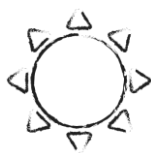


# Potential for Solar Photovoltaic (PV) adoption in Portugal

## Why Solar PV for Electricity Generation



The great solar potential in Portugal increases security in supply and grid autonomy for consumers in different sectors.



Consumers have the opportunity to save energy, foster new markets and trading models (e.g. consumers' aggregation).



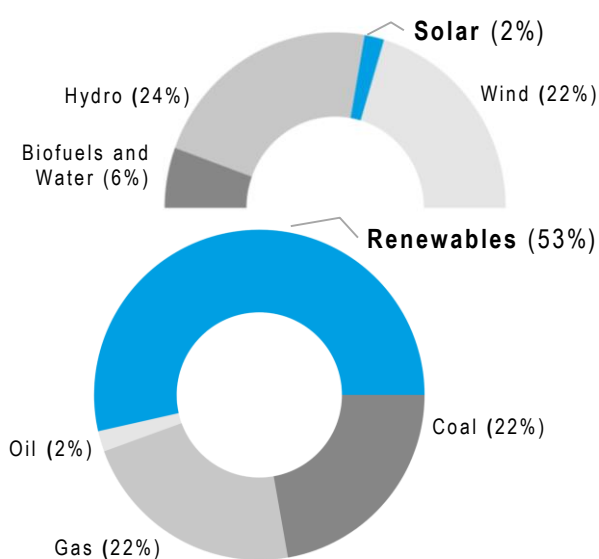
Portugal will reduce its ecological footprint, CO<sub>2</sub> emissions, and promote renewable energies, rather than fossil fuels.



Recent legislation stimulates a self-consumption logic: consumers save by avoiding the costs of buying energy from the grid.

## The underuse of Solar PV in Portugal

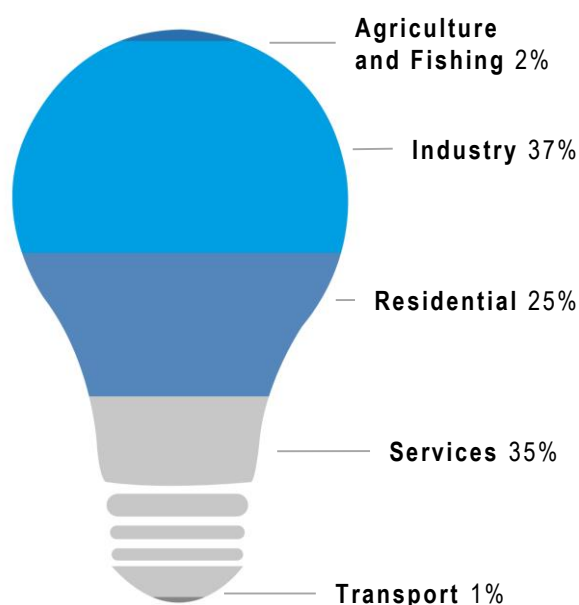
**Underused resources.** In Portugal, 53% of electricity generation is renewable (IEA *Average*: 24%). The other half is assured by fossil fuels, representing 350 tonnes of CO<sub>2</sub> emissions per GWh in 2015. Only 2% of electricity generation is supplied by solar power in the country.



**Figure 1.**  
Portuguese energy mix (i)

**Electricity.** Currently, 93% of the demand comes from buildings.

Industry, Services and Residential are the most demanding, ensuring 93% of demand. Therefore, there is a huge potential for decentralized solar energy on the buildings sector.



**Figure 2.**  
Electricity demand per economic sector (ii)

## Key Messages

- **Services** sector has the highest potential for self-consumption, having the highest avoided costs (high self-sufficiency rate) and the lowest paybacks
- **Industry** Depending on the type of industry, the solar match profile may be higher, with paybacks of 4 to 7 years.
- **Residential** Depending of the size of the family, house occupation and electric equipment profile, average paybacks are between 5 to 8 years, and self-sufficiency rates go from 6% to 20%.
- **Location** Faro reports the highest potential, while Lisbon and Porto perform more or less the same.
- To increase the contribution of solar power to the energy mix, we must think globally and act locally, towards the decentralized energy production, and towards the use of domestic and local resources.
- To boost the adoption rates, consumers need impartial tools to make informed and low risk decisions.

i. IEA, "Energy Policies of IEA countries – Portugal 2016 Review", 2016, *Reference to a report*

