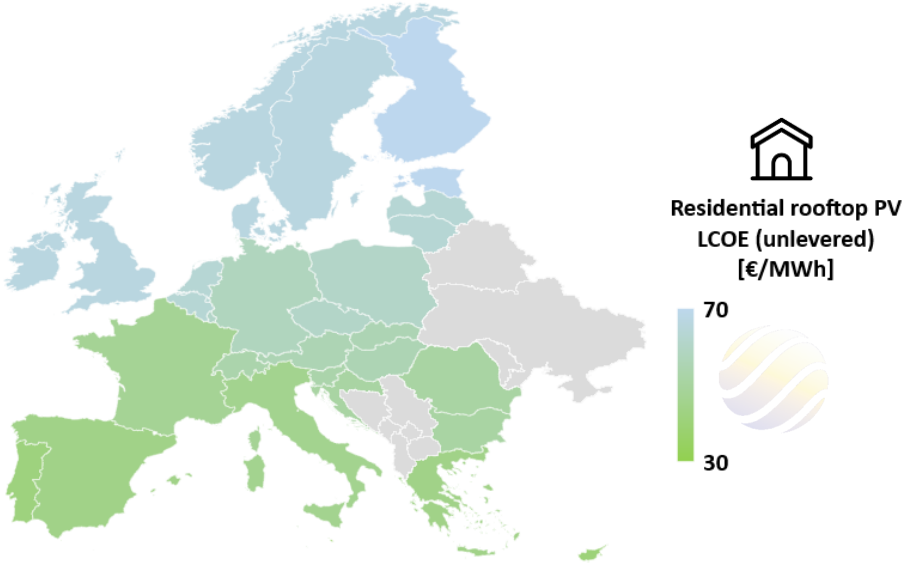
Competitiveness of PV
An overview of the situation in Europe

- After steady price reductions along the solar PV supply chain for many years, PV components' prices increased almost continuously from mid-2020 until the course of 2022. Record highs were recorded for PV components (e.g., >40 USD/kg for polysilicon in 2022 compared to around ~10 USD/kg in early 2021), raw materials (some of which are key to PV such as copper, aluminium or polymers) and freight costs. These rising prices were the result of a combination of factors leading to a sharpened imbalance between supply and demand, because of internal and external factors. While post Covid-lockdown economic recovery drove the demand, the supply side was affected in various ways (e.g., halted production for polysilicon due to lockdowns in China as well as fire outbreaks and natural disasters in the country, reinforcing the already existing under capacity of this step of the value chain, container shortages, …).
- While prices along the PV value chain are still higher than their early 2020 level, they are on a downwards trends again with some components seeing rapid price declines in the recent weeks (e.g., polysilicon and wafers, …). This trend is expected to maintain in the coming months especially as new production capacities will continue to be brought online.
- All in all, this turmoil along the PV value chain witnessed in the last two years has not halted the booming PV market, neither globally nor in Europe. In addition, the current energy crisis and the rising electricity prices have even further consolidated and enhanced the competitiveness of PV systems, on all market segments.
- In the following slides, we will first study the competitiveness of distributed rooftop PV systems in the residential and C&I cases, and then the case of ground mounted PV plants.

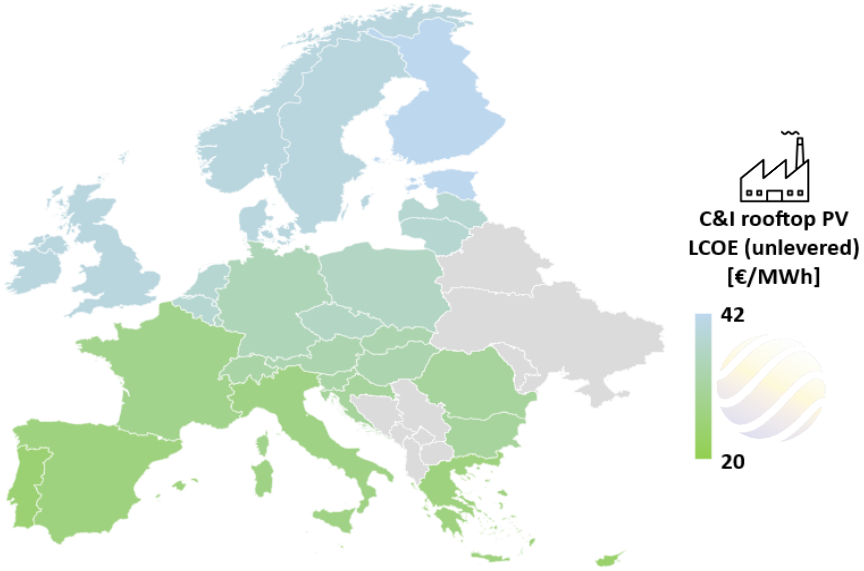
Distributed PV is very attractive in European countries

