

# An Analysis of Capacity Market Mechanism for Solar Photovoltaics in France

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**Abstract-** The energy policy in France that focuses on energy transition and reduction of greenhouse gases, has provided favourable conditions for the deployment of solar photovoltaics. In September 2018 more than 80% of the expected plan of solar photovoltaics capacity for this year was reached. After 2010 the support for solar photovoltaics in France took the form of capacity market mechanism. This paper aims to provide insight to this shift that brought the highest additional installed capacity of solar photovoltaics in France. The objective of this paper is to provide an indicative analysis on how the capacity market mechanism for solar photovoltaics in France has changed over years and how administrative procedures related to this mechanism have been improved. The analysis shows that this system has been favourable to small scale producers even that lately a tendency is seen to move towards large-scale projects. The system has seen a high level of competition, especially between ground-mounted projects, oversubscribing the required volume with more than 12 times. For each MW solar photovoltaics required through calls for tender, 3.5 MW were offered by the submitted dossiers. We found that in 2017 the average price of tenders for solar photovoltaics almost halved compared with the level this indicator had in 2011. For ground mounted solar photovoltaics projects, the prices decreased by 72%. For rooftop installations the decrease accounted for 60%. Despite the improvements done in administrative procedures, still some barriers are in place influencing the speed of the deployment of solar photovoltaics technology in France.

**Keywords** solar photovoltaic, capacity mechanism, administrative procedures, competition level, costs.

## 1. Introduction

Policies in energy and environmental protection are very crucial in many countries [1]. The attention towards solar photovoltaics (PV) today is considerable, due to the potential that this technology has in the deployment of renewable energy [2]. Understanding the role of support schemes in the deployment of renewable technologies as solar PV, is a relevant and actual topic in both global and European energy context [3]. The EU adopted in 2013 a guidance document to support its Member States for the designing and reforming renewable energy support schemes [4]. Further changes were implemented from 2014 when the European Commission introduced its "Guidelines on State Aid for Environmental Protection and Energy" [5]. These Guidelines set the general

conditions for investments and operating aid for any features of new RES support schemes through 2020.

On 24 December 2018 the revised Renewable Energy Directive (RED II) [6] establishes a binding EU target of at least 32% for 2030 with a review for increasing this figure in 2023. The RED II states "*Market-based mechanisms, such as tendering procedures, have been demonstrated to reduce support cost effectively in competitive markets in many circumstances. However, in specific circumstances, tendering procedures may not necessarily lead to efficient price discovery. Balanced exemptions may therefore need to be considered to ensure cost-effectiveness and minimise overall support cost*". Article 4(2) of the same directive states "*Support schemes for electricity from renewable sources shall provide incentives for the integration of electricity from renewable sources in the electricity market in*

a market-based and market-responsive way, while avoiding unnecessary distortions of electricity markets as well as taking into account possible system integration costs and grid stability". Different energy policies and public support programs for renewable energies, as well as the different grades of liberalization of their domestic electricity markets are applied in EU countries bringing to different EU market conditions for photovoltaics [7].

France keeps now the fourth position among EU countries regarding to the deployment of solar PV, having also installed the largest EU photovoltaics system. France plans to install 10.2 GW solar PV in 2018 and 30 GW between 2020 and 2035. France presented its long-term climate action plan under the Paris Agreement end of 2016. The country set a 40% target reduction in emissions by 2030 compared to 1990 and a 75% reduction by 2050 compared to 1990. To meet this target, France needs to cut 9-10 Mt of CO<sub>2</sub> every year.

This paper aims to provide an analysis of the capacity market mechanism implemented in France to support the deployment of solar PV. The paper is structured to provide a short overview of support system for renewables in France, a description of tendering system for solar PV, a description of the improvements of administrative procedures for the removal of regulatory and non-regulatory barriers, a short section of solar PV costs in Europe and France and some empirical findings from the shift towards capacity market mechanism in France.

## 2. Support system for renewables in France

The Electricity Law of 2000 [8] set the level of first feed-in tariffs in France. It regulated the free access to the grid of French energy producers. Since 2000 the number of technologies eligible under the French national feed-in tariff mechanisms has increased over time. The increased number of renewable technologies under the feed-in tariff scheme showed ambitiousness of French Government multiannual plans, mainly for electricity sector. France's national plans/targets have been set also in the light of EU renewable energy directives of 2001 and 2009. The feed-in tariff mechanism operated with only technology-specific program-size caps. The Energy Code (2011) consolidated the French energy framework composed by several decrees and orders that implements the support schemes for the deployment of renewables [9].

