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Original Research Article

Critical assessment of support for the evolution of photovoltaics and feed-in tariff(s) in Italy

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ABSTRACT

The feed-in tariff(s) mechanism involves an obligation on the part of an electricity provider to purchase electricity generated by renewable energy sources in its relevant area, paying a tariff determined by public authorities and guaranteed for a specific time period. Feed-in tariff(s) have been the primary mechanism used for supporting the development of renewable energy sources in the EU and, up to date, they are being applied in 20 EU Member Countries.

On 6 July 2013, the Italian experience with feed-in tariff(s) for photovoltaic systems finished. During its lifetime of eight years, this incentive mechanism, named "Conto Energia", was characterized by periods of great success followed by others of serious skepticism. The implementation of the Italian feed-in tariff(s) mechanism was changed many times, becoming very close to the European standard.

Introduction

The crisis of traditional fossil fuels (coal, petroleum, and natural gas), the ongoing climatic changes, and the consequently increasing attention towards environmental issues require new and urgent energy incentive policies able to turn the present European energy system, on which our society is based, into a more environmentally and economically sustainable one.

The recourse to Renewable Energy Sources (RESs) to satisfy a significant part of the European Union (EU) energy needs is considered an essential instrument, because these sources can contribute not only to the reduction of climatic changes but also to the diversification of primary energy sources, important industrial growth, and increase in employment [12,13,36].

Therefore, the issues of energy-efficient technologies are the core of the most recent energy policies of the EU, based on the acceptance of the cooperation strategies between the EU Member Countries aimed at diversification of energy sources, energy efficiency improvements, and Greenhouse Gas (GHG) emissions reduction [54].

Considering the EU targets for the year 2020 (20% reduction of GHG emissions and 20% increase in electricity produced from RESs), the easiest way to attain these goals is through a relevant increase in Distributed Generation (DG) within the electrical power distribution systems, thus allowing the exploitation of several RESs.

Among the various technologies based on RESs, photovoltaics (PV) attracts considerable attention today due to its potential to make an important contribution to renewable energy production in the near future [34,60,17,7,46,32,10,11,18]. In 2012, indeed, PV industry production increased by almost 40% and reached a worldwide output of about 40 GWp of PV modules [48]. Yearly growth rates over the last decade were on average between 40% and 90%, which make the PV industry the fastest growing one today.

This is basically due to the following cornerstones:

- Solar radiation is a free and inexhaustible source of energy;
- There is no need for expensive maintenance;
- There are no noise emissions;
- Integration in buildings does not present the typical environmental impact of other "green" technologies (for example wind turbines);
- In the last five years, there has been a decrement of residential PV electricity system costs of almost 60% in the most competitive markets, so the cost of PV-generated electricity is already cheaper than residential electricity retail prices [52];
- PV plants allow the environmental costs associated with CO_2 emissions to be reduced.

In the coming years, the development of PV plants will increase thanks to the above cornerstones, incentive policies, and, most

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importantly, the decreasing costs and improved efficiencies of PV modules [60].

As early as 2008, during the greatest PV diffusion period, some scientists advocated for the reduction of tariffs granted for solar-based electricity. In Germany, for instance, the large feed-in tariff(s) (FITs) guaranteed for solar electricity constituted a subsidization regime that, if extended to 2020, threatened to reach a level comparable to that of German hard coal production [41].

Basically, incentive policies are promoted by national governments and encouraged by the EU, which is striving to ensure the PV industry remains competitive on the worldwide market.

The most common incentive mechanism in Europe is the FITs.

This mechanism obligates an electricity provider to purchase electricity generated by renewable energy producers in its relevant area, paying a tariff determined by public authorities and guaranteed for a specific time period.

Up to today, the FIT mechanism is being applied in 20 EU Member Countries and in 63 countries worldwide [31].

In Italy, the FIT mechanism has been named "Conto Energia" and has been changed five times from 2005 to 2012, becoming, at the end, very close to the European standard.

On 6 July 2013, the €6.7 billion ceiling of the Conto Energia was reached with 18.2 GW of installed power and the Conto Energia ceased after 30 days 5 August 2013.

The purpose of this work is to provide a critical analysis of the evolution of the FIT mechanism in Italy from its beginning in 2005 to its conclusion on 6 July 2013.

In particular, this work examines the five versions of the Conto Energia, analysing for each one both the advantages and the critical issues and commenting on its influence on the development of the PV market in Italy.

Moreover a short comparison with the implementation of the FIT mechanism in the main EU countries is provided. Finally, it is shown that the high complexity of the Italian technical standards and bureaucratic processes have made the Italian incentive mechanism very difficult to be implemented by users and technicians.

