

# FACT SHEETS ABOUT PHOTOVOLTAICS

European Technology & Innovation Platform PV

*PV the cheapest electricity source almost everywhere*

## PV the cheapest electricity source almost everywhere

The cost of photovoltaic (PV) systems has decreased dramatically over the past years. Market prices of PV modules have decreased by about 90% and system prices 80% during the past decade. PV has reached parity with retail electricity in most countries and market segments, and wholesale parity in many countries. The concept of Levelised Cost of Electricity (LCOE) is used for making fair comparisons with electricity prices and the cost of other power generation technologies. In this report, LCOE is defined to be the generation cost, i.e., including all the costs involved in supplying PV power at the point of connection to the grid. PV LCOE is based on PV system capital (CAPEX) and operational (OPEX) expenditures and includes the costs and profit margins of the whole value chain including financing, project development, manufacturing, installation, operation and maintenance.

PV system CAPEX can be divided into two parts: the modules and the Balance of System (BoS). For decades, module prices have very closely followed the so-called learning curve, which means that each time the global cumulative PV generation capacity doubles, the price of modules decreases by about 25%. However, during the last decade the learning rate (LR) has been about 40%. It is expected that LR

will be around 30% during the next decades, mainly because of better manufacturing processes, less use of materials and continuously improving module efficiencies. Since a large part of BoS depends on the area of the modules, higher efficiency will also drive down the BoS significantly.

According to the base scenario by the European Technology and Innovation Platform for Photovoltaics (ETIP PV), the cumulative global PV capacity would increase from the end of year 2018 figure of 0.50 TWp to about 3 TWp by 2030 and to 20 TWp by 2050. Applying this volume growth, a 30% LR and an average 0.4%-point annual average efficiency improvement, PV LCOE would decrease from 2018 by at least 40% by 2030 and by 60% by 2050. Figures 1-4 show the PV LCOE at five European locations with four system sizes and different nominal Weighted Average Costs of Capital (WACC) rates. Annual inflation is set at 2% which means that e.g. 4% nominal WACC corresponds to 2% real WACC. PV system lifetime is 30 years and annual degradation 0.5% in all cases. OPEX decreases from 2019 to 2050 from 10 to 5 €/kWp/a, except for the utility-scale, where it is 15% less. All prices are given in 2019 real euros. Other input parameters are given in Tables I and II.

Location	Rooftop		Ground	
	2019	2030	2019	2030
London	980	1040	1030	1100
Munich	1120	1200	1190	1270
Toulouse	1260	1350	1340	1430
Rome	1480	1580	1570	1670
Malaga	1670	1790	1770	1890

Table I. Yield parameters (in kWh/kW<sub>p</sub>/a)

PV system type	2019	2020	2025	2030	2040	2050
Residential 5 kW <sub>p</sub>	1.11	1.05	0.84	0.72	0.55	0.45
Commercial 50 kW <sub>p</sub>	0.74	0.69	0.54	0.46	0.35	0.28
Industrial 1 MW <sub>p</sub>	0.55	0.51	0.40	0.33	0.25	0.20
Utility-scale 50 MW <sub>p</sub>	0.47	0.43	0.34	0.28	0.21	0.17

Table II. CAPEX parameters (without VAT, in 2018 €/W<sub>p</sub>)

If compared with the average variable retail electricity prices, even excluding the fixed fees which cannot be saved by own PV consumption, PV electricity is already cheaper in all five locations with all realistic WACC rates and consumer segments.

