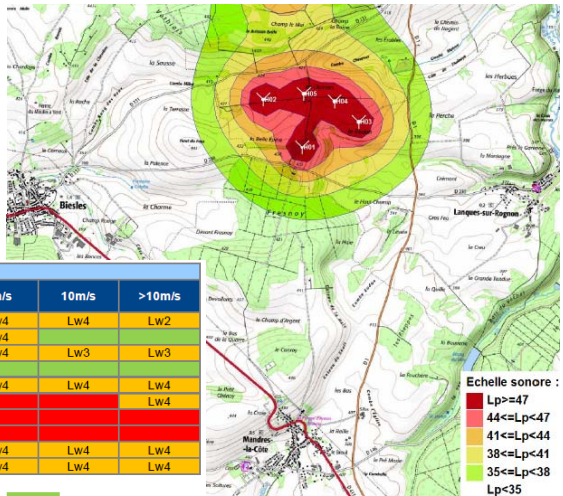
Noise in France

- Based on ICPE / norm NFS 31-114 three main criteria
  1. Allowed Emergence Against Background Day (7h - 22h): 5dB(A), Night (22h - 7h): 3dB(A) noise level if >35 dB(A) including new turbine
  2. Absolute noise 60 dB(A) during the night R are included (R= 1.2 x tip height)
  3. Marked tones must not exceed 30% of period
- Preconstruction and Postcontruction Assessment

Picture Venathec



Principe du calcul de la vitesse standardisée Vs



Point n°6 - La Herse - Période nocturne 22h-5h30 - Direction O

Night Curtailment plan									
Standard wind speed at 10m height	3m/s	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	>10m/s
E02							Lw4	Lw4	Lw2
E03				Lw7	Lw4	Lw4	Lw4		
E04				Lw7	Lw4	Lw4	Lw4	Lw3	Lw3
E05				Lw4	Lw4				
E06					Lw2	Lw2	Lw4	Lw4	Lw4
E07			Lw7	Lw7					Lw4
E08									
E10									
E11				Lw4	Lw4	Lw4	Lw4	Lw4	Lw4
E12				Lw4	Lw4	Lw4	Lw4	Lw4	Lw4

Standard mode
Low noise mode
Stop

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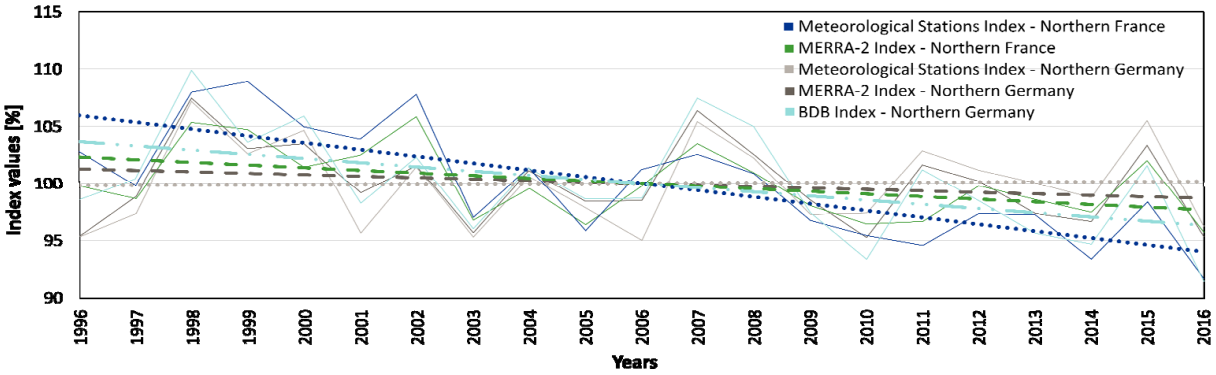
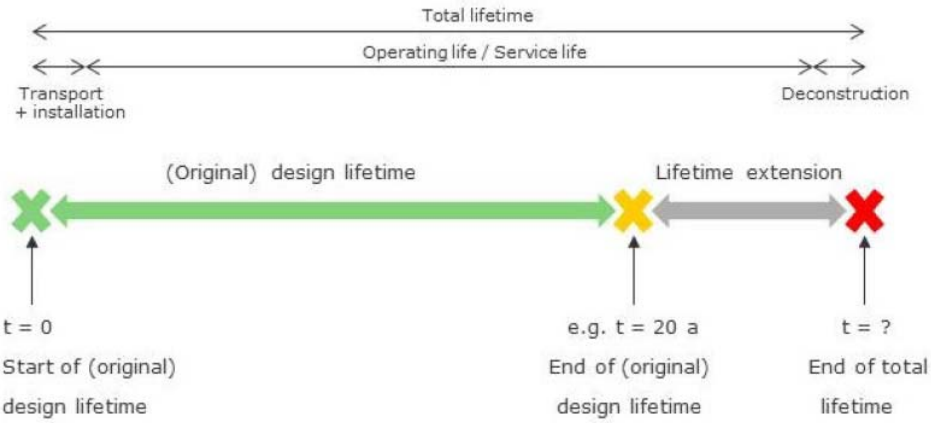
Energy Production Assessment

