MSc Program
Renewable Energy in Central and Eastern Europe

A comparative analysis of RES support schemes in EU-27. Romania - a case study

A Master's Thesis submitted for the degree of
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supervised by
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Affidavit

I, **Dan Nicolae Gherghelas**, hereby declare

1. that I am the sole author of the present Master Thesis, "“A comparative analysis of RES support schemes in EU-27. Romania – a case study”,
2. 92 (plus annexes, list of acronyms and bibliographical references) pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
3. that I have not prior to this date submitted this Master Thesis as an examination paper in any form in Austria or abroad.

Vienna, October 15, 1012

Abstract

Controlling the GHG emissions in order to prevent an abrupt climate change is maybe one of the hottest topics worldwide. The mankind seems to have understood that by continuing to burn fossil fuels will not only lead to an abrupt depletion of energy resources but also our climate will dramatically be affected by the end of this century.

Stepping towards an economy based on renewable energy resources is the only way to leave the planet clean for our successors. But generating energy from RES is still not as price competitive as the energy from conventional sources. In order to support market competitiveness of such technologies, most of the countries, especially the OECD members, have adopted substantially financed support schemes. Most frequently used such instruments are feed-in tariffs, feed-in premiums, tradable green certificates, investment subsidies, loan subsidies, tax incentives, most of the countries actually applying a combination of instruments to achieve their RES targets. European Union has proved to be a world driver in assuming generous RES quota achievements while aggressively promoting the RES technologies.

At a time of economic uncertainties and after the recent years bobbling in some RES technologies, it came the moment of reflection and policy re-shaping. What is the best support scheme to implement and what is the adequate level of support? Terms like “effectiveness” and “efficiency” in applying various support schemes have stirred up large debates in the scientific or political circles.

The present work aims to help drawing some conclusions on the above questions. The analysis refers to the EU Member States. It is based on public statistics, public opinions reflected in press articles, economic scientists’ viewpoints, personal interviews with public administration officials, as well as on own professional experience and judgment.

The work starts from recovering the last two decades history on evolution of global thinking and global legal framework on renewable energy sources, with an emphasis on the developments in the EU. Then, a presentation of support schemes applied in EU is provided. The work restricts the analysis to the electricity markets instead of treating also heating and biofuels, as the electricity accounts for the most part of the financial support in EU countries. To be able to make a comparative analysis of the schemes, a number of country systems are more in-depth reviewed. With a clear picture of past performance, recent developments and technological, financial and legal trends, some conclusions had to be made.

Although all schemes have proven effectiveness, depending on the level of support and on the annual quota capping, our view is that the fixed-price systems (FPS) are more efficient than the quota-based systems (QBS) for many reasons. And, within the FPS category, a fixed-in premium seems to evolve as the policy new trend due to its better adaptability to the market needs.

Last section of the work is dedicated to Romania, as a relatively new entrant in the club. Romania has adopted the TGC system. Although currently it is perceived like a new El Dorado for RES-E project developers and investors, the system has dangerous weaknesses that ought to be known by the policy makers.

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1. Introduction

The selected topic, a comparative analysis of RES-E support schemes, is one of extreme importance and actuality, in a world marked equally by climate change concerns and economic crisis. The two opposite drivers raise great interest in searching for the most appropriate and efficient tools to cope with the need of greening the world economy by means of developping alternative energy sources and technologies.

The present study tries to answer to a core question, that is, “what type of RES-E support scheme has proved to be more efficient and effective?” And, in connection with the main goal, there is a subsidiary point of interest: Does Romania apply adequate supporting policies, based on the Older Member States experience?

Drawing conclusions in such sensitive subjects assumes a good amount of work and research. The structure of the study should give the impression of roundness and completeness. Therefore, we considered essential to start with a review of international and European past and current policies and legal actions in the field of RES to understand from where we start, where we are and what would be in the future. Decarbonisation of the global economy assumes a huge amount of investment, a cross country policy coordination and determination in implementation. Based on scientific evidence and alarming signals, the world policy makers have started to understand that the GHG accumulation in the earth atmosphere will have dramatic climate change implications, therefore, both the OECD and the developing countries started to implement adequate policies to cut the GHG emissions by gradually replacing conventional energy sources with RES technologies, (see Chapter II).

Because the costs of generating energy from RES have been above the costs of energy from conventional sources, most of the world countries understood to encourage the technological development via financial support. As such support has been performing in line with the technologies, the next chapter of the study (III) addresses the evolution of RES-E technologies in terms of specific investment costs along with the electricity generation costs. Although we make a small review as well for the RES-H and RES-T schemes in European Union, the focus will be on RES-E as the main absorbent of financial effort. The chapter also provides in the beginning for some methodological tools used by the marketing management science in evaluating and predicting the evolution of a product (renewable technology) cost in connection with the production scale, consumer behaviour and investor’s perspective. Actually, I meant to make some useful links between a couple of different disciplines, such as marketing, engineering and finance.

The RES-E support schemes are presented in Chapter IV. First, a general presentation of theoretical tools is made, followed by a review of past evolution and current status of support schemes in a number of selected countries. The countries are considered to be representative for various policy models applicable in EU for supporting RES. The quantitative and qualitative evidence is then put in the specific economic and social context, to outline the change drivers. With the findings of extensive analysis and by applying professional judgement, the author draws some conclusions, largely explained in the latter sections of the chapter.

The work cannot be complete without an extensive analysis of the RES-E support system in own home country, namely Romania. With some work experience in the Romanian electricity sector and now, with a good theoretical backup in the field of renewables, the author gives a close and critical eye on the sector evolution from legal, economic and social perspectives. Although they may be perceived as too critical, the recommendations made at the end of the study should be at least analyzed by the Romanian policy makers, as the conclusions are rather unfavourable for the current development of the sector.

2. World energy outlook. Towards a free carbon market

2.1. International context

The intense world efforts for spreading the use of renewable energy sources (RES) is substantiated by both the necessity of reducing greenhouse gases (GHG) emissions and increase in countries' energetic security by reducing dependency on fossil fuels in the context of "durable development" concept.

The use of energy is responsible for the majority of greenhouse gas emissions (see graph below), of which the energy generation sector representing 31%, transport 19%, industry 13%, households 9% and others 7%.

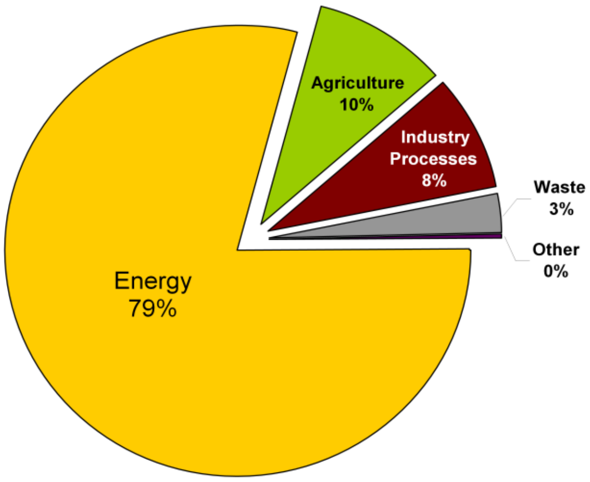


Fig. 1 Share of GHG emissions in 2008 (Source: EEA 2010)

Since the adoption of Kyoto Protocol for the United Nations' Framework Agreement on Climate Change, in 1997, the energy production from renewable energy sources industry has been pushed up towards globalization, driven by the fact that world countries assumed targets of GHG reductions. Under this Protocol, the industrialized countries set up the target of diminishing the annual GHG emmisions with 5.2% until 2012 as compared to the 1990 level. The Kyoto Protocol was signed in December, 1997, in Japan, by 84 nations, but, unfortunately, only 37 ratified it subsequently, most of them being developing countries. Following that protocol, many worldwide or europewide other conventions have been agreed upon aiming at durable world development, such as Haga Agreement (November 2000) or Bonn (July 2001).

During the World Summit on Sustainable Development in Johannesburg (September 2002) the energy was one of the most controversial debates topic, with progressist approaches blocked by national protectionists, own interests or shortseeing views. Thus, the objective of a joint commitment towards RES targets was delayed for days until 4th of September, 2002, when all the countries recognized the necessity of increasing the share of RES in total energy sources by signing the Implementation Plan.

In 2000, the weight of RES in total energy production worldwide was 13.8 %. The energy sector today contributes 80% of CO_2 emissions and 60% of total manmade GHG emissions annually. On today's policies, these emissions are on a trajectory that will lead to an estimated increase in global temperatures by the end of the century of six degrees Celsius or more. Therefore, any effective strategy to mitigate climate change must depend on a rapid shift in patterns of production, transmission and use of energy, in other words, an energy revolution. New technology development and deployment is essential in this regard, as is illustrated by IEA projections that describe the contributions that technology can make to steering us away from today's unsustainable energy trend , towards one that would still meet rising energy needs while preserving the world's climate.

By analyzing the development trend over the last three decades one can observe an annual growth rate of RES of 2%. It is obvious that on the medium run the RES cannot become a full alternative to the conventional energy sources but it is certain that, based on the local potential, due to advantages related to local abundant availability, independence from imports, low cost, these should be used in complementarity to the fossil and nuclear fuels.

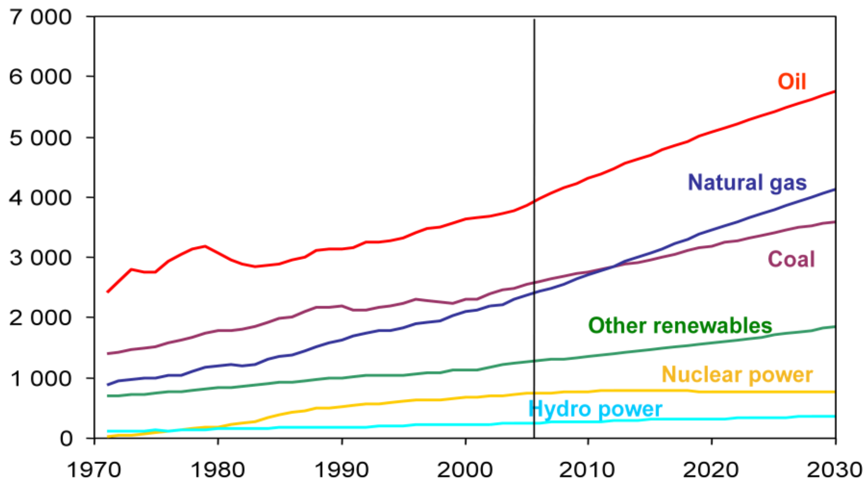


Fig 2. – Domination of fossil fuels over the next decades (Source IEA 2008)

As depicted in the numerous scientific studies, it is unanimously accepted that a strong augumentation in the GHG emmissions will induce a global warming with between 2 and 6 C by the end of this century, with catastrophic effects on the environment.

Through the natural exchange between atmosphere, biosphere and oceans some 11 billion tons of CO2 from atmosphere may be absorbed (or 3 billion tons carbon equivalent), which represents only half of the actual annual mankind's GHG emissions. That has led to a permanent increase of CO2 concentration in the atmosphere from 280 ppm before the industrial revolution to more than 360 ppm nowadays.

The Intergovernmental Panel on Climate Change (2007) and International Energy Agency (IEA) (2008c) estimated that in order to limit for a limitation in the rise of average global temperature to 2 C, the concentration of GHGs should not exceed 450 ppm CO2. This transposes into the following milestones in terms of action: a peak of global emissions in 2015 and at least a 50% cut in global emissions by 2050, compared to 2005. In 2009, the G8 committed to an 80% cut in their emissions by 2050 in order to contribute to a global 50% cut by 2050. The 80% reduction would allow some space for developing countries to soften the reduction curve while reaching the global 50% target. 1

At the United Nations Climate Change Conference held in Copenhagen, 2009, most participants agreed on the emission reduction targets. Considering that all commitments assumed during or after the conference, in subsequent negotiations, would be fulfilled, emissions in 2020 are expected to reach 49 Gt CO2, which is still above the 39-44 Gt CO2 threshold corresponding to the two degree target. IEA forecast scenario shows that in 2030 the fossil fuels will continue to be the dominant energy source (see table below).

Table 1. Share of primary energy sources in total energy mix in 2030

	Total energy use (Mtoe)		Growth rate 2008 – 2035	Share in total energy mix (%)	
	2008	2035	%	2008	2035
Coal	3,315	5,281	1.7	27.0	29.3
Oil	4,059	5,026	0.8	33.1	27.8
Gas	2,596	4,039	1.7	21.2	22.4
Nuclear	712	1,081	1.6	5.8	6.0
Hydro	276	439	1.7	2.2	2.4
Biomass and agricultural waste and residue	1,225	1,715	1.3	10.0	9.5
Other renewables	89	468	6.3	0.7	2.6
Total	12,271	18,0481.4	1.4	100.0	100.0

Source: IEA

The long term challenge of the entire world is both the shift from fossil fuels to renewable energy as well as the major improvements in energy efficiency in order to achieve ambitious GHG emissions reduction targets. "To reduce

[1] Renewable energy – Investing in energy and resource efficiency, United Nations Environment Program, 2011

emissions to a level that would limit the concentration of GHGs at 450 ppm in 2050, the IEA projects that renewable energy would need to account for 27% of the required CO2 reductions, while the remaining part would result primarily from energy efficiency and alternative mitigation options such as carbon capture and sequestration (CCS)"[2]. Spreading the investments in renewables in the developing countries will greatly influence the CO2 reductions.

Substantial damages will occur even with a rapid greening of the energy system, but the effect will be even more dramatic in the absence of coherent measures. "The annual global costs of adapting to climate change have been estimated by the United Nations Framework on Climate Change Convention (UNFCCC 2009) to be at least US$ 49 - US$ 171 billion by 2030. About half of these costs will be borne by developing countries. Moreover, climate change is likely to worsen inequality because its impacts are unevenly distributed over space and time and disproportionately affect the poor (IPCC 2007)".[3]

In view of European Commission (EC), the industrialized countries must commit themselves to a reduction of GHG emissions by 30% in 2020 compared to the 1990 baseline, within the frame of an international coherent system "post 2012". The industrialized countries have the technological and financial capability to undertake the most part of the effort until 2020. The trading schemes for CO2 emission certificates will have to become the key instruments to allow the industrialized countries to efficiently achieve the objectives.

The economic growth that will foster the GHG emissions in the developing countries brings about the necessity that such countries speed up the limitation of emissions. Economic growth and corresponding GHG emission growth in the developing countries will bring about the necessity that such countries start limiting the emissions in absolute values after 2020. In 2020 the developing countries will account for more than half of GHG world emissions.

Many developing countries have already started to significantly diminish the growth rate of the GHG emissions through economic, security or environmental policies. Such nations have plenty of strategic options under which the benefits overcome the costs, like improvement of energy efficiency, promotion of E-RES, enforcement of legal measures on air, water or soil quality, methane recovery from wastes.

The following pillars should support the tightening of actions in those countries:

- Extension and optimization of „clean" development, as provided by the Kyoto Protocol, to large national economic sectors scale;
- Improvement of access to external financing for creating the pre-requisites for adoption/ import of clean technologies;
- Enforcement of emission certificates trading schemes for those sectors capable of adequately monitor the CO emissions;

[2] Idem
[3] idem

- Taking on adequate and quantifiable targets for emissions reduction by industrialized and developing countries while for less developed countries the targets should be low, in order that the global monitoring system be sustainable and applicable;
- Strengthening of international co-operation in the field of research and technological development, closely followed by extension of results;
- Conclusion of an international agreement on the energy efficiency standards.