The new organisation of the electricity market was done through the Law No. 2010/1488 of December 2010 [10] which established the Regulated Access to the Historical Nuclear Electricity (ARENH). Under this regulation to the alternative suppliers it was given an access to nuclear electricity in order to sell it to end consumers. The law ended the regulated tariffs for industrial consumers [11]. Law No. 2015/992 (the Energy Transition for Green Growth) sets out the reform of the feed-in tariff (FIT) support scheme, its funding towards a market premium and calls for tender for large-scale mature renewable facilities.

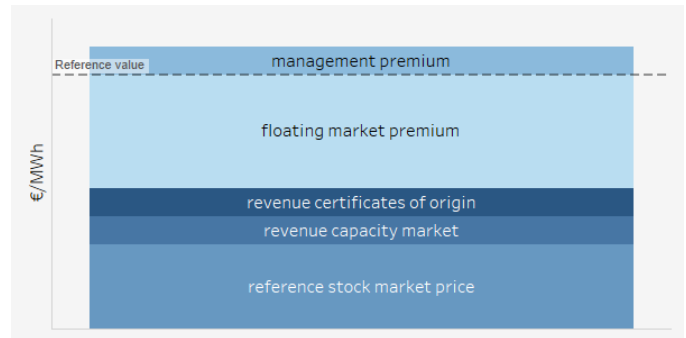


Fig. 1. Additional remuneration scheme in France

The law aimed to ensure the cost-competitiveness of renewable energies defining that FITs contracts are exceptional, and the main support mechanism is the feed-in premium (FIP). The French electricity market is structured conform to the EU legal and regulatory framework. The support for renewable technologies as solar PV, wind, biomass is already carried on through the capacity market mechanism. The National Regulatory Agency is in charge for the organization of the tenders [12].

Until 2016, support for renewable electricity production consisted of a purchase obligation on an open-ended basis or in the form of a call for tender. Both methods are very similar as they are open to all and are financed in the same way. They both enable operators of renewable electricity installations to benefit from a long-term purchase contract at a guaranteed price (generally 15 to 20 years). The main difference is that, in a call for tender, the electricity sale price is one of the elements making up the tenderer's bid, while for the open-ended method, a purchase price is set by the State for each type of installation. The tender procedure, which previously comprised a 'simplified' and an 'ordinary' procedure laid down by [13] Decree No 2002-1434 of 4 December 2002, was reformed in 2016. There is now only one type of procedure, meaning that the time between launching the call for tenders and the selection of successful applicants can be reduced. The procedure was introduced under [14] Decree No 2016-170 of 18 February 2016. Changes were made to the support scheme for renewable electricity production in 2016.

A new support scheme, the 'additional payment', was introduced, which will, in part, take the place of the purchase obligation (Figure 1). This additional payment consists of a premium paid to renewable electricity producers on top of the market price received for the sale of the electricity. The premium should help ensure that producers receive enough remuneration overall to cover the cost of running their installation while guaranteeing a normal return on invested capital. It is also allocated in two ways, namely on an open-ended basis or by tender.

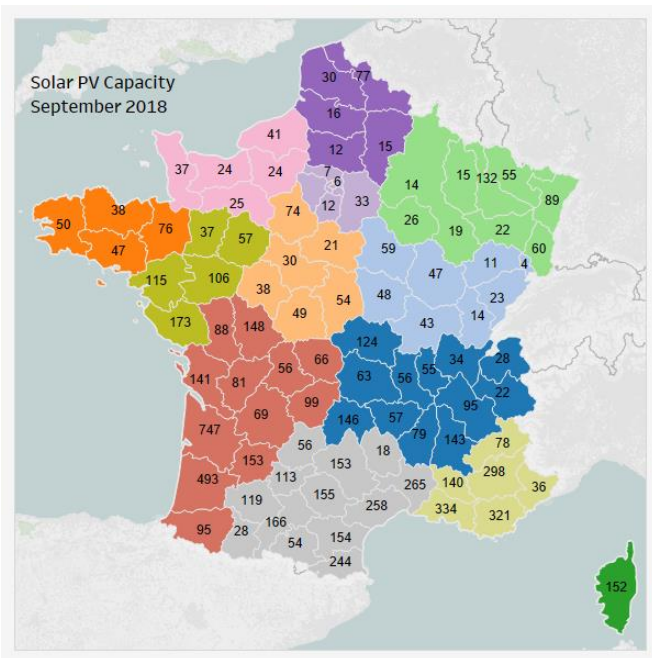
The scheme chosen was an ex-post premium, calculated as the difference between a reference price set either by the State under an open-ended system or by the applicant under a call for tenders, and a market reference price calculated by the sector (e.g. average annual electricity spot price). If the market price is greater than the reference price, the producer is required to reimburse the difference [15].

