THE END OF THE BEGINNING: EVOLUTION OF THE FRENCH LARGE-SCALE RENEWABLE ELECTRICITY SUPPLY SUPPORT SCHEME

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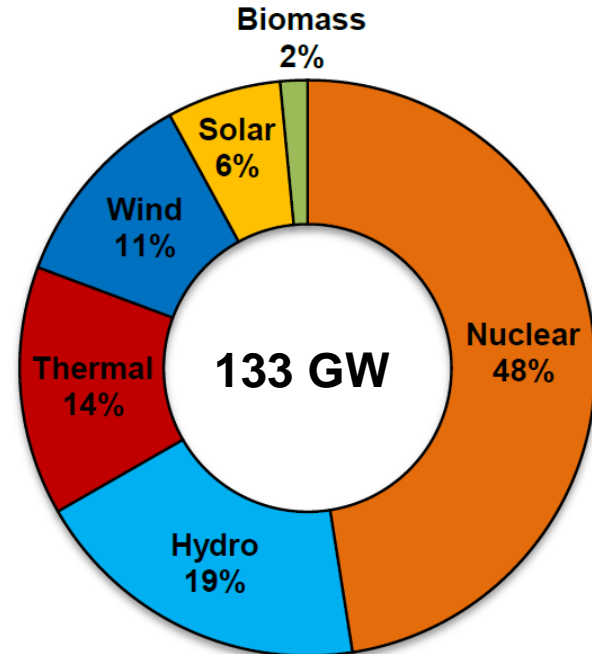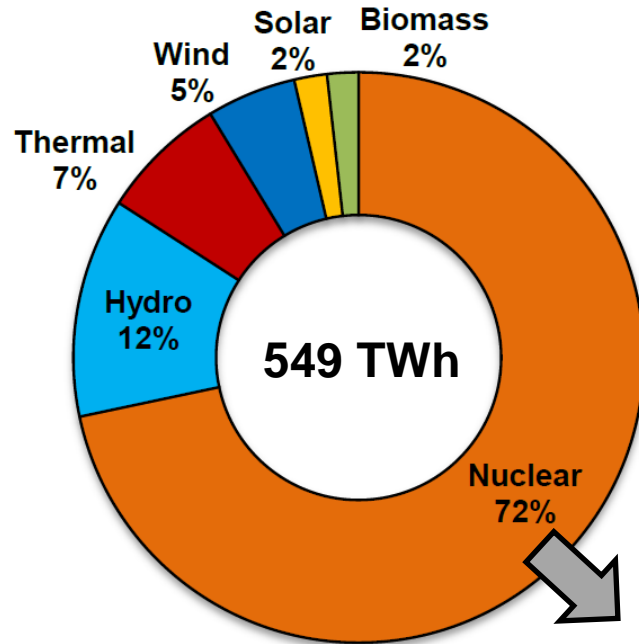**Sidney LAMBERT-LALITTE**
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France electricity sector context

*__France production (left) and capacity (right) electricity mix in 2018__*

France production electricity mix 2018 — 549 TWh:
Nuclear 72%, Hydro 12%, Thermal 7%, Wind 5%, Solar 2%, Biomass 2%

Objective = 50% in 2030

France capacity electricity mix 2018 — 133 GW:
Nuclear 48%, Hydro 19%, Thermal 14%, Wind 11%, Solar 6%, Biomass 2%

Source: RTE, Bilan électrique 2018.

Renewable energy support: the feed-in tariff

Evolution of French solar PV feed-in tariff (2006-2018)