In the framework of our topic, the World Energy Outlook 2011 issued by the International Energy Agency presents very interesting sectoral policy evolutions for the major world players under three major scenarios.

That is, the first scenario, named by IEA "current policies scenario" is based on the assumption that all countries will act in the medium and long run according to the existing agreements and commitments in force as at mid of 2011.

The second, known as "new policies scenario", starts from the first scenario assumptions and comes with additional restraints derived from i.e. recent international commitments and plans, including the Cancun Agreements, extended support for further development of RES generation technologies or gradual elimination worldwide of the fossil fuel consumption subsidies.

The third scenario, also named "450 scenario", comprises the whole set of actions that, according to IEA sources, "is consistent with a 50% chance of meeting the goal of limiting the increase in average global temperature to 2 C compared to the pre-industrial levels" or, equivalently, to stabilize the GHG concentration at 450 ppm by 2050. It is worth noting the formulation "50% chance" through which the international experts draw the public attention on the lack of mathematical relationship between mankind measures and climate evolution. Moreover, the 450 scenario seem to be a very difficult task in achieving full and unconditional support from all nations. I will present in the following excerpts from the IEA report only for European Union and, for comparison, United States and only for the power generation sector. The analysis comprises also the transportation fuel and industrial sectors.

Table 2. Power sector policies and measures as modeled by scenario in selected regions

	Current Policies Scenario	New Policies Scenario	450 Scenario
European Union	- Climate and energy package; - Emissions trading system - Support for renewables sufficient to reach the 20% share in	- Extended support to renewable-based electricity generation technologies	–Emissions Trading System strengthened in line with the 2050 roadmap. –Reinforcement of government support in favor of renewables. –Expanded support measures for CCS

	2020 - Financial support for CCS, including use of credits from ETS New Entrants' Reserve - Early retirement of nuclear plants in Germany by end of 2022		
United States	– State-level support for renewables. – American Recovery and Reinvestment Act (2009): tax credits for renewable and other clean energy sources, prolonged over the entire projection period. – Lifetimes of US nuclear plants extended beyond60 years.	– Shadow price of carbon adopted for investment decisions from 2015. – EPA regulations including Maximum Achievable Control Technology (MACT) for mercury and other pollutants. – Extension of support for nuclear, including loan guarantees. – Funding for CCS (demonstration-scale).	– Shadow price for investment decisions from 2015 to 2019; CO2 pricing implemented from 2020. – Extended support to renewables, nuclear and CCS.

(Souce: IEA, World Energy Outlook 2011)

In both last two scenarios, It is outlined the necessity that the European Union reinforces the public support for renewables. The last policy developments after the 2008 – 2009 crisis show massive reductions especially in those countries applying feed-in tariffs, with expected consequences in the investment related indicators. But we will revert at this topic in a later section.

2.2. Evolution of EU legal framework supporting RES

Promotion of renewable energy sources has been one of the main EU energy policy objectives over the last two decades. It is well known that European countries were amongst the most aggressive supporters of Kyoto Protocol at the time of its conclusion, in 1997, and have been constantly the world drivers in promoting the RES technology development and power generation. A brief overview of legislative evolution is presented in the following.

The EU Directive 2001/77/CE on the promotion of electricity produced from renewable energy sources in the internal electricity market set the goal of doubling the share of renewables in total power consumption until 2010, with the declared targeted share of 15% of E-RES of the total power consumption. The Directive set also indicative targets for the 10 New Member States (NMS) which were to be negotiated and included in the accession treaties. Also, this Directive establishes rules applying to the support of electricity from renewable energy sources while it leaves to the MS to decide which type of support they want to use.

European Commission Decision 1230/2003/CE „Intelligent Power for Europe" comprised measures for promotion of renewables and for enhancing the energy efficiency. The program paper was supported at that time by sub-programs for supporting sustainable development projects and for improving the co-operation between EU countries and developing countries in the field of RES. The budget allocated to the framework program for period 2003-2006 was EUR 200 mil, although both the Commission and the Parliament advocated for larger financial appropriations to the program.

Directive 2002/91/CE on energetic performance of the buildings (especially the insulation, micro-climate conditioning and use of E-RES) was passed in 2002 (with subsequent application starting from 2006). The Directive approaches topics like methods to assess the building energy performance, minimum large buildings performance standards as well as energetic certification systems.

Through a Directive proposal in July 2002 [COM(2002) 415], the Commission aimed to determine speeding up the technological development and use of combined heat and power systems (CHP). Generation of both power and heat in a single primary energy transformation process allows for primary energy savings, in congruence with the energy policy objectives. Such a proposal generated intensive debates both in the Council and the Parliament, and set sights on a unitary definition of CHP generation. The Directive was passed by co-decision in February, 2004 (2004/8/CE).

In May 2003 it was enforced the Directive 2003/30/CE on promotion of use of biofuels and other renewable fuels for transportation. The Directive set objectives for the Member States (MS) to ensure the use of minimum shares of biofuels in total national fuel consumption and, for such purpose, to adopt national indicative targets. The reference values for the directive objectives were as follows: 2% until 31st of December, 2005, and 5,75% until 31st of December, 2010, the values being calculated with reference to the fuels energy content.

On April 5, 2006, the EC Directive 2006/32/CE was enforced (to abrogate the Council Directive 93/76/CEE) on energy efficiency at end users and energy services. That was aiming at consolidation of energy efficiency in EU and regulating the energy services markets (like lighting, heating, cooling or hot water supply).

In May, 2004, the Commission undertook an evaluation of the RES contribution to the European energy sector and submitted an information to both the Council and the Parliament, along with proposals for concrete actions. [COM(2004)366].

In response, the Parliament recognized the strategic importance of RES and proposed compulsory targets for 2020 to be addressed to Member States, in such a way that to draw strong signals to market players and political leaders

(2004/2153(INI)). Thus, the E-RES becomes a major component of EU's strategy on long term industrial development and environment.

On December the 7th, 2005, the Commission issued a paper called „The Action Plan on biomass" [COM(2005) 628], drawing coordinates for development of energy sector based on wood, residues and agricultural crops. The Plan was aimed at eliminating the market obstacles and promoting the sector development. The Commission Communication known as „An EU Strategy on Biofuels", [COM(2006)34], dated 8th of February, 2006, was meant to promote large scale production and use of biofuels along with an analysis of opportunities for the developing countries.

On 8th of March, 2006, the Commission released the Green Paper called "A European strategy for sustainable, competitive and secure energy" [COM(2006) 105]. The document approaches six key priority axes, i.e. internal power and gas markets, security of supply, diversification of energy sources, encouraging innovation and technological world leadership, a coherent external energy policy. A particular attention was paid to tackling on climate change by increasing the energy efficiency and increasing the use of renewable energy. At the time the Commission committed to prepare the "Renewable Energy Road Map".

In January 2007, the Commission released the Communication the European Council and the European Parliament, "An energy policy for Europe" [COM(2007)1] that brought forward legislative proposals to start the implementation of the Road map. The most significant provisions of that document, with major consequences in the Member States' medium and long term energy policies, were the following:

- The overall targets for Europe of year 2020 should be the famous "20/20/20" objectives, that is 20% reduction of GHG emissions, 20% share of E-RES in total energy generation mix, 20% reduction in energy consumption (to be developed in a sectoral Action Plan for Energy Efficiency 2007 – 2012). As well, the biofuels should represent 10 % of vehicle fuels by 2020.
- Such targets should become legally binding for all MSs, allowing instead for each MS to make their options, depending on local pre-requisites, to determine the best renewable energy mix. Each country's adherence to the common roadmap was assumed to be realized through National Action Plans (to be submitted to and approved by the Commission) providing for specific objectives and sectoral quantifiable targets for each of the renewable energy sectors - power, biofuels and heating.
- The document put an emphasis on the internal market development and quality of energy services: increasing interconnection capabilities based on a Priority Interconnection Plan, reducing administrative burdens for access to grid/ prioritization for E-RES producers, enhancing competence and independence of market regulators, increased and fair competition through separation of management of networks by production or sales, allowing implementation of national aid schemes for the most vulnerable citizens to protect them from increasing energy prices, better information of consumers about different suppliers and supply options.
- As the investment costs were still prohibitive in the absence of adequate financial support, the E-RES should be supported through national schemes.

Investments in both power generation and technological innovation may be also eligible under the European financing programs, like cohesion and structural funds, or dedicated research programs.

The debates on the EC Communication ended in 2009 through the Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. The Directive provides also for comprehensive mechanisms for monitoring the MS' achievement of the goals by 2020.

In January 2011, the EC released a Communication to the Parliament and Council on the progress of MS towards achieving the 2020 goals. In the document it is stated that "the review of Member States plans shows that the new approach is starting to pay off. A comprehensive and binding regulatory framework is proving catalytic in driving forward renewable energy development to achieve the ambitious targets that the EU has set itself (….). The challenge is now to move from policy design to implementation at national level, with concrete action on the ground. The implementation of the Directive and the presentation of plans are encouraging signs of progress that need to be sustained. (Communication "Renewable Energy: Progressing towards the 2020 target" [COM/2011/31]).

An accompanying document to the above mentioned Communication is a "Review of European and national financing of renewable energy" stressing the need of further improvement of financing mechanisms at European level in order to support private investments in the renewable sector. We will revert on the findings and conclusion of the document on a later section of the thesis.

In connection with the regulations on renewable energy sector, the EU legislation was completed in recent years directives and regulations on other "hot" domains directly competing for supporting the achievement of 2020 clean energy targets.

One is the Parliament's and Council's Directive on energy efficiency [COM(2011)370] based on a EC's Energy Efficiency Action Plan released in the same year. The Directive set a common framework for promoting the energy efficiency through measures meant to eliminate barriers or overcome certain market deficiencies that put a burden in the field of energy supply and consumption. The Directive opens the doors towards the buildings concept of the future, the increased efficiency of power generators and improved communication between energy suppliers and end users. Also, there are imposed to the MS a common set of rules for monitoring and reporting the energy efficiency indicators meant to help them achieving the 2020 objective.

Other important legal support, although addressing not only to RES but to the whole energy sector, is brought about by EU centralized bodies in the field of energy infrastructure, technological innovation support (SET-Plan), market integrity and transparency or emissions trading scheme (ETS).

To complete the actual programming framework, the Commission released in December, 2011, a Communication [COM(2011)885] known as "Energy Roadmap 2050", as a pathway towards a de-carbonized economy. Beyond its scientific, political or social role, the roadmap "will allow Member States to make the required energy choices and create a stable business climate for private investment, especially until 2030" (*Günther H. Oettinger, European*

Commissioner for Energy). Under the reference scenario, considering as pre-requisites the existing regulatory framework, including the 2020 targets for RES and GHG reductions, as well as an average annual GDP growth of 1.7%, the projections lead to the following picture of EU 2050:

- ***Energy efficiency***: based on a high rate of existing buildings refurbishments according to the new energy efficiency standards, more severe requirements for the new constructions and appliances and energy savings obligations for the utilities suppliers, the energy demand may drop by 41% compared to a reference peak of 2005 – 2006;

- ***Share of renewables*** may reach some 75% of final gross energy consumption and close to 100% electricity consumption;

- ***Diversified energy generation sources and technologies,*** freely competing in the market without any supporting measures;

- ***Low share of nuclear power,*** under the assumption that no new nuclear power plants will be built except for those currently in a project stage;

- ***Decreasing share of conventional fuels based power plants,*** equipped with CCS facilities, a technology that might reach market maturity starting with 2030;

- ***Increased share of electricity in the final energy demand*** up to 36 – 39%, significantly replacing the actual carbon intensive technologies for heating/cooling and transportation;

- ***Electricity prices at end consumer will rise until 2030 and fall thereafter.*** The main driver of price increase will be the huge amount of investment in capacity generation, grid upgrade or storage facilities while the operating costs will curve down.

The roadmap is the most comprehensive analysis to date on the cost of shifting to low-carbon power generation. It is based on economic, policy and technical analyses by leading consultants, industrial players or representatives of civil society. The main outcome of the scenario is that becoming an almost fully de-carbonized economy is not only achievable but also feasible. The roadmap will certainly become the milestone for future regulatory development of EU's energy sector.

In view of the above recapitulative table of EU's regulatory development in the field of renewables and related sectors, it is clear that Europe, in the last two decades, has assumed and conclusively played a global leading role to the benefit of mankind. No one should doubt about the path that Europe committed on the economic and social change towards a clean and stable environment with all related costs, without any option for turning back. The major question remains whether the other main world players will be willing to commit themselves in the same direction and at the same cadence.

As a personal consideration, a long term pessimistic scenario, maybe beyond 2050, would state that the world countries will fail to reach the assumed carbon saving targets for various reasons, and many negative influences on the mankind's evolution path will occur. It might come a time when everybody will have to pay for carbon emissions rights, directly, like for any fast moving consumer good or hard currency. The shy, now, cross-country carbon credits markets might become a daily part of our lives, an accompanying step for each of our usual procurement.

What the Roadmap does not take into consideration sufficiently in assessing the 2050 RES share in total energy generation is the actions/ reactions of fossil fuel suppliers' establishment in the world economy. It is true that both oil and gas reserves are limited and the exploitation costs might rise significantly in decades but such industries are at maturity stage and all private undertakings are and will be perceived as, what is called in strategic management discipline, "cash cows". The establishment will sharpen the opposition to an aggressive RES development through many political and economic leverages.

3. RES technology evolution. Generation costs and investment costs

3.1. Methodological considerations on technology lifecycle

In the strategic management science, the technology lifecycle (TLC) describes the commercial phases a certain technology passes through, from the gains perspective. In the introductory phase, the R&D expenses are the most significant, the technology is put under market trial and, sometimes, pilot projects are developed to support both R&D effort and test market acceptance, thus generating net losses.

In the early stages of presence in the market, or ascent phase, the technology needs sustained marketing financial effort (public information, distribution channels, sometimes public subsidies, depending on the strategic importance of the technology), the R&D effort continues while the sales are still limited but growing profit generating.

At the maturity phase the technology is market proven, R&D and marketing expenses are limited, market awareness is at top, large economies of scales lead to minimum production costs, hence, the profits are maximized.

After maturity, when market saturation occurs, a declining trend in sales and profits give the signal of technology phasing-out.

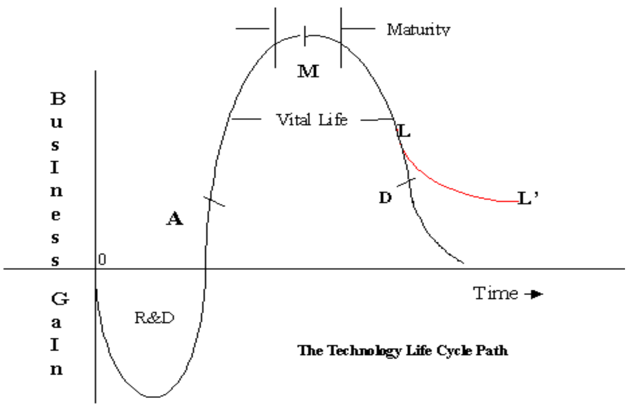


Fig 3. Technology Life Cycle curve

Some technologies, such as food processing, textiles, steel or mining, have a long life cycle (with minor variations in technology incorporated with time) whilst in other cases, such as electronic devices or pharmaceutical products, the lifespan may be quite short.

In practice, depending on many factors, such as the character of the needs served (basic or physical, social, self-esteem), availability of resources, scale of addressees, etc, the technology lifecycle could last from years to hundreds of years.