**3. Solar PV in France’s electricity sector**

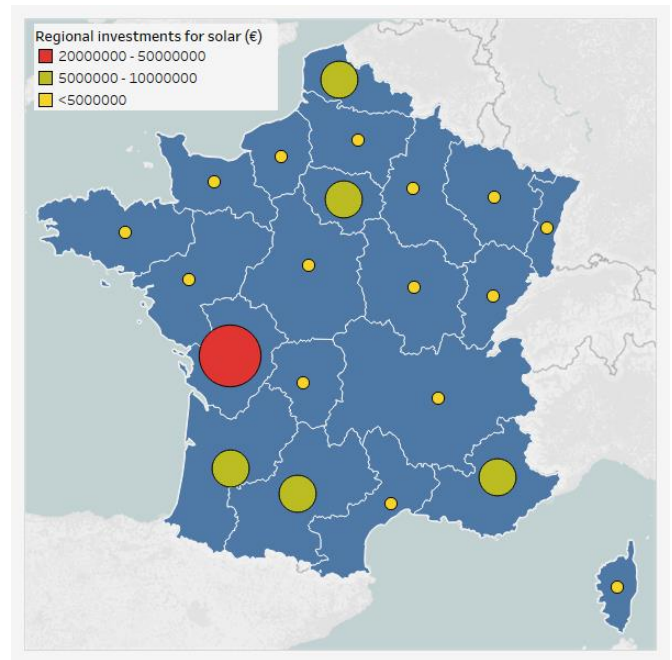
France plans to install 30GW of solar photovoltaic between 2020 and 2035. The multiannual energy program (PPE) set the objective of achieving 10.2 GW in 2018. For 2023 this objective is set to 18.2 – 20.2 GW [16].

Figure 2 illustrates the installed solar PV capacities in France’s regions as reported by September 2018. The connected power of the solar PV park reached 8766 MW, almost 9-fold the level of 2010. This capacity represents more than 80% of the 2018 PPE objective. The highest additional capacity was seen in 2011 with 1768 MW. Since 2005 the deployment of solar PV in France took place with an average annual growth rate of 30%. The current capacity corresponds to 418330 solar PV plants installed by end of September 2018. Most photovoltaic plants in France are of small-scale. More than 70% (297523) of solar PV plants in France have a capacity less than 3 kW providing only 9% (801 MW) of the total installed capacity for this technology.

The French capacity market scheme for solar photovoltaic supports the installations with a capacity larger than 250 kW. Between 2011 and 2018 the share of these installations in the total installed capacity increased from 39% to 53%. The share of installations less than 3 kW more than halved whereas the share of projects with capacity 100 kW – 250 kW dropped from 22% to 13%. In meanwhile the share of the projects with capacity 36 kW – 100 kW increased from 8.6% to 13.3% [17]. The support for solar PV in France increased by a factor of almost 12 between 2010-2018, from €0.25 billion to nearly €2.9 billion [15]. In November 2018, the EU state aid approved the French scheme to support solar installations for electricity. The scheme has an indicative budget of 600 M€ for the deployment of 350 MW additional capacity of innovative solar installations from 100 kW to 5 MW [18].



**Fig. 2.** Solar PV capacity (MW) in France by regions, September 2018



**Fig. 3.** Regional investments for solar PV from EU Cohesion Funds, 2007-2013

France has been one of the countries to have received high investments for solar through the EU Cohesion Policy Funds over period 2007-2013. A total of 1071 M€ (0.31%), were allocated to solar energy investments across the European regions over this period.

As shown in Figure 3 the main regions in France, in which were allocated the highest EU Cohesion Policy 2007-2013 investments for solar, were Nouvelle-Aquitaine, Occitanie, Provence-Alpes-Côte d’Azur, Île-de-France and Nord-Pas-de-Calais [19]

Number of patents for solar PV in France have reached 1781 in 2016 with the highest number of additions in 2010 (+305). After this year the patents for solar PV in France decreased significantly [27]. Solar PV sector in France created 5200 jobs in 2016, contributing with 5% to the EU-wide employment for solar PV with a turnover at €0.7 billion [26].

**4. Tendering system for solar PV in France**

Table 1 shows the legislative framework of support schemes for solar PV projects in France. The tendering system is characterized by different categories of installations (small, medium or large) and types (rooftops, ground-mounted, in buildings). Pay-as-bid is being used as the standard price finding mechanism. The price has been always the main criteria for the selection of bids in a tender procedure. Other criteria such as environmental impacts, contribution to R&D and/or the stage of the project development has played a role as well. Depending on the solar PV tender category, a significant number of documents were requested to the participants, as for example the ISO-certification [12]. Apart from past tenders for medium scale solar PV (2011 and 2013), financial prequalification’s were requested for all tenders ranging from 30 to 100 €/kW.

