ASSESSING FEED-IN-TARIFF POLICY APPROACHES FOR AN ACTIVE PROMOTION OF RENEWABLE POWER. COMPARATIVE ANALYSIS FOR WIND AND PV TECHNOLOGIES

IRINA NASALCIUC *

ABSTRACT: *The consequence of business-as-usual frameworks (BAU) has occasioned the market failures of modern economies inclusively of energy markets which shifted from BAU models to low carbon economies. Periodic paradigm shifts operating on energy markets drive impressive market transitions aiming to perform higher innovative approaches over the composite energy generation portfolios thus providing advanced managerial mechanisms for renewable energy sources-electricity (RES-E) strategic deployment inclusively. In this context it appeared imperious to develop smart policies and patterns of promoting renewables beyond and stimulate a fast transition to smart grids. The current paper aims to better address the policy risks and to extend the relevance of policy learning process involved in the course of boosting up a whole industry system. The study reveals an updated overlook on the feed-in-tariff policies operating on green markets, identifies their regulatory risks and offers a new sight over the interconnection Investment- Regulatory Policy- Economic efficiency in targeting new investments of RES-E, focusing on a case study assessment.*

KEY WORDS: *support policies, feed-in-tariffs, investment risks, policy learning.*

JEL CLASSIFICATIONS: *D78, D81, E65, G18, L52.*

1. INTRODUCTION

Being overwhelmed in the shifting to another energetic era process, unfortunately, we don't realize the real importance and the magnitude of energy issues, which imply an obvious impact over the society and its productive capacity. Despite all the researches which proof that renewable technologies have registered innovative progress offering competitive costs with conventional sources and that conventional technology externalities result in inconvenient ecological, social and economic

* *Ph.D. Student, National Institute for Economic Research, Republic of Moldova, fedco.irina@yahoo.com*

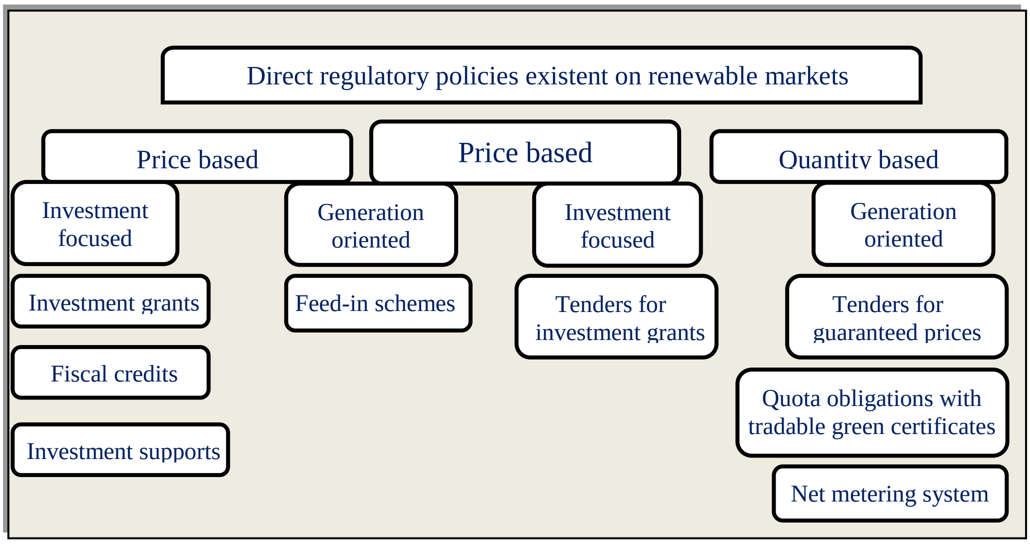
circumstances; the subsidy reform and the reorientation of economic and legislative stimulations for energy sector is still locked in.

The development climates for renewable markets are highly sensitive to policy regulations which are being adopted and may discourage the deployment of large scale projects giving free way only for little renewable projects. The scientific literature is approaching the lack of normative and stable policies of renewable markets as major obstacles in further investment attracting for decarbonized grids (Komendantova et al., 2012, pp.106). Actually, it is obvious that an efficient deployment of renewable markets require a responsible assumption and a fragmentation of risks involved in the investment process as by private sector as well as by public sector. The promoting policies for renewables have already a historic evolution which was materialized in a plurality of models and frames being able to absorb the risks and uncertainties from renewable markets. There exist even opinions which argue that choosing the policies for renewable projects imply in fact a choice of risk allocation (Gross et al., 2007).