In modern days, the TLC could be extended through continuous R&D or marketing effort, through various techniques that are subject to economics sciences. The major aims are to continuously cut costs, adapt to market demand, behavior or constraints or improve life and lifestyles (see concept below).

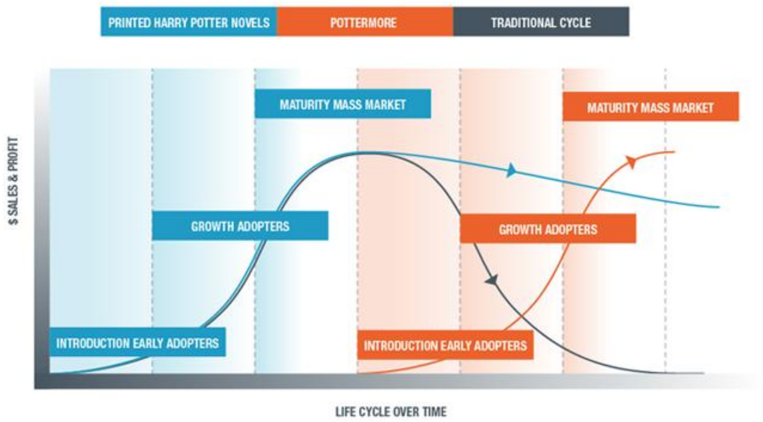


Fig 4. Extended technology lifecycle

In other strategic model, called Boston Consulting Group matrix, the players or technologies in the market are categorized into four groups: dogs (low market share in a slow growing or declining market – meaning no perspective for the business/ technology), question marks (low market share in a high growing market – meaning intrinsic problems for the business/ technology, better to change it from the grounds), rising stars (high market share in a growing market – excellent pre-requisites for further expansion, competitive technology) and cash cows (high or dominant market share in a stable or declining market – stay in the market, reduce costs and harvest the prior efforts through stable profit margins).

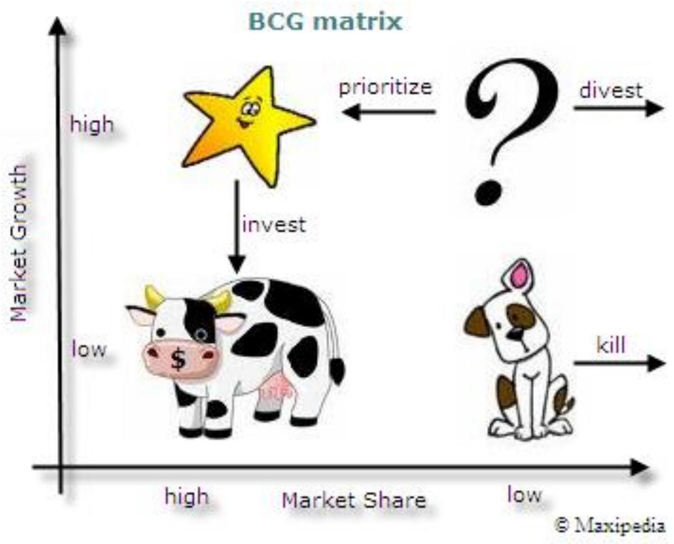


Fig. 5 – Boston Consulting Group matrix

Why the above introductory presentation of some strategy approaches? Because they apply to all products, businesses or technologies. RES technologies aim at providing energy services by transforming the cheap, available and theoretically unlimited sources of primary energy into final energy. The transformation instead bears significant costs that, at current stage of development, cannot still compete with the fossil fuels based technologies. If we look at Figure 3, we may assess that the majority of the market proven technologies are in phase A, while all conventional sources based technologies are at market maturity. The figure below depicts the evolution of energy technologies in terms of market share. This also gives a good idea about the technology lifecycle.

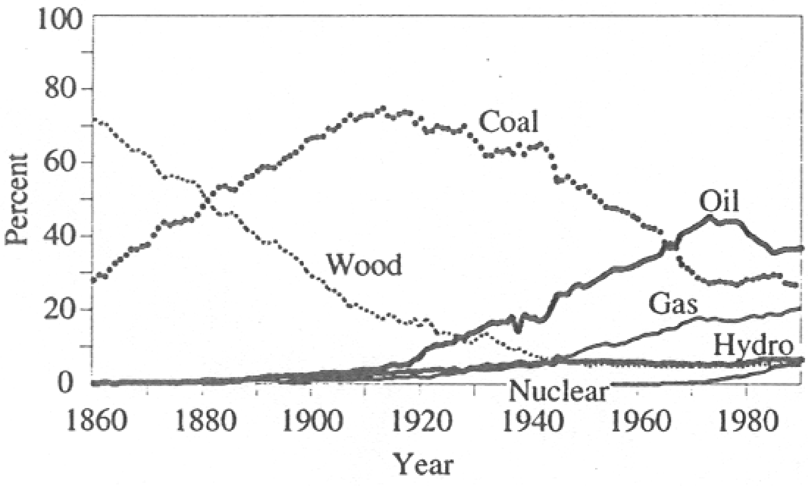


Fig. 6 – Time evolution of market share of conventional energy technologies

It could be noticed that in the pre- and industrial era, the main driver in technology evolution was the global demand. Starting with 1970s, once the oil crises shook the world, the mankind became aware about the limitations on fossil resources and nuclear power joined the race, the competition added new drivers for the technological development in energy generation, like costs and security of supply. The 1990s brought about the renewables along with world awareness about environment protection against GHG emissions. I am confident that over the next decades drivers like primary energy transformation efficiency or size of generator capacity will become important drivers for the industry.

In our actual competitive framework, the most sensitive driver for a full market acceptance for a particular RES technology is the generation cost. Except for the biomass technology, where the fuel cost account for a significant share in the total operation cost, all other technologies use free raw materials, therefore the generation costs heavily depend on the investment cost (and project lifespan).

The notion of “learning curve” or “experience curve” applies to the decreasing investment cost of RES technologies along with the increase in the world physical production of generation units, or, better expressed, in MW installed capacity. The more mature the technology, the lower the decreasing rate of investment cost (this case applies to the conventional fuel generation technologies – see figure below). The underlying reasons for the learning curve effect are labor efficiency, optimization/ standardization/ specialization in using the manufacturing equipment, changes in the mix of inputs, increasing process automation, continuous R&D effort and product improvement based on market feed-back, economies of scale in inputs supply and product distribution.

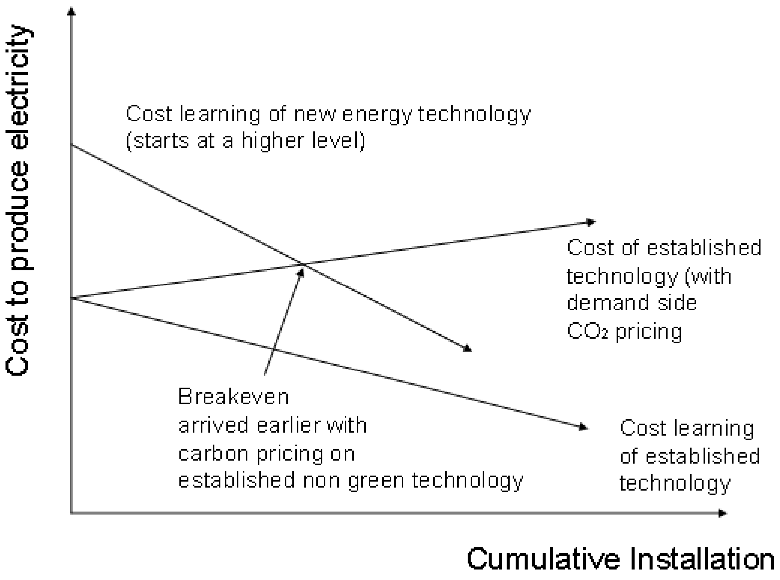


Fig 7 – General model for generation cost evolution of RES vs conventional

Although the learning curve for the established technologies would show a declining cost with the cumulative MW installation, the increasing CO2 pricing attached to the energy production will make in the coming time horizon that the generation cost increase. Thus, a so called breakeven point between RES and conventional generation costs will occur in the coming years, a moment that will be speculated by the national governments to completely eliminate the support schemes for RES generation.

With reference to Fig.4, for fossil fuel based technologies, a predictable driver for extended the lifecycle is the further investment in carbon capture and storage facilities (CCS) that will neutralize some 85% of CO_2 emissions. Thus, the costs with CO_2 emissions will be greatly reduced in the balance with the depreciation cost with CCS installation. Compared to an actual 7.5 – 8 EUR market price per certificate, a price of 14 EUR will make an investment in CCS facility feasible, some studies reveal. And that price may be achievable much earlier than 2020. Instead, just in order to maturing the technology, the European Commission will subsidize a couple of pilot investments in MS through the NER300 Program.

In light of the theoretical aspects in the above, in this stage of development of RES technologies and due to the pressing need for development of alternative energy sources in the international context of climate change (one major driver mentioned before), almost all national governments enforced support schemes for investments in RES generation to make them feasible for project investors. The type and magnitude of the support depends on national policies in the sector based on assumed medium and long term targets.

As we will see in the following, the European Union set common principles, policies and targets for all MS although the types of support schemes remained free choices of national governments.

In order to be able to assess the opportunity and effectiveness of different support schemes, we must first make an updated analysis of costs of different RES technologies.

3.2. Generation costs of RES-E technologies

As the focus of this work is on analysis of support schemes for power generation, we will analyze the actual level of the power generation costs as a basis for further discussing the opportunity, effects and advantages or disadvantages of using the different supporting tools.

The level of support for each technology basically aims at ensuring the investor a certain profit margin over the generation cost of the energy produced. The generation cost is mainly composed of depreciation cost (based on the investment cost and project lifespan), operations and maintenance, fuel cost and financial cost.

The energy cost accounting practitioners may use in their forecasts two formulas: long run marginal cost (LRMC) or levelised cost of energy (LCOE). The first notion refers to a more static perception about the energy production environment and is taken into consideration for installation of additional generation capacity. LRMC methodology necessarily applies for any individual project forecast as part of the feasibility study. In most of the cases sensitivity analyses are needed in order to predict the business course.

The levelised cost is “the price at which electricity must be generated from a specific source to break even over the lifetime of the project. It is an economic assessment of the cost of the energy-generating system including all the costs over its lifetime: initial investment, operations and maintenance, cost of fuel, cost of capital, and is very useful in calculating the costs of generation from different sources.

It can be defined in a single formula as:

$$\mathrm{LEC} = \frac{\sum_{t=1}^{n} \frac{I_t + M_t + F_t}{(1+r)^t}}{\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}}$$

where

- LEC = Average lifetime levelised electricity generation cost
- I_t = Investment expenditures in the year t
- M_t = Operations and maintenance expenditures in the year t
- F_t = Fuel expenditures in the year t

- E_t = Electricity generation in the year t
- r = Discount rate
- n = Life of the system"

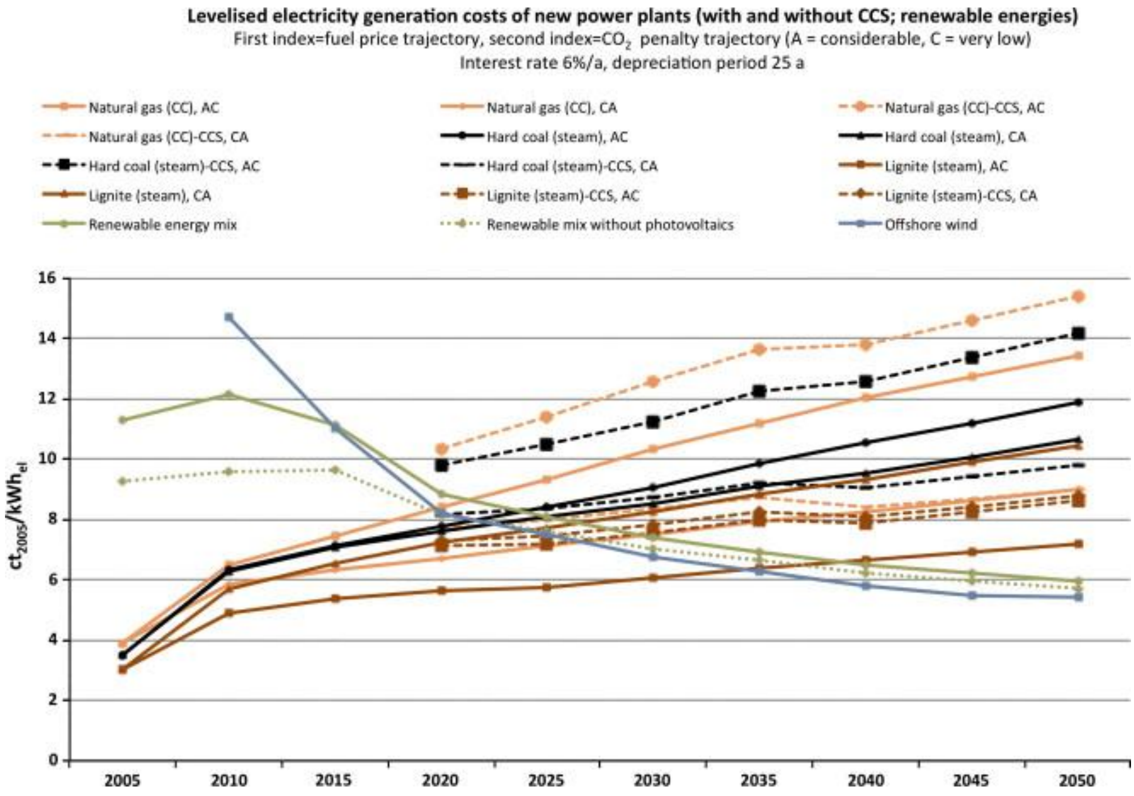
[Wikipedia – Cost of Electricity by Source]

The advantages of using LCOE are, on one hand, that it is an internationally used cost assessment formula, including by the International Energy Agency and, on the other hand, allows for the calculation of a mean cost under the conditions of variable annual costs or for a group of projects under the same technology. Though, it has some limitations in use, i.e. it ignores two major characteristics for power generation: TOD or Time-of-Day, that is the moment of a day the power is generated (peak/base loads) which might drive different sale prices and hence, different profitabilities, and dispachability of the assets that might incur balancing capacity payments.

The broad range of generation costs between countries or regions, within the same technology, is given by various factors like investment costs, labour costs, environment constraints, access to electricity transmission lines, fuel costs, infrastructure, as well as economic variables like country risk assessment, interest reference rates or inflation rates. Therefore, when assessing the LCOE, the result will always consist of a bandwidth of values. The dispersion of values within the same technology may also be a factor of maturity of the technology or of heterogeneity of fuel prices. For example, in case of coal and gas plants the width of the band values is smaller compared to hydro or solid biomass. Even such plants costs may be influenced by variables like property values, local labour costs, environmental costs, access to fuel transportation or access to power transmission lines, as well as variation in technical efficiency of operation. Production from solar and wind generation is largely driven by local climate conditions, which greatly increases the variance across projects in levelized cost.

One researcher in the field of RES-E technologies costs should necessarily refer also to the conventional energy generation sources (CES). The policy mix towards economy decarbonisation comprises not only encouragement instruments for RES but also penalisation of polluters, amongst which, as we saw even in Fig. 1 from second chapter, the CES-E producers account for almost 80% in total GHG emissions. The increasing financial burden from CO_2 prices on CES-E levelised costs will lead to a general breakeven with the RES-E costs, thus making continuation of support policies for RES-E unsustainable and discriminatory. The major problem is WHEN and TO WHAT EXTENT the financial support for RES should be cut, a problem that should be on the agenda of all governments.