	Wind Farm Rated power	12.0	MW	
0	Gross Energy Output		GWh/annum	Relevant: Data basis / long-term
1	Wake effect	##.#	%	Future: Review of public data basis
2	System availability	##.#	%	Experience / Project
3	Electrical efficiency	##.#	%	Relative high
4	Turbine performance	##.#	%	To be considered
5	Environmental	##.#	%	Icing…
6	Curtailment	##.#	%	Highly relevant
	Net Energy Output		GWh/annum	



Operational life

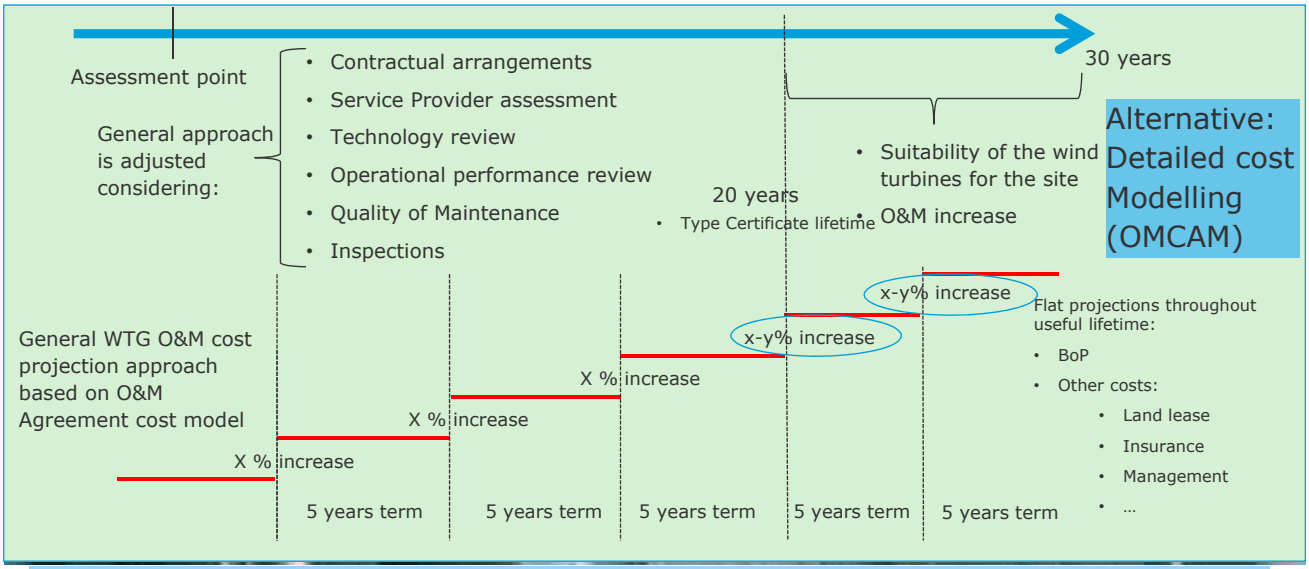


- **Structural 'Design life'** (Certified) of the turbines is generally 20, sometimes 25 years.
- **Structural 'Site life'** - the achievable safe lifetime at the site specific environment
- **'Economic life'** – the time it is commercially viable to operate the turbines within structural life bounds. To be considered:
  - land lease, operating permits,
  - market conditions,
  - end of design lifetime inspections,
  - turbine performance, operational costs and accepted failure risk,
  - the economical arbitrage against Repowering.
- Transactions often based on operational lifetime of 25 to 30 – To be checked.