Feed-in tariff:
1. purchase obligation
2. fixed price for every kWh produced
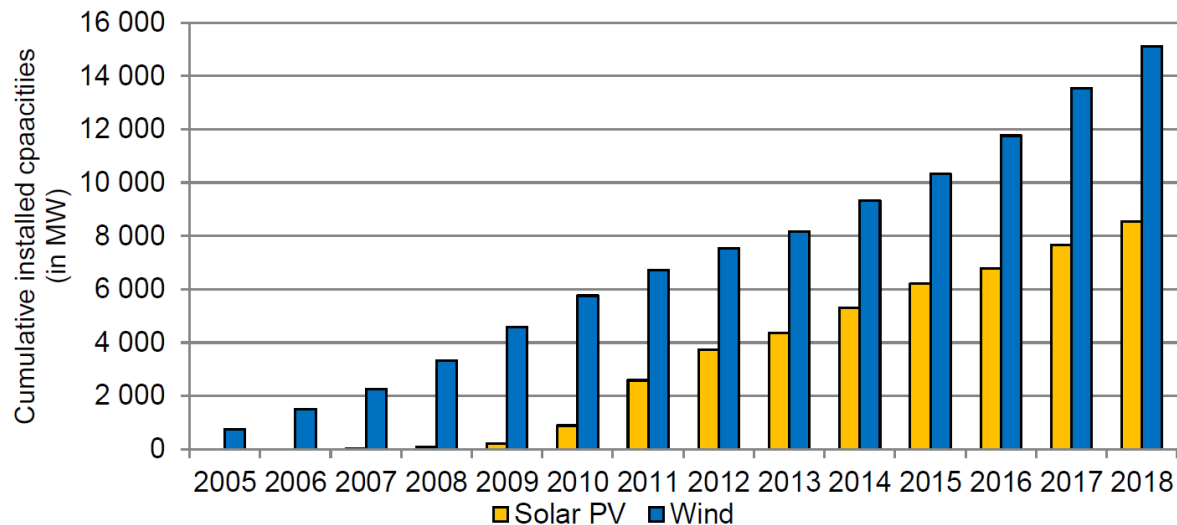3. fixed period of time of price guarantee

Legend:
- Residential [3 to 9 kW]
- Commercial & Industrial [9 to 100kW]
- Large-scale *
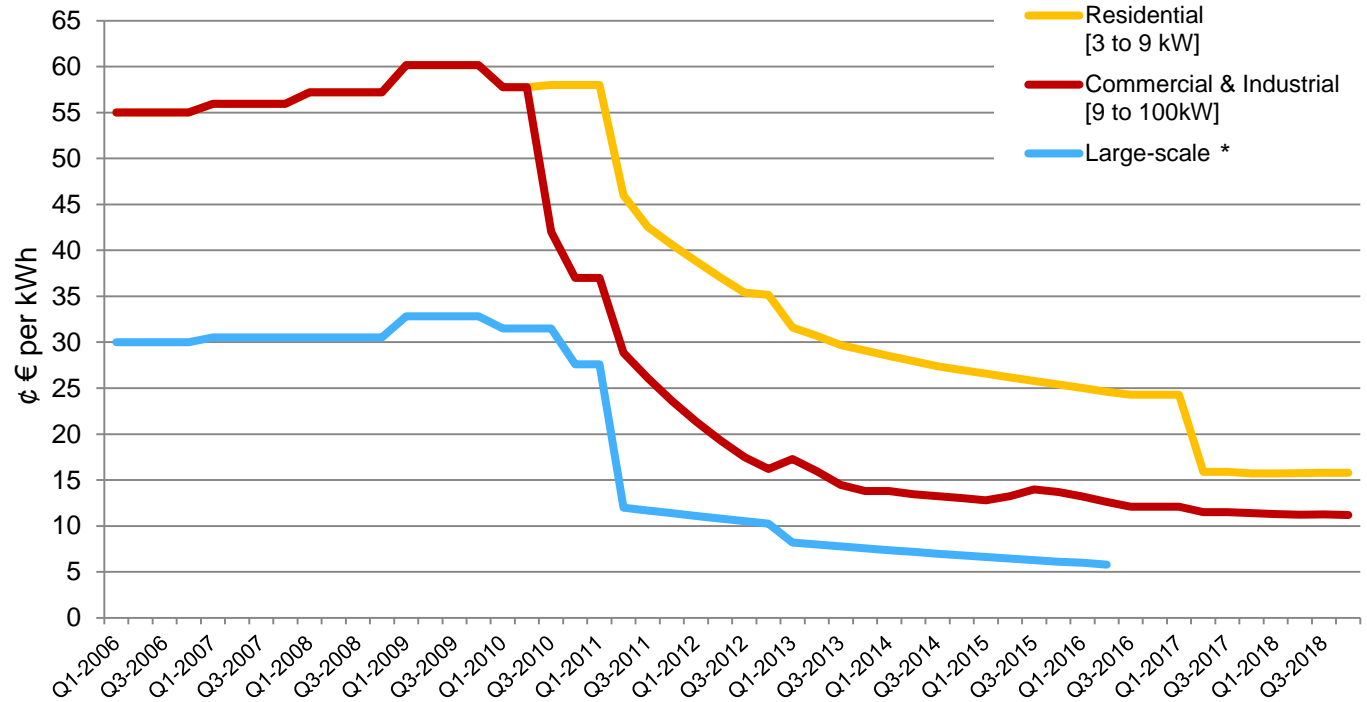
* Today, all large scale project are granted through auction
→ Tariff is set at 0.