2. REVIEW ON REGULATORY POLICIES OPERATING ON RENEWABLE ELECTRICITY MARKETS AND THEIR OPERATING MODELS

Development of smart RES-E markets involves a responsible and innovative process approach and assignment of existing technologies to the needs and demands of consumers involving reasonable social costs and supporting the incessant development of this sector. In the context of a growing global demand for energy and climate change risks, a continuous pressure is therefore experienced for identifying new policies and efficient models of energy production from green sources that may automatically adapt to future market conditions. It is important, moreover, to specify that certain technologies may require greater or smaller efforts in boosting RES-E market development and innovation, and governments will have to pay special attention to this aspect in their opportunity studies for the policies envisaged. A responsible awareness for concerns regarding the consistency of policies placed on markets with the national RES availability, the levels of economic development, the stability and convertibility of currency markets, with the national existing and projected profiling industries, the levels of solidarity and social cohesion, the fluctuation peculiarities of energy demand over the year etc. represents after all the promising success of propelling renewables on emerging markets. Promoting renewables through regulatory instruments entails direct or indirect involvement of the state and taking the necessary actions to achieve the targeted indicators of long and short term energy policies. Thereby, the direct involvement of the state aims a quick and immediate deployment of intelligent RES-E while indirect involvement of the state ensures constant climates of maintaining and developing long-term strategic green energy. Surely, as the purpose of this work aims in particular the assessment direct regulatory policies of renewables, we will focus our attention on this issue in particular.

Analyzing the Figure 1, there can be observed the regulatory policy plurality and the deployment models for an intensive promotion of renewables which applied in different combinations and under different market conditions form individual deployment climates of financing the green electricity generation.



Source: made by the author basing on literature review

Figure 1. Assessing the direct regulatory policies operating on renewable markets

The direct regulatory policies based on prices aim to stimulate the RES-E producers through the price policies applied which may take the form of an investment focused or a generation oriented policy. Investment focused policies are looking for production costs reduction and respectively the reduction of electricity prices charged and acts to this aim through the investment supports for project financing, through investment grants or through fiscal measures. Generation oriented policies, in turn, aim to compensate producers for each kWh of electricity generated, controling the prices charged to end users and protecting investors in market risks allocation.

Thus, the direct regulatory policies that aim in particular to stimulate and amplify the generation volumes may appear in the form of policies focused on investments or those generation-oriented. Quantity based and investment focused policies are being implemented through tendering systems for accessing investment grants. Quantity based and generation oriented policies are identified by quota obligations with tradable green certificates (TGC), net metering systems and tenders for guaranteed prices This type of policies do not protect producers of RES-E from market risks, offering instead other opportunities for renewable producers.

The direct regulatory policies based on prices pass the RE development success on private sector and do not participate directly in investment risk mitigation for investors, which must undertake all investment risks on their own, existing experiences which reveal additional liquidity risks faced by investors due to size, type and regulations of exchange for the TGC market. Despite all the disadvantages, the system allows producers to compete fairly on electricity markets and at the same time is able to stimulate some development trajectories envisaged towards the national energy markets. Yet, there are approaches assuming that the more accentuated the discrepancy of risk levels related to TGC systems compared to FIT schemes will result in time, the higher the profit requirements from investors will arise (Lemming, 2003).

There can be underlined also that the best practices experienced with quota obligation systems may be considered those of UK, Belgium, Poland, Italy and Sweden. At the same time, almost all research papers underline the importance of FIT policies proving their efficiency especially in the case of mature technologies, which reached to apply reasonable costs in time (country ex.Germany, France, Austria, Italy, Spain, Poland, Olanda, etc). Even though, there exist opinions arguing that, in the case of efficient technologies, the producers would prefer the quota obligations with tradable green certificates policies more than FIT policies because of the higher revenues obtained.