High retail electricity prices for residential customers have strengthen the attractiveness of PV in this segment

LCOE* of residential PV in European countries



LCOE* of C&I PV in European countries



Notes:
** unlevered LCOE ;*

Assumptions:

System lifetime = 25 years

Residential PV:
Installed capacity = 5 kWp ;
CAPEX = 1,25 €/Wp ;
OPEX = 10 €/kWp.a ;
Discount rate = 2%

C&I PV:
installed capacity = 400 kWp ;
CAPEX = 0,8 €/Wp ;
OPEX = 10 €/kWp.a ;
Share of debt = 80% ;
Cost of debt = 3% ;
Cost of equity = 4% ;
Corporate tax rate = 25% ;
Depreciation = 20 years

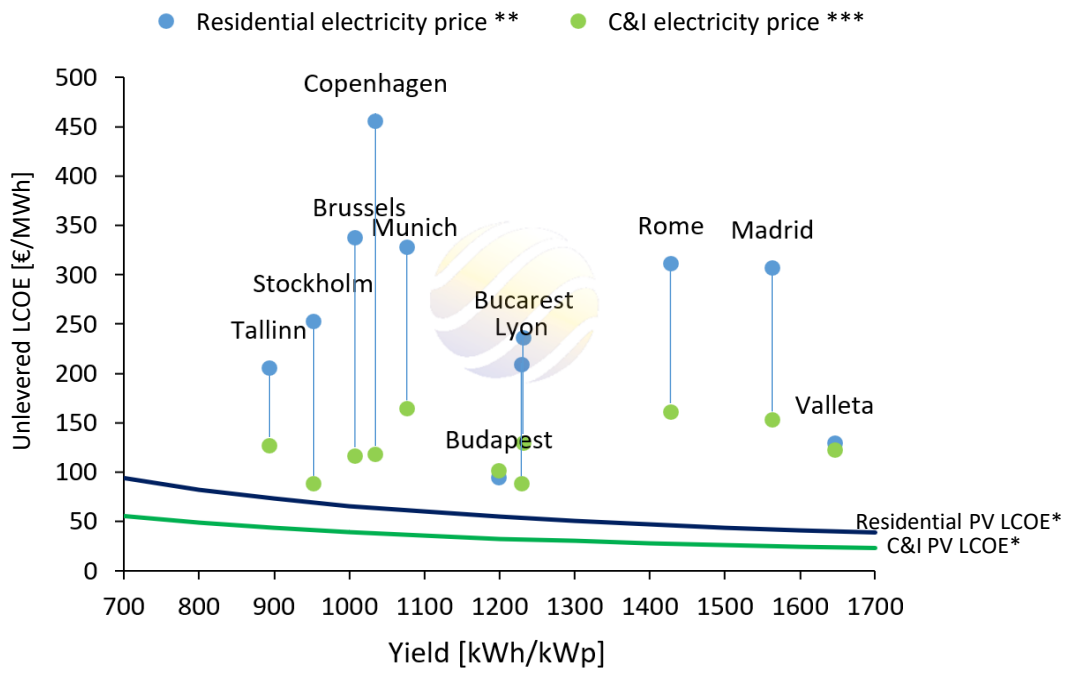
Lexicon:

PV: Photovoltaics
LCOE: Levelized Cost of Electricity
C&I: Commercial and Industrial

Distributed PV is very attractive in European countries

High retail electricity prices for residential customers have strengthen the attractiveness of PV in this segment

LCOE of residential and C&I PV in Europe



Key take-aways

- Residential PV is competitive across the entire continent. The LCOE of such systems ranges **from 95 €/MWh in the most Northern parts of Europe to below 39 €/MWh in the most Southern parts**. This confirms that grid parity has been reached on this segment. Compared to retail electricity prices for residential customers, LCOE values are significantly lower, allowing important revenues under the form of savings on the electricity bill.
- C&I PV is competitive in all considered geographies. The LCOE ranges **from 56 €/MWh in the most Northern parts of Europe to 23 €/MWh in the most Southern parts**. For most C&I customers, retail electricity prices are higher than the LCOE even if the gap is not as important as in the residential case.

