



Economic analysis of different supporting policies for the production of electrical energy by solar photovoltaics in western European Union countries

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ABSTRACT

Within various renewable energy technologies, photovoltaics (PV) today attracts considerable attention due to its potential to contribute a major share of renewable energy in the future. However, PV market development is, undoubtedly, dependent on the political support of any given country.

In this paper, after a brief analysis of national support policies in PV technology in western European Union (EU) countries, the authors perform an economic analysis of the main support mechanisms as implemented in the same countries, based on the calculation of the cash flow, the Net Present Value (NPV) and the Internal Rate of Return (IRR) indices. The analysis shows that in some situations support policies can be inconvenient for the owner of the PV-based generation system and that, in many cases, the differences between the implementation of the same support policy in different countries, can give rise to significantly different results.

The analysis carried out in this work could help:

- to assess the impact of PV energy policies in different western European member states;
- renewable energy companies to identify potential PV markets and investigate the policy landscape across western EU countries.

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1. Introduction

In 2001, the EU officially recognized the need to promote Renewable Energy Sources (RES) as a priority measure for environmental protection and sustainable development and also for meeting Kyoto protocol (EC, 2001) targets quicker.

With the European Council (EC) act 7224/1/07 (EC, 2007) European countries have promoted the use of RES, targeting an objective of a 20% contribution of RES on the total European energy production in 2020. This ambitious goal has been confirmed by the European Directive 2009/28/EC (EC, 2009), the so-called “Climate and Energy Package”, that represents the concrete proposal from the EU for a revision of the Kyoto protocol. The Climate and Energy Package includes:

- the reduction of at least 20% of greenhouse gases, from 1990;
- the production from RES of 20% of internal energy consumption; and
- the use of bio-fuels to cover at least 10% of the energy consumption for transport.

These ambitious goals will only be reached with an effective incentivisation policy of RES-based production systems and with a concrete effort towards the improvement of the energy efficiency of these sources.

Within various RES-based technologies, PV today attracts considerable attention due to its potential to contribute a major share of renewable energy in the future.

The solar resources worldwide are abundant and cannot be monopolized by few countries. However, PV and other RES are the only sources of energy that will offer a price reduction rather than an increase in coming decades.

Electricity generated with PV systems and other RES have many positive benefits for the European economy. With increasing installations of RES, the electricity generated can help to reduce the dependency of EU countries on energy imports. In addition, electricity from PV is generally produced during peak hours, that is, when electricity is most expensive.

In 2008, the total PV power installed in EU member states doubled with respect to the cumulative PV power installed in previous years. The total PV power installed in 2008 in the EU-27 totalled 4592 MWp, bringing to 9533 MWp the total installed PV power in EU countries at the end of 2008. Spain represented almost half of the new installations in 2008 with almost 2.7 GW of new capacities, followed by Germany with more than 1.5 GW of additional PV connected power. Italy connected almost 260 MW

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while France, Portugal, Belgium, the Czech Republic and Bulgaria also achieved good scores confirming Europe as the global leader in the deployment of solar PV energy (IEA, 2008).

The enormous progression in 2008 has been specifically due to the development of the Spanish market which represents more than 45% of the global PV market.

PV market development is, undoubtedly, dependent on the political support of any given country, that is defined in the national laws. The introduction, modification or fading out of such incentivisation schemes can have great consequences on the PV market.

In this paper, a brief description of the different support policies in PV technology in western EU countries is carried out (the definition of western Europe is according to UNESCO¹).

A comparative economic analysis among the main support measures (feed-in tariffs (FIT) and tradable green certificates (TGC)) implemented in western EU countries is performed. The analysis is based on the calculation of cash flow and the NPV and IRR indices.

2. Supporting strategies for PV systems in western EU countries

PV development is strongly related to support policies promoted by different national governments and encouraged by the EU that strives to ensure the PV industry remains competitive in the worldwide market.

Therefore, PV technology is currently still very expensive (from 3 to 7 €/Wp all-inclusive for grid-connected PV systems) and its cost is above grid parity.

Different forms of financing for RES (and specifically PV systems) have been defined and put into effect in the last decade and the most popular in Europe are the FIT system and the quota system regulation in combination with a TGC market.