Renewable electricity sources development (past & future)

Cumulative installed capacities for solar PV and onshore wind in France (2005-2018)


French targets in terms of solar PV and wind installed capacities (in GW)

	2018 (observed)	Target 2018 (from PPE 2016)	2023	2028
Solar PV	**8.5**	**10.2**	**20.6**	**[35.6 - 44.5]**
Onshore wind	15.1	15.0	24.6	[34.1 - 35.6]
Offshore wind	-	0.5	2.4	[4.7 - 5.2]

Source: RTE, Panorama de l'électricité renouvelable en 2018; French Ministry for the Ecological and Solidary Transition.

High penetration of variable electricity supply impact
Market eviction for thermal power plants

« Merit order » load curve (stylized)
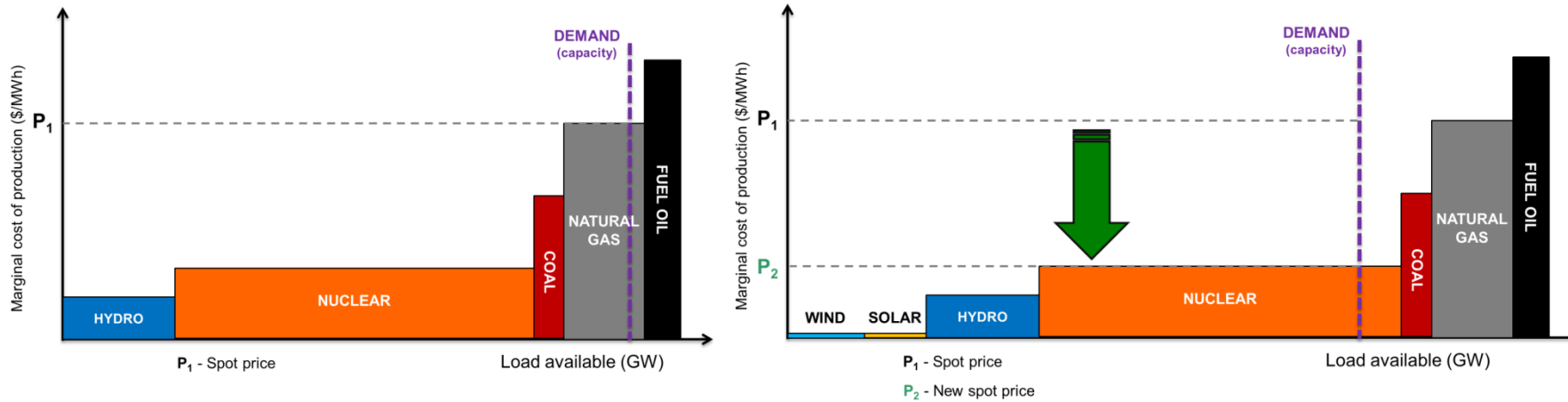
Average annual hours of operation per type of technology in France

	2007	2009	2011	2013	2015
Coal	3300	3000	2000	2900	1900
Natural Gas (CCGT)	4500	4200	3600	1500	1000

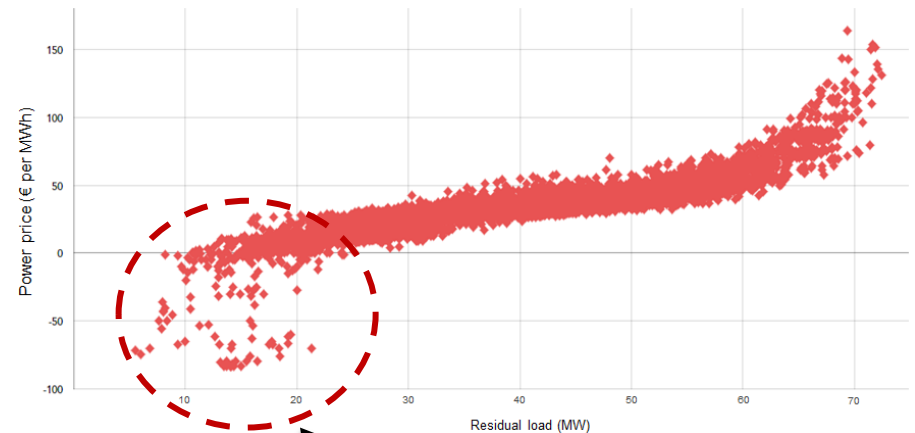Source: RTE, Bilan prévisionnel 2015.