Notes:

** unlevered LCOE ;*
*** DC consumption band, Eurostat, H12022*
**** IC consumption band, excluding VAT and other recoverable taxes, Eurostat, H22021*

Assumptions:

System lifetime = 25 years

Residential PV:
Installed capacity = 5 kWp ;
CAPEX = 1,25 €/Wp ;
OPEX = 10 €/kWp.a ;
Discount rate = 2%

C&I PV:
installed capacity = 400 kWp ;
CAPEX = 0,8 €/Wp ;
OPEX = 10 €/kWp.a ;
Share of debt = 80% ;
Cost of debt = 3% ;
Cost of equity = 4% ;
Corporate tax rate = 25% ;
Depreciation = 20 years

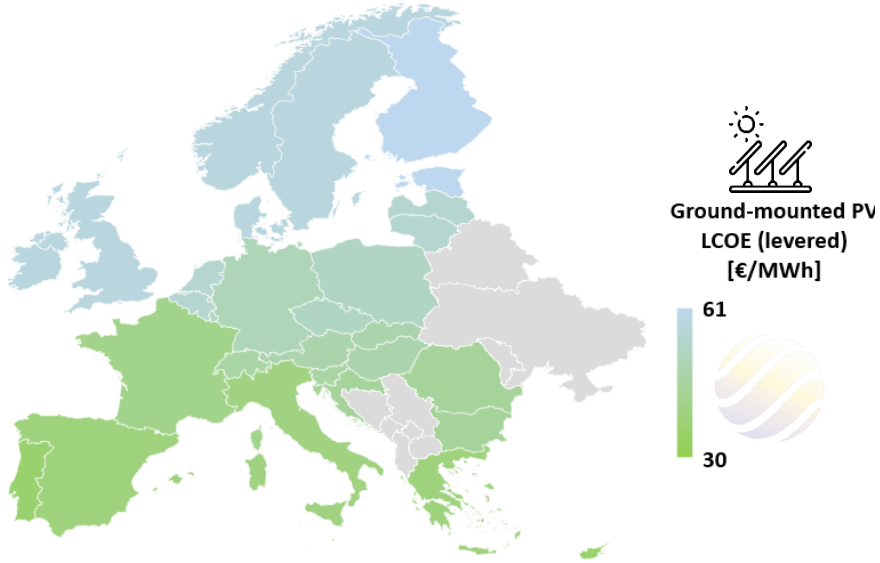
Lexicon:

PV: Photovoltaics
LCOE: Levelized Cost of Electricity
C&I: Commercial and Industrial

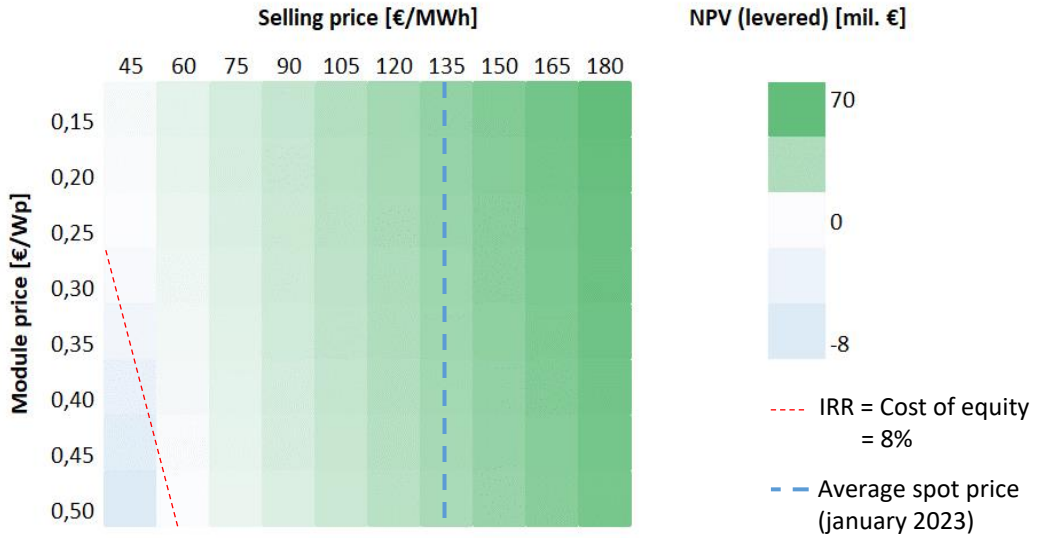
Centralized PV in Europe can be very competitive

With an LCOE of a few € per MWh, solar PV is significantly cheaper than recently observed spot prices in Europe

LCOE* of ground-mounted PV in European countries



Sensitivity of NPV to electricity sales price and module price



Notes:

** unlevered LCOE*

Yields used are country averages and assume the installation of monofacial modules in ground-mounted systems without trackers

Assumptions:

System lifetime = 25 years

Ground-mounted PV:
Installed capacity = 50 MWp ;
CAPEX = 0,6 €/Wp ;
OPEX = 9 €/kWp.a ;
Share of debt = 80% ;
Cost of debt = 3% ;
Cost of equity = 8% ;
Corporate tax rate = 25% ;
Depreciation = 20 years

