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Comparative analysis of different supporting measures for the production of electrical energy by solar PV and Wind systems: Four representative European cases

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Abstract

In the 9th of March 2007, the European Council decided a fixing goal of 20% contribution of the renewable energy sources (RES) on the total European electric energy production in 2020.

In order to reach such an ambitious goal, all the European countries are adopting different support policies for encouraging the installations of RES-based generation systems.

In this paper, after a brief review on the main support policies for RES in Europe, the specific situations of four representative countries (France, Germany, Italy and Spain) are examined, with the purpose of putting into evidence the main differences in the support policies adopted for Photovoltaic (PV) and Wind systems.

In particular, a comparison based on the calculation of the pay-back-period (PBP), the net present value (NPV) and the internal rate of return (IRR), for different sized PV and Wind systems, shows that in some situations a support policy can be not convenient for the owner of the RES-based generation system and that, in many cases, the differences between the way of implementation of the same support policy in different countries, can give place to significantly different results.

Keywords: Support policies; PV systems; Wind systems; Feed-in-tariffs; Net metering; Green tags

1. Introduction

In 2001, the EU has officially recognized the need of promoting renewable energy sources (RES) as a priority measure since their exploitation contributes to environmental protection and sustainable development and makes it possible to meet Kyoto targets more quickly (Directive 2001/77/EC, 2001).

The latest evidence of the diligence of the European countries in promoting the use of RES is the European Council act 7224/1/07, 2007 targeting an objective of 20% as contribution of the RES on the total European energetic production in 2020. Such a bond represents, without doubts, a challenging goal, that will be able to be reached only with an effective RES incentivation policy and with a concrete effort towards the improvement of the energetic efficiency of these sources.

Abbreviations: AEEG (Italian), authority for electric energy and gas; BIPV, building integrated PV system; EU, European union; FIPV, field installed PV system; FIT, feed-in tariff; GT, green tag; IEA, international energy agency; IRR, internal rate of return; NIPV, not integrated PV system; NPV, net present value; PBP, pay-back-period; PIPV, partially integrated PV system; PV, photovoltaic; RAT, reference average tariff; RES, renewable energy sources; VAT, value added tax; WACC, weighted average cost of capital.

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Table 1
Energy produced by RES-systems in the EU-27 (Elaboration from Nomisma Energia, Data from Eurostat)

RES-based technology	Energy produced in 1997 (GW h)	Energy produced in 2005 (GW h)	Variation in the period 1997–2005 (GW h)	Percentage variation in the period 1997–2005
Biomass	28,835	81,474	52,639	8.1
Geothermal	3956	6614	2658	5.0
Hydro	273,959	264,949	–9010	−0.4
Mini-Hydro	37,179	39,107	1928	0.6
Photovoltaic	41	1457	1416	12.1
Wind	7330	69,424	62,094	11.2

In the present paper, after a brief review on the main support policies for RES in Europe, the Authors examine the support policies adopted for Photovoltaic (PV) and Wind systems in France, Germany, Italy and Spain.

Only PV and Wind systems have been selected for the present analysis. This choice is due to the higher grow rate in the last decade of these two technologies with respect to the other RES-based systems, as shown in Table 1 (Nomisma Energia, 2007). The data reported in Table 1 show how, among all the RES-based technologies, PV and Wind systems expected to contribute a major share of renewable energies in the coming decades.

The four countries considered in the study have been chosen essentially for two reasons:

- They are the countries that have reached the best results in the promotion of both PV and Wind technologies in Europe. In effect, Germany, Spain and Italy are, respectively, at the first, second and fourth place in Europe as producers of electric energy from PV and Wind sources. France is at the fifth place for the production of PV electric energy but only at the 11th place as Wind energy producer (Nomisma Energia, 2007);
- They are the countries in which the supporting strategies for PV and Wind systems have been implemented in the most different ways, like will be shown in the following, and so the most representative for the purposes of this study.

A comparison based on the calculation of the pay-back-period (PBP), the net present value (NPV) and the internal rate of return (IRR) for different sized PV and Wind systems, shows the advantages and the limitations of each national support strategy and gives rise to suggestions for future studies on possibilities of improvement.

2. Supporting strategies for PV and Wind systems

As the use of solar and wind energy expands, so the measures for financing them increase.

Different forms of financing for PV and Wind systems have been put into effect in the last decade: capital subsidies, VAT reduction, taxes credits, green tags, net-metering, feed-in tariffs, etc.

Table 2
Financing strategies for PV systems in the EU-27 (Nomisma Energia, 2007)

EU country	Feed-in tariffs	Net metering	Capital subsidies, grants or rebates	Green tags
Austria	✓		✓	✓
Belgium		✓	✓	✓
Bulgaria				
Cyprus	✓		✓	
Czech Republic	✓	✓	✓	✓
Denmark	✓	✓		✓
Estonia	✓			
Finland			✓	
France	✓			
Germany	✓			
Greece	✓		✓	
Hungary	✓			✓
Ireland	✓		✓	✓
Italy	✓	✓		
Latvia	✓			
Lithuania	✓		✓	
Luxembourg	✓		✓	
Malta			✓	
Netherlands	✓			✓
Poland			✓	
Portugal	✓		✓	
Romania				
Slovak Republic	✓			
Slovenia	✓			
Spain	✓		✓	
Sweden	✓		✓	✓
United Kingdom			✓	✓

Tables 2 and 3 show the different financing strategies activated in the 27 countries of the EU, for PV and Wind systems, respectively.

The effects of capital subsidies on the PV market in Europe have been discussed in Jahn and Nasse (2003) and Weiss et al. (2003).

Below is a discussion on green tags, feed-in tariffs and net-metering, since they are representing the most actual support strategies.

2.1. Green tags

Green tags (GTs) are the property rights to the environmental benefits from generating electric energy from RES. GTs can be sold and traded and their owners can legally demonstrate[1] to have purchased renewable energy.

An energy producer is credited with one GT for every 50 MW h of electricity produced from RES. A certifying agency gives to each GT a unique identification number

[1] In Italy, from 1999, a Ministerial Decree (Italian Ministry for Economical Development Decree, 1999) states that all the great producers (production over 100 GW h) of electrical energy from fossil sources have to produce a given quantity of electrical energy from renewable sources. According to the above-mentioned Decree, the producers can build new plants based on RES or can purchase renewable electrical energy from ecological producers. In this second case a GT can demonstrate the purchase of the clean energy to the Italian Government.