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High penetration of variable electricity supply
Impact 2: some short-term negative price episodes

Number of hours with negative prices in France
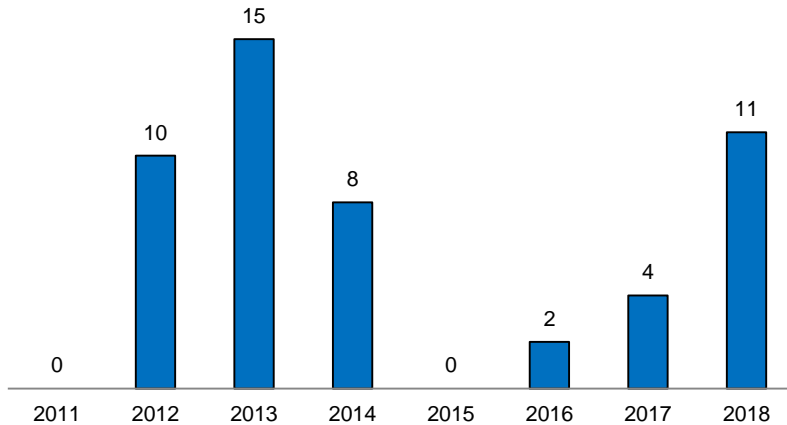
Example: Germany power prices as a function of residual load in 2017
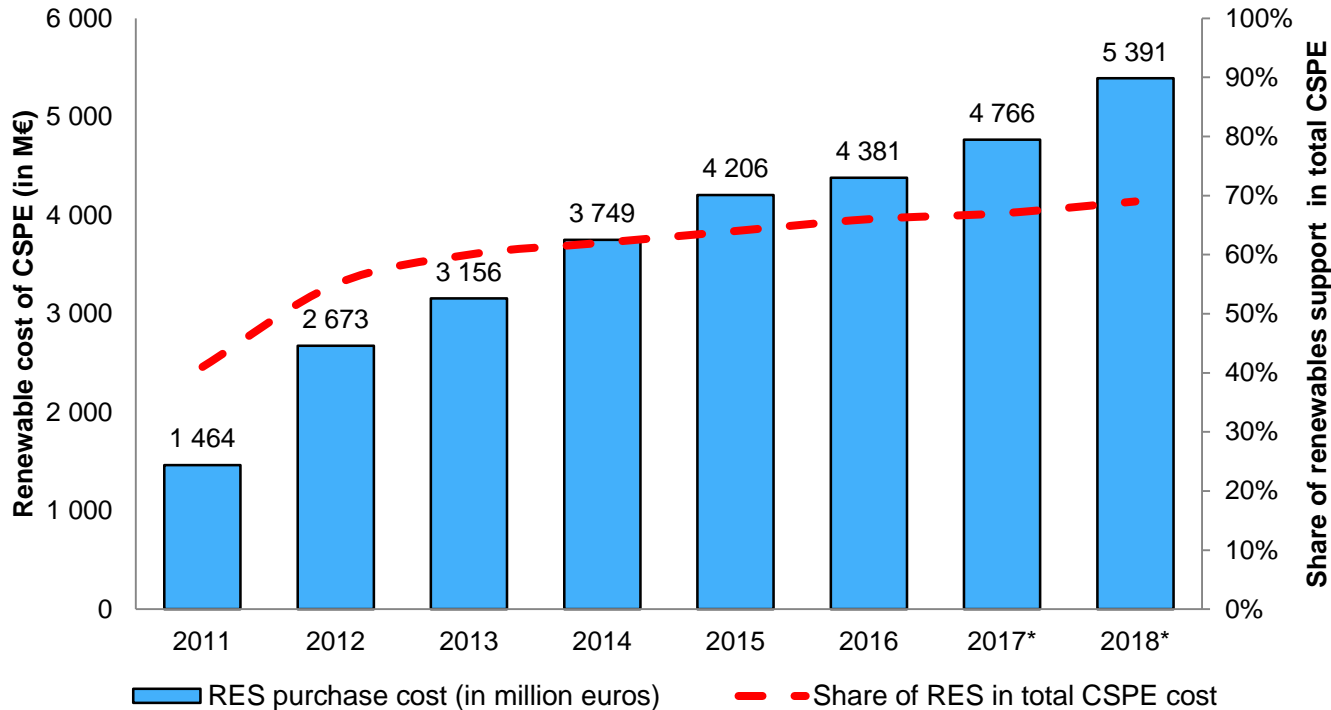