A long term projection of the levelized costs for both RES-E and CES-E is presented in the next figure. But such an "official" perception in the reference year 2011 should be prudently assessed as some factors either on the side of RES or CES might alter the projection.



[4] **Fig 8 – Levelised electricity generation costs**

The projections are based on 2010 figures from a bundle of projects commissioning. According to the graph, a mass breakeven of RES-E with the conventional fuels electricity generation is expected to happen after 2020, or, depending on the evolution of carbon emission certificates price, even earlier, in 2015 – 2017.

We may raise a couple of observations to the accuracy of the projection.

First, the expectations of future evolution of carbon price varies widely amongst market observers while the 2007 – 2012 developments have shown rather a monkey market that makes difficult to predict the price of carbon emission allowances. As we mentioned in the previous section, according to the actual technology costs, there is a certain breakeven price per ton for emission allowances to make feasible investment in carbon capture and storage facilities. The effect of postponement in mass CCS projects would rather draw the BEP between conventional and renewables sooner than expected. The graph below shows the evolution of CO_2 certificates prices on the most representative European exchange.

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[4] Energy Solutions for a Sustainable World - Proceedings of the Third International Conference on Applied Energy, May 16-18, 2011 - Perugia, Italy

Fig. 9 – Trading market time evolution of CO_2 certificates

(Source: EEX – European Energy Exchange)

Second, many projections for RES-E generation costs exclude the photovoltaics technology from the general trend or treat it separately, as behaving somewhat distinctly due to still high levelized energy cost (high capital intensity, low energy efficiency and low capacity factor). The assumptions are based mainly on the capex figures before 2011. Instead, the sector developments during 2011 and 2012 show a sharp decline in investment costs (we will see in the next section) with unexpected consequences in the generation costs.

Third, the agricultural and forestry products fuelled biomass technologies may face in the near future challenges in terms of generation costs due to the escalating prices of raw materials (especially in biofuels, biogas or combustion/gasification based on agricultural crops). The current common moderate approaches show a relatively slow pace of increase as a base for generation costs projections. Since biomass accounts for more than 50% in the total renewables mix, any sharp unbalance in the biomass technologies generation cost may drive the mix slope significantly.

The EC DG Energy forecasts a stable to moderate growth for such inputs:

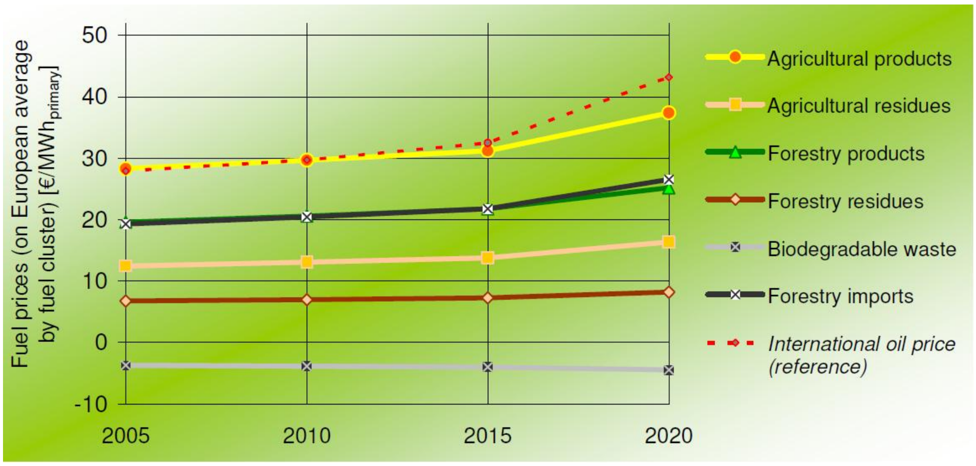

Fig.10 – Fuel prices for agricultural and forestry products, time evolution and estimates

(Source DG Energy, Ecofys 2011, PECPNL084659)

In May, 2011, the UK Committee on Climate Change released the report "Costs of low-carbon generation technologies" previously commissioned to Mott MacDonald. An updated picture of levelized generation costs by technology in 2011 pound figures was included into the report. By using the ECB annual average exchange rate for GBP/EUR, the figures are as follows:

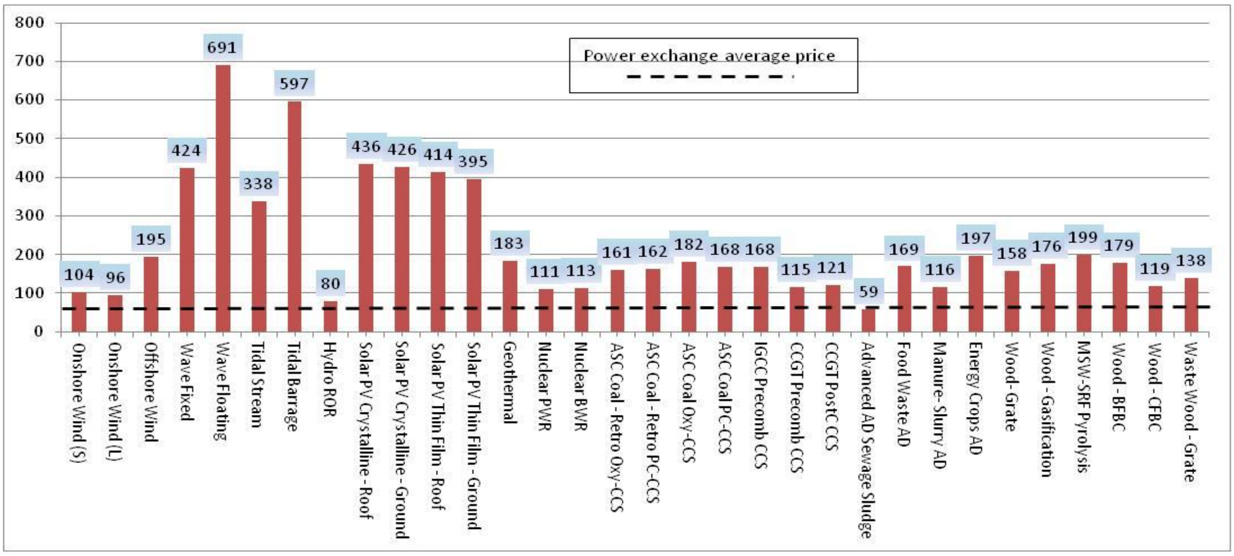

Fig 11 - Levelized costs in 2011, under base case assumptions and average discount rate[5]

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[5] "Cost of low carbon technologies" – Mott MacDonald, commissioned by Committee on Climate Change, May 2011

Even if the statistics refer to the UK setup, with its competitive advantages and disadvantages, they could be easily extrapolated to the old EU Member States to give a broad image on the value gap between power generation costs and grid parity.

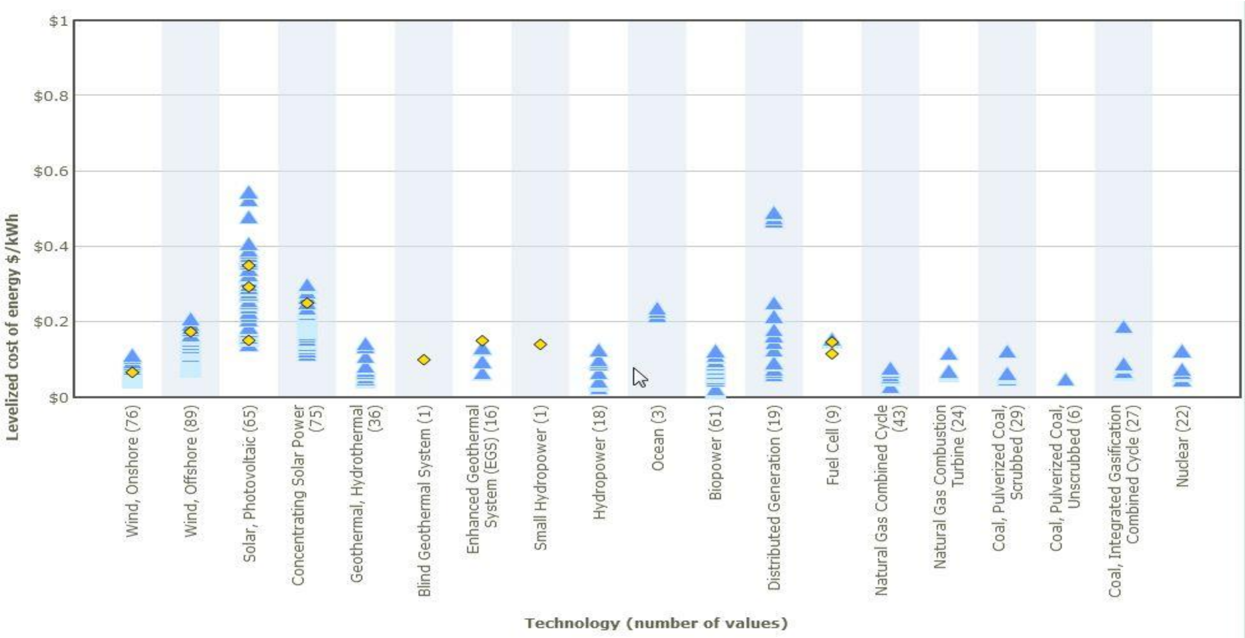

Fig 12 - Levelised RES technology costs in US, figures updated in April 2012

(Source**:** US National Renewable Energy Laboratory (NREL)**,** USA)

The “grid parity” is the point at which the costs of generating electricity from renewable sources are equal to or less than the price of purchasing power from the grid. In any electricity market statistics there are three reference price levels: base load, average and peak load. Reaching grid parity is considered to be an important point in the development of new sources of power, the point at which the subsidy support becomes inopportune and turns into unfair competition.

As could be seen from the graph above, the biogas production, basically using zero or low cost substrates like manure or MSW, and, to a lesser extent, the run-of-river SHPs, could support operations without subsidizing. Even the onshore wind, apparently in a market mature phase of the technology, needs support. The rest of technologies are out of potential profitability area and need support for further development based on learning curves and scale economies.

3.3. Investment costs of RES-E technologies

As a main component of the electricity generation cost, the investment cost gives the real measure of the technology level. It seems to have become a very dynamic parameter especially during the last years while many market regulators closely monitor it in order to fine tune their support policies. Compared to natural potential, consumer behavior, grid, O&M or fuel costs, the technology component of the investment cost is a more unitary parameter at global level due to fast spreading of the technology innovation and market penetration by global manufacturing players.

Main components of the investment cost are the following: project development costs (including design, project management, project permitting), land acquisition, technological equipment with mounting, machinery, civil works, grid connection and grid reinforcement, plant decommissioning.

In the following we will make an overview of the actual investment costs of main RES technologies, with a focus on European market. For providing updated figures, we used as main information sources the International Renewable Energy Agency – IRENA (sectoral surveys released in 2012 on wind, photovoltaics, CSP, hydro and biomass), International Energy Agency – IEA (World Energy Report Outlook 2011 and 2012).

Wind power

The current investment cost for onshore new plants ranges from 1,290 to 1,860 Eur/ kW installed (IRENA). IEA provides for a weighted average of 1,690 USD/kW or 1,270 Eur/kW at the official exchange rate used in 2011 monitoring table of 0.76 USD/EUR. The lower figures seem a little too low optimistic for the moment since almost all major non-Chinese producers do not have prices for equipment (blades, generator, tower, gearbox) lower than 1,000 EUR/kW and an average budget model show a proportion of 65% wind turbine cost in total investment cost. Using the same exchange rate (all figures in the graph below are in 2010 USD terms) it comes that neither now not during the peak sales in 2009 the price per MW has fallen below 1,000 EUR.

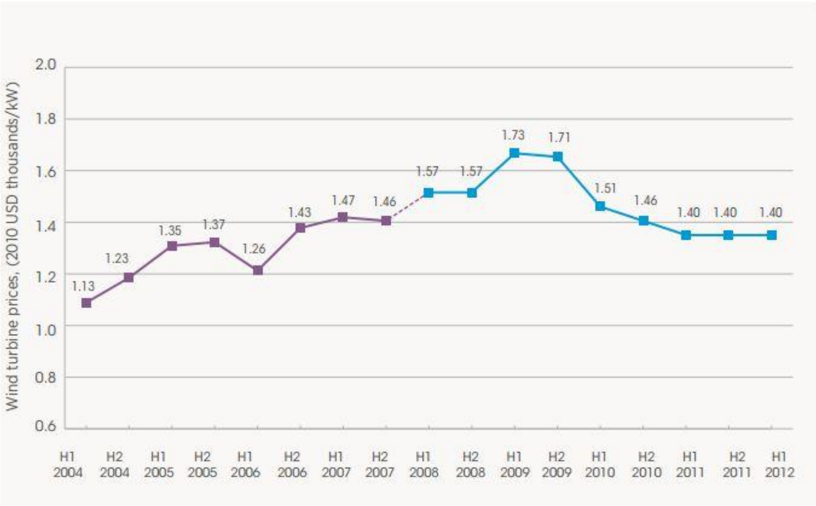

Fig 13 - Evolution of wind turbine prices (Source: BNEF, 2011b)

A more adequate average figure for the investment cost is in the range of 1,400 – 1,450 EUR/kW for Europe.

The historical average learning rate between 1980s and 2004 was 7% (IEA, GWEC). The projections show that the cost decreasing slope will flatten in such a way that for 2015 – 2018 a further 5 to 10% cut will occur while for 2020 between 12 to 20%. The uncertainties on reduction potential come from reverse drivers: on one hand, continuous increase in magnitude of the installations and power leads to decreasing unit prices while there are no signals of drops in security of raw materials supply sources.

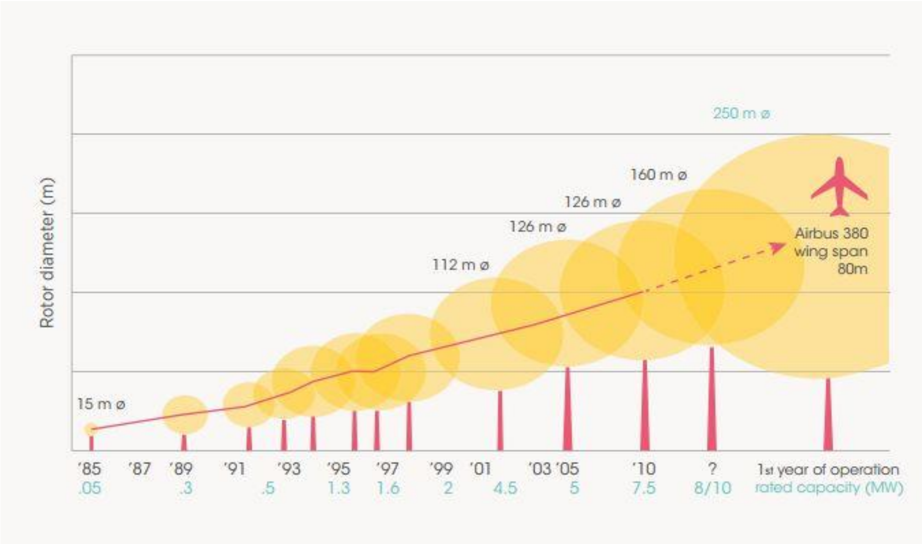

Fig 14 – Evolution of wind plant magnitude (Source: UpWind 2011)

On the other hand, grid congestions, grid connection and balancing costs in Europe make increasingly difficult site identification and project permitting. A prolonged increase in the demand will continue to absorb the manufacturing capacity. Also, land procurement itself becomes an increasingly costly item. The last thing is a good example of creation of inflation through market intervention.