**Table 1.** Legislative framework for solar PV support schemes in France

|                      |           | FIT | Capacity |
|----------------------|-----------|-----|----------|
| Act of 07.12.2010    | Tender    |     | X        |
| Decree of 09.11.2016 |           |     |          |
| Act of 28.05.2016    | On demand | X   |          |
| Order of 09.05.2016  |           |     |          |

France set minimum bid prices for the more recently introduced tendering procedures for rooftop solar PV (42 €/MWh for the last one, 50 €/MWh initially), large scale solar PV and ground mounted solar PV installations (66 €/MWh for the last one, 95 €/MWh initially). Figure 4 shows how the solar PV projects average price and number of bids selected have changed in tendering system over period 2012-2017.

France do not charge any fee for participating in the tendering procedures. France foresees a reduction in support time in case of delayed realization of the solar PV installation. Throughout the tendering system, the guaranteed support time for solar PV installations is 20 years [12].

Before 2016, calls for tender were divided into two categories, i.e. building installations with a capacity of between 100 and 250 kW and (ground or building) installations with a capacity in excess of 250 kW. Since 2016, calls for tender have been categorized differently and now distinguish between building installations (with a capacity of between 100 kW and 8 MW) and ground or canopy installations with a capacity of between 500 kW and 17 MW. For all calls for tenders launched since 2016, installations with a capacity of more than 500 kW have been eligible for support in the form of an additional payment, while those with a capacity of less than 500 kW have benefited from support in the form of purchase prices. The purchase price level for installations of less than 100 kW depends on their capacity and nature (sale of surplus or total). The price schedule can be found on the website of the French Energy Regulatory Commission [15].

Based on the requests for connection received during the preceding quarter, purchase prices are adjusted automatically each quarter. Prices fall by between 5 % and 10 % per year if the number of requests to connect installations is in keeping with the target trajectory (of approximately 350 MW/year) [15].

According to the France’s 2017 progress report [15] “three calls for tenders for developing building installations (with a capacity of between 100 and 250 kW) were previously launched, following the simplified tender procedure set out in Decree No 2002-1434 of 4 December 2002 [13]:

➤ A first call for tenders was launched on 1 August 2011 and closed in March 2013. This call for tenders covered a capacity of 300 MW and ran for seven successive application periods.

➤ A second call for tenders was launched on 26 March 2013 and closed in June 2014. This call for tenders covered a total capacity of 120 MW and consisted of three application periods.

➤ A third call for tenders was launched on 20 March 2015 and closed in June 2016. It covered a total capacity of 240 MW and was divided into three application periods, each lasting four months”.

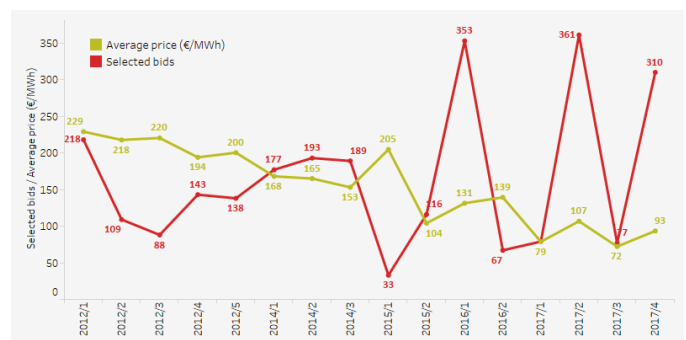
A new call for tenders for building installations was launched in September 2016 following the new tender procedure and consisting of two categories of candidate, namely for capacity of between 100 kW and 500 kW and capacity of between 500 kW and 8 MW. The call for tenders initially covered a volume of 1350 MW, split over three years, with nine application periods of 150 MW each. As of 2018, volumes will be increased progressively up to 250 MW for each application period. In the past, installations with a capacity in excess of 250kW (both ground and building installations) received support under the ordinary call for tender’s procedure [15].

According to the same progress report [15] “various criteria were used to select successful tenderers, i.e. price, environmental impact, industrial innovation, project time-frame, etc. Priority was given to areas of little competitive value, such as industrial wastelands, with a view to preserving biodiversity and agricultural and forestry uses. For this category three calls for tenders were launched:

➤ A first call for tenders was launched on 15 September 2011 and closed on 3 August 2012. This call for tenders related to the construction of 450 MW of new large-scale solar projects.