134 hours of negative prices in 2017

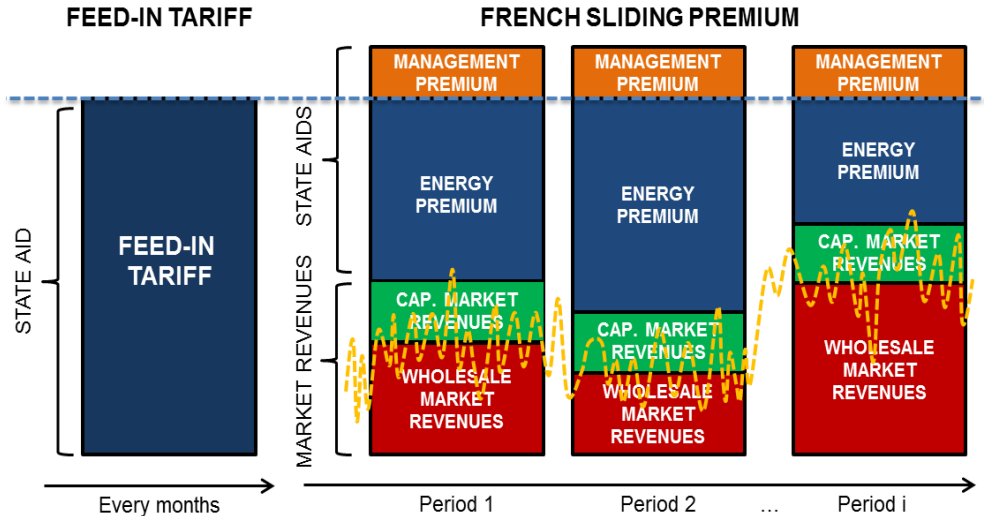# High penetration of variable electricity supply impact
A high cost burden for the community

Renewable electricity costs in French CSPE (in million euros)

Cost projection:
7 180 M€ in 2025
(75% for solar PV and wind)

