

Missing production: Lack of wind resource or stops due to negative spot prices?

Overview of recent years in Northern half of France

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Combined impact of wind resource and negative spot prices: Production shortfall exceeded 10% over the past 2 years

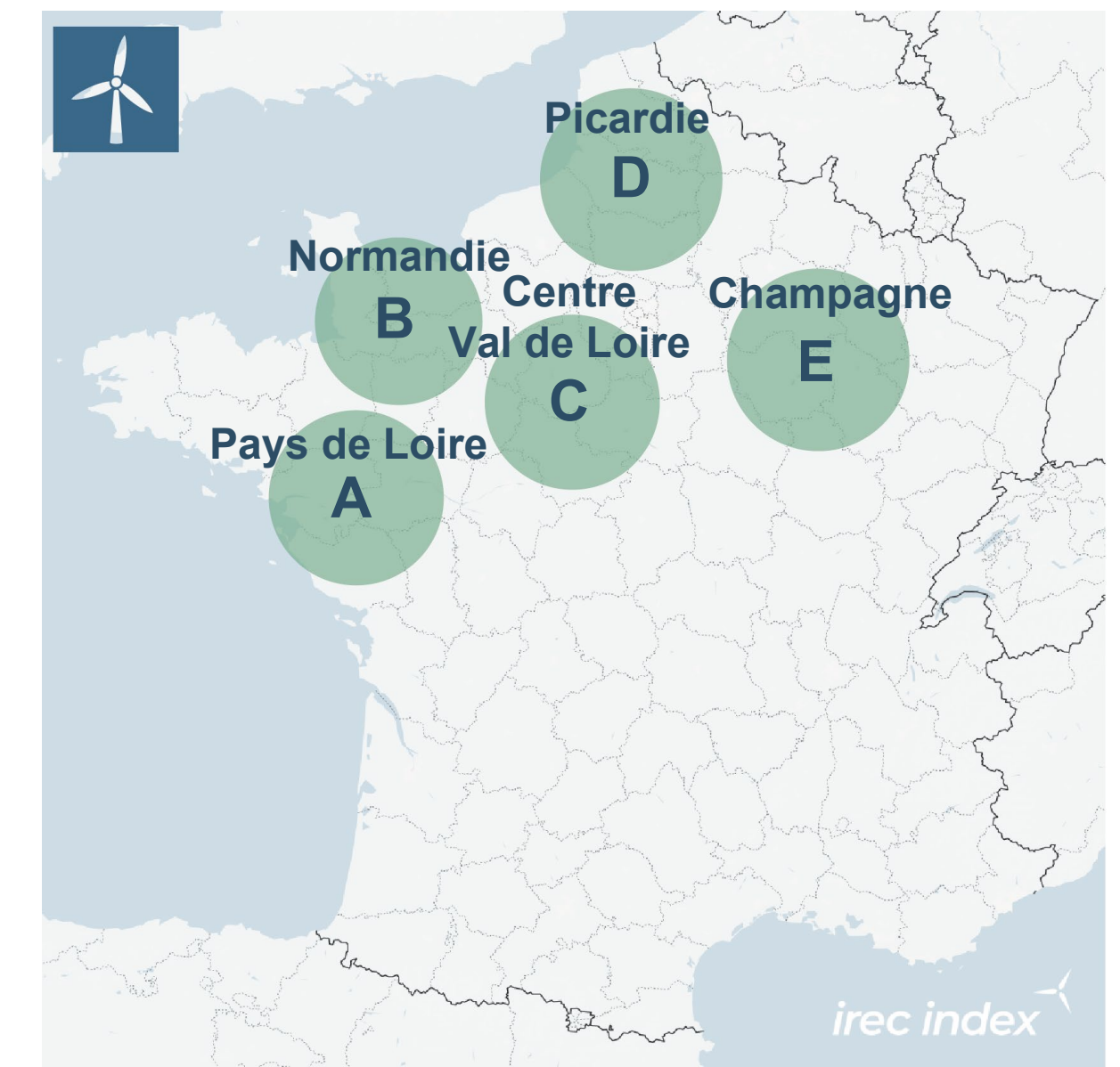
Context

In the context of growing frequency of negative spot prices periods in France, many wind farms have experienced quite significant shutdowns recently as the tariff system which has been in place for the last 10 years encourages the stop of the assets during negative price events. Although financial compensations have been received by wind farm owners, how much production was missed during these events? Moreover, this phenomenon occurred during a period when wind resource experienced significant fluctuations - from very high wind levels to lower wind levels - making it challenging to assess the true production capacity of the assets.