O&M Costs Projections

Investors need to assume costs for economical lifetime considered - 25-30 years

There are not only full service contracts



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Developers and results of first onshore wind tender

France Market Status end 2017

- Total generating: 130.7 GW
- Wind: 13.7 GW

Average project size is 23MW, 9.9 MW is the smallest, 54 MW is the largest; for a total of 22 projects. Those projects are located in 8 regions, 44% of those projects are located in Hauts-de-France. The tender rules included a 2-3€/MWh bonus for projects with community participation (20-40%). About a third of the winning schemes were in that category.

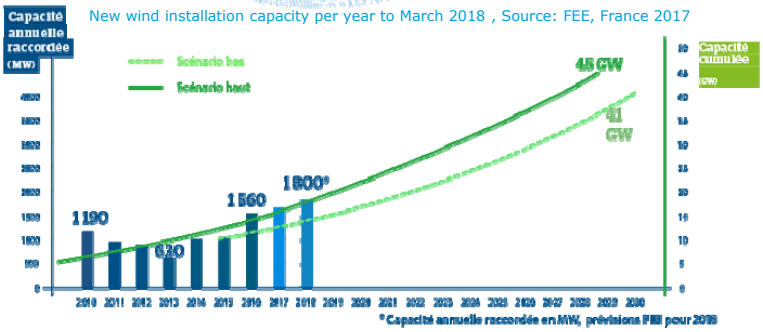
The deadline for accepting proposals in the second 500-MW auction was June 1st 2018.

Tender #	Application by	Target capacity (MW)
1	Dec 17	500
2	Jun 18	500
3	Dec 18	500
4	Jun 19	500
5	Dec 19	500
6	Jun 20	500

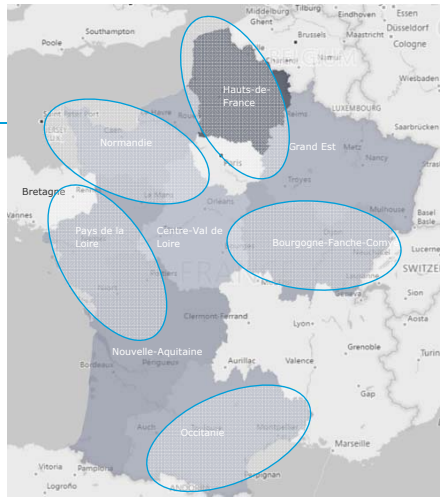
Top Developers / IPPs in France	Installed MW 30/06/17	Awarded MW in last tender 28/02/18
Engie	1,335	
EDF EN	1,250	10
Energie Team	588	
Valemo	566	36
Boralex	521	
RES	502	
Wind Prospect	498	
VSB EN	436	17
ERG / CSO	420	
EDP	406	
Kallista Energy	342	
Quadran	311	74
Enertrag	294	
WPD	257	65
Greensolver	237	
Eurowatt	231	
ABO Wind	181	
Energie Env.	167	
P&T Tech.	157	
H2AIR	137	33
TOTAL	**8,836**	**235**

Source: Finergreen, 2018

Evaluation of development projects



New wind installation capacity per year to March 2018 , Source: FEE, France 2017



Information and sources used:

- Data for development projects has been gathered from regional public databases covering the nine regions in France with the highest installed capacity (mid-2017): Grand Est, Hauts-de-France, Occitanie, Centre – Val de Loire, Bretagne, Nouvelle-Aquitaine, Pays de la Loire, Normandie and Bourgogne-Franche-Comté. However, not all sub-regional databases have been included.
- Data for wind farm projects in the Auvergne-Rhône-Alpes region is not included as the data is not easily accessible. Three regions; Provence-Alpes-Côte d'Azur, Île-de-France and Corse are left out due to low wind farm development activity.
- The format, contents and quality of the data in the regional databases varies. Some of the databases include projects with permits only, for others wind farm ratings or maturity are unknown.
- Owners have only been identified for a smaller part of the project.
- The projects included for the Normandie region have been given the status "Likely operational", as checks indicate that projects may already be operational. The projects are still included to represent the Normandie.