2.1. FIT schemes approaches and plurality- for an active promotion of renewables

Feed-in schemes (feed-in-agreements- FIA) are part of the price-based policies and generation oriented that emerged in the early '90s being developed continuously over time. Currently FIA represents one of the most implemented "engines" of intelligent energy propulsion among European countries, offering benefits to all stakeholders and providing investors with long term contracts (power purchase Agreements-PPA) for electricity off-take. The PPA can be fixed for 10-25 years and guarantee a determined price payment for each kilowatt-hour produced, dependent or independent of electricity market prices, basing on composite cost criteria like project scale and site, project technology type and resource quality. The FIA offer the possibility to policy makers to control national energy technology portfolios mix, to promote RE technological progress through de-risking policy instruments and to ensure the control of energy supply security. Thus, FIA can take the form of a **feed-in-tariff** (FIT) **payment system** or a **feed-in-premium** (FIP) **payment system** which assume different risk levels to reaching the rate of return assessments made by investors. As a FIT policy implies fixed price payment levels independent from the market prices fluctuations, it is considered to be less risky to investors than a FIP given the certainty of stable generation revenues thus avoiding to interact with the electricity spot markets and consequently keeping away from market risks. A FIP policy assumes a premium payment added to the spot market electricity price, thereby following the market electricity price fluctuations and providing less risk protection from market risks to investors. In what follows we will see the most important plurality of FIA FIT and FIP payment schemes according to Kitzing et al., (2012, pp.3) Couture T.D. et al. (2010) and Couture T. and Gagnon Y. (2010): **Fixed FIT** (market-independent policy)– non-variable minimum electricity price levels determined depending on technology group maturity for full life-cycle periods remaining independent of variables like inflation, price of fossil-fuels etc.; **Time-dependent FIT**- assuming two-three categories of payments for different technologies deployed or demand levels registered(day/night, peak-/ off-peak); **Target price FIT**- the payment scheme is starting from target prices and applyies adjusting add-ons above market prices (known as contracts for difference); **Indexed FIT –** payment schemes depend on national economic indicators as exchange rate to euro or price of natural gas, uncertain at the investment stage; **Constant FIP** – non-variable adder-on top of the spot market price remaining independent on electricity price increases; **Sliding FIP** – premium payments which are dependent on market price being limited with an established premium cap and premium floor.

The RE policy plurality require careful government attention when **attributing FIA to various technologies** paying consideration to compatibility of national resources with innovative RE technologies, national/regional spot market deployment levels and social costs of RE. From all FIA categories constant FIP could be the most risky policy to society as during peak demand hours the spot market prices increase and the constant adder-on enlarge the total costs of RE generation. Simultaneously, under this approach, investors are motivated to increase their outputs during high demand hours, thus obtaining financial surcharges covering their equity returns. It is worth mentioning that, currently, is considered that sliding FIP could provide both investment security to RE investors and protection from exaggerated policy costs. While, the fixed FIT assumes only the risk of decreasing updated value of RE generation revenues given the long technology lifetime and the unchanging stable payment commitments independent from inflation, spot market prices etc. it appears that indexed FIT solves this issue.

The FIA schemes participate directly in the technologic progress stimulation and implementation of innovative projects with high performance levels able to give rise to advantageous cash-flows and to diminish the interference of risks and uncertainties on renewable markets. Besides, the most successful performances in developing efficient renewable portfolios were identified in countries which have implemented FIT policies for an active promotion of renewables, considering more recent evidence (Held, et al., 2006, pp.865) which shows that „a well-designed FIT system provides a certain deployment of RES in the shortest time and at lowest costs for society". Considering the FIT policies, it may be specified that modern designs of FIT policies are able to align harmoniously short-term goals (meeting the targeted generation capacities by penetrating the RE technologies existent on RE markets) and long-term goals (promoting and developing the RE technologies) so they can compete independently with traditional technologies, what is surely difficult to achieve by implementing quota obligation policies or net metering systems (Lesser and Su, 2008). Most European countries choose to implement FIT payment systems rather than FIP ones forasmuch eliminating additional risks (inflation, fossil-fuel energy prices, etc.) and providing equity investment feasibility to project developers and trending to socially efficient costs. Besides, most researchers find that well-adapted FIT schemes are the most effective and cost-efficient promotion pathway (Meyer, 2003), (Huber et al., 2004).