➤ A second call for tenders was launched on 13 March 2013 and closed on 16 September 2013. It related to the construction of 400 MW of photovoltaic projects, split equally between roof and ground systems.

➤ A third call for tender was launched on 27 November 2014 and closed on 1 June 2015. This call for tenders related to the construction of 800 MW of new large-scale solar projects”.



**Fig. 4.** Evolution of solar PV tenders’ average price and bids selected (2012-2017)

A call for tenders for ground installations was launched in August 2016 following the new tender procedure and consisting of three categories of candidate (capacity of between 500 kW and 5 MW, capacity of between 5 and 17 MW, carpark canopy installations with a capacity of between 500 kW and 10 MW). The call for tenders initially covered a volume of 3000 MW, split over three years, with six application periods of 500 MW each. Two calls for tenders for self-consumption installations were launched in France after 2016:

➤ A first call for tenders was launched in August 2016 for a volume of 40 MW split between two application periods. Installations with a capacity of between 100 and 500 kW were eligible under the call for tenders. 72 projects were chosen for a weighted price of 40.88 €/MWh

➤ A second call for tenders was launched in March 2017 for a period of three years, with a volume of 150 MW/year (three application periods per year). 62 projects were chosen for a weighted price of 19.35 €/MWh.

To enable an initial entry onto the market for innovative installations for which a demonstrator was already in place, a call for tenders was launched in March 2017 for developing innovative installations. The call for tenders consisted of three application periods of 70 MW each (one application period per year)".

**5. Improvement of administrative procedures to remove regular and non-regular barriers for deployment of solar PV in France**

Article 15(1), (d) of the [6] states “*simplified and less burdensome authorisation procedures, including a simple-notification procedure, are established for decentralised devices, and for producing and storing energy from renewable sources*”. Tendering system in France is a points-based criteria system for (i) price, (ii) simplified carbon evaluation, (iii) environmental impact and (iv) contribution to research and development with a maximum score of 30 points. The weighted score for price ranged between 12 (>250 kW) and 20 (<250 kW) [20]. The first tenders for the medium-scale PV plants applied a prequalification criteria, requiring the bidder to be the owner of the building where the installation was planned to be built and a carbon dioxide (CO<sub>2</sub>) assessment and a statement of recycling of the installation after its lifetime had to be submitted along with the bid. The CO<sub>2</sub> assessment was contributing to 33 % of the evaluation, whereas the price of the bid contributed to the rest. The support was paid for 20 years, and 80 % of it was

fix and 20 % indexed. Many bids did not pass the prequalification criteria in the first year’s rounds, which resulted in low competition level and higher prices than expected. The prequalification criteria were recognized to be challenging and the instructions for that insufficient. Therefore, the tender rules were re-designed for the next rounds and thus the two first rounds in 2013 cancelled [21].

Table 2 shows the evolution of administrative barriers for deployment of photovoltaics in France over period 2010-2016. Since 2012, facilities using renewable energy with a capacity less than 12 MW were automatically authorized. In 2016, the levels below which an operating license does not have to be requested were raised to 50 MW for all renewable sectors [15]. After 2016 the administrative procedure for applying to the Prefect for a purchase obligation certificate (CODOA), which was a prerequisite for all purchase contracts, has been abolished, thereby speeding up the implementation of projects [15].

Until 1 January 2018, a transition phase has been established during which a simple process of self-certification by the generator replaces the conformity certificate [22]. According to the new provisions the tender specifications are written by the Minister of the Economy then submitted to the CRE for approval, with just one month allocated to reach a decision. The specification must include several elements: the geographical area, the desired maximum power, a detailed description of the installations referred to and the conditions applicable to them, or an exhaustive list of the proposed evaluation criteria and their weighting or order of precedence. In relation to the criteria, the quantitative criteria represent at least 50% of the total weighting [22].

After the publication of the call at the CRE website to the applicants are given at least six months to send their applications. This timeframe is unchanged from the previous rules. Starting from the closing date for the submission of the application files, the CRE has between 15 days to four months to examine the bids received [22]. Previously, the CRE had two months as part of the accelerated procedure to examine the files and that there was no set regulatory time frame for the regular procedure [22]. The single environmental authorization reforms have taken place in successive steps: an initial three-year experimental phase governed by orders applying to several regions and a second phase during which the experiment was generalized to the entire national territory as a result of the “Macron law”. The application of a single environmental authorization will be shortened processing times in 10 months versus 15 months for projects not benefiting from the single authorization [22].

