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

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ABSTRACT

Today, photovoltaic (PV) attracts considerable interest in relation to renewable energy technologies, because of its potential to contribute significantly to the future of renewable energy. However, PV market development is related strongly to the support policies introduced by national governments, defined in national laws. The modification or fading out of such incentive schemes can strongly influence the development of the PV market in any given country. In this paper, after a brief review of national support policies in PV technology in eastern European Union (EU) countries, the authors perform an economic analysis of the main support mechanisms that are implemented in these countries. The comparative analysis is 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 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.

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1. Introduction

In 2001, the European Union (EU) decided to promote Renewable Energy Sources (RES) as a priority measure to fight against environmental pollution and to meet more quickly the targets of the Kyoto protocol. At first, with the European Directive 2001/77/EC (EC, 2001) the EU established officially to increase the share of electricity produced from RES from 14% to 22% of gross electricity consumption by 2010. Successively, with the European Council (EC) Act 7224/1/07 (EC, 2007), the EU decided on a goal of 20% as its contribution of RES in relation to the total European energetic production in 2020. This objective has been confirmed with the European Directive 2009/28/EC (EC, 2009), the so-called “Climate Action and Renewable Energy Package”. The main objectives fixed by the Directive include:

- a green-house gas reduction of at least 20% with respect to 1990 levels;
- the production from RES of about 20% of the European internal energy consumption by 2020;
- the promotion of bio-fuels to cover at least 10% of the energy consumption for transport.

These goals will only be realized with an effective incentivization policy of RES-based production systems, with a diversification of energy resources including RES and with a concrete effort towards the improvement of the energy efficiency of these sources.

The Directive fixes the contribution expected from each EU member state to meet these objectives and proposes many measures to help achieve them. Each member state must increase the production from RES of 5.5% from 2005 levels; the remaining portion depends on the gross domestic product (GDP) per capita in order to reflect different levels of wealth across EU members. These two terms are summed together to obtain a total production from RES of about 20% of the European internal energy consumption, by 2020. The Directive obliges each member state to present, by June 2010, a National Renewable Action Plan providing an indicative trajectory to meet its 2020 objective, followed by a progress report presented every two years. Defaulting member states are subject to infringement proceedings.

Among different RES-based technologies, PV today attracts growing attention because of its potential to contribute a major share of renewable energy in the future.

The solar resource worldwide is abundant and cannot be monopolized by any country. Moreover, PV and other RES are the only sources of energy that will offer a price reduction rather than an increase, in coming decades.

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The most important advantages of the solar resource are:

- its abundant, free and unlimited source of energy;
- the absence of excessive maintenance and management costs;
- the absence of conversion mechanisms producing tiresome emissions;
- it can be easily integrated in public or private buildings without an environmental impact typical of other RES technologies (i.e. wind turbines).

In 2008, the total PV power installed in EU member states doubled with respect to the cumulative PV power installed in previous years. In effect, the total PV power installed in 2008 in the 27 countries of the EU (EU-27) amounted to 4592 MW, bringing it to 9533 MW as the total installed PV power at the end of 2008.

Although the PV market in European developing countries is still quite small, it has been growing rapidly in recent years. Cumulative installed power increased from 8 MW in 2007 to more than 60 MW at the end of 2008. Until 2006, the installation of small off-grid PV plants prevailed in eastern EU countries. Starting from 2008, large-scale on-grid PV plants have been put into effect. At the end of 2008, on-grid installations constituted 96% of the total installed PV plants.

The large increase of PV installations in 2008 is a consequence of the enormous development of the Czech market, stimulated by the effectiveness of the implemented support measures. Other developing member states, such as Slovakia and Bulgaria, have adequate PV support schemes, especially including effective Feed-in Tariff (FIT) systems.

Table 1 represents the cumulative installed PV power in 2008, in each eastern EU country, divided between on- and off-grid PV plants (Eurobserv'er, 2009).

Access, distribution and transmission of RES electricity is guaranteed by national laws in all the EU developing countries. Not all countries give priority to PV energy, but the principle of non-discrimination of energy produced by RES is always valid.

Several obstacles obstruct the effective development of the PV sector: lack of effective national support policies or incorrect design of support mechanisms, poor customer awareness, strong nuclear and oil lobbies, high grid connection costs paid by PV electricity producers, the long time that is spent on administrative procedures before installing PV systems and complexity of grid connection procedures.

PV market development is strongly dependent on the political support within the different countries. In effect, the cost of PV energy is still rather high and several studies are being carried out to research new PV materials and devices, focusing on the reduction of PV generation cost expected from the technological implementation.

Table 1
Cumulative installed PV power in 2008 in eastern EU countries.

Country	Off-grid [kW]	On-grid [kW]	Total [kW]
Bulgaria	32	1375	1407
Czech Republic	380	54,294	51,674
Estonia	12	0	12
Hungary	180	270	450
Latvia	4	0	5
Lithuania	55	0	55
Poland	832	179	1011
Romania	205	245	450
Slovak Republic	20	46	66
Slovenia	100	2046	2146
Total	1820	58,455	57,275

In this paper, after a brief review of national support policies in PV technology in eastern EU countries, the authors perform a comparative economical analysis among the main support mechanisms as implemented in these same countries. The evaluation is based on the calculation of the cash flows, the NPV and the IRR indexes. The definition of eastern Europe is according to UNESCO.¹

2. Supporting strategies for PV systems

In fact, PV technology is still very expensive and its cost is above the grid parity. Its development is connected strongly to support mechanisms carried out by the different national governments.

The main purposes of national policies that support the development of PV systems are:

- to promote the PV technology even while the cost of PV is significantly above grid parity to allow it to achieve the economies of scale necessary to reach grid parity;
- to promote national energy independence, high tech job creation and reduction of CO₂ emissions.

In recent years, different instruments to finance RES (PV systems specifically) have been defined and implemented. The most popular in Europe are the FIT system and the quota system regulation, in combination with a Tradable Green Certificate (TGC) market.

Other policy instruments are capital subsidies, net metering and tax credits, frequently used as supplementary measures in many member states.

Below, we discuss the FIT and TGC systems. A description of the remaining supporting policies can be found in Campoccia et al. (2009).

2.1. Feed-in Tariffs

The FIT mechanism regards the obligation to be on the part of the utility to purchase the electricity generated by PV system (a RES-based system in general) within its service area; with this system, a tariff is paid, which is determined by the public authorities and guaranteed for a specific time period. Alternatively, the FIT can be paid in the form of an additional premium, on top of the electricity market price (feed-in premium).

In the case of a fixed tariff design, a FIT value represents the full price received by an independent producer for any kWh of electric energy produced by a PV system. In this case, the remuneration is independent from the electricity market price. Differently, the development of the electricity bill has repercussions on the remuneration level under the feed-in premium option. Hence, the feed-in premium represents a variation of the commonly used fixed tariff towards a market-based support instrument. At present, most of the European countries with feed-in systems opt for the fixed tariff model.

With the FIT system, the extra cost does not fall upon the taxpayer but is distributed across the utilities' customer base. Different tariffs are defined for different countries, depending on resource conditions and socio-political situations. A discussion on the success of the FIT as a support programme for RES is reported in Pietruszko (2006).

¹ Eastern EU countries, according to UNESCO, are: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic and Slovenia.

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