The present work aims to clarify the respective roles of the wind resource fluctuations and the stops due to negative spot prices in the production decrease for several regions in the Northern half of France where a significant wind power capacity is installed. Both reasons being the main causes of production variation common to many operating wind farms.

Method

The variation in production due to fluctuations in wind resource over recent years has been quantified using irec indexes, wind energy indexes established by Eoltech since 2011 and widely used today by wind farm owners (www.irecindex.com). These indexes have been also considered to estimate the foregone production in each region due to the stops during negative spot price events. The modelling accounted for stops during hours of strictly negative spot price events. As they were quite rare before 2020, the focus was made on the 6 past years.

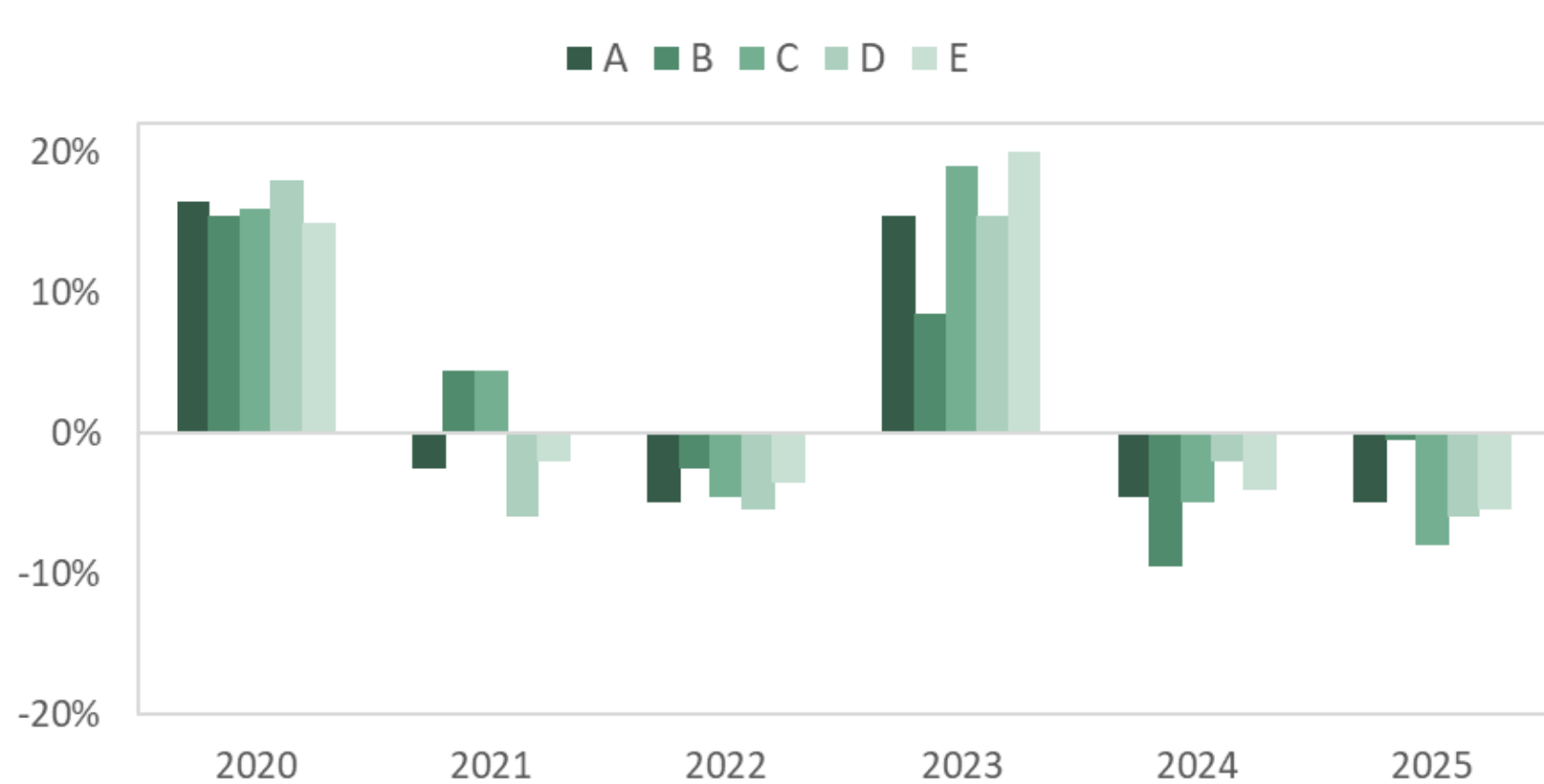


Production variation due to wind resource fluctuation

The production of wind farms has varied significantly over the past few years due to wind resource fluctuations (the decade 2016-2025 is considered as the long-term reference hereafter).

Production gain/loss due to wind resource fluctuation

Year	Region				
	A	B	C	D	E
2020	+16.5%	+15.5%	+16.0%	+18.0%	+15.0%
2021	-2.5%	+4.5%	+4.5%	-6.0%	-2.0%
2022	-5.0%	-2.5%	-4.5%	-5.5%	-3.5%
2023	+15.5%	+8.5%	+19.0%	+15.5%	+20.0%
2024	-4.5%	-9.5%	-5.0%	-2.0%	-4.0%
2025	-5.0%	-0.5%	-8.0%	-6.0%	-5.5%



2020 and 2023 were very windy, leading to production levels that exceeded +15% compared to the long-term average. The wind resource level was significantly lower in 2024 and 2025 (5% to 10% below the long-term average), resulting in a production decline of around 20% or more compared to 2023.

Occurrence of negative spot prices

The first significant episodes of negative spot prices occurred in 2020, but then were quite rare in 2021 and 2022. A significant increase is observed in 2024, and even more so in 2025.

Number of hours of negative spot prices

Year / Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2020	0	4	8	31	27	5	12	0	0	3	6	6	102
2021	0	2	3	2	18	8	5	23	0	3	0	0	64
2022	0	0	0	0	0	0	0	0	0	0	0	4	4