**Table 2.** Existing regular and non-regular administrative barriers for deployment of solar PV in France

|   | 2010           | 2012        | 2014        | 2016           |
|---|----------------|-------------|-------------|----------------|
| One-stop-shop   | present        | present     | not present | not present    |
| Online application  | partly present | not present | not present | not present    |
| Maximum time limit for procedures                         | partly present | not present | not present | not present    |
| Automatic permission after deadline                       | present        | present     | present     | present        |
| Facilitated procedures for small-scale projects (PV case) | not present    | not present | not present | not present    |
| Identification of geographic sites                        | -              | not present | not present | not present    |
| Single environmental application                          | present        | present     | present     | partly present |

Source: [28], [15]

**6. Measures ensuring transmission and distribution of electricity from solar PV in France**

In its 4<sup>th</sup> Progress Report [15] France stated that “all producers of electricity from solar PV have a right of access to the grid that is guaranteed by law. If the system operator refuses to grant access, the regulator may impose a penalty, unless the refusal is justified by objective, non-discriminatory and open criteria. These criteria may be based only on imperatives connected with the proper performance of public service tasks and on technical grounds relating to grid safety and security and the quality of grid operation. Producers are entitled to obtain a technical and financial proposal for their connection under the conditions laid down in the system operator’s technical reference documentation”. The connection time shall not exceed 18 months for installations with installed power exceeding 3 kVA. For installations with power not exceeding this threshold, the maximum time of two months starting from acceptance of the connection offer is unchanged. The deadline begins from the date on which the network operator receives the signed connection offer and does not include the time needed for commissioning the generating installation [22].

**7. Trend of solar PV costs in Europe and in France**

Solar PV is now the cheapest source of electricity. The fall of prices for photovoltaics modules since 2009 has been significant in Europe. As shown in Figure 5 German crystalline module index price dropped by 82% over 2009-2017, to 0.45 €/kW [20]. Solar PV module costs fell rapidly until 2013 but have experienced more modest cost reductions in recent years as photovoltaics module manufacturers made efforts to return profit margins to more sustainable levels and various trade disputes affected minimum prices in different markets. The weighted average Levelised Costs of Electricity (LCOE) of utility-scale solar PV fell 73% over 2010 - 2017, to USD 0.10/kWh. Increasingly, this technology is competing head-to-head with conventional power sources – and doing so without financial support [24].

Since 2010 the solar photovoltaic costs in France have seen a remarkable decrease. The utility-scale solar PV installed cost over period 2010-2017 saw a 77% decrease. The average total installed costs of residential solar PV systems, during period Q2 2007-Q1 2017 decreased by 66%.

The electricity costs of utility-scale solar PV in 2017 were 71% below the costs in 2010. The LCOE from residential solar PV systems, decreased by 61% over period Q2 2007-Q1 2017 [24].

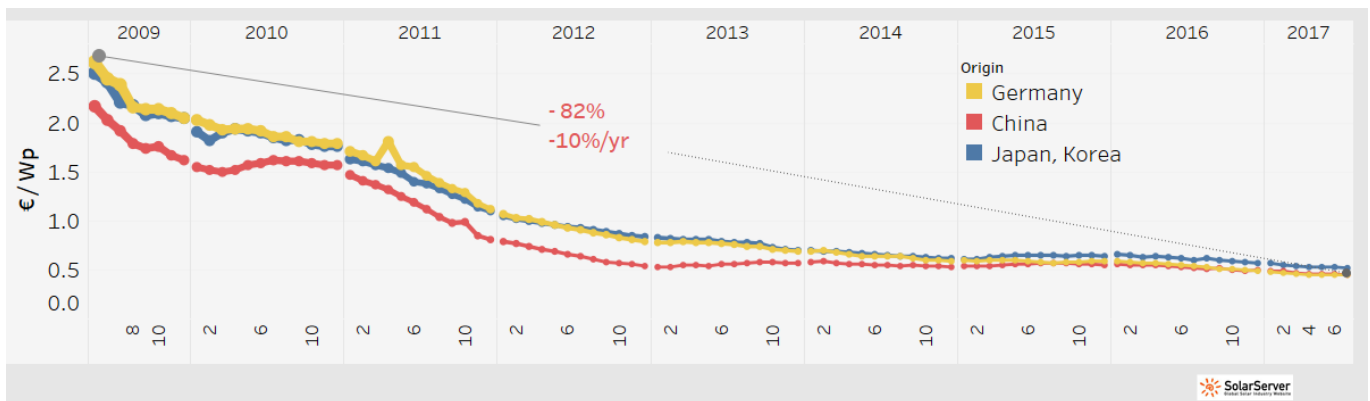
**8. Indicative analysis of capacity market mechanism for solar PV in France**

The thresholds of 100 kW and 250 kW for 2011 solar PV tenders in France were chosen because: (i) the 250kW threshold is the limit between low voltage and medium voltage in electricity network and corresponds to a connection threshold for (ERDF); (ii) the 2010 FIT scheme, distinguished the threshold of 250kW, and (iii) the facilities between 100 and 250kW correspond to non-residential roofs category that exploded during 2006-2010 [20].