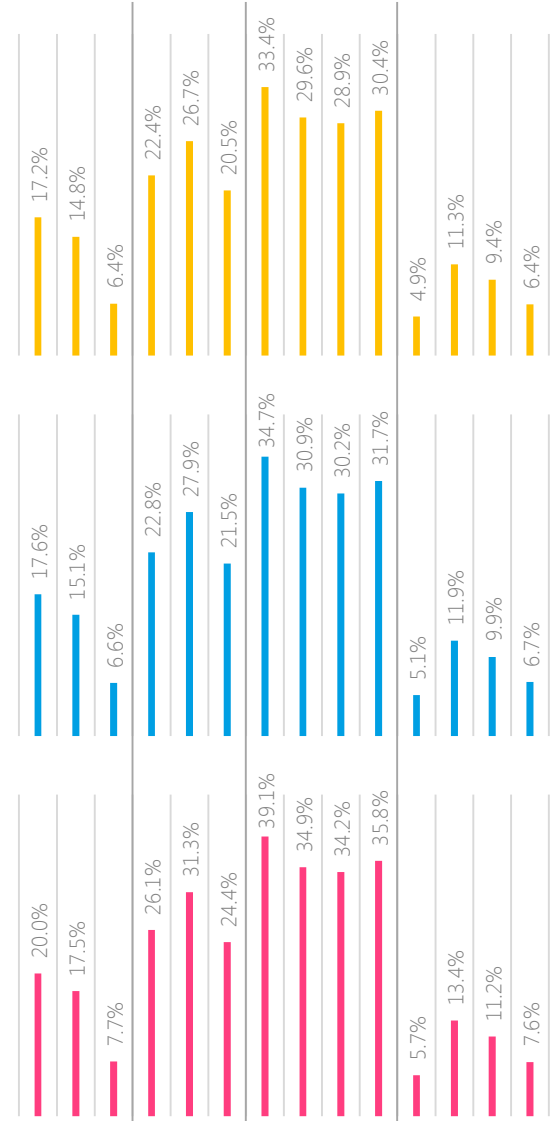
ii. DGEG, "Energia em Portugal", 2015, *Reference to a report*.

# Techno-economic Analysis

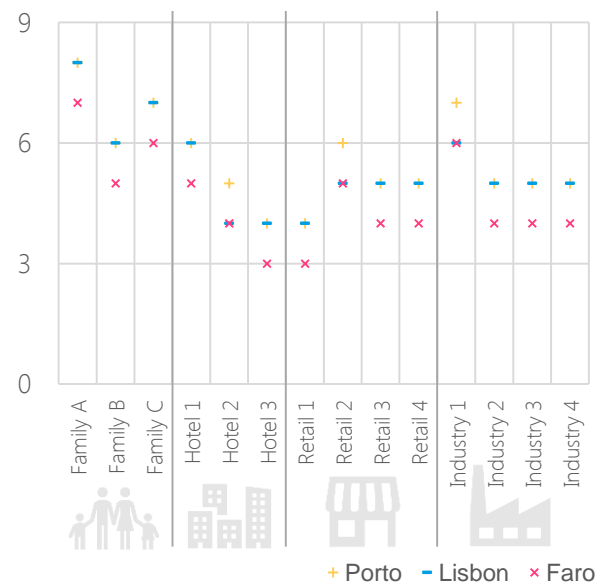
We used **Key Performance Indicators** as Discounted Payback Time (DPBT) and Self-Sufficiency Rate (SSR) to assess the techno-economic performance of PV panels, for different locations in Portugal (Porto, Lisboa, Faro) considering the best case scenario in terms of energy tariff and photovoltaic panel orientation. We analysed the solar energy production match with typical consumers real profiles of different economic sectors: residential; services, such as retail and accommodation (hotels); and industry.



SELF-SUFFICIENCY RATE (%)



PAYBACK TIME (YEARS)



- Family A:** Working couple, only home at night; optimal PV capacity: 0,25 kWp
- Family B:** Working couple, with two small children, benefit from time-of-use tariffs; optimal PV capacity: 0,25 kWp
- Family C:** Working couple, with three young children, half-day presence at home; optimal PV capacity: 1,5 kWp
- Retail:** Working-day demand, night and weekends with baseline consumption; optimal PV capacities 50-360 kWp
- Hotels:** Working-day demand, increased consumption on weekends and holidays; optimal PV capacities 5-40 kWp
- Industry:** Working-day profile, low demand on weekends; or a 24/7 profile; optimal PV capacities 20-1380 kWp

## Self-sufficiency Rate (SSR).

SSR reports the percentage of demand that is assured by solar power. **Retail and hotels (services) in Faro** have the greater self-consumption potential, due to higher SSR.

## Payback Time (DPBT).

DPBT informs in how many years consumers earn back their investment. **Retail and hotels (services) in Faro** have the greatest potential, seeing a return of investment in as little as 4 years!

# Recommendations

- ❑ Policies should focus on providing **impartial information on key performance indicators** (KPI) to minimize the risk of investment for consumers. A national simulation platform, GIS based, would be a good tool.
- ❑ There is great potential for solar energy generation in buildings, especially in the **retail and accommodation sectors**.
- ❑ If every residential consumer in Portugal installed a minimum solar PV capacity of 250 Wp per house (~1m<sup>2</sup>), it would represent: i) an increase of 1.34 GW of solar power installed, with 246% solar production increase regarding 2016; ii) 4.3% solar contribution in electricity demand; iii) avoiding 326 kton of CO<sub>2</sub> emissions, with a total private investment of 2,7 M€.
- ❑ Legislation and regulation for **new energy trading models**, specially peer-to-peer trading, must be advanced, previewing actual new financial trends applied to the energy market.