3. POLICY APPROACHES FOR PV AND WIND SYSTEMS IN SELECTED COUNTRIES

Seeking for a quantitative analysis towards the stimulating policies of renewables in Europe, there can be noticed the supremacy of generation oriented policies and the obvious dominance of FIA policies. FIT policies are implemented in most of European countries and withal FIP policies are gaining more and more popularity in the last years. Given the ascertained popularity of FIT policies and their implementation efficiency submitted by mostly European countries, the current study intends to examine their key features and the importance of policy learning process basing on three country case studies: Germany, Spain and Japan undertaking the implemented policies towards wind and PV technologies. Respectively, we are seeking for a quantitative review of the efficiency levels entailed by the FIT policies on electricity markets based on PV and wind technologies in countries that have proved extensive experiences with these technologies and different efficiency levels of policy approaches developed over time (Spain, Germany and Japan). Also, we aim proving the importance of policy learning when establishing harmonious FIT systems able to be adapted automatically to future RES-E market fluctuations and transitions.

3.1 Why Germany, Spain and Japan?

Much evidence shows that the wind and PV technologies are being installed in continuously progressive rhythms in the last decades and the experienced financing systems were also shifting in lots of countries, that’s why only this technologies where taken into account for this economical analysis. A strong accent in choosing the case study countries comes from the aggregate data availability found in the literature. Coming from the same considerations, the reference 2012 year was chosen for this research paper.

- **Germany** is already a classic model of implementing successful policies on promotion of renewable technologies coming from its total renewable power capacity per capita registered by the end of 2015 which places it on the second position among worldwide countries (REN21, 2016, pp.21). In 2012 the basic supporting scheme applied in Germany was a FIT system, in the same year was also introduced a FIP supporting scheme especially for the renewable electricity generators based on biomass technologies. The mitigation measures for high investment risks undertaken by the German government for renewable electricity markets were focused on full coverage of investment costs provided that it will not go by € 25 million per project. The state ensures long-term and low-interest loans with fixed interest periods of 10 years with repayment-free-start-up periods. The wind and solar electricity technologies market were already mature enough and were segmented between onshore and offshore wind technologies and respectively building-mounted systems and the ground-mounted technologies (see Table 1).
- In the same context we can mention the **Spain**’s records, which is placed on the forth place coming from its total cumulative per capita renewable power capacity scored by the end of 2015 (REN21, 2016, pp.21). The legal framework for RES in Spain is the **Real Decreto Law (RD)** which in 2012 year was suspended till 2013 year. However the RES industry was still developed and flourishing. The renewable operators were given the opportunity to choose between FIT schemes and FIP systems coming from the average market electricity prices (arts. 35-43 RD 661/2007). The PV electricity operators were ensured with FIT contracts for 25 years (RD 1578/2008) and the wind electricity generators with 20 years FIT contracts (see Table 1). Historically, the Spanish regulatory policy framework may be referred to as a *‘stop-and-go’* approach which registered several sector collapses: the 2007-2008 public budget crash and the 2012-2013 policy collapse.

• **Japan** is considered the fourth top country in total renewable power capacity recorded by the end of 2015. The current quantitative analysis selected this country coming from its active initiatives of mediating the climate change process expressed inclusively through the ratified Kyoto Protocol agreement. Another big reason of including Japan in the current analysis is that according to World Intellectual Property Organization (WIPO, 2012) 55% of worldwide patent applications for renewable energy industry belongs to it, and this entitles Japan as the world's RES technologic know-how leader. The 2011-2013 years marked a great transition process of the Japan's energy mix portfolio taking drastic shifting decisions of rapid phasing-out the nuclear power plants forasmuch mediating a trade deficit in 2011 and consequently stressing more attention on renewables. The Japan's government chose to establish a FIT system for accelerating the investments in RES industry for wind, PV, hydro, geothermal and biomass technologies. The FIT tariff levels offered in 2012 for PV and wind technologies were twice as high the FIT tariffs set in Germany and Spain (see Table 1) but with anticipated rapid declining trends for the next years.

