



Renewable investments: The impact of green policies in developing and developed countries



Antonio A. Romano^a, Giuseppe Scandurra^{a,*}, Alfonso Carfora^a, Mate Fodor^b

^a Department of Management Studies and Quantitative Methods, University of Naples "Parthenope", via Generale Parisi, 13, Napoli – I 80132, Italy

^b ECARES – European Centre for Advanced Research in Economics and Statistics, Université Libre de Bruxelles – 42, Av. Roosevelt, Brussels, Belgium

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ABSTRACT

In this paper we explain the effectiveness of green policies on the basis of development stage of countries.

The analysis conducted on developing and developed countries in the time span 2004–2011, following a two-step approach: in the first step, we consider the green policy sectors (regulatory policies, fiscal incentives, and public investments) while in the second step we analyze individually the policies adopted by countries.

Results confirm that not all policies promote the investments in Renewable sources and their effectiveness depend by the stage of development of the countries.

1. Introduction

In this review we develop and apply a framework for the evaluation of various policy schemes. Moreover, in this paper we want to analyze the effectiveness of the energy policies that support the renewable generation. The framework suggested contributes to the development, use and integration of evaluation practices. These evaluation schemes are useful for an ex-ante policy effectiveness evaluation. In fact, the need to limit the effects of climate change, and battle the depletion of traditional energy sources, has led to the emergence of a variety of international agreements. These have different objectives, but they converge towards the goal of limiting the use of primary energy through:

1. improvement of energy efficiency of production processes;
2. increasing the share of electric energy in the total primary energy;
3. the reduction of greenhouse gas emission (especially CO_2);
4. the use of renewable energy (especially wind and solar).

For less developed countries without effectively distributed electricity on their territories, micro generation plants represent an important opportunity to achieve some of the above listed goals [1]. They also reduce dependence on foreign countries for many importers of primary energy in general and electricity in particular. The geographical areas of origin of petroleum products are inherently unstable, not to mention the alarming prospect of reaching “peak oil”.

The costs and returns of investment made for the construction of power plants based on renewable sources, however, still represent a critical factor for their widespread use. Nevertheless, the impact of these factors tends to decrease over time, in accordance with the diffusion of plants themselves. To promote the objective identified in point 4, various countries have established a set of economic policies to support the transition from traditional sources (especially fossil fuels) to renewable and environmentally friendly¹ ones. Generally, the policies start in some of the least developed countries, and they strengthen the transition process in other countries. It is generally understood that the differential of the total cost (investment and production) between the fossil fuels and renewable sources tends towards zero over time.

Based on the schematic proposal from Renewable Energy Policy Network (REN21) (2), policies implemented can be grouped into three categories. They are independent of the economic and social development level of the implementing country.

- Policies for the creation of a new regulatory framework (Regulatory Policies): they provide a “prize” for economic operators that enter the network, and/or produce, in whole or in part, electricity from renewable sources. The best known among these policies are the Repurchase rate (Feed in Tariff), Net Metering, Green Certificates (Tradable REC) and Forced Share (Renewable Portfolio Standard);

- Policies for granting tax incentives (capital subsidies, grants or rebates, investment or production tax credits; Reductions in sales, energy, CO_2 , VAT or other taxes; energy production payment) - Direct

* Corresponding author.

E-mail address: giuseppe.scandurra@uniparthenope.it (G. Scandurra).

¹ It should be pointed out that in most of the scientific literature, the generation of electricity from hydro, is not considered to be renewable energy, because of its peculiar characteristics, which impose direct state intervention.

public investment in offering productive and competitive public and government grants.

It is commonly assumed, especially in the theoretical and qualitative literature, that green policies for the renewable sources (GPRES) are major drivers of the development of generation from renewable sources. Empirical evidence, however, does not provide conclusive proof for this statement.

Researchers have investigated the relationship between investments in power plants from renewable sources [RES] and policies adopted by various countries aimed at promoting renewables. The impact of social and economic development levels on this process has also been addressed.

In particular, the literature can be divided into two large groups. The first group refers to methods of appraisal, traditionally with multi-criteria analysis (see, e.g., [3]). The other group assesses effectiveness and ex post outcomes. These include econometric models usually based on panel data.

Many scholars have analyzed the effectiveness of policy instruments using a multi-criteria framework. Multi-criteria analysis departs from the fact that a number of criteria are relevant to policy formulation and evaluation (e.g. [4–6]).

However, due to the fact that evaluation is principally normative in nature ([3]), value criteria are needed on which normative judgements are based regarding any significant impact ([7–9]). Criteria are evaluation standards that impose the framework upon which a policy option is assessed and eventually chosen ([4,10]). Mundaca and Richter [11] assess the American stimulus policies for renewable energy using an indicator-based methodology. They find that stimulus programs have had a positive effect on the RE sector, but they are resource-intensive. The analysis highlights numerous challenges, notably related to causality and additionally.