Legend: RES purchase cost (in million euros) — Share of RES in total CSPE cost

* 2017 and 2018 are estimates

Renewable electricity support: sliding-premium

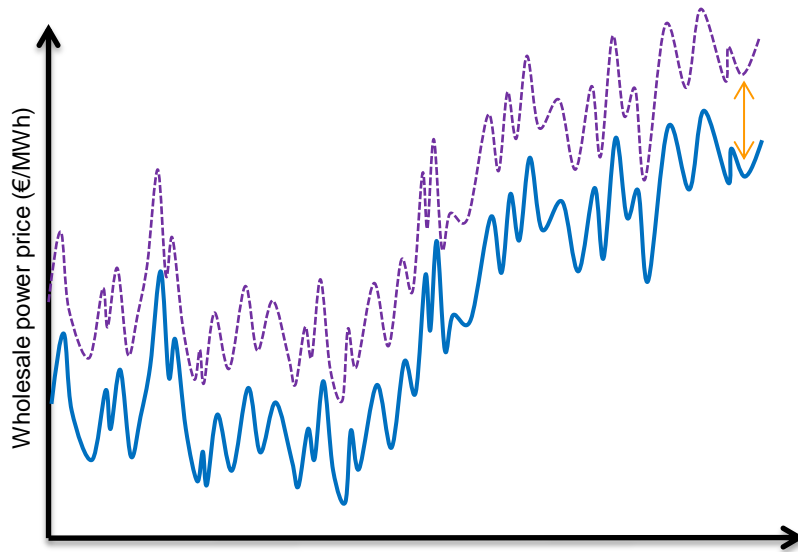
FEED-IN TARIFF

FRENCH SLIDING PREMIUM

$$SP = \sum_{i=1}^{n} q_i \times (c - p^*_i) - q_{cap} \times p_{cap} + \sum_{i=1}^{n} q_i \times p_m$$
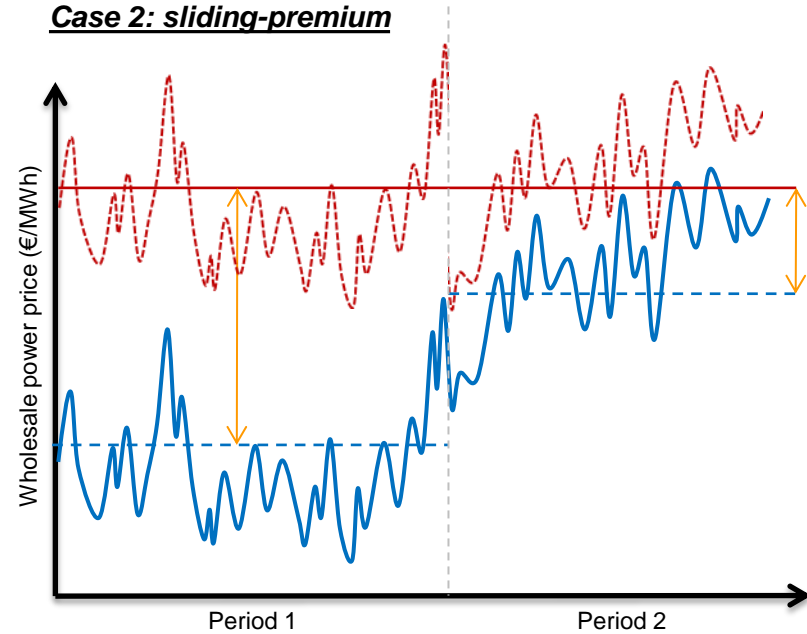
Where:

- SP: sliding premium

- q_i: the volume of electricity injected by the installation over the period i

- c: the contract reference price, defined for each market segment by the regulator, or granted through an auction mechanism

- p^*_i: corresponds to the reference market price of electricity during period i.

- q_{cap}: corresponds to the volume of capacity guarantees on the capacity market over a year

- p_{cap}: reference price on the capacity market

- p_m: corresponds to a management premium, proportional to the electricity produced.

Source: authors.

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Renewable electricity support: feed-in premium vs. sliding premium

Case 1: fixed premium

Case 2: sliding-premium

Wholesale power price (€/MWh)

Wholesale power price (€/MWh)

Period 1

Period 2

―――― Wholesale power spot price (€/MWh)

―――― Contract reference price (€/MWh), granted through auction

‒ ‒ ‒ PV producer revenue with a fixed-premium (i.e. spot price + fixed-premium)

‒ ‒ ‒ Average spot price for period i (€/MWh)

↕ Premium value (€/MWh)

‒ ‒ ‒ PV producer revenue with a sliding premium (i.e. spot price + sliding premium)

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Renewable electricity support: feed-in premium vs. sliding premium

Case 1: fixed premium

Wholesale power price (€/MWh)

Case 2: sliding-premium

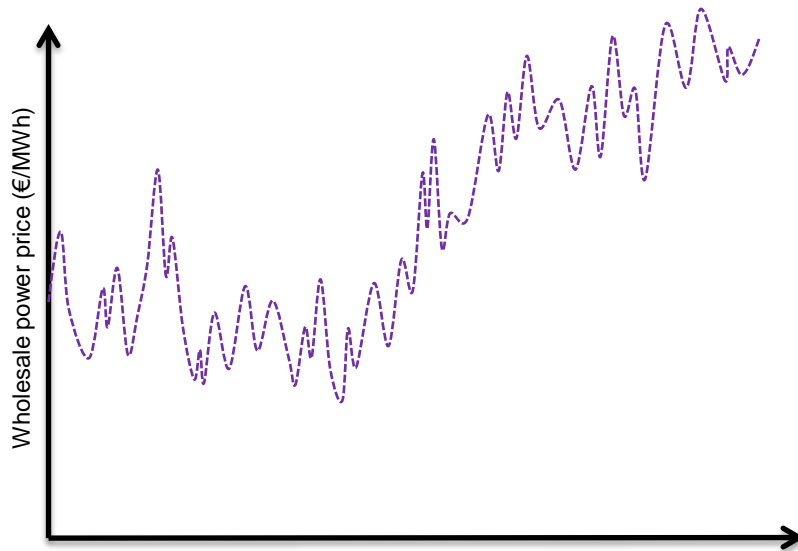Wholesale power price (€/MWh)

Period 1   Period 2

—— Wholesale power spot price (€/MWh)