3.2 Economical analysis on FIT policy approaches in case study countries

The efficiency of policy implementation for renewables may be foreseen through the known a series of indicators that show the efficiency/inefficiency levels of concerned cycle cost - LCC, internal return on investment, cost-benefit analysis - CBA, etc. These indicators pursue certain aspects of renewable energy project financing and are able to refer integrally the future efficiency levels of renewable investments.

The simple payback model is one of the simplest indicators which do not cover the discount rates, the effects of inflation and currency fluctuations which cannot be ruled out from a feasibility study performed at advanced research levels.

Conversely, an important indicator of renewable projects under risk conditions expressing their economic efficiency is the Net Present Value (NPV). This indicator is considered to be one of the most representative models to assess the effectiveness of social and private regulatory policies on renewables. According to the Kitzing and Weber (2015) study, this indicator has the following formula:

$$NPV^{FIT} = \sum_{t=1}^{T} \frac{(q_t * \mathrm{FIT}) - (Ct + Ci)}{(1+r)^t} - \boldsymbol{q_i * i} \qquad (1)$$

Where: I_0 - capital expenditure, C_t - operating and maintenance (O&M) costs, C_i - insurance costs, r- discount rate (cost of capital), T- lifetime of the project, q_t – the quantity of RES electricity production for a given period of time, q_i – the RES electricity capacity added in 2012 per technology, i – the average investment costs

The case study entails also the internal rate of return (IRR) indicator looking to reify the efficiency levels of aggregate country RES projects under FIT systems. Thus we considered the following formula for IRR indicator:

$$C_0 - \sum_{t=1}^{N} \frac{C_t}{(1+IRR)^t} = 0 \qquad (2)$$

The study implies the average FIT rates for each technology type applied in 2012 in the countries under analysis making possible the calculation of incomes (I_t) for wind turbines and photovoltaic installations given the recorded electricity generation volumes **(see Table 1)**. Also, the economical analysis is conducted admitting that the entire generation volume added in 2012 was driven into the transmission network, thus being calculated the generation volume of energy added in the respective year as a percentage of total generations identified. Equally, we admitted that the generated electricity from wind and PV installations was financed through a FIT scheme being applied an average tariff per technology. It is important to specify that the study took into account a level of 5% rate of interest and admitted that FIT supporting levels will not change during the projects lifetime (corresponding to the duration of FIT contracts). Withal, the study took into consideration the FIA contracting duration ensured by the selected countries which in most cases represents 20 years excepting the case of Spain which have set a 25 years contracting period for PV technologies and the reference average tariff (RAT) per technology. Besides, the economical assessment considered a 3 % expenditure on O&M services from the aggregate projects revenues and a 6% expenditure on insurance services.

Table 1. RES-E indicators for wind and PV technologies in selected countries in 2012

No	Country	Added renewable electricity capacity (GW/year)		Cumulative renewable electricity capacity (GW/year)		Generated renewable electricity cumulative /added (q_t) (GWh)		Reference average tariffs for renewable electricity projects based on FIT systems €/kWh					
								Wind		PV			
										Roof mounted		Ground mounted	
		Wind	PV	Wind	PV	Wind	PV						
1.	Germany	2.44	7.6	31.3	32.7	46 000 / 3 588	28 000 / 6 507	>50 kW	0.09	< 30 kW	0.24	<10 MW	0.18
										>30kW <100kW	0.23		
								Offshore	0.15	>100kW <11 MW	0.22		
										>1 MW	0.18		
2.	Spain	1.12	0.2	22.8	5.1	48 500 /2 381	8 169 /320	0.078		<20kW	0.28	<10 W	0.13
										>20kW <2MW	0.26		
3.	Japan	0.07	2.0	2.6	7.00	4 800 /128	6 600 /1 885	<20 kW	0.418	>10 kW	0.36	>10kW	0.30
								>20 kW	0.167	< 10 kW	0.35	<10 kW	0.30

Source: realized by the author basing on the data collected from the EEG (German Energy Blog, 2012), REN21(2013), IRENA(2013)