The average incentives of period 2011-2017 for solar PV, given through the capacity market mechanism tended always to decrease, approaching as such to the wholesale electricity price. Banja & Jégard [13] found that in 2017 the average price of calls for tenders almost halved compared with 2011. The introduction of separate tenders for different categories of solar PV projects lead to different price developments for these categories. Going through this analysis we found that since 2011 for ground mounted solar PV projects, the bid prices decreased by 72%. For rooftop installations the decrease accounted for 60%. For installations in buildings the price decreased by 60% (Figure 6).

After the re-design, the tendering system in France started been successful in ensuring an enough level of competition, which is estimated as the ratio between the bids volume vs the required volume. The level of competition is not constant and large variations can be observed. These variations can be due to the volume auctioned, number of rounds organized, the preparedness of the project developers, etc [12].

As shown in Figure 7 projects related mainly to ground-mounted systems and innovative electricity generation facilities from solar PV had the highest level of competition. For ground mounted installation the level of competition was the highest. The tendered volume has been subscribed 12.4 times in 2013 where 188 dossiers with a capacity of 1240 MW where presented for a capacity of 100 MW. In 2014 the tender volume has been subscribed 10.7 times.



**Fig. 5.** Trend of crystalline module index price, (2009-2017)

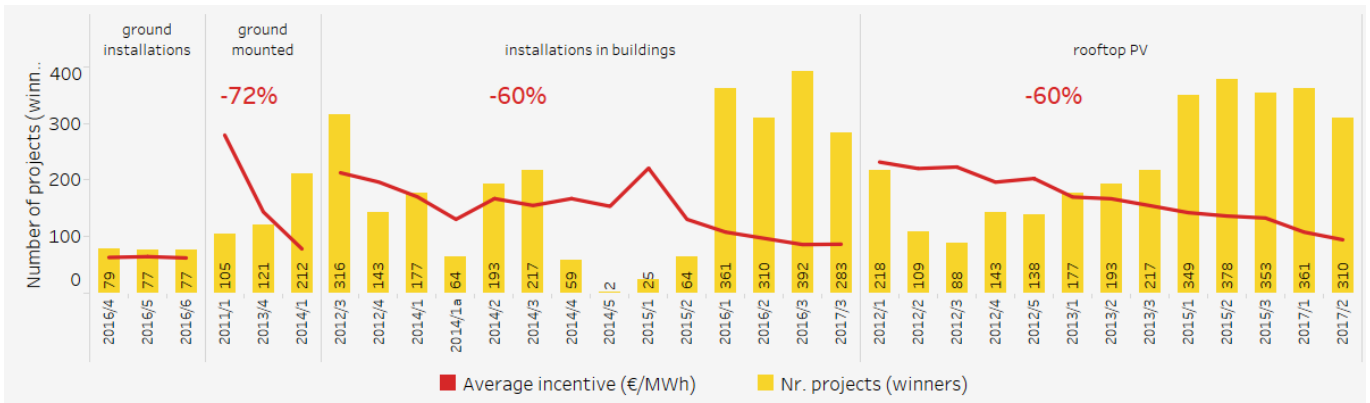


Fig. 6. Trend of average price & number of projects in solar PV tenders in France, (2011-2017)

In 2015 the number of dossiers presented for the tender of overlay installations with capacity >5 MW was 137 with an overall capacity of 1332 MW. Only 12 projects for a capacity of 125 MW were selected. Over 2016-2017 the ground-mounted tender saw a level of competition of 5.5 (among the highest) when 203 dossiers (742 MW) were presented for a required capacity of 135 MW. Only 33 projects were selected. The highest ratio between the price of dossiers and the average price of bids selected was found for ground-mounted projects during the tendering procedures over period 2016-2017. A correlation coefficient of 0.67 was found between the all capacity of dossiers submitted and all tender volume required, when a linear model with a coefficient of 3.5 was applied.

A large number of candidates competed for a small share of required bid capacity in the calls for tenders for solar photovoltaic in France over period 2011-2017. Nealy 3000 was the number of projects that were presented in the calls for tenders organised between 2012 and 2014. Only in 2014, nealy half of these candidates participated at the calls for tenders that were characterised by the lowest ratio of winning bids versus the submitted dossiers. Over 2012-2014 almost 1300 contracts for solar PV were given. This number equals to almost half of contracts given over period 2011-2017. 12-months was the time between the appeal and the date in which the tender was organized. The majority of calls for tender were developed in more than 1 period. 2011 was the year with the largest number of periods and the smallest fraction of capacity of bid [17].

