

SOLAR PHOTOVOLTAIC ROOFTOP SYSTEMS

WHAT ARE SOLAR PHOTOVOLTAIC ROOFTOP SYSTEMS?

A solar photovoltaic (SPV) rooftop system is typically mounted on the roof of commercial or residential buildings. SPV rooftop systems on residential buildings have capacity range of about 5 to 20 kWp, while those mounted on commercial buildings have a range between 100 kWp to 1 MWp. Larger industrial roofs can accommodate capacity between 1-10 MWp.

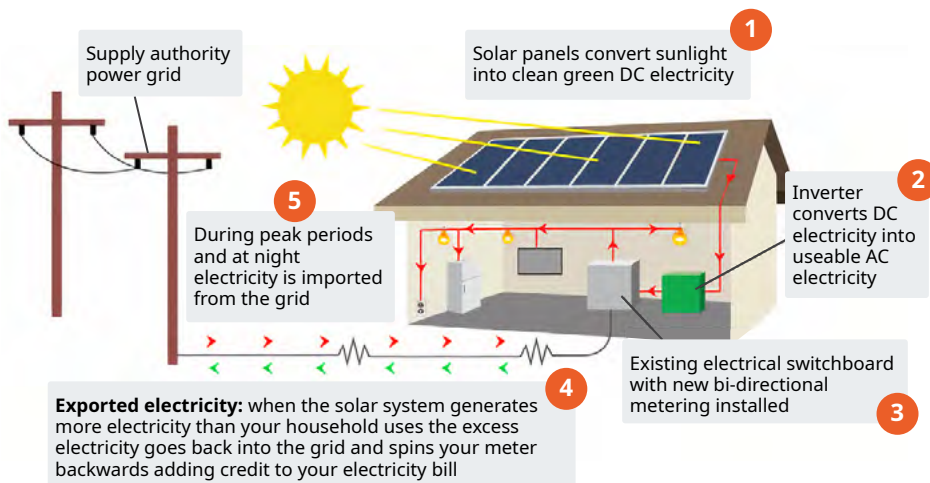


Figure 1: Solar Photovoltaic Rooftop System. [Source](#)

A CLOSER LOOK AT SPV ROOFTOP SYSTEMS

SPV rooftops are affected by various factors (time of the year, roof slope, direction, roof slope and aspect, shading losses etc). An average house has enough roof space to accommodate the required PV modules in series-parallel connection.

TABLE 1: INFORMATION ABOUT CAPACITY OF SPV ROOFTOP FOR GIVEN ROOF SPACE [1]

Available roof space (sq. ft)	Pitched rooftop	Flat rooftop
300	3 kW	2 kW
500	5-6 kW	3-4 kW
1000	8-10 kW	6-8 kW
5000	50-70 kW	30-40 kW

KEY FACTS



The prices of the solar photovoltaic panels have **decreased by 70%** since 2010 [3].

131GW



Worldwide PV market size, with **PV electricity gross of 2.2% of overall electricity share** [7].

According to the US National Renewable Energy Laboratory (NREL), SPV rooftops can potentially cut **100 TONS OF CO₂ EMISSIONS**, 1/2 ton of SO₂, 1/3 ton of NO_x [5].

Tesla is building its Gigafactory outside Sparks, Nevada, with a **70 MWp SOLAR PV ROOFTOP SYSTEM**.



With roughly 100,000 PV modules, over an area of 1.9 million square foot, it is pitched to become the largest solar PV rooftop installation [6].



The cost of electricity from residential SPV rooftops is falling rapidly. Since 2012, these costs have fallen **45%** for cities in California and **66%** in German cities [4].

In California metropolitan areas, due to the state's relatively high and complicated time-of-use tariffs, **SPV rooftop systems are a potential economic investment**, even without financial support [4].

SPV rooftop of size 1 kWp would generally require 5 m² - 8 m² of clean shadow free area. This means that a 25 kWp system will require about 2,000 m² of clean shadow free rooftop area for installation. Figure 2 shows how the SPV systems look like on top of building rooftops.

A 1 kWp SPV rooftop system generates on average 4.5 - 5 kWh per day over a year (location with 5.5 sunshine hours) [2]. This means a 25 kWp system will generate 112.5 kWh per day and more than 41,000 units annually.



Figure 2: SPV Rooftop Systems Installed in Vauban, Freiburg. [Source](#)



Figure 3: SPV Rooftop Installation. [Source](#)

FINANCIAL FACTS

On average, SPV rooftop systems from 1-10 kWp can cost up to 1,000 \$/kWp, capacities above that cost 900 \$/kWp. This means that a 25 kWp system can be installed for as low as \$22,500. These systems now have a return on investment less than 3-4 years.

SPV systems are known for low-to-zero operation and maintenance costs. In general, it can be calculated to be as low as 0.5% - 1.0% of the total project cost. System installation and customization takes about 4-6 weeks. On-site installation work is limited to 1-2 weeks. SPV rooftop systems are expected to have a lifespan of 25-30 years.

BI-DIRECTIONAL METERING (WHICH ENABLES NET METERING)

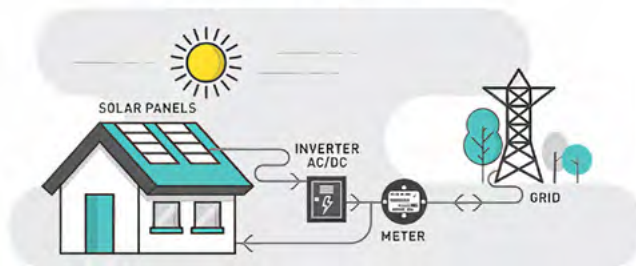


Figure 4: Bi-Directional Net Metering. [Source](#): ©Proteus, 2017

Net Metering

The excess solar electricity produced is exported to the grid and the consumer receives bill credits. The net meter mechanism helps to save on electricity bills during cloudy days and there is no sale of solar electricity in this process.

Feed-in Tariff (FiT)

FiT has led to the SPV expansion in the 21st century. This process helps the installer to sell solar electricity to electric utilities at a price fixed by the public utility commission.



Figure 5: Feed-In Tariff Mechanism

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