Another actual trend in the technology is the use of gearless turbines, a trend that has been given by the German producers. This way, also the O&M costs will face cuts.

The investment costs for offshore wind turbines range from 3,000 to 3,420 EUR/kW (IRENA) or an average of 2,575 EUR/ kW (IEA). Again, the IEA figures look too optimistic for the same reasons. The cost varies largely in terms of distance to the shore due to the heavy investment in undersea array cabling and transmission lines that could account for some 20% in the cost structure. Expectations until 2015 are that the investment cost decline down to an average of 2,800 EUR/ kW (IRENA).

Small Hydropower (SHP)

Although there is not so far a common understanding amongst the specialists on the enclosure or not of large hydropower in the renewables” sector, we will not include it in the current work, mainly because it does not make subject to support schemes.

SHP is the special category of RES whose investment cost is spread on a large bandwidth mainly because of the particular design and site conditions for the civil works. Depending also on the type of plant (RoR, high head) and size of water catchment, the civil works could account for 60 to 75% of the project investment budget.

Thus, the international statistics show a cost range between 800 and 6,000 EUR/kW (IRENA) with an average cost of 2,950 (IEA).

The electro-mechanical equipment and civil works are the two main cost components with the ratio between them varying large in terms of plant size (for large hydropower the civil works could account for as much as 75% of investment while for a small RoR plant the equipment could go as high as 50%), local energy needs, water and environment management constraints, location accessibility, geological features, access to grid.

The SHP equipment manufacturing is a long lasting, mature industry therefore no significant price fluctuations may occur in time.

Though, one major constraint may be considered in the future development of the industry, that is, the limited, relatively easily quantifiable potential of one country's rivers commercial exploitation, which might limit the further issuance of water management permits, especially in those countries where the sector is largely developed.

PV Power

Investment costs and, implicitly, the generation costs of photovoltaic technology is the hot topic for debates nowadays. With a learning rate estimated at 20 to 24% (EPIA, 2011) (price decrease by doubling installed capacity) the last years has shown a dramatic increase in installed power, with Europe accounting for almost three quarters of global demand:

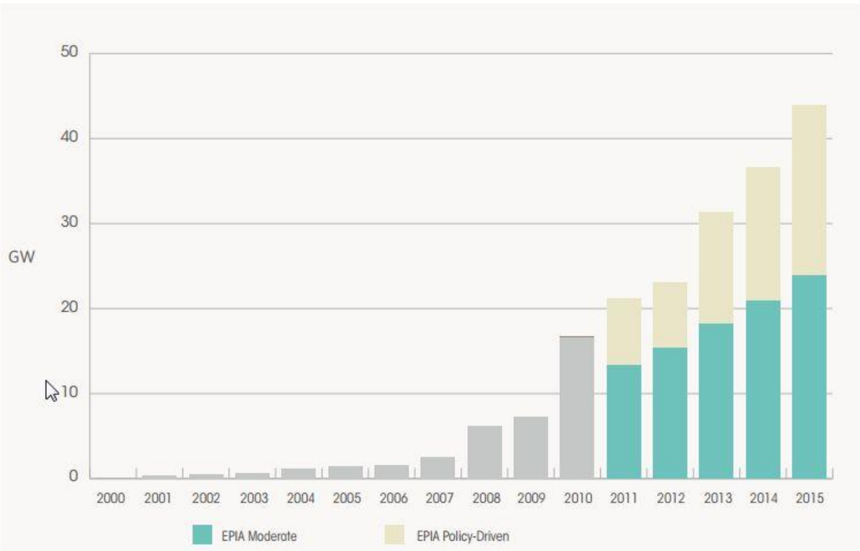

Fig 15 - EPIA scenarios for global annual new installed PV capacity, 2000 To 2015

(Souce: European Photovoltaic Industry Association, EPIA, 2011)

For further developments, the IEA predicts an average annual growth rate until 2020 of about 17%.

Under the above assumptions, it is far from being accurate to estimate the actual state of play considering the 2010 – 2011 figures from the official reports (IEA, IRENA, DG Energy). For example, World Energy Report 2011 shows an average of 2,190 EUR/kW, while IRENA gives even higher thresholds.

Based on actual practice and market transactions, the mid-2012 investment cost for PV plants is in the range of 1,400 – 1,500 EUR/kW (including cost of land and permitting procedure). In a certain way, the sharp decline in PV modules prices in 2011 and 2012 surprised most of the market players.

Typically, the PV modules account for 40 to 50 % of project budget, the rest being represented by the mounting system, inverters, cabling, project design and permitting, grid connection, land acquisition, automation.

Importantly, the cost differences between the two dominant technologies of 2nd generation, c-Si and A Si, are negligible.

Under the new investment cost assumptions, the levelized generation cost declined sharply, somewhere around 150 EUR/MWh. Many European market regulators reacted promptly in their technology support scheme starting with end of 2011.

Concerning the new picture of investment costs for PV power generation, a hot issue came on the public agenda recently. The Chinese modules tend to be considerably cheaper than the US, Japan or EU's producers, and this cannot be measured by the traditional low quality features of Chinese products, like in the past. All OECD countries have imposed strict quality control standards and trading authorization criteria. Allegations about dumping practices from the Chinese government led to a recently launched EC investigation against the PV panels Chinese manufacturers. The industry stakeholders reacted differently: while the local producers warmly welcomed the initiative, the AFASE (Alliance for affordable Solar Energy) claims that introduction of protectionist measures will increase again the prices of solar arrays.

The near future is a little uncertain for the PV industry mean figures but one thing is sure, that the PV power is a rising star as one of the dominant technologies of the future.

Biomass

"Biomass" concentrates a broader range of distinct technologies based on the use of biological residues to produce electricity, heat and fuels.

Like hydropower, some biomass based technologies are well established with long market performance. Amongst them, biomass combustion and anaerobic digestion (AD) are mature technologies. For the purpose of our work we will treat only the biomass CHP technologies.

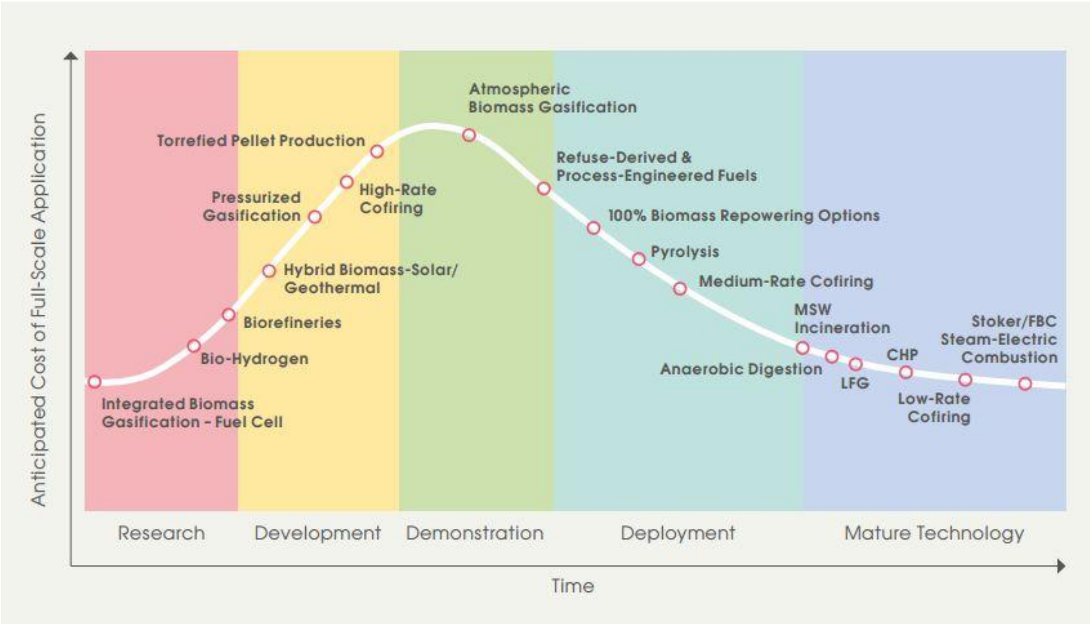

Fig 16 - Biomass power generation technology maturity phase

(Source: EPRI – Electric Power Research Institute, 2011)

In terms of size, the biomass power plants may be categorized into small (less than 1 MW_{el}), medium (1 to 10 MW) and large (more than 10 MW). If we look at 1 MW plant cost as the standard cost, the smaller capacities will be built at considerably higher costs per MW due to the minimum fixed investment requirement while for the larger capacities the cost per MW grows but at a lower rate compared to the reverse situation due to increasing complexity of operations. Depending on the size of the reference plants included in the analysis basket, the values for average investment costs vary largely from a source to another.

Table 3 - Biomass plant investment cost

RES-E category	Plant technology	Inv Cost (EUR/kW)		
		Min	Max	WEO*
Biogas	Agricultural biogas plant CHP	2,550	4,290	2,122
	Landfill gas plant CHP	1,500	2,100	n/a
	Sewage gas plant CHP	2,400	3,550	n/a
Biomass	Biomass plant CHP	2,600	4,375	2,771
	Co-firing CHP	450	650	445
Biowaste	Waste incineration plant CHP	5,800	7,425	5,519

(Sources: Ecofys, 2011, DG Energy, and *World Energy Outlook, 2011 – IEA)

Like in case of PV, the last years imports of cheaper Chinese equipment, especially CHP engines, prime movers, boilers, filters and cleaners, mixers and pumps (for AD) have drawn down the investment costs by 20 to 25%. Despite the full technology accreditation for the market, many operators show some resistance to the cheap imports to the benefit of traditional EU manufacturers. For example, a 1 MW agricultural based CHP digester with all components manufactured in EU costs some 2.5 mil EUR while same capacity including non-OECD manufactured components may cost 1.8 to 2 mil. EUR.

At this stage there is still little discussion on the learning curves and cost reduction potential of biomass technologies. Things are complicated by the broad range of technological solutions, non standardization of design, variety of feedstock as well as multitude of “sub-technologies” in a different market maturity phase, from pilot projects to large scale production.

The IEA forecasts and average learning rate of 5% for the biomass generation technology as whole until 2035. Though, our view is that on a longer run more significant growth rates and, implicitly, cost reductions will occur on those technologies based on cheapest and most available feedstock, like straw, wastes and disposals.

Other RES power technologies

Due to limited availability and heterogeneity of data, small market share in EU-27 and, except for geothermal, the early phase of industry maturity, the following renewable sources will be just mentioned as far as the investment costs are concerned.

Table 4 - Other RES technologies investment costs

RES-E category	Plant technology	Inv Cost (EUR/kW)		
		Min	Max	WEO*
Geothermal	Geothermal power plant	2,575	6,750	1,800
Solar thermal	Concentrated Solar Plant	3,600	5,025	5,400
Wave energy	Wave power plant - shoreline	4,750		
	Wave power plant - nearshore	6,125		5,000
	Wave power plant - offshore	7,500		
Tidal stream energy	al (stream) power plant - shorel	5,650		
	l (stream) power plant - nearsh	6,825		
	Tidal (stream) power plant - of	8,000		

(Sources: Ecofys, 2011, DG Energy, and *World Energy Outlook, 2011 – IEA)

One conclusion of the research carried out during preparation of the work, there is a generalized lack of up-to-date statistics on RES generation costs, especially in EU. Almost all figures in various reports and databases are dated back in 2009 – 2010, even if they refer to 2011 as a reference year, while the markets react spontaneously to any driver changes, like investment costs. The tremendous amount of investments during last two years in European countries are motivated by more than comfortable project rates of return in fields like wind power or PV caused by the unexpected gap between constant support instruments and quick decrease in investment costs. As no continuous monitoring of the sensitive market conditions occurs, the European taxpayers are supporting the RES-E operators’ profits. One big question mark came to us from the fact that the websites of the specialized pan-European bodies of wind (EWAE) and PV operators (EPIA) do not provide for any updated statistical reference to investment costs of LCOE for the specific technologies.

Our opinion is that the central administration(s) should create such instruments publicly accessible in order to better support the policy acts.

4. RES-E support schemes in EU countries. Past, present, perspectives

4.1. General considerations

Back in early 1980s, many EU-15 governments had tried to encourage both the social awareness about the need of greening the economies and the research and development, as well as the market introduction of new RES-E technologies through the means of the financial incentives in the form of investment subsidies, loans or reduced taxes. Successful models had proved to be applied in Germany and Denmark, where, for example, it was possible to obtain preferential real estate loans for building wind parks.

Such schemes were completed with promotional campaigns in various European countries, on voluntary green power initiatives, encouraging the consumption of energy from renewable sources at higher prices. Even in the most environmentally concerned countries the rate of success, measured in number of customers adhering to such programs, were very limited, with no practical influence on the industry development.

In the mid-1990s, after Kyoto protocol, in various European countries, promotional programs based on fixed regulated tariffs for the purchase of electricity from specified renewable sources became more common. Meanwhile, competitive tendering, was introduced in the UK.

In recent years, another type of instrument emerged, that is the obligated quotas for RES-E, associated with Tradable Green Certificates, introduced in some Member States.

From each MS' self-regulatory policy, to a mixture of instruments nowadays governed by EU common regulations, targets, reporting and monitoring and jointly developed mechanisms, and, perhaps to a harmonized RES promotion system in the coming years, European Union has managed to become a world leader in the field of green energy production.

Following the provisions of the Directive 2001/77/EC, and, later on, Directive 2009/28/EC, the EU MS implemented different RES support schemes for power generation, heating and cooling or biofuels for transportation. The Directive allowed for each MS to choose its own particular model, and this is what they did, depending on internal factors like policy goals, geography, existing energy production mix and infrastructure, cost effectiveness or budgetary perspective, cultural mindset. Even the instruments are similar in many countries, the implementation systems may differ for many reasons.

4.2. Support instruments for energy generation

4.2.1. Brief history

Back in early 1980s, many EU-15 governments had tried to encourage both the social awareness about the need of greening the economies and the research and development, as well as the market introduction of new RES-E technologies through the means of the financial incentives in the form of investment subsidies, loans or reduced taxes. Successful models had proved to be applied in Germany and Denmark, where, for example, support for RES went deeper, even to that it was possible to obtain preferential real estate loans for building wind parks.

Such schemes were completed with promotional campaigns in various European countries, on voluntary green power initiatives, encouraging the consumption of energy from renewable sources at higher prices. Even in the most environmentally concerned countries the rate of success, measured in number of customers adhering to such programs, were very limited, with no practical influence on the industry development.

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4.2.2. RES-E support instruments

Main RES-E support instruments are the following:

Feed-in tariffs (FIT).

They are the most frequently applied incentive instruments in EU-27 and consist of a flat price per MWh fed into the grid, usually set for a period between and fifteen years or more, to be paid by the distributors to the power generating companies. Subsequently, the distributors recover the additional expenditure from end consumers. The FIT schemes are periodically adjustable depending on the evolution of investment cost for various technologies, electricity generation costs and on other market drivers, in order to keep attractive rates of return for investors without creating the possibility of overcompensation to the prejudice of consumers. The FIT schemes usually vary by RES technology and rated capacity magnitude, depending on the short and medium run political targets.

FIT have proved to be an easy manageable instrument, with low administration costs, investor's security of returns and business predictability, easily achievable economic national targets. The more predictable the business, the lower the expected rates of return and, thus, the lower the additional costs for the end users. Due to the sharp decline in investment costs for some RES technologies, like wind and PV, over the last years, the FIT system has proven its adaptation capability.