Consequently, Japan's efforts to stimulate the PV share in renewable electricity mix are visible but not exceeding Germany's performances. Spain invested more in wind technologies and reached the lowest FIT tariff level of developing them. There is also worth mentioning, that Spain ensured a FIT policy regime only for onshore wind technologies, establishing a FIP scheme for offshore technologies, thereby the offshore technologies will be further excluded from our analysis. Further, coming from the literature findings (EPIA, 2013, pp.23) about the PV market trends assigned to the period envisaged, we assumed the next added PV capacities for 2012 year:

- **Germany:** Residential- 9%, Commercial/Industrial- 55%, Ground mounted- 36%
- **Spain:** Residential- 5%, Commercial/Industrial- 52%, Ground mounted- 43%
- **Japan:** Residential- 65% , Commercial/Industrial- 15%, Ground mounted- 20%

According to this ascertainment we obtained the following data (**see Table 2**):

Table 2. Wind and PV added capacities and generations in 2012

No	Country	Wind power mix capacity added in 2012 (MW)		Solar power mix capacity added in 2012 (MW)			Power mix generations added in 2012 (GWh)				
							Wind		PV		
		On.	Off.	Resid.	Com. /Ind.	Gr. Mount	On.	Off.	Resid.	Com. /Ind.	Gr. Mount.
1.	Germany	2320	120	680	4180	2740	3408.6	179.4	585.63	3578.85	2342.5
2.	Spain	640	480	10	104	86	1357.1	1023.8	16	166. 4	137.6
3.	Japan	70	-	1300	300	400	128	-	1225.25	282.75	377

Source: made by the author basing on personal calculations and the data collected from Japan Photovoltaic Energy Association (http://www.jpea.gr.jp/index.html) and World Wind Energy Association (http://www.wwindea.org/)

Thus, the data comprised in Table 2 and Table 3 represents the preliminary derivative economic indicators for the renewable electricity generators for 2012 year in the selected countries.

Table 3. Derivative economic indicators obtained for the categories of RES-E in 2012

No	Country	Average investment costs (€/W)					Volume of invested capital (millions €)				
		Wind		PV			Wind		PV		
		On.	Off.	Resid.	Com. /Ind.	Gr. Mount	On.	Off.	Resid.	Com. /Ind.	Gr. Mount
1.	Germany	1.27	1.67	2.00	1.96	1.89	2946.4	200.4	1 360	8192.8	5178.6
2.	Spain	1.10	1.54	3.63	2.95	2.27	704.0	739.2	36.3	306.8	195.22
3.	Japan	1.97	-	4.87	3.79	3.68	137.9	-	6331	1137	1472

Note: when assessing the average investment costs for 2012 year in Japan was considered a course: 1 JPY = 0.0087 € and for Germany and Spain: 1 USD = 0.7576 €
*Source: made by the author basing on the data collected from Cloete **(2014)***

3.3. Results and discussion

When comparing the different ways to apply the FIT policy in Germany, Spain and Japan it leads to some interesting results (see Table 4) that are discussed below:

- The Germany's PB and IRR indicators present the highest level of efficiency uniformity for the technologies under review while the Japan's PB indicators are the most contrasting. This is confirming the high levels of policy learning reached by Germany and the initiation process of policy learning from Japan.
- The analysis confirmed the maturity of onshore wind technologies across all countries showing generous NPV's and IRR's. Besides, we consider the Japan's approach too socially costly to society showing the highest IRR (24,39%) and the shortest PB (4,04 years) indicator and consequently exaggerated FIT compensations

offered to producers. Given the fact that the installed wind capacity was the most modest one and the average investment costs were the highest, it confirms that the Japan's experience with the FIT policies is inchoative and only at market exploration stages. The undue installed FIT levels mediate a too fast running payback indicator and exaggerated IRR. The most suitable approach for onshore wind was adopted by Germany, offering optimal investment returns (7,05%) and a payback run (10,55 years) proving the policy learning impact.