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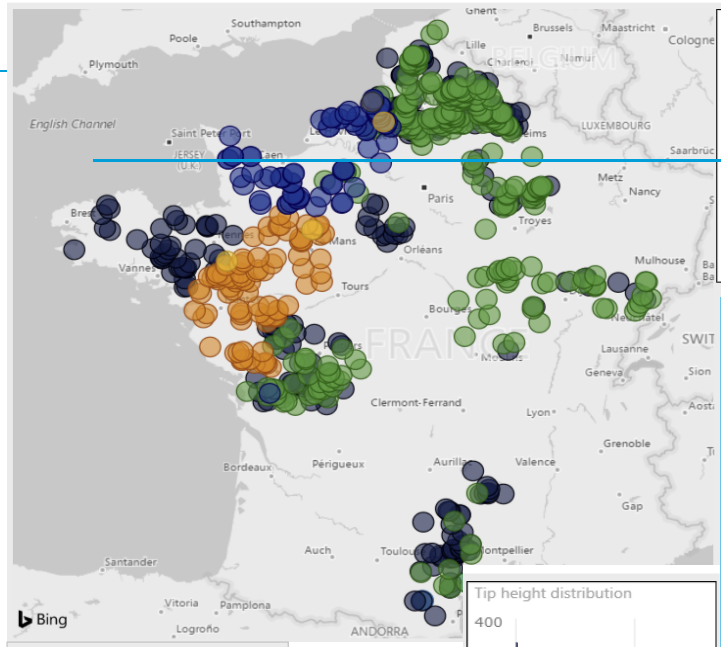
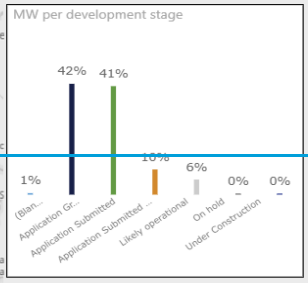
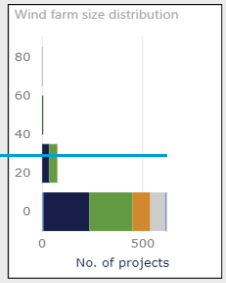
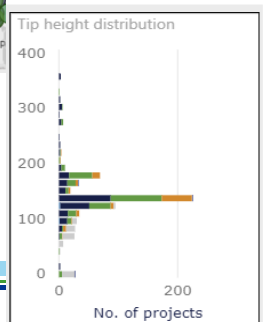
Development projects summary

10,311…	14.67	3446	135	703
Sum MW	Avg MW	No of turbines	No of Owner	No of Projects









More than 700 development projects with 10.3 GW were identified. Refused and withdrawn applications are not included in these numbers.

Of the total, 42% have permit, 41% have submitted application, 10% have submitted application that might already be granted, while 6% is likely operational.

The average size is 15 MW, and 619 of 703 projects are smaller than 25 MW.

274 of the projects, or totally 6.5 GW, are projects that are 15 MW or larger. Most of the larger projects either already have a permit or the application for permit is submitted. There is only one project with a permit for 90 MW and 30 turbines.

Market insights

- High activity on transactions is seen in the market, where developers are on sell all or part of their assets/pipeline.
- The most active players in transactions are French and international utilities, but also smaller independent investors. Often, utilities and institutional investors form Joint Ventures.
- Financing / Refinancing also plays an important role for market development.
- To reach the political targets by 2023 additional 8.0 - 12.2 GW of new wind capacity must be installed. The identified projects consists of more than 10.3 GW of wind farm potential.
- Remaining greenfield potential in France is potentially very high, as significant parts of territory are currently blocked for wind. This may change by different regulation as current national government is in favor of wind energy.
- On the other hand, announcements of further changes (offshore) create insecurity.
- Changing regulation takes time to be implemented.
- Grid connection waiting time is an important bottleneck for development. In the south, grid connection might be more limited than elsewhere due to less dense network.
- For many projects, application for PPA was conducted before (or in) 2016 under the previous (transitory) regime. Normally, these need to reach commissioning within three years (until 2019).

SAFER, SMARTER, GREENER