

# PV Financing Best Practice: Gran Plaza 2 Shopping Centre (Spain)

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## General project description

The shopping center segment can be considered a special case in Spain. The technical building code (“Código técnico de la edificación, CTE” in Spanish<sup>1</sup>) requires shopping centers to have a minimum contribution of PV electric power to their consumption. Therefore shopping centers are one of the few applications which have seen any movement in Spain in the last years.

The technical building code requires shopping centers with more than 3.000 m<sup>2</sup> or 5.000 m<sup>2</sup> of built-up area<sup>2</sup> to install a PV system. The minimum nominal capacity of the system to be installed is calculated by a formula that takes into account:

- Climate zone
- Built-up area of the building
- Building use

Therefore, all shopping centers built since 2009 (first year in which the regulation was effective) are obliged to own a PV system in Spain.

## Business case description / economic parameters

The electricity generated by the systems is used for self-consumption. The electricity is usually consumed in the common areas of the shopping center given that the shops cannot sign an additional supply contract to their regular contract with the utility. On average between 5 - 10% of the consumption could be covered by PV generation.

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<sup>1</sup> CTE DB HE5

<sup>2</sup> Depending on the type of building different limits are applied: for hypermarkets/ superstores the limit is 5.000 m<sup>2</sup>, for multistore buildings and entertainment centers it is 3.000 m<sup>2</sup>. The CTE further establishes the requirement of the installation of a PV system for warehouses, administrative buildings, hotels, hospitals and exhibition centers. Regardless of the built-up area the minimum capacity to be installed is 6,25 kWp, although in the case of shopping centers this capacity is surpassed by far



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In those cases analyzed for PV Financing, the property owner made the investment for the PV system. Because installing the PV system is mandatory and generally does not provide positive financial returns, the owner generally does not pay special attention to any performance parameters of the investment. The system is built to fulfill the minimum requirements of the regulation and the main objective is therefore to minimize costs.

Electricity tariffs for shopping centers are too low for the LCOE achieved by PV systems to compete<sup>3</sup>. Their relatively large consumption allows the centers to negotiate attractive tariffs with electricity companies. Further, there is no incentive to install additional capacity not used for self-consumption as that there is no assured remuneration or premium for PV excess generation and usually space limitations exist on the roof tops.

Therefore, the economic analysis is used by the owner to decide on the capacity to be installed considering the minimum required by law. In all cases seen during the PV Financing analysis except one, the system's capacity was limited to the required minimum.

In this case, a property management company decided to install a system with more capacity than required by regulation. An installation with a larger capacity was designed in order to add value to the proposal which was submitted during the tender of the shopping centre's development. According to the project developer, the greener image was a decisive factor in the awarding of the project.

The shopping centres in general use the PV installations to improve their image with respect to sustainability. Some centres include the PV panels in the car park and provide recharging installations for electric vehicles.

## Technical project parameters

As an example for a PV project carried out by a shopping centre, the technical data of installation of Gran Plaza 2 in Madrid will be presented:

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<sup>3</sup> For example, for larger shopping centers with a 6.1 tariff, a variable part of electricity of below 8 ctEUR/ kWh (average) could be negotiated, in the case of smaller shopping centers (with a 3.0 tariff) the variable could be around 10 - 11 ctEUR/kWh (average)

	Gran Plaza 2
Location	Madrid
Construction year of shopping centre	2012
Installation year of PV system	2012
Installed capacity	288 kWp (255 kWn)
Built-up area	200.000 m <sup>2</sup>

The modules are of the polycrystalline type and installed on a structure that does not need any perforation in the roof. The fixed Sunpower structure tilts the modules slightly to improve the panel's orientation and achieve higher generation. 17 Danfoss inverters have been installed.

The installation has an expected annual production of 400.000 kWh which are self-consumed by the building. Given the good fit of demand of a shopping center with the generation (peak demand is found in summer during the day, when the generation is the highest) there is no excess electricity and no storage has been installed.<sup>4</sup>

Gran Plaza 2's installation has been connected to the building management system of the shopping center which allows the technical staff to control the PV generation in real-time. Grid control applications have been included which provide information about the load of the PV system and the shopping center in general. Even though no excess electricity is generated by the system, the control system has been programmed to disconnect the switches in case generation surpassed demand in any moment.

## Replicability/ Outlook

The PV projects carried out by shopping centers are part of their business activity and any information related to economic variables is seen as sensible data. Nevertheless, the introduction to this segment presented in this document allows the drawing of some general conclusions.

Principally the system introduced in the shopping center segment in Spain seems to be a good idea: PV systems are being installed in applications with high energy demand and with

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<sup>4</sup> For shopping centers located in regions where shopping centers close on Sundays, this might be different. In the case of Madrid, shopping centers are open 7 days a week

a very suitable demand curve. The generated electricity is consumed close or directly at the point of consumption.

However, in practice the implementation is not working as well. When looking at the minimum required capacities that are being installed by the centers it becomes clear that PV systems are not considered an attractive investment by this consumer segment. Shopping centers install in order to comply with the regulation instead of investing in PV projects because of positive financial returns. Given the relatively high irradiation in Spain and the good fit of a shopping center's demand, a PV system could be an attractive investment for the centers.

One of the barriers to installing larger capacities seems to be the missing possibilities to use the energy within the shopping center or to inject it into the grid with reasonable remuneration. For example, if it were possible to sign several supply contracts, the shops could receive the electricity generated by the PV system under a PPA contract. The capacity would then not be limited to covering the demand of the common areas.

Further, a net-metering system (or similar) would allow those shopping centers that close during certain days of the week to better adapt the capacity of the system to their demand during the other days while not "wasting" the energy when they are closed.

The regulation regarding PV self-consumption and direct sale of PV energy would have to be changed to make investments attractive for shopping centers.

## Annex

### Self-consumption in Spain

In Spain, any electricity consumer is legally permitted to generate PV electricity for self-consumption, albeit without receiving any compensation for the excess generation. There is neither a feed-in tariff scheme nor a net-metering mechanism (nor comparable) in place. Certain requirements for legalizing the installation exist. Two types of self-consumption are permitted legally:

- Instantaneous self-consumption, under ITC BT 40 for Low Voltage Generating Installations, included in the Spanish Low Voltage Electric Technical Regulation (REBT).

- Grid connected self-consumption, under the Royal Decree 1699/2011, of 18 November 2011, on the grid connection for electricity production for small scale renewable energy installations.

In July 2013, the Spanish government presented a draft proposal for the PV market. The measures designed in this proposal included the following elements:

- No compensation for the excess PV generation fed into the grid
- A fee charged for every kWh of PV self-consumption

Even if the final net-metering regulation has not yet been published, it has created uncertainty regarding the installation of PV systems.

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