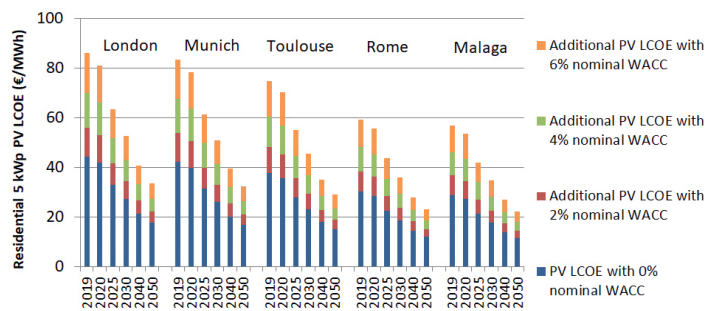


# FACT SHEETS ABOUT PHOTOVOLTAICS

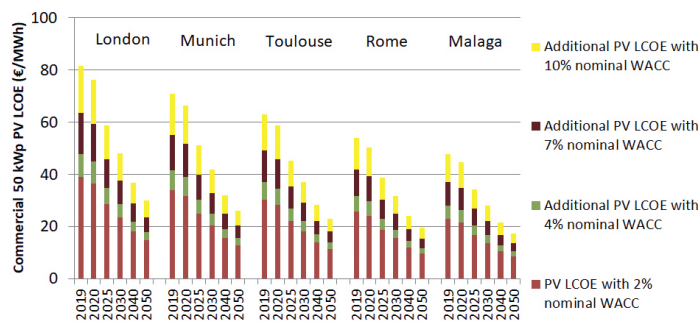
European Technology & Innovation Platform PV

*PV the cheapest electricity source almost everywhere*

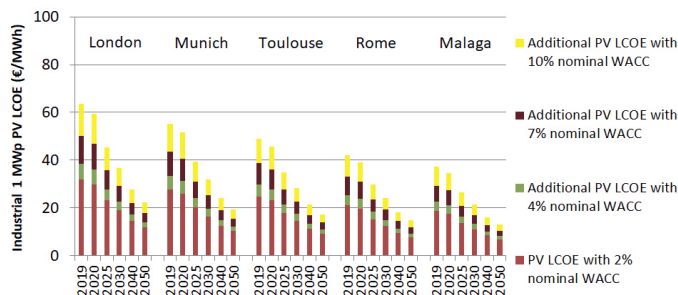
When comparing with the average wholesale (spot market) electricity prices in 2018 (Spain 57, Italy 61, France 50, Germany 42 and UK 65 €/MWh), utility-scale PV electricity is already competitive in Rome, Malaga, Toulouse and London with over 10% and in Munich with 9% nominal WACC. In Malaga, utility-scale PV LCOE with 7% nominal WACC is currently 23 €/MWh, decreasing to 14 €/MWh by 2030. In several countries around the world, power purchase agreements (PPAs) below 20 €/MWh have been signed which proves that PV already is the cheapest electricity form when a moderate interest rate truly reflects its inherent low technology and environmental risk.



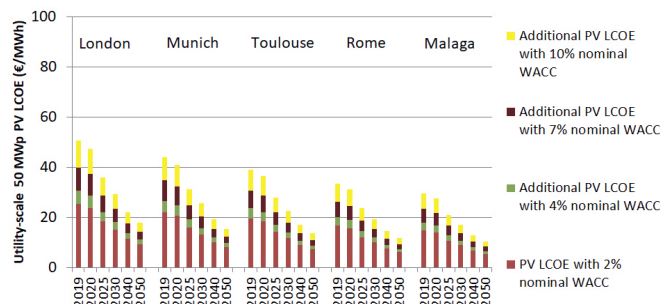
*Figure 1. PV LCOE (in 2019 €) at five European locations with different nominal WACCs for 5 kWp residential rooftop PV. VAT (2019 rate: UK 5%, GER 19%, FRA 20%, ITA 10%, ESP 21%) has been added to the residential PV CAPEX.*



*Figure 2. PV LCOE (in 2019 €) at five European locations with different nominal WACCs for 50 kWp commercial rooftop PV.*



*Figure 3. PV LCOE (in 2019 €) at five European locations with different nominal WACCs for 1 MWp industrial PV.*



*Figure 4. PV LCOE (in 2019 €) at five European locations with different nominal WACCs for 50 MWp utility-scale PV.*