Reversely, FIT system has the disadvantage of giving room for substantial revenue to the investors in case of substantial fall of generation costs, therefore the work for predictability from decision makers should be carefully done

Another particularity is that the power producers do not sell the production directly in the market but rather to suppliers therefore they do not have an interest to adjust production depending on the wholesale market price evolution. Thus, they might create unbalances that other market participants should tackled with.

The MS running the FIT system are: Germany, Austria, Spain, Portugal, Greece, Ireland, Luxembourg, Hungary, Bulgaria, Cyprus, Malta, Lithuania, Latvia, Slovakia and France. A few countries, including Cyprus and Estonia, do not apply technology specific tariff systems and apply a unique feed-in tariff for all technologies.

Feed-in premium systems (FIP).

Such a system has developed over the last years as a means of overcoming the FIT system minuses. FIP guarantee the producer certain extra flat revenue while the electricity is traded directly by the producer in the market, thus being exposed to the price fluctuations. Usually, the premium varies between some annual limits, in line with the market volatility.

In this way, the producers are stimulated to adjust the production to the market demand, especially for those who have a significant fuel cost component, while they benefit of minimum guaranteed revenues but are limited on the upper level. The system's main advantages are the limitation of excess supply and avoidance of overcompensation.

Countries implementing such schemes are Netherlands and Denmark while in other countries like Czech Republic, Spain, Estonia and Slovenia the scheme co-exists with FIT, the producers being allowed to make an option between the two models.

Tradable Green Certificates (TGC). Depending on the country's RES target for the coming year and based on recent year share of each energy supplier (distributor) in total power consumption, the market regulator allocates an annual quantitative quota obligation for each supplier to buy green certificates in the free market. The sellers are the RES producers who receive periodically a number of TGSs for each MWh evacuated into a public grid. Differences between the national RES share planned for the year and the actual RES-E production induce price fluctuations for the TGCs and may stimulate or discourage further RES investments.

Each RES technology bears a number of TGC per MWh, depending on the national policy options for the sector.

In theory, such a system is profitable for the self-adjustment of RES generation capacity. Even more positive results would be derived from differentiation of GC allocations in terms of technology novelty or energy efficiency.

The most relevant minus of the scheme stands, on one hand, in the severe uncertainty for the investor in case of downward TGC market price fluctuations and, on the other hand, on the possibility of windfall revenues or over-compensation in case of a bullish evolution. Overall, the upfront difficulty in an investment decision relies on the unpredictability of the business. Consequently, such national markets will be exposed to higher expected rates of return on the investments.

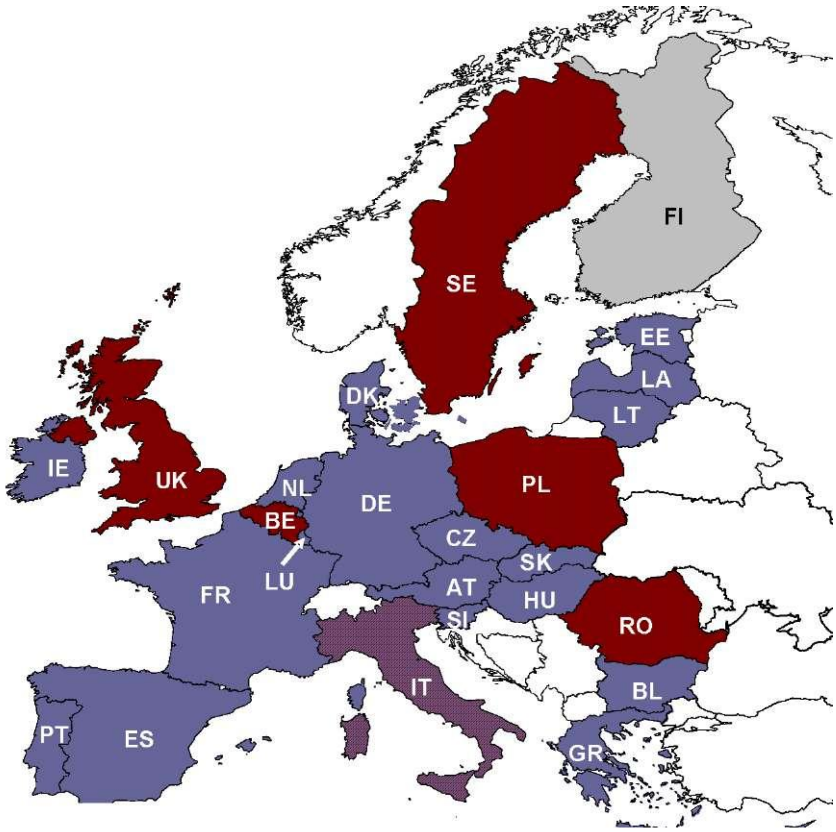
In some cases, the government has the possibility to protect itself against large premiums to be paid by power end users by periodically adjusting the number of TGC to be allocated per technology but, with an additional/double uncertainty effect on the investors side.

Countries applying TGC schemes are UK, Belgium, Poland, Italy, Sweden, and Romania. In countries like UK and Italy, the governments introduced a mix system with quota obligations and FITs or FIPs for some less mature technologies

Whether FIT, FIP and TGC represent the main policy instruments applied in each of the EU-27 countries, some accompanying measures may be applied in order to fulfill the envisaged RES policy goals. They are:

Tax incentives. They apply either to investments or to profit tax and might become powerful tools if properly designed and implemented. **Investment subsidies**, usually financed from the European funds like Regional Development Fund, Cohesion Fund or Rural Development Fund, they support in most of the cases lack of either initial equity or banks' propensity to finance the sector. Another support scheme is the ***Financial incentives*** consisting in subsidies to bank loans interest and other loan repayment terms facilities, like longer repayment terms and interest holidays.

The figure below shows the use of support schemes throughout Europe-27.



Where: ◻ Feed-in tariff, ◻ Tradable green certificates, ◻ Tax incentives, ◻ Mixed system

Fig 17 – Main support systems applicable in EU - 27
(Source: European research project futures-e, EIE/06/143/SI2.444285, 2008)

Another scheme that used to be in force in countries like Netherlands, France, Denmark or Spain was the ***tendering procedure*** for larger power quantities, especially those produced in off-shore wind parks. Some analysts criticized the system arguing that it induces rather a slow pace of RES development and an unfavorable effect upon the business predictability.

4.2.3. Support instruments for heating and cooling

Burning of biomass in centralized heating plants or CHP plants is extensively practiced in Austria, Germany, Baltic and Scandinavian countries. Solar thermal heating technologies account only for a very low share of the total amount of RES-heat generated. Similarly, ground source heat pumps and geothermal heating technologies represent only a marginal share of RES-heat production, but are expected to experience further growth in the future.

The limited market expansion of RES-H production, as compared to the booming RES power sector, is basically due to the lack of a consistent and coherent support framework. The instruments supporting RES-H are in most of the EU countries reduced to investment or loan subsidies or tax incentives.

An overview of the schemes for RES-H support in EU-27 is presented in the following table:

Table 5 – RES-H support schemes in EU-27

Country	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE
Investment subsidy	X	X	X	X	X	X		X		X	X	X	X	X
Tax exemption	X	X					X				X	X		
Financial incentives			X			X		X			X			

Country	IT	LT	LU	LV	MT	NL	PL	PT	RO*	SE	SI	SK	UK
Investment subsidy		X	X	X	X	X	X	X		X	X	X	X
Tax exemption	X	X				X				X			X
Financial incentives								x					

(Source: European Commission, DG Energy, project PECPNL084659, 2011)

* Note that in case of Romania, the RES-H support is linked by the TGC scheme, in the sense that for every MWh_{el} produced in biomass/biogas CHP plants with high energy efficiency (automatically means that the heat produced is used in industrial processes or district heating) it is allocated one GC.

As one can observe from the above table, the investment subsidies are the most frequently applied incentive scheme.

4.2.4. Support instruments for transportation biofuels

Once Directive 2003/30/CE on promotion of use of biofuels enforced, the sector faced a boost at European level, mainly in the frame of 2006 – 2008. The measures supporting the development consist of a mix between quota obligations and tax exemptions (see table below):

Table 6 – RES-T support schemes in EU-27

Country	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE
Quota obligation	X		X	X	X	X	X		X	X	X			X
Tax exemption	X	X		X	X	X	X	X	X		X	X	X	X

Country	IT	LT	LU	LV	MT	NL	PL	PT	RO*	SE	SI	SK	UK
Quota obligation		X	X	X		X	X	X	X		X	X	X
Tax exemption	X	X	X	X	X		X	X	X	X	X	X	X

(Source: European Commission, DG Energy, project PECPNL084659, 2011)

The boost of biodiesel production in Europe and bio-ethanol in Americas stirred up intensive debates on the unfair competition with the food sector. Starting with 2009, the world prices for almost all important crops have grown constantly. The rise in prices and scarcity of raw materials economically shrink the European biodiesel producers, and plenty of production capacities closed, thus putting in danger the achievement of EU 2020 target.

In the summer of 2012, the severe draught not only in USA and Europe, but also in large producing countries like Russia, put more aggressively on the G20 discussions agenda the need for quitting the biofuels targets in USA and EU, with voices coming mainly from FAO and other agricultural governing bodies. The arguments against biofuels come from the direct (change of use of crops) or indirect (change of use of land) competition with the food sector, including human, animal stock or food industry consumption. Moreover, the high volatility of prices in the world market creates big uncertainty for biofuels production businesses that can hardly be covered through regular hedging instruments. For example, the chart below shows the evolution of world corn prices (main raw material for bio-ethanol in US) starting with 2008, without depicting the recent 23% price increase in July 2012 compared to the similar period of 2011.

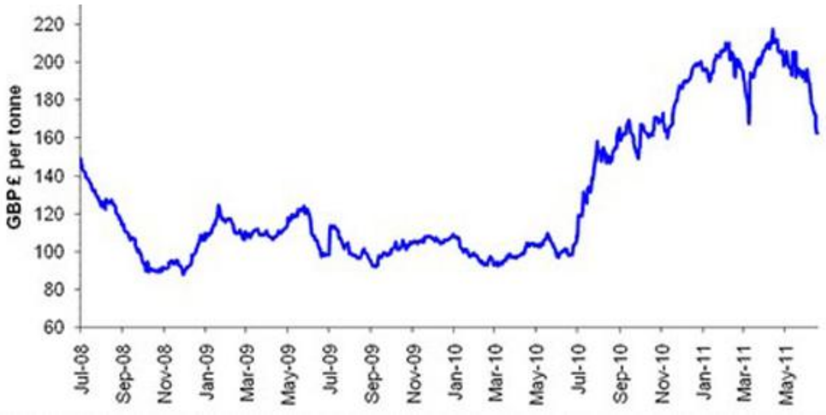


Fig 18 – Evolution of world corn prices

Our opinion is that the further subsidizing of biofuels production sector is not sustainable as a long run policy option, while the R&D efforts should focus on other fuel options for the future. At EU decision making level, the energy sector think tank should work closely with the peers from agriculture and environment in order to release the additional pressure on agricultural output prices.

5. Relevant country experiences. Comparative analysis

In this chapter we will enlarge on the specific support mechanisms in some of the major EU countries, their past and current evolution, in order to be able to understand the RES market driving vectors.

5.1. Support schemes in EU countries

5.1.1. Germany

The leading power of EU in terms of RES-E development, Germany has based its growth on a traditional FIT scheme. In general, all technologies are eligible for support

Technology	Eligibility conditions	Amount	Support period
Wind	Both wind onshore and offshore, with limited exceptions	Onshore: €ct 4.87 – 8.93 per kWh (according to duration of payment) + repowering bonus of €ct 0.5 per kWh and system service bonus of €ct 0.48 per kWh Offshore: €ct 3.5 – 19 per kWh (according to duration of payment and scheme chosen by system operator)	20 yrs*
PV	Existence of local development plans	Roof-top: €ct 18.3 – 24.4 per kWh (subject to a digression rate that should be subject to annual approvals by law Ground-mounted, less than 10 MW: €ct 17.9 – 18.8 per kWh**	20 yrs
Geothermal	No special	€ct 25 per kWh plus	20 yrs
Biogas	The biogas plant should not exceed 750 kW (after Jan 1, 2013). If biogas is obtained from manure, the capacity should not exceed 75 kW (after Jan 1, 2012). Obligation to produce CHP or minimum percentage of manure (60% for BM and 100% for BW) is used or 60% manure is used in producing	Biogas from biomass: €ct 6 – 25 per kWh (according to system size and fuel Landfill gas: €ct 5.89 – 8.60 per kWh Sewage gas: €ct 5.89 – 6.79 per kWh	20 yrs

	biogas. Obligation to keep record of substances. No escape of biogas. Full recovery of dry composting residues. Electricity generation at the site of AD.		
Hydro power	Investment under the Federal Water Act. Eligible only if the plant was erected in the spatial context of a barrage weir or dam which had already existed before or was newly built primarily for purposes other than the generation of electricity from hydropower	€ct 3.4 – 12.7 per kWh (depending on system size and date of commissioning)	20 yrs
Biomass	The substances regarded as biomass are specified in a separate ordinance (BiomasseV). Eligible only if a certain percentage of the electricity (usually 60%) was generated from CHP. Obligation to keep record of substances.	€ct 6 – 14.3 per kWh (according to system size) plus bonus for use of special substances	20 yrs

(Sources: Observ'ER, RES LEGAL Europe - EC, PVTech, country reports, press articles)

Notes:

- * For all FITs the applicable period is 20 years plus the whole year of plant commissioning.
- ** tariffs are valid starting with 1.01.2012
- All FITs are subject to an annual digression rate stipulated in the law, starting with 2013, in order to stimulate the further cost reduction. The figures range from 9% in case of PV, 7% for offshore wind starting with 2018, 5% for geothermal, to much lower levels like 1.5 for onshore wind, 2% for biogas and biomass, 1% for small hydro. Due to fast market development, for PV there were introduced special reserves from the government to easier adapt the FIT to market.

A couple of further observations may be drawn. The scheme for SHP does not encourage new greenfield investments as it seems that the overall natural capacity for damming up the internal rivers is close to the upper limits. The regression rate proves that the technology is at full maturity and no further significant cost reductions are envisaged.

Limitations introduced in the size of AD allows for a better public concern about the environment protection and tries to prevent the inconveniences made to local neighboring communities. Both for biogas and biomass, a careful monitoring and a greater focus on the feedstock use shows concern for avoiding conflict with the traditional agricultural resources. Almost compulsory presence of CHP generation units is in the line with enhanced energy efficiency goal.

Wind sector still receives good incentivizing, both onshore and offshore.

Subject to hot national debates in 2012, the incentives plan for PV, already changed starting with 1st of January, 2012 are proposed to be further downsized. The announcement of the measure severely affected the industry, with a drop in sales of arrays of 50% only in April 2012 and plenty of bankruptcies throughout 2012 amongst domestic solar cells producers. The government approach on PV sector was unusual for the German recognized propensity for long term stability and predictability but the FIT cuts looked more like a radical intervention on the market in order to temperate the retail electricity prices escalation accompanying the RES boom in general, and PV in particular.

5.1.2. United Kingdom

The UK is experiencing both Feed-in-Tariff and a quota system, the first one being introduced beginning with 2010. The RES-E producers with capacities larger than 5 MW apply for the quota system, while those operating generators between 50 kW and 5 MW may chose between the two systems.