2023	8	0	4	2	25	14	47	0	15	3	0	29	147
2024	8	0	5	84	60	78	50	46	17	13	0	0	361
2025	0	0	10	90	133	130	7	66	57	20	0	0	513

Over the past two years, more than 85% of negative price occurrences took place between 10 am and 5 pm during the period from April to October, a time period representing less than 20% of the year.

Resulting production losses

Production losses were modelled in the different regions, assuming a systematic shutdown during hours when prices were strictly negative.

Production losses due to negative spot prices

Year	Region				
	A	B	C	D	E
2020	-1.5%	-1.5%	-1.5%	-2.0%	-1.5%
2021	-1.0%	-1.0%	-1.0%	-1.0%	-1.5%
2022	0.0%	0.0%	0.0%	0.0%	0.0%
2023	-2.5%	-2.0%	-2.5%	-3.0%	-2.5%
2024	-5.0%	-4.5%	-5.0%	-5.0%	-4.5%
2025	-5.5%	-5.0%	-5.5%	-6.5%	-5.5%

Results: combined impact

In 2024 and 2025, the production of many wind farms was significantly impacted by low wind resource levels, combined with increasing production losses linked to negative spot price events. The gap with 2023 is huge in the considered regions which have experienced a high wind resource that year, that overshadowed the impact of production losses due to shutdowns during negative prices (relatively minor that year).

Combined impact on production (Wind resource and stops during negative spot prices)

Year	Region				
	A	B	C	D	E
2020	+14.5%	+14.0%	+14.5%	+15.5%	+13.0%
2021	-3.5%	+3.5%	+3.5%	-7.0%	-3.5%
2022	-5.0%	-3.0%	-4.5%	-5.5%	-4.0%
2023	+12.5%	+6.5%	+16.0%	+12.0%	+17.5%
2024	-9.5%	-13.5%	-10.0%	-7.0%	-8.5%
2025	-10.5%	-5.5%	-13.0%	-12.0%	-11.0%

Conclusions

Many French wind farms have experienced a severe production decline over the past few years, linked to a decrease in wind resource combined with an increase of in negative spot prices episodes.

The observation of a low production level does not necessarily call into question the future production capacity of the farms if both reasons explain the production shortfall compared to the budget.

While, until now, owners have received financial compensation to cover most of the losses due to stops during negative prices events, the uncertainty on the future frequency of these events and potential changes in compensation mechanisms could influence project profitability.