Worldwide strategies for supporting PV systems

In the last decade, several incentive policies for PV systems have been carried out: capital subsidies, VAT reduction, tax credits, green tags, net-metering, FITs, and so on. The experience has demonstrated that, depending on the different forms of its implementation, each incentive mechanism can lead to advantages but also disadvantages for the electricity producers and the community.

Some studies [51,58] have proposed simple microeconomic models for comparing these mechanisms with respect to social welfare. Fouquet and Johansson [39] and Sarasa-Maestro et al. [56] reported two interesting discussions on the incentive policies for PV system remuneration in EU countries, explaining how support policies for PV systems have evolved in these last years.

Dusonchet and Telaretti [29,30] performed a comparative economic analysis of each individual European incentive mechanism for PV systems based on the calculation of the Net Present Value (NPV), the Discounted Cash Flows (DCFs), and the Internal Rate of Return (IRR).

The effects of capital subsidies on the PV market in Europe have been discussed since 2000 [43,33] and most recently by Dusonchet and Telaretti [29,30].

FITs and net-metering are the most commonly used support strategies, as discussed by Campoccia et al. [4,5,6], Zahedi [59], and Antonelli and Desideri [3].

Net-metering is a simple standardized protocol for the exchange of the electricity produced by local RES-based generators belonging to residential customers. With net-metering, customers can offset their electricity consumption with small-scale RES over a whole billing period, using the electricity at a different time to when it is produced, without considering when the power is consumed or generated, and storing their energy in the electricity provider grid.

Providers may benefit from this support mechanism because, when customers are producing electricity during peak periods, the system load factor is increased. Net-metering is a widespread mechanism for supporting PV systems especially in the US [16] and since the end of the last Conto Energia it is the preferred support mechanism for small-sized PV systems in Italy.

At present, from 1 January 2013 to 31 December 2014, PV systems installed on residential buildings and connected to the LV grid with a net-metering contract can benefit from a tax credit of 50% of the total purchase, installation, and design cost and a VAT reduction of 10–22% (design cost excluded).

The FIT mechanism involves the obligation on the part of an electricity provider to purchase electricity generated by RES in its service area, paying a tariff determined by a public authority and guaranteed for a specific time period (generally 20–25 years). A FIT's value represents the full price that a producer receives for any kilowatt hour of electricity generated and may include a premium above or in addition to the market price; it excludes tax rebates or other production subsidies paid by the government.

Different tariffs are defined for different renewable technologies across countries depending on resource conditions (e.g. solar irradiation, wind availability, etc.) and socio-political situations. The amount of an FIT is determined so as to guarantee the cost-effective operation of RES plants. At present, the FIT mechanism is being applied in 20 EU Member Countries and in 63 countries worldwide [52].

Couture and Gagnon [14] have shown that these different ways of structuring FIT policies can have important impacts on the RES market.

The following countries are those that have obtained the best results in PV promotion in the last few years thanks to FIT policy.

In France, FITs for PV systems are composed of a basic tariff and may be increased by a premium. They are accompanied by other financial incentives such as a tax credit for individuals or reduced VAT and accelerated investment depreciation for companies [40].

The structure of the French PV FIT policy, presenting a basic tariff and a premium, is very similar to the Fifth Conto Energia.

Moreover, in both Italy and France, a reduced VAT is allowed for the purchase and installation of PV systems.

In Germany, the FIT mechanism is also very similar to the Fifth Conto Energia. Moreover, as an alternative to receiving the FIT, a producer can sell its electricity directly to a third party by a supply agreement or on the stock market and claim a market premium from the local electricity provider. The market premium is calculated each month [37].

In Greece, the support mechanism establishes that the grid operator or the electricity market operator is obliged to pay the producer for all the electricity fed into to the grid. FITs are based on the average marginal system price, so they can change every year. FITs are paid for 20 years but may be extended by contract between the parties [49]. A great difference from the Italian Conto Energia is the non-constant values of FITs in time.

In Spain, the Royal Decree RD 1578/2008 [55] has regulated the economic regime of solar PV plants installed after September 29, 2008. Basically, the two main features of this Royal Decree are: (a) the adoption of a capacity quota system for each type and subtype of PV installation (this gave rise to the creation of the Registry for the pre-allocation of support, in which all the PV installations are inscribed); (b) the classification of PV installations into type 1 (roofs/facades) and the rest (in general, large PV generation plants). Moreover, type 1 plants were divided into 1.1 (installed power less