Some papers address ex post policy effectiveness. Johnstone et al. [12], using a fixed effects panel data model, study the effect of different green policies on technological innovations, and they show how different policies are effective for RES. Popp et al. [13] analyze the investments in renewable energy, and show that policies do not always encourage investment. Marques and Fouinhas [14], using a panel of European countries, emphasize the importance of policies in strengthening the use of renewable energy in said countries. Zhao et al. [15], on the other hand, using a panel dataset of 122 countries, point out that policy only brings about limited improvements in renewable energy usage. Romano et al. [16], using a panel probit model on a set of 43 countries, estimate the probability that countries adopt the FIT under different scenarios. Wang and Chang [17] examine the development of policy instruments that support the low-carbon governance in China. The instruments are analyzed in five aspects in relation to the key policies in low-carbon governance. In order to establish good low-carbon governance in China, they suggest to concentrate on the operational rather than the strategic level. Nejat et al. [18] review the status and current trends of energy consumption, CO₂ emissions and energy policies in the residential sector, both globally and in ten countries (China, the US, India, Russia, Japan, Germany, South Korea, Canada, Iran, and the UK) that account for two-thirds of global CO₂ emissions. They found that energy policies can be successful if they are enhanced by making them mandatory, targeting net-zero energy building, and increasing public awareness about new technologies. Developing countries can join the developed countries in GHG mitigation if they are supported by financial investment and capacity-building in highly efficient, clean-energy projects while Abdmouleh et al. [19] report an analytic survey of the most relevant publications, reports and scientific papers dealing with policies encouraging RE and a classification of the different types of support (financial, fiscal, political, legislative and technological).

Using a panel data regression analysis on a sample of 26 provinces and four centrally-controlled municipalities over a ten-year period (2002–2011), Zheng et al. [20] investigate provincial energy saving and emission reduction policies, finding the empirical support for the positive impacts of provincial energy saving regulations on the improvement of local air quality. In a recent paper, Hansen et al. [21] explore the diffusion of solar PV in different market segments across three countries in East Africa (Kenya, Tanzania and Uganda). They find movement from donor and government-based support to market-driven diffusion of solar PV and a transition from off-grids to grid-connected solar power plants. Zamfir et al. [22] review the public policies used to support the development of renewable energy in Romania with the aim to disclose their objectives, regulations, measures, results and changes made in recent years. They examine the support schemes for the development of renewable energy both in the European Union and in Romania.

Feurtey et al. [23] study and compare the institutional factors underlying the decision making process that directly or indirectly influence the energy policy decisions to invest in wind energy in France and in Quebec. They highlight that political choices are dynamic and vary with a change in the wind energy context, the balance of power between pressure groups, supranational influences, energy evaluation approaches and social acceptance.

The results from different analyses are surprising in some ways. They seem to show, on the one hand, the positive effect of public investments on spreading clean technologies. On the other hand, however, they provide contradictory results with regards to the role played by the Regulatory Policies and Fiscal Incentives. Since it seems reasonable to believe that the two sets of economic measures should have some impact on investment in renewables, there is the problem of identifying a pattern of analysis that can shed light on this apparent discrepancy. In a previous analysis, Romano et al. [16] noted that a very popular intervention in the recent past (Feed in Tariff) seems to lose, over time, some of its driving force in the industry.

Based on the experience of the authors and on the literature it seems clear that the role played by the three groups of various policy measures, within a country depends on the stage of development. Probably, a group of interventions effective in a certain stage of development loses a part or all of its effectiveness over time. As the economic policies evolve towards new balances with the development of countries, they are also likely to establish new balances within each group described above. There are reasonable indications on the effectiveness of policies within homogeneous groups of countries in different stages of development. These are important to provide decision-makers with useful information on actions to be taken in a timely and appropriate manner to the particular socio-economic situation encountered.

The novelty of this paper lies in the distinction in the analysis makes between developed countries and developing ones. This distinction is led by the consideration that public support policies have different impacts depending on the level of development of countries. In addition, to meet the need to evaluate the effectiveness of policies within the three groups, we analyze the individual energy policies and/or grants adopted by countries.

Naturally, the models we consider do not only assess policies. They also analyze the social and economic conditions that are - in the vast majority of the literature - held accountable negative effects, such as total carbon dioxide emissions.

We focus on a panel of 56 countries observed over a ten-year period (from 2004 to 2013), with different social, political and economic characteristics. The presence of heteroskedasticity and contemporaneous correlation requires the use of the Panel Corrected Standard Errors estimator in order to obtain consistent estimates. The

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