Table 4. Investment efficiency indicators for technologies and countries surveyed

No	Country	NPV (in €)					IRR (%)					PB (years)				
		Wind		PV			Wind		PV			Wind		PV		
		On.	Off.	Res.	Com./Ind.	Gr. Mount.	On.	Off.	Res.	Com./Ind.	Gr. Mount.	On.	Off.	Res.	Com./Ind.	Gr. Mount.
1.	Germany	532.612	103.974	233.941	2.736.533	-396.800	7.05	10.58	6.95	6.31	4.07	10.55	8.18	10.63	11.18	13.49
2.	Spain	496.447	-	14.508	168.999	13.699	12.35	-	9.35	11.33	5.45	7.30	-	8.90	7.79	11.99
3.	Japan	273.858	-	-1.328.768	-14.703	-189.376	24.39	-	2.37	4.84	3.43	4.04	-	15.77	12.62	14.30

Source: made by the author basing on personal calculations

- Germany was the single country developing an offshore wind market under a FIT policy regime. It offered a 10.58% IRR, a 8.18 years PB and a promising NPV, much higher than the one of onshore wind technologies aiming the unlocking of upfront investments on this sector. Actually, we specified the added capacities of offshore wind by Spain which are four times bigger than the Germany's ones, meaning that the premium offered by the Spanish RES framework was even more stimulatory (with an average of 0,091€/kWh) than the FIT rates offered by Germany.
- Surprisingly, Spain have fixed advantageous FIT levels for all PV technologies while in Japan the efficiency indicators show FIT system deficiencies for all PV technologies. In the European countries under review the residential and commercial/industrial PV technologies (building integrated PV systems-BIPV systems) seem to be more insistently propelled than the ground mounted systems (not integrated PV systems –NIPV systems). In Germany the highest IRR (6,95%) and advantageous PB levels (10,63 years) for PV technologies is attributed to residential systems while the NIPV systems seem to not perform profitable returns, offering a 4,07% IRR, a 13,49 years PB level and a negative NPV. In Spain the highest efficiency is offered to commercial and industrial BIPV systems with a 11.33% IRR, a 7,79 years PB and a positive NPV. The residential BIPV systems are ensured with a 9.35% IRR, 8,90 years PB and favorable NPV. The Ground mounted NIPV systems are the most slightly promoted among PV technologies in Spain, but still with a positive NPV, a profitable

IRR (5,45%) and a 11,99 years PB. Japan entailed a FIT system mediating inconvenient financial returns to investors and fluctuating between 2,37 and 4,84 IRR, 12,62 and 15,77 years PB and consequently ensuring negative NPV levels.

4. CONCLUSIONS

The current paper presented a theoretical review on regulatory policies and an economic analysis which included three case studies with individual peculiarities of approaching the FIT policy mechanism identified in 2012 for PV and Wind technologies: Germany- with a long-term, stable RES-E framework and continuous market deployment which reached a RES-E market maturity; Spain – with a long-term ‘stop-and-go’ RES-E framework, and fluctuant market evolution (i.e. PV market collapse of 2007-2008 years) and Japan – a novice FIT policy developer with an impressive R&D background on RES technologies.

The undertaken case study confirmed that PV technologies were still on their way of market penetration in 2012 offering more and more advantageous system costs due to the economies of scale and policy learning, thus the FIT systems were in place in all countries under review. Even though, the FIT schemes were feasibly set in Germany and Spain, while in Japan they resulted to be inefficiently established. Another key ascertainment is that unlike Japan, Spain and Germany have entailed a FIT law framework which was encouraging the installation of BIPV technologies awarding them with higher FIT payments than the ones offered for ground mounted PV technologies (NIPV). The NIPV systems reached the grid-parity only in Spain being offered only a modest IRR and NPV levels while in Germany they seem inefficient coming from the negative NPV and little IRR. However, the pessimistic outcomes of Germany may be reversed if taking into account the capital subsidies which were actually neglected in the current case study analysis. Also, there is an obvious tendency of propelling the BIPV technologies more than NIPV technologies (in Germany and Spain) given the probability to generate an agricultural lands scarcity at regional or even national level.

There was also certified the maturity of onshore wind technologies and of policy learning concerned to this technology type, being close to compete directly with conventional energy prices, being regulated through well-adjusted FIT tariffs and already acquainted policy mechanisms. It was also revealed that the offshore technologies were just entering the renewable markets in 2012 and the experience with the efficient FIT approaches was little and modest. Still, Germany have established an efficient FIT system for offshore technologies and ensured a stimulatory impulse for developing this type of technology, proving the importance of policy learning process.