Other policy instruments, no longer used in any European country as the main policy scheme, are capital subsidies, net metering and tax credits. These support instruments are frequently used as supplementary measures in many member states.

A description of the above-mentioned supporting policies can be found in Campoccia et al. (2009).

Numerous countries are developing brilliant support policies for PV, of which Italy and France are emerging as the new high-potential markets. Others, such as Belgium, Portugal and Greece, are following with promising support schemes.

In recent years, several studies have been carried out to describe and analyze the different support measures applied in EU countries, not only in regards to PV. For instance, Klein et al. (2008) analyze the FIT designs applied in the member states of the EU, and also investigate the design options used to reduce electricity generation costs as well as the costs for society.

Meanwhile, Harmelinka et al. (2006) have examined the effectiveness of EU policies and present a monitoring methodology providing a framework for evaluating the effectiveness of renewable energy support policies. Applying this monitoring protocol at EU-level the paper shows that with the current policies in place, the share of electricity production will reach a level of 15–18% of total electricity consumption, whereas the target is 20%.

Table 1 represents the current considered financing strategies in western EU countries, which is described in more depth in the next section.

Table 1

Current financing strategies for PV systems in western EU countries.

Country	FITs	TGCs	Capital subsidies	Tax credit	Net metering
Austria	x		x		
Belgium ^a		x	x	x	x ^a
Cyprus	x		x		
Denmark			x	x	x
Finland ^b					
France	x			x	
Germany	x		x	x	x ^c
Greece	x		x	x	
Ireland ^d					
Italy	x		x	x	x
Luxembourg	x		x	x	
Malta			x	x	x
Netherlands	x			x	
Portugal	x ^e		x	x	x ^f
Spain	x			x	
Sweden ^g			x		
United Kingdom		x	x	x	

^a Energy subsidies for PV plants are implemented separately for the three regions of Belgium (Flanders, Brussels and the Wallonia Region). Net metering is available only in Wallonia, for PV plants below 10 kWp.

^b At present, no FIT schemes or purchase obligations are available in Finland.

^c Only for PV installations smaller than 30 kWp.

^d A FITs plan is active, but PV is not included. The use of solar electricity is very low in this country.

^e Valid only for PV installations below 3.68 kWp (16 A single-phase).

^f Valid for PV installations below 5.25 kWp (25 A single-phase).

^g A new support mechanism for installation of PV systems in Sweden, in 2009, has been announced by the government (valid for a three year period) but it is still not active.

2.1. Austria

Several studies were carried out in Austria to estimate the potential of PV energy in the country and, particularly, in the Alpine area (Culver and Jäger, 1998).

The main promotion scheme for RES in Austria is a draft amendment, published in November 2007, of the existing RES law, which increased the annual allocated budget for RES. According to this amendment, the responsible authority is obliged to purchase the electricity produced from RES and pay the corresponding tariff (adjusted annually by law). The overall assigned budget is limited to €21 million per year for new RES plants, up to 2011. The PV annual budget corresponds to about 3.3 MWp of PV installations per year. This budget, although higher than the former, still causes some uncertainty for PV producers. Furthermore, new RES producers must request permission which is granted as long as there is sufficient budget for the current year. Each year's RES producers must request permission and join the bottom of the list.

Even though the “new RES” are supported mainly via long-term guaranteed FITs, the financial cap is too low to significantly increase the PV market.

The FITs are financed by a supplementary tax on the electricity net-price and by a fixed price purchase obligation for electricity dealers.

FITs are guaranteed for ten years (plus two years) with lower tariffs. For the following period (up to a maximum of 24 years) a purchase obligation at the market price for electricity is applied.

The FIT values in Austria, in 2009, are outlined in Table 2.²

The FITs are valid until the end of 2011.

Environment subsidies of 30–40% of total costs are granted by the federal government. Some of the federal states have additional investment support schemes.

¹ The western EU countries, according to UNESCO, are: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, The Netherlands, Portugal, United Kingdom, Spain and Sweden.

² Photovoltaic Austria Federal Association, <http://www.pvaustria.at/>.

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