According to [11] only few data are available for the evaluation of realization rate of tendering system in France. Tenders carried out for different PV categories in 2011 showed realization rate between 68% and 95% and for the 2013 round between 73% and 93%.

9. Conclusions

This paper aims to analyse the dynamics of the solar PV French policy over period 2011-2017. The analysis described here shows some interesting results on how the capacity market mechanism is implemented in France to support the deployment of solar PV.

- The largest additional installed capacity of solar PV in France was observed after 2010 when the French policy support for this technology start moving towards capacity market mechanism.
- The decrease of average support level for solar PV through tendering system and the increase of the number of large-scale projects in the calls for tender, the additional capacity of solar PV in France has decreased after the maximum reached in 2011;
- Tendering system for solar PV is set more as a technology-specific system. France has introduced tendering procedures for different categories of PV projects, such as ground mounted PV, rooftop PV, carport PV and/ or Concentrated Solar Power (CSP);

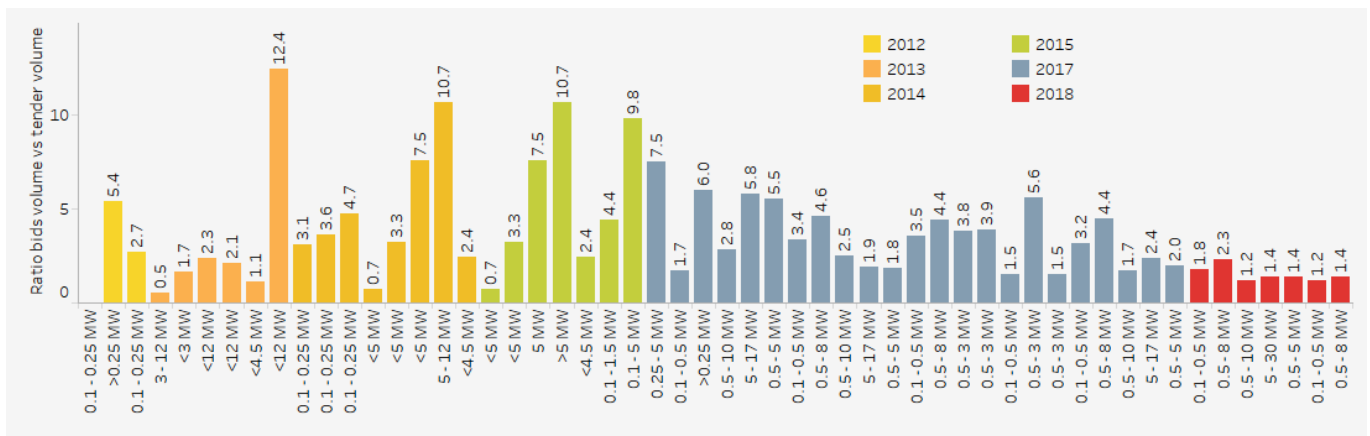


Fig. 7. Level of competition in solar PV tendering system in France, (2011-2017)

➤ The shift towards the capacity market mechanism has been accompanied by accelerated cost reductions in the solar sector. Over a period of 7 years the utility-scale solar PV installed costs decreased in average by 11% each year. For residential solar PV systems, the decrease of installing costs took place by 6.6% yearly in average terms over a period of 10 years;

➤ The decrease in support prices for solar PV is observed from one tender to another. Even that this decrease does not show the effectiveness of the tendering system, since other external factors (e.g. cost of capital and raw material, regulatory changes, strategic behaviour) have influence on the outcome of the tender, it shows that France has created a favourable set of organisational structures, rules and informal norms to support this technology. It reflects also the decrease over time of the costs for solar PV projects;

➤ Tendering system for solar PV in France is characterized by a high level of competition especially for ground-mounted systems. Project prices for these systems decreased in average terms by 12% yearly over the period under analysis. The highest level of competition is observed in tenders organised between 2013 and 2015;

➤ The analysis showed that for each MW capacity solar PV required 3.5 MW were offered by the participants in calls for tender.

➤ Despite the improvements in the administrative procedures to remove the regular and non-regular barriers, a significant number of documents are already subject of permitting procedures for solar PV, depending also from the category of the project.

➤ The latest solar PV tenders in France have attracted many small-scale producers, but it is needed these tenders to be simplified in respect to simplicity of design, online application, financial guarantees, complicated prequalification criteria, in order to allow them to be successful

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