(in the heatmap)
Yield = 1300 kWh/kWp

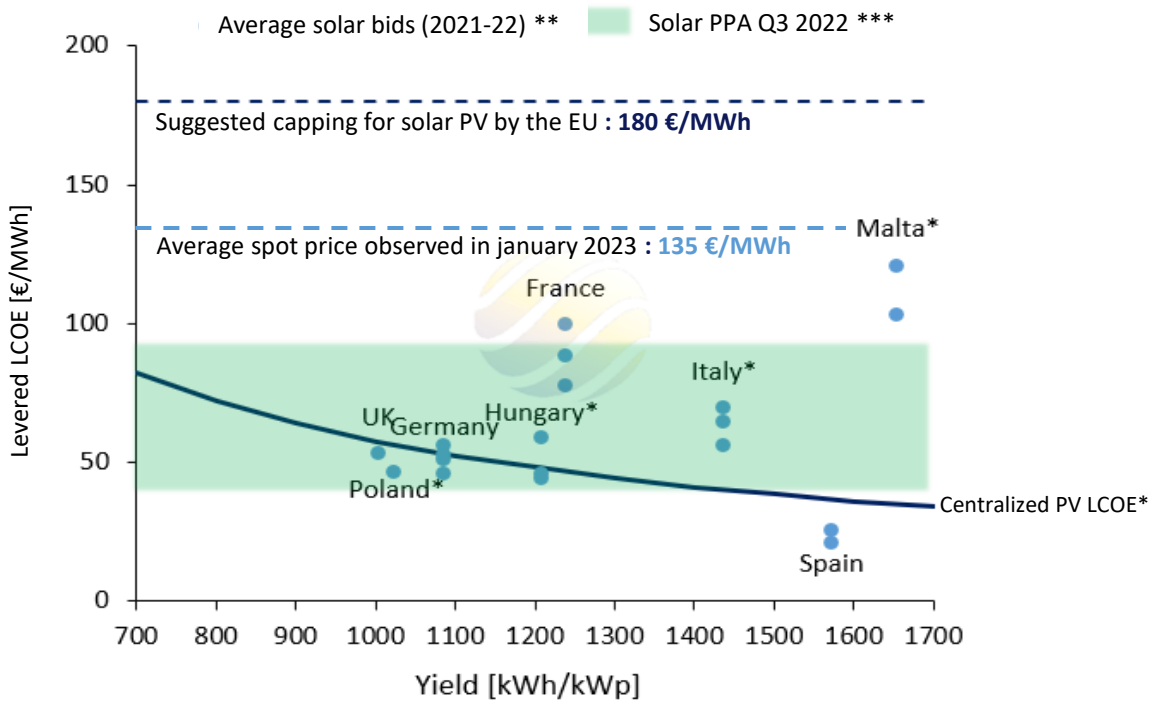
Lexicon:

PV: Photovoltaics
LCOE: Levelized Cost of Electricity
NPV: Net Present Value
PPA: Power Purchase agreement
IRR: Internal Return Rate

Centralized PV in Europe can be very competitive

With an LCOE of a few € per MWh, solar PV is significantly cheaper than recently observed spot prices in Europe

LCOE* of ground-mounted PV in Europe



Key take-aways

- Ground-mounted PV is competitive in all considered geographies.
- The levered LCOE of such systems ranges **from 83 €/MWh in the most Northern parts of Europe to below 34 €/MWh in the most Southern parts**.
- Considering the average spot prices still witnessed on the market today, PV investments remain highlight profitable, even in case of (very) high module prices.

Notes:

** levered LCOE*
*** Lowest bids are displayed for countries followed by a star*
**** LevelTen Energy*

Yields used are country averages and assume the installation of monofacial modules in ground-mounted systems without trackers

Assumptions:

System lifetime = 25 years

Ground-mounted PV:
Installed capacity = 50 MWp ;
CAPEX = 0,6 €/Wp ;
OPEX = 9 €/kWp.a ;
Share of debt = 80% ;
Cost of debt = 3% ;
Cost of equity = 8% ;
Corporate tax rate = 25% ;
Depreciation = 20 years

Lexicon:

PV: Photovoltaics
LCOE: Levelized Cost of Electricity
NPV: Net Present Value
PPA: Power Purchase agreement
IRR: Internal Return Rate

Contact us at
info@becquerelinstitute.eu

or visit our website
becquerelinstitute.eu

APPLIED RESEARCH

STRATEGIC CONSULTING

TECHNICAL ASSISTANCE

BECQUEREL INSTITUTE