The research confirmed the importance of policy learning process in applying efficient FIT designs able to reward the producers with stimulating tariffs and to keep the social costs at reasonable levels. Thus, we consider that Germany is the only country which reached the policy and technological maturity for deploying effective regulations able to raise a whole RES-E industry system. The goal of this research is considered to be reached given the impartial overlook on RES-E regulatory policies issue and its attempt on targeting the investigation course implying a representative case study assessment and consequently contributing to a revolutionist understanding of the innovative policy learning importance in deploying large scale RES-E industries.

REFERENCES:

[1]. Cloete, S. (2014) *Seeking Consensus on the Internalized Costs of Utility Scale Solar PV*, Available at: http://www.theenergycollective.com/schalk-cloete/2148511/seeking-consensus internalized-costs-utility-scale-solar

[2]. Couture, T.D.; Gagnon, Y. (2010) *An analy.sis of feed-in tariff remuneration models: Implications for renewable energy investment*, Energy Policy 38, pp. 955-965

[3]. Couture, T.D.; Karlynn, C.; Kreycik, C.; Williams, E. (2010) *A policymaker's guide to feed-in-tariff policy design*, U.S. Department of Energy's Solar Energy Technologies Program and U.S. National Renewable Energy Laboratory, NREL/TP-6A2-44849

[4]. EEG (2012) *German Feed-in Tariffs 2012*, German Energy Blog, Available at: **[].** http://www.germanenergyblog.de/?page_id=8617

[5]. EPIA - European Photovoltaic Industry Association (2013) *Global Market Outlook for Photovoltaics 2013-2017*, Brussels

[6]. Gross, R.; Heptonstall, P.; Blyth, W. (2007) *Investment in electricity generation: the role of costs, incentives and risk*, Imperial College Centre for Energy Policy and Technology of the UK Energy Research Centre

[7]. Held, A.; Haas, R.; Ragwitz, M. (2006) *On the Success of Policy Strategies for the Promotion of Electricity from Renewable Energy Sources in the EU*, Energy & Environment Vol. 17, No. 6, pp. 849-868

[8]. Huber, C.; Faber, T.; Haas, R.; Resch, G.; Green, J.; Ölz, S. (2004) *Action plan for deriving dynamic RES-E policies - report of the project Green-X*, Available at: www.green-x.at

[9]. IRENA (2013) *Renewable Power Generation Costs in 2012: An Overview*, Available at: https://costing.irena.org/media/2769/Overview_Renewable-PowerGeneration-Costs-in-2012.pdf

[10]. Kitzing, L.; Mitchell, C.; Morthorst, P.E. (2012) *Renewable energy policies in Europe: converging or diverging?*, Energy Policy 51, pp.192-201

[11]. Kitzing, L.; Weber, C. (2015) *Support Mechanisms for Renewables: How Risk Exposure Influences Investment Incentives*, International Journal of Sustainable Energy Planning and Management Vol. 07, pp. 117-134

[12]. Komendantova, N. (2012) *Perception of risks in renewable energy projects: The case of concentrated solar power in North Africa*, Energy Policy 40, Austria, pp. 103-109

[13]. Lemming, J. (2003) *Financial risks for green electricity investors and producers in a tradable green certificate market*, Energy Policy 31, pp.21–32

[14]. Lesser, J.A.; Su, X. (2008) *Design of an economically efficient feed-in tariff structure for renewable energy development*, Energy Policy 36, pp. 981–990

[15]. Meyer, N.I. (2003) *European schemes for promoting renewables in liberalized markets*, Energy Policy 31(7), pp. 665–676

[16]. REN21 (2013) *Renewables 2013. Global Status Report*, Available at: http://www.ren21.net/ Portals/0/documents/Resources/GSR/2013/GSR2013_lowres.pdf

[17]. REN21 (2016) *Renewables 2016. Global Status Report*, Available at: http://www.ren21.net/ wpcontent/uploads/2016/10/REN21_GSR2016_FullReport_en_11.pdf

[18]. WIPO (20120 *World Intellectual Property Indicators 2012*, Available at: http://www.wipo. int/edocs/ pubdocs/en/intproperty/941/wipo_pub_941_2012.pdf,pp.36