The quota system has a longer tradition, since 2002, and is based on the electricity suppliers' obligation to market inside their source mix a certain quota of renewables set up annually by a specialized body (Ofgem) depending on the national RES target assumed. The RES-E producers receive a number of certificates (named "renewables obligation orders – ROC") per MWh exported into the grid that will be sold to suppliers at a pre-established price, adjustable annually.

Capacities smaller than 50 kW may apply for Microgeneration Certification Scheme, an independent scheme that certifies microgeneration products.

The FIT scheme is applicable only for wind, hydro, PV and AD:

Technology	Eligibility conditions	Amount	Support period
Wind	Eligible 50 – 5,000 kW	up to 1.5kW = 0.358 GBP/kWh 1.5kW - 15kW = 0.28 GBP/kWh 15kW - 100kW = 0.254 GBP/kWh	20 yrs*

		100kW - 500kW = 0.206 GBP/kWh 500kW - 1.5MW = 0.104 GBP/kWh > 1.5MW = 0.049 GBP/kWh	
PV	Eligible 50 – 5,000 kW	up to 4kW = 0.21 GBP/kWh 4kW - 10kW = 0.168 GBP/kWh 10kW - 50kW = 0.152 GBP/kWh 50 kW - 250kW = 0.129 GBP/kWh > 250kW = 0.085 GBP/kWh Stand alone = 0.085 GBP/kWh	25 yrs
Biogas	Eligible 50 – 5,000 kW	up to 250kW = 0.147 GBP/kWh 250kW - 500kW = 0.136 GBP/kWh > 500kW = 0.099 GBP/kWh	20 yrs
Hydro power	Eligible 50 – 5,000 kW	up to 15kW = 0.219 GBP/kWh 15kW - 100kW = 0.196 GBP/kWh 100kW - 2MW = 0.121 GBP/kWh > 2MW = 0.049 GBP/kWh	20 yrs

(Sources: Observ'ER, RES LEGAL Europe - EC, PVTech, country reports, press articles)

Starting with December 1, this year, some adjustments will be made to FITs, in the sense of slightly lowering the wind incentives while increasing those for micro CHP.

The Renewable obligation scheme provides for a certain amount of power generated per one green/obligation certificate (ROC) – some kind of a "reverse quotation", as follows:

Technology	Amount of electricity generated stated in

	one ROC (MW)
Landfill gas	4
Sewage gas, biomass co-firing	2
Onshore wind, hydro, biowaste CHP, biomass co-firing CHO, standard gasification, standard pyrolysis, co-firing of energy crops	1
Offshore wind, co-firing of energy crops CHP, dedicated biomass	2/3
Wave, tidal system, advanced gasification, advanced pyrolysis, dedicated energy crops, dedicated biomass with CHP, PV, geothermal, tidal barrage, tidal lagoon	1/3

(Sources: Observ'ER, RES LEGAL Europe - EC, PVTech, country reports, press articles)

In addition to the above main supports, there is a also applicable a tax regulation mechanism, so- called Climate Change Levy (CCL), which is charged on the power consumption from conventional sources by the end consumers The tax is collected from the power suppliers, who re-invoice it to their consumers through the electricity bill. RES-E delivered is exempt from this tax.

The support setup in UK is a complex mechanism. The partial switch to FIT in 2009 had come in order to both simplify the administrative procedures for the small power generators and to better test and monitor the effectiveness and efficiency of each of the two major models, TGC and FIT.

5.1.3. Spain

The core RES-E support is a price regulation mechanism, based on FIT and premium prices plus an income tax facility. The operators may chose between one of the two schemes but within the annual market cap set out by the authorities for each technology. In general, all technologies are eligible except for photovoltaics.

The maximum project size eligible for support is 50 MW. Projects between 50 and 100 MW may receive some incentives only for high energy efficiency solutions. The biomass and small hydro operators also may benefit of some variable tariffs which depends on the time of the day the power is fed into the grid, thus grid operators trying to better harmonize frequency according to daily consumption curve.

FIT tariffs:

Technology	Eligibility conditions	Amount*	Support period**
Wind	Both wind onshore and offshore, under market cap	Onshore: for 20 years: 7.32 €ct/ kWh	20 yrs*

		from the 21st year onwards: 6.12 €ct/ kWh Offshore: n/a Premium cap&floor: Onshore: 7.12 - 8.49 €ct/ kWh Offshore: max 16.4 €ct/ kWh	
PV	Eligible under the constraints of prior registration and approval within a cap adjustable quarterly	Roof-top: < 20 kWp: 26.6 €ct/ kWh ; > 20 kWp: 19.3 €ct/ kWh Ground-mounted, 12.2 €ct/ kWh	25 yrs
Geothermal	No special market cap	7.441 €ct/kWh from the 21st year onwards: 7.0306 €ct/kWh	20 yrs
Biogas	Eligible under the market cap	8.6311 – 14.1141€ct/kWh (depending on system size) from the 16th year onwards: 7.0306 €ct/kWh	15 yrs
Hydro power	Tidal, wave, ocean are eligible. Small hydro under the market cap.	Small hydro: 8.4237 €ct/kWh from the 26th year onwards: 7.5814 €ct/kWh	25 yrs
Biomass	Eligible under the market cap	7.0284 – 17.1596 €ct/kWh (depending on energy source and system size) from the 16th year onwards: 7.0284 – 12.7362 €ct/kWh	15 yrs

(Sources: Observ'ER, RES LEGAL Europe - EC, PVTech, country reports, press articles)

Notes:

* As a reaction to sharpening of Spain's public debt crisis, at the beginning of 2012 the Council of Ministers approved by law a moratorium on subsidizing all new RES-E projects for an unknown period.

** As a general rule, all systems are eligible for financing over the whole lifespan. Instead, after a pre-defined period of operation the tariffs are reduced. The table above contain in the last column the main eligibility period

Spain is a particular case in the European context of RES support policies, a rather “how not to do” model. Thus, based on a Royal Decree from 2006, Spain started to heavily subsidize through FITs all new RES-E projects along with a lift in the upper size limits for project eligibility. Photovoltaics industry found the proper ground for a boom: the high guaranteed returns (FIT for ground-based PV systems was 44 €ct/kWh), relatively low administrative entry barriers and cheap land, very high solar irradiation (between 1500 and 1950 kWh/m2/yr) led to an installed capacity of 2,500 MW in 2008, from 88 MW existing in 2006. Moreover, the support scheme provided for a subsidy throughout the whole lifespan of the project and also applied an uncapped PV FIT. It was by far the most generous support scheme in Europe at that time.

Such measures made Spain the world's third biggest market, after Germany and the United States in terms of annual capacity installation with dramatic consequences in terms of retail electricity prices and public deficits accumulated at the level of the two transmission and system operators.

Signs of industry overheating, along with the general economic fall due to the financial crisis, made the policymakers to adjust the FIT policy. In case of PV, the hottest issue in the field and the largest deficit driver, Spain’s government enforced in 2008 new legislation providing for severe cuts in FITs, down to 32 – 34 €ct/ kWh for roof-top and 29 €ct/ kWh for ground-mounted, an annual 500 MW capacity cap for 2009 and 2010 and 400 MW for 2011 and 2012. Spain also limited the project size to 10 MW for ground-mounted systems and 2 MW for rooftop.

Further policy adjustments took place in 2009 and 2010.

The results of the precipitated and dramatic measures heavily affected the solar industry, not only in Spain but worldwide. In Spain, the 2009 the newly installed capacity plummeted by 95%, some 25,000 people lost their jobs and plenty of operators and solar panel producers and distributors went bankrupt. Furthermore, numerous law suits against the public authorities were filed.

At beginning of 2012, as part of the austerity measures pack, the government suspended the support scheme for an unpredictable period. The public deficit from PV support has aroused to an unbearable level of EUR 25 billion.

The above consequences are the bad part of an unsustainable support policy. It was a dramatic lack of coordination between costs and support levels, between goals and performance, between standards and actual quality, between targets and supportability. Instead, there is a “good part” of the business: During the boom, in Spain a whole R&D and manufacturing industry consolidated, not only in solar PV technology but also in wind and others. Spanish companies have managed to expand operations overseas, taking their experience to new destinations, including in Europe’s hottest new markets. There is also more emphasis on household systems, the educational factor being of utmost importance. If unsuspended, the current support scheme allows for still good profitability figures and would continue, at a capped pace, the growth in installed capacity.

5.1.4. Italy

Italy is another example of a country where a mix of support schemes is applicable. Due to generosity of incentives, Italy had become during the last years one of the leading European countries in renewables.

They applied a quota system for all technologies above 1 MW and a FIT scheme for RES-E producers lower than 1 MW – photovoltaic systems were promoted by a premium tariff. Moreover, it used to be applied also a premium tariff for those capacities managing to fit the actual power production with their production forecasts on an hourly basis, within a certain variation bandwidth, as well as tax regulation mechanisms like reductions in value-added tax (for wind and PV) and real estate tax. Net-metering system was applied as well.

As can be noted, Italy's support system used to be until this year one of the most complex in Europe.

Quota system

Initiated in 1999, the quota system was redefined by law in 2008, imposing the producers and importers of fossil fuel based energy to choose amongst the following options: to generate green electricity, to buy green certificates from RES-E producers or from the market regulator or to import them, provided that other EU countries adopted similar mechanisms. One MWh production of green energy corresponded to one green certificate. A specialized body (Gestore di Servizi Elettrici) was buyer at last resort for the TGCs market.

The allocation of TGCs was made by applying a certain coefficient to one GC depending on the technology. The price of one GC was set at the difference between 180 EUR and the average electricity wholesale market price established annually by the competent authority. In 2008, at year end, the price paid by GSE for the unsold certificates was 112.88 EUR.

In order to relief the administrative burdens, for all RES-E producers with capacities smaller than 1 MW a FIT scheme was operational. The eligibility period is 15 years.

Technology	GC coefficient	Optional FIT (< 1 MW) €
Landfill and sewage gas	0.8	180
Biomass and biogas with CHP	1.8	-
Onshore wind	1	220
Offshore wind	1.5	-
Wave and tidal	1.8	340

system		
Biodegradable waste, biomass	1.3	280
Geothermal	0.9	
Small hydro	1	

(Source: RES LEGAL Europe - EC)

The new legislation enforced in 2011 provides for the total elimination of the quota system starting with 2013. Also, the entitled GC beneficiaries will switch, starting with 2015, to a FIT system. Practically, after 2015 there will not be a market for TGC any longer. A support scheme to replace the TGC for 2013 has not been published yet.

Due to the huge solar irradiance potential, Italy has been treating the PV sector distinctly. Also, the same law provides for new FITs for all technologies, revisable periodically and capped by the budget allocation and RES targets.

During 2008 – 2011 the Italian PV market enjoyed substantial incentives under FIT schemes. For example, in 2008 the FITs were ranging from 0.36 to 0.49 €/kWh, depending on the size of installation and level of grid integration. The legal framework (Conto Energia) has passed a couple of modifications, currently being under implementation Conto Energia V. The tariffs have being successively decreased, but the real downturn was in 2011, mainly under the pressure of public deficit crisis (Conto Energia IV).

Conto Energia IV provided for some eligibility limitations for the PV installations: minimum 1 kW nominal power, compliance with technical standards, product certifications and guarantees from manufacturers, new technical requirements for inverters in order to ensure better dispachability and operations security.

Some project categories were assumed to receive slightly higher tariffs: PV systems not mounted on buildings and located in industrial or commercial areas, exhausted quarries or landfills or contaminated areas, small PV systems installed in municipalities with less than 5,000 inhabitants, building-mounted PV systems replacing building parts containing asbestos, systems for which at least 60% of the investment cost is originated in EU.

The FIT levels decreased significantly:

- June 2011: € 0.264 – 0.387 per kWh
- December 2011: € 0.172 – 0.298 per kWh
- 1st semester 2012: € 0.148 – 0.274 per kWh
- 2nd semester 2012: € 0.133 – 0.252 per kWh

Although the previous version contained financial provisions for the time horizon 2013 – 2015, the public budget crisis forced the Italian government at the middle of 2012 to come up with a new law – Conto Energia V.

The major amendments consist in annual limitations of the total installed capacity and a limited budget for the support scheme. The feed-in tariffs should be reduced twice a year. The budget will be allocated to all registered capacities. All arrays larger than 12 kW must register, compared to the previous situation when only producers larger than 1 MW should have been registered. The producers will be given a priority in the register, according to some criteria, such as: order of registration, replacing of asbestos with roof-top PV systems, falling under energy classes, systems built with European components, projects on brownfields, arrays on buildings, greenhouses, etc. Another objective of new legislation is to enhance grid stability, by imposing new inverters parameters even to the already operating facilities.

The FITs range from 11.9 €ct/kWh, for roof-top systems larger than 5 MW, to 20.8 €ct/MWh for roof arrays smaller than 3 kW. The rates for ground-mounted arrays range from 11.3 to 20.1 €ct/kWh for the same system sizes.

Some conclusions may be drawn in the Italian case. Again, like in Spain, an industrial boom happened in the RES sector, especially in PV, and a little less in wind. The industry lobby proved to be powerful enough to impede a timely, pro-active reduction in FITs to keep pace with the decline in investment costs. The legal movements appeared to be spontaneous in the eyes of investors, thus creating some havoc in the market, closure of companies, lost of jobs and rush away of capitals.

It is obvious that the public budgets burdens in case of Spain and Italy largely contributed to the freeze of markets. And, once the major PV markets in Europe, together with Germany, cool down, the whole global industry should re-orient either towards new emerging markets or to a technological shift in investment costs or in energy efficiency.

It is worth noting that, despite the EU directives providing that the electricity suppliers should pay the RES producers at FIT rates, the difficult task was transferred on the shoulders of system operators (Spain) or government (GSE – Italy), thus generating public deficits.

5.1.5. France

The French RES promotion system is based on FIT, while for the construction and operation of large RES-E plants the government organizes tendering procedures. The support setup is completed by fiscal incentives like VAT reduction and income tax deductions.

The ministry responsible for energy invites tenders at irregular intervals per technology to reach the target production of electricity from renewable sources, which is specified in the multi-annual investment plant. There are many voices criticizing the bureaucracy accompanying the tendering procedure and the inherent prolonged timeframe until project commissioning. The system might explain the relatively low pace of RES development in France but, the same system has managed to avoid sector overheating like in case of Spain or Italy. France's option is to strictly control achievement of annual targets and thus to control the electricity prices at end user to the prejudice of industry faster development.

FIT system:

Technology	Eligibility conditions	Amount*	Support period**
Wind	Both wind onshore and offshore, but permitted only within the designated special wind development areas	Onshore: for 10 years: 8.2 €ct/ kWh from the 11th year onwards: between 2.8 and 8.2 €ct/ kWh, depending on site productivity Offshore: for 10 years:13 €ct/ kWh from the 11th year onwards: between 3 and 13 €ct/ kWh, depending on site productivity For French overseas dpts a unique tariff of 11 13 €ct/ kWh	15 yrs onshore 20 yrs offshore*
PV*	Eligible at maximum 12 MW installed capacity	Roof-top: from 21.37 to 38.8 €ct/ kWh Ground-mounted: 11.8 €ct/ kWh	20 yrs
Geothermal	Eligible at maximum 12 MW installed capacity	20 €ct/kWh with 8 €ct/kWh premium for energy efficiency	15 yrs
Biogas	Eligible at maximum 12 MW installed capacity	Varies between 81.2 €ct/kWh and 97.5 €ct/kWh for domestic waste; Between 111.9 and 133.7 €ct/kWh for plants using agricultural residues. Bonuses granted for high energy efficiency. Landfill gas 4.5 – 5 €ct/kWh**	15 yrs
Hydro power	Eligible at maximum 12 MW installed capacity	Wave, tidal 15 €ct/kWh Maritime current and	20 yrs

		RoR: 6 €ct/kWh (available bonuses: 0 – 41.6 €ct/kWh)	
Biomass	Eligible at maximum 12 MW installed capacity. For biomass combustion CHP the minimum capacity is 2 MW.	Basic tariff €ct 4.34/kWh, to be supplemented by an energy efficiency-related premium for >5-MW installations (ranging from €ct 7.71/kWh to €ct 10.62/kWh)	20 yrs

(Sources: Observ'ER, RES LEGAL Europe - EC, PVTech, country reports, press articles)

Notes:

* The prices are valid for the first quarter of 2012. The law stipulates that in case of PV prices may be adjusted quarterly, based on the fulfillment of targets.