- - - PV producer revenue with a fixed-premium
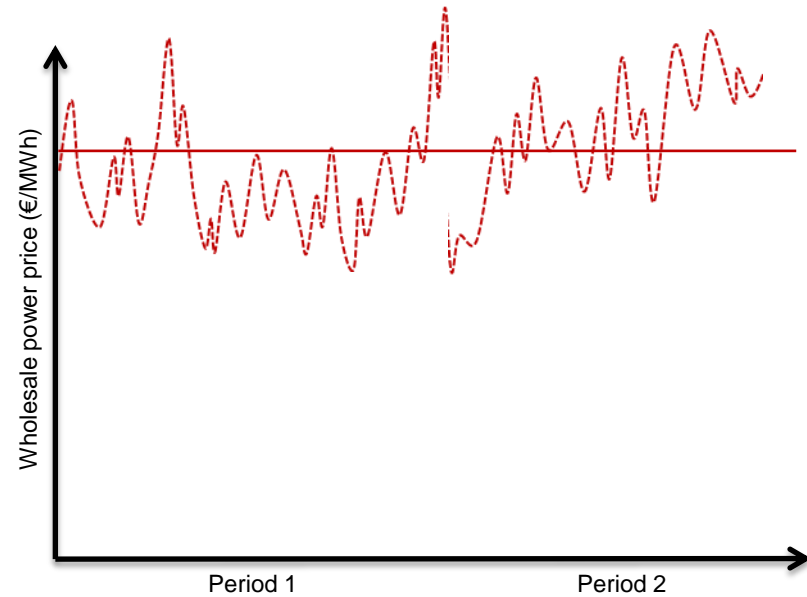(i.e. spot price + fixed-premium)

↕ Premium value (€/MWh)

—— Contract reference price (€/MWh), granted through auction

- - - Average spot price for period i (€/MWh)

- - - PV producer revenue with a sliding premium
(i.e. spot price + sliding premium)

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Renewable energy support

Monthly average day-ahead spot prices (in euros per MWh), global average and weighed by wind and solar PV production

Source: CRE (2019).
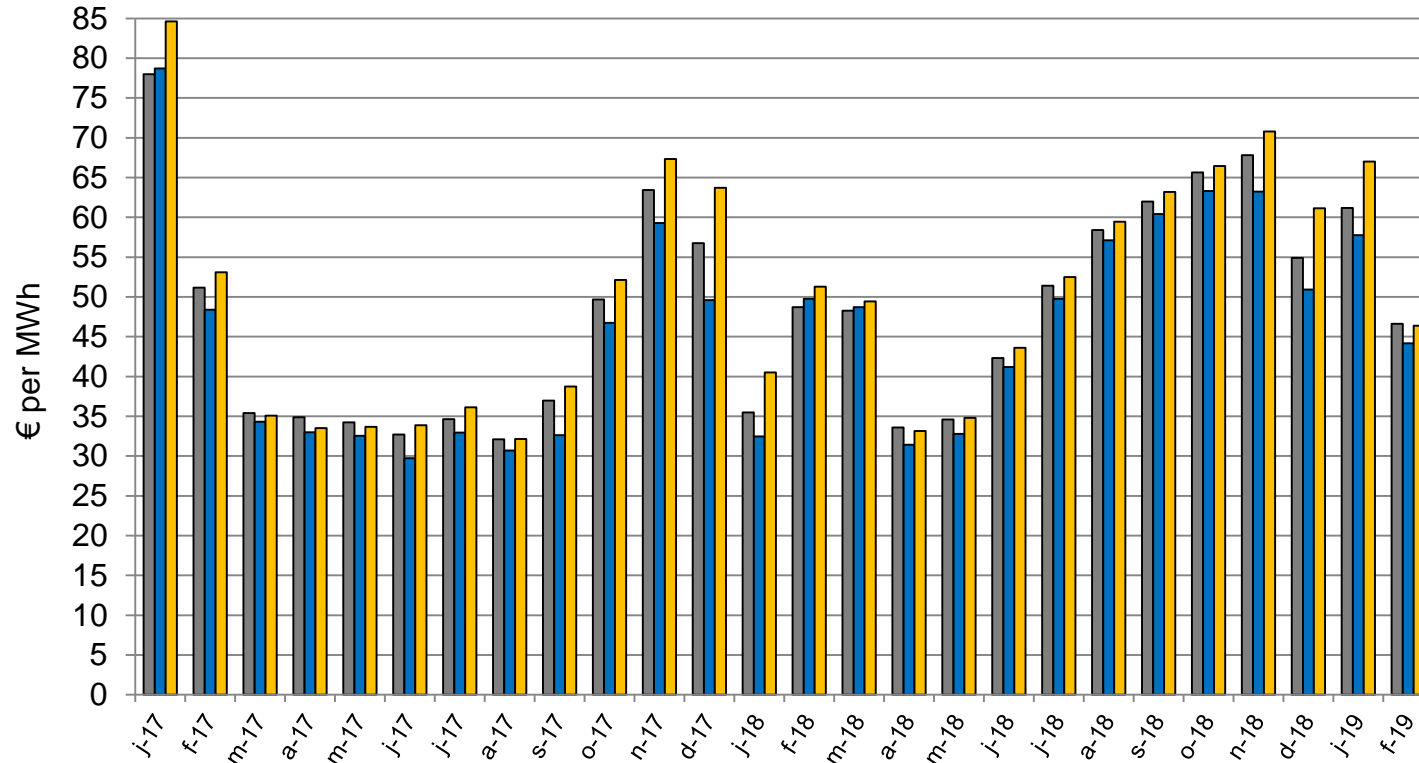
Cost of finance for solar PV installations

Evolution of the average cost of finance for selected solar PV market segment (2017-2020), as stated in recent tenders results

Source: CRE (2019).
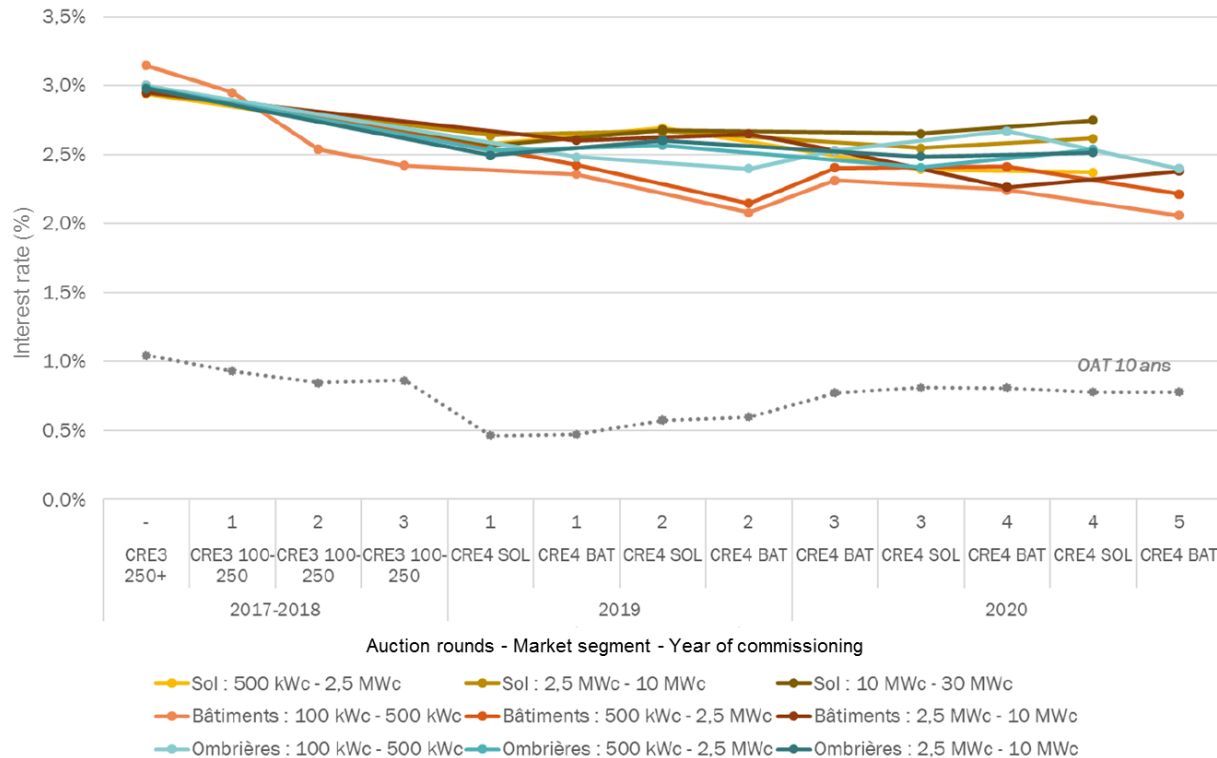
Conclusion

- FITs have successfully supported the early stages of solar PV and wind installations in France

- However, this support scheme needed to be reformed due to :
  – a need to sensitize renewable producers to market competition
  – a high cost for the community

- The sliding-premium implemented in France is a *compromise* between a full market exposure (fixed-premium) and a full out-of-market system (FIT)
  – **exposing RE producers to price variations**
    ✓ missing money & negative prices sensitization
  – **while maintaining a rather low cost of finance for >500kW PV installations**
    ✓ low cost of finance (< 3% in 2017-2019 tenders)
    ✓ lower cost support for the community

- The **premium revision time step is a key parameter** in the design if such a support scheme
  – in its current design, the monthly revision in France does not capture seasonal price variations on the French electricity market