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Comparative economic analysis of support policies for solar PV in the most representative EU countries

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ABSTRACT

The purpose of this paper is to study the positions of some European Union (EU) countries on the development of PV systems. After a review of the main support policies for PV systems in Europe, the specific situations of five representative countries (France, Germany, Greece, Italy and the U.K.) are examined, with the purpose of describing the main differences in their implementation of support policies adopted for PV systems. In particular, comparisons based on economic indexes such as the net present value (NPV) and the internal rate of return (IRR) are carried out for different sized PV systems, showing that in some situations support policies can be inconvenient for the PV system owner. The paper also shows that the best profitability for a PV system owner is obtained in those countries in which there is an active electricity compensation scheme.

The comparative analysis carried out in this work could help:

- to assess the impact of PV energy policies in European member states;
- to predict how the PV market could evolve in the selected EU member states;
- to gain an insight into the future of possible energy policies.

Contents

Abbreviations: AEEG (Italian), Authority for Electric Energy and Gas; BIPV, building integrated PV system; CEI, *Comitato Elettrotecnico Italiano*; EEG, German Renewable Energy Act; EU, European Union; FiT, feed-in tariff; GSE, *Gestore Servizi Energetici*; IAB, *intégration au bâti*; IEA, International Energy Agency; IRR, internal rate of return; ISB, *intégration simplifiée au bâti*; NPV, net present value; OFGEM, Office of Gas and Electricity Market; PBP, pay-back-period; PV, photovoltaic; RES, renewable energy sources; ROCs, renewables obligation certificates; RPS, renewable portfolio standards; VAT, value added tax

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1. Introduction

The development of the photovoltaic (PV) sector in the last decade has been fuelled by the implementation of various supporting strategies aimed at reducing the gap between PV energy cost and the price of energy for conventional generation. The deployment of support policies has spurred the reduction of PV energy costs, but despite this PV is still not very competitive and its development still requires adequate support mechanisms, simple grid connection procedures, and so on.

In 2009, the European Union (EU) established a new common framework for the promotion of energy (both electrical and thermal) from renewable energy sources (RES) with Directive 2009/28/EC (Renewable Energy Directive) [1]. The directive establishes a target for each EU member state, calculated according to the share of energy from RES in its gross final consumption for 2020. The selected target is in line with the overall '20-20-20' goal for the EU, which means a saving of 20% of its primary energy consumption and greenhouse gas emissions, as well as the inclusion of 20% renewable energy in its energy consumption (European Council Act 7224/1/07, 2007) [2].

Among various renewable energy technologies today, PV attracts considerable attention due to its potential to contribute a major share of renewable energy in the future, as shown in Table 1 [3]. In effect, PV was the first source of electricity installed in Europe, in 2012 [4].

Table 1
Energy produced by RES-systems in the EU-27.

RES-based technology	Energy produced in 1997 (GW h)	Energy produced in 2011 (GW h)
Biomass	28,835	81,474
Geothermal	3,956	5,249
Hydro	311,138	390,006
Photovoltaic	41	41,514
Wind	7,330	143,368

In 2012, there was at least 28.6 GW of PV power installed in the world, bringing the cumulative PV capacity to around 96.6 GW [5] at the end of 2012. In Europe, PV systems for a total rated power equal to17.27 GW were installed in 2012, below the 22.13 GW of 2011, bringing the PV cumulative capacity to 69.6 GW. German remains at the forefront, with 7.604 GW of installed PV power in 2012, followed by Italy (3.647 GW), France (1.079 GW), the U.K. (0.925 GW) and Greece (0.912 GW). Spain, despite impressive growth in recent years (especially 2008), is at the 3rd place in Europe for cumulative PV capacity (4.706 GW) behind Germany (32.461 GW) and Italy (16.450 GW), but its additional PV power was very low in 2012 (223 MW).

The 96.6 GW of installed PV power all over the world corresponds to an annual PV electricity production of 115 TW h. Compared to the total world electricity consumption of 19,000 TW h, this comprises 0.6% of the total electricity demand of the world. The PV contribution to the electricity demand has surpassed 1% in several countries. Italy is in the first place, with a percentage close to 7%, which corresponds to a higher percentage of 14% referred to as peak electricity demand. Germany is in the second place, with 5.6%, followed by Greece (3.5%). In Germany, in particular, the 32.461 GW of cumulated PV capacity produces, on certain days, up to 45% of the instantaneous power demand and around 14% of the electricity during peak periods [5].

Fig. 1 shows the PV power installed in the selected EU countries, in 2012, related to the total EU PV production. Fig. 2 shows the same power sharing but refers to the cumulative PV capacity at the end of 2012.

The purpose of this paper is to study the positions of some EU countries on the development of the PV sector. After a brief review of the main support policies for PV systems in Europe, the specific situations of five representative countries (France, Germany, Greece, Italy and the U.K.) are examined, so as to describe the main differences in the implementation of the support policies adopted for PV systems. The selected countries are the most representative, as they have achieved the best results in the development of PV sector.

The comparative economic analysis is carried out by calculating, for each EU state, the net present value (NPV) and the internal rate of return (IRR) for PV plants of different sizes.

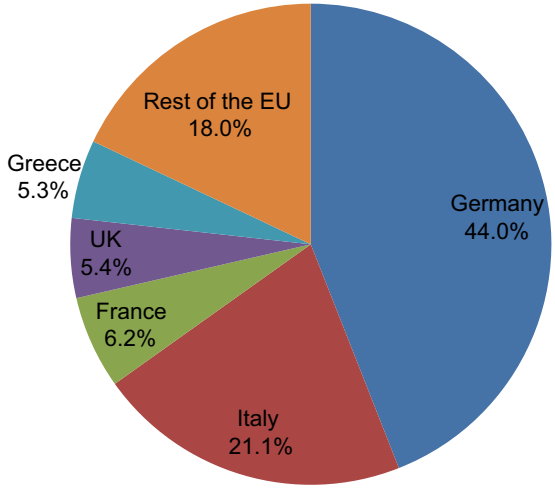

Fig. 1. PV power installed in EU in 2012.

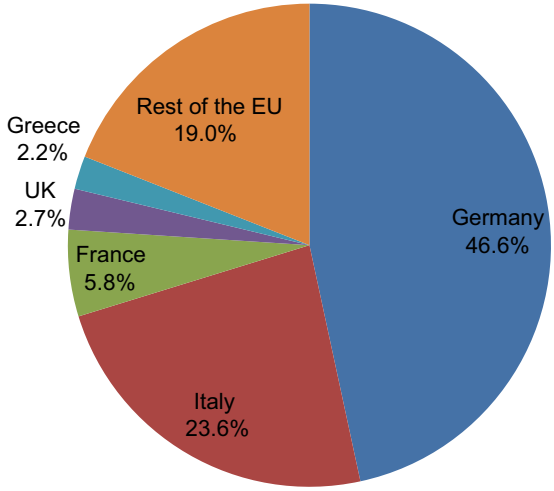

Fig. 2. Cumulative PV power in the EU at the end of 2012.