Generation capacities between 100 and 250 kW are subject to a simplified bidding procedure while the larger capacities undergo the normal procedure.

** The FIT may be slightly increased for high energy efficiency.

Despite specific policy approaches for each RES technology, some underlying principles make the French support system one of the best performing, in our opinion, in Europe.

First, the system of public tendering has advantages and disadvantages. The major inconvenience is the time consuming process of project preparation, selection, implementation, which makes sometimes the technological requirements losing sight of the newest innovations. Also, the volume of investments per time unit is lower than in case of an open window system. The advantages stand in a careful planning of the RES-E capacities to be developed under each technology, with appropriate means of achievement. The terms of reference for each call for projects may be easily adapted to technology performance and novelty, level of market maturity, availability of resources (like in case of biogas/biomass), financial resources available, actual trends in the international markets. The system has been able to avoid market overheating and dissipation of resources over the last years.

Another important feature of the French system is the preference for the small investments, generally smaller than 12 MW for all technologies. Moreover, under the PV technology, the support is awarded preferentially to the roof-top systems, integrated or not, on private or administrative buildings, to the prejudice of the large ground-based projects. The onshore wind parks are allowed only in specially designated area. It comes clear that, on one hand, the French government avoids the use of agricultural or industrial land for RES investments and, on the other hand, it encourages the domestic investors to the disadvantage of multinationals. Smaller projects better support the investment multiplier effect in the domestic economy, fiscal advantages to the public budgets, as well as job creation.

The rather conservative French policy has not helped the development of large multinational manufacturers, like in case of Spain, Germany or Italy. Notwithstanding, France recently enforced some protectionist measures like a 10 percent bonus on the purchase price of a PV modules if at least 60 percent of the added value of the entire installed system is European, similar to those introduced in Italy.

5.1.6. Netherlands

In the period between 2003 and 2007 a feed-in tariff system was applied.

The actual Dutch RES support framework is operational since 2008. It is a mixture of instruments addressing to all categories involved in both production and consumption of RES-E. Thus:

a feed-in premium price based scheme for the industrial capacities producing for the market;

a tax regulation mechanism I (reduction of environmental protection tax) addressing those businesses or households generating electricity for own consumption;

a tax regulation mechanism II (tax credits awarded only for businesses investing in energy efficiency systems or in RES-E generation projects)

Tax regulation mechanism I stimulates the investments in RES-E generation capacities, under all technologies, for own consumption by exempting the beneficiaries from the payment of a so-called environmental protection tax which otherwise would be compulsorily paid. The level of tax regresses in line with the amount of electricity consumed within one year, as follows:

- Less than 10,000 kWh: 11.21 €ct/kWh;
- Between 10,000 kWh and 50,000 kWh: 40.8 €ct/kWh;
- Between 50,000 kWh and 10,000,000 kWh: 10.9 €ct/kWh;
- Larger than 10,000,000 kWh: 1 €ct/kWh (for private use) and 0.5 €ct/kWh (for businesses);

The tax regulation mechanism II is designed to stimulate companies' investments in RES projects by awarding them tax credits that may go up to 41.5% of total investment value. It is similar to investment grants but supported from the revenues due by investors to the tax authorities. The value of applications is limited to the allocated annual budget.

The feed-in premium price scheme ensures certain project profitability over an eligibility period depending on the technology by granting subsidies to the power generators computed as a difference between a basic amount and the price of electricity sold in the wholesale market. The basic amount is an average price per electricity unit including all costs and a reasonable profit margin. The basic amount is set annually while the allocation of resources is organized as a tendering system in four stages under the principle “first in, first served”; each stage offers a certain basic amount which is increased gradually until the fourth stage. As the annual budget is capped, those projects offering the lowest costs are the largest chances to qualify for support in the early stages. See table below (figures were valid for the 2011 allocations):

Technology	Eligibility conditions	Basic amount*	Support period**
Wind	Onshore wind: Eligible within a specific category* Installations < 6 MW: Subsidies may be awarded for a maximum of 1760 FLH** Installations greater than or equal to 6 MW: Funding is provided for a maximum of 2400 full FLH Offshore wind in national waters and in the sea: Eligible within the open category Offshore wind in national waters eligible for capacities <= 3 MW; offshore wind in the sea no size limitation. For offshore wind plants in national waters, funding is provided for a maximum of 2000 FLH For offshore wind plants in the sea, the maximum number of subsidized is 3180 FLH	Onshore: Stage 1: 11.3 €ct/kWh, Stages 2-4: 12 €ct/kWh Offshore: Stage 1: 11.3 €ct/kWh, Stage 2: 13.8 €ct/kWh, Stage 3: 16.3 €ct/kWh, Stage 4: 18.8 €ct/kWh	15 yrs
PV*	Eligible within the open category Only PV systems with a capacity >= 15 kWp Funding is provided for a maximum of 1000 FLH	Stage 1: 9 €ct/kWh, Stage 2: 11 €ct/kWh, Stage 3: 13 €ct/kWh, Stage 4: 15 €ct/kWh	15 yrs
Geothermal	Eligible within the open	Stage 1: 9 €ct/kWh, Stage 2: 11 €ct/kWh,	15 yrs

	category Installations are eligible only if the drilling depth is at least 500 m. Funding is provided for a maximum of 6500 FLH	Stage 3: 13 €ct/kWh, Stage 4: 15 €ct/kWh	
Biogas	Biogas: Eligible within a specific category Systems are eligible if they use combustion of biogas from the co-fermentation of animal waste or combustion of biogas from the fermentation of other substances. Funding is provided for a maximum of 8000 FLH Landfill and sewage gas: Eligible within a specific category. Electricity is eligible if generated from landfill and sewage gas. Funding is provided for a maximum of 8000 FLH.	Biogas: (Co)fermentation of animal waste: Stage 1: 9-14 €ct/kWh, Stage 2: 11-17.1 €ct/kWh, Stage 3: 13-20.2 €ct/kWh, Stage 4: 15-20.5 €ct/kWh Fermentation of other substances: Stage 1: 9-14 €ct/kWh, Stage 2: 11-14.9 €ct/kWh, Stages 3 and 4: 12.9-14.9 €ct/kWh Landfill and sewage gas: Stages 1-4: 6 €ct/kWh	12 yrs
Hydro power	Eligible within a specific category. In order to be eligible, plants shall have a drop height of at least 50 cm. Plants whose drop height is 50 cm to 5 m are eligible for subsidies for 3800 FLH. Plants with a drop height of min 5 m are eligible for subsidies for up to 4800 FLH	Drop height from 50 cm to 5 m: Stage 1: 9 €ct/kWh, stage 2: 11 €ct/kWh, stages 3 and 4: 12.2 €ct/kWh Drop height greater than or equal to 5 m: Stages 1-4: 7.1 €ct/kWh	15 yrs
Biomass	Systems <= 10 MW, eligible within the open category. Eligibility applies to systems that generate electricity from thermal conversion of solid or liquid biomass and have a capacity of less than or equal to 10 MW. Funding is provided for a maximum of	Systems <= 10 MW: Stage 1: 9-14 €ct/kWh, Stage 2: 11-17.1 €ct/kWh, Stage 3: 13-19.4 €ct/kWh, Stage 4: 15-19.4	12 yrs

	8000 FLH Systems > 10 MW eligible within a specific category. Eligibility applies to systems that generate electricity from thermal conversion of liquid biomass and have a capacity > 10 MW. Funding is provided for a maximum of 8000 FLH	€ct/kWh Systems > 10 MW: Stage 1: 9-15.4 €ct/kWh, Stage 2: 11-15.4 €ct/kWh, Stages 3 and 4: 11.5-15.4 €ct/kWh

(Sources: Observ'ER, RES LEGAL Europe - EC, PVTech, country reports, press articles)

Notes:

* The open category refers to the low cost technologies (landfill and sewage gas, hydro, biomass, onshore wind) while the special category refers to more costly technologies which require higher funding (PV, offshore wind, geothermal).

** FLH – full load hours/ year. This is a base assumption under which the basic amount is computed.

Whether the Dutch system was perceived like conservative at the time of its introduction, in time it began to be considered as an appropriate solution to many drawbacks deriving from the FIT and TGCs systems.

Although there are some corrections that may be introduced at the level of payable subsidies, the Dutch systems slightly differentiates from a pure premium system in that the bonus varies as a difference between a fixed basic amount and a fluctuating market price, the producer's revenues remaining fixed. A pure premium is a fixed bonus while the producer's total revenues vary along with the fluctuating market price plus fixed bonus, within a cap and floor limits.

The most innovative technique it seems to us as being the multistage tendering which, within a budget cap, stimulates competition amongst electricity producers.

Nowadays, an increasing number of EU countries are looking at the FIP system as a solution (in terms of budget constraints and budget efficient allocation, technology cost control, innovation and competition) for the current schemes drawbacks.

5.1.7. Poland

The Polish RES support system is based on a technology-uniform quota obligation. In addition, investment grants financed from EU funds and fiscal privileges are available.

Poland, a country that used to generate some 90% of its electricity from coal (compared to Romania, where large hydro used to account even before 1990 for roughly 25 – 27% of total primary energy sources), has had to tackle with an outstanding challenge of achieving a 15% share of RES in total final energy consumption by 2020.

The mechanism of TGC was introduced in 2005, a year after EU accession. According to the law, the electricity suppliers should buy green certificates from the RES-E producers, corresponding to the national assumed RES quota, under the sanction of a penalty. Paying the penalty is another means of fulfilling the RES quota by the supplier. Its level is computed annually according to a statutory formula, while the TGCs are traded on a regulated market. The RES-E producers sell as well the energy at the market wholesale spot prices or through longer term bilateral contracts.

The uniform-quota system has advantages and disadvantages. The main advantage is that it encourages the cheapest technologies in terms of LCOE. From that perspective, last years brought about in Poland moderate investments in onshore wind and massive deployment of co-firing biomass plants that made raw material imports boost. Many environmentalist groups severely criticized the support system facilitating the expansion of co-firing plants since they do not allow for a significant GHG emissions reduction. Disadvantages come from the fact that the technological innovation is not enough supported and the most advanced technologies are not deployed.

There are no state guaranteed prices for the GCs on the market. The validity period varies for each technology between.

The table below shows the evolution of both energy prices and GCs prices over the last years:

Table 6 - Evolution of TGC prices in Poland

	2006	2007	2008	2009	2010
Electricity price (€/MWh)	30.12	31.6	36.6	35.9	49.3
Max TGC price (€/MWh)	61.5	64.2	70.6	59.8	64.9
Penalty (€/MWh)	92	96	107	77.2	90.2

(Source: Ecofys, 2011, Renewable Energy Policy. Country Profiles)

It is worth noting that the GC prices have fluctuated in the market in equivalence with the difference between the penalty and the electricity price. The advantage for the suppliers to buy green certificates from the market is pure accountancy since the penalties are not tax deductible while the GCs do. In such conditions, the annually set up substitution fee acts like an upper cap for the GC price upward fluctuation. The cumulated revenue per MWh for RES producers gives a clear picture on the level of incentivizing different technologies.

As the biomass has received a special treatment in Poland, the authorities had distinctly introduced an elaborated "multi-color" certificates scheme, with brown, yellow, purple and red options, depending on the size of the plant, type of fuel used, use of biogas, high energy efficiency obtained in a cogeneration unit. Thus, it has been possible to obtain:

- Brown certificates (replacing green certificates) - biogas-to-methane upgrading and evacuation into a gas grid;
- Yellow certificates – for cogeneration units fired with gaseous fuels or for capacities below 1MW, regardless of the type of fuel used;
- Purple certificates – for (co)generation units fired with captured coal mine gas and/or biogas from biomass, including sewage sludge and landfill gas as a source;
- Red certificates – for high energy efficiency cogeneration units above 1 MW or those fired with non-gaseous fuels.

Practically, each type of biomass/ biogas plants irrespective of the utilization of fuel, has been eligible for additional support. Due to lacks in legislation, sometimes, for the same power produced, the operator was enabled to receive more different certificates, i.e. yellow, purple and red, leading to a high windfall returns.

The heavily supported biomass co-firing has led to a severe increase in imports of raw materials that stirred up as a significant foreign exchange pressure on the trade account with some USD 300 mil yearly (Economy Minister, Miroslaw Kasprzak).

As the main conclusion for the Polish quota system, it has been a rather experimental system with limited effectiveness, encouraging the low cost technologies and keeping away the others. The government has not had flexible legal instruments to adapt to market developments while the consequences have been a modest penetration of electricity market by many RES technologies.

In order to foster the industry development, to keep pace with the RES 2020 agenda and to get a more in-depth sophistication in policy instruments, the Polish government announced a shift towards Feed-in tariffs starting probably with 2013, based on a new Renewable Energy Sources Act recently announced. Based on the existing law draft circulating for public consultation, here are some major changes accompanying the new planned support system:

- Eligibility period: 15 years, with the exception of biomass co-firing limited at only 5 years;
- Review of FIT levels every three years;
- Annual programs capped by the budget;
- Scaling back in revenues for onshore wind and biomass co-firing along with better remuneration for PV, offshore wind and biogas. The small scale installations will be also better supported, but unlike German roof-top model, the envisaged capacity will be larger than 100 kWp.

5.1.8. Czech Republic

The Czech support scheme is based on a price regulated mechanism, consisting in either FITs or a green bonus topping the market price, to be paid by the system operators. Incentivizing RES-E producers is also supported from investment grants or subsidized loans programs, plus a tax exemption for sale of green electricity.

Under that format, the Czech mechanism operated between 2005 and 2011, and was considered one of the most remunerative across Europe at its time, especially in the field of photovoltaics, where the installed capacity soared from 5 MW in 2005 to 2,330 at 2010 year-end.

Technology	Eligibility conditions	Amount*	Support period**
Wind	Under the following limitations: max 1 km^2 in area covered and max 20 MW	Between 9 and 15 €ct/ kWh, depending on date of project commissioning	20 yrs
PV*	Until March 2011, all systems eligible. After, only the roof-top and façade integrated installations up to 30 kWp.	<30kWp = 0.48 €ct/ kWh >30kWp = 0.24 €ct/ kWh >100 = 0.23 €ct/ kWh	20 yrs
Geothermal	Eligible	18 €ct/kWh	20 yrs
Biogas	Eligible	Between 11 and 17 €ct/kWh	20 yrs
Hydro power	Eligible at maximum 10 MW installed capacity	Between 5 and 15 €ct/ kWh, depending on date of project commissioning	30 yrs
Biomass	Eligible, under limitations concerning the type of biomass used	Between 6 and 19 €ct/ kWh,	20 yrs

(Sources: Observ'ER, RES LEGAL Europe - EC, PVTech, country reports, press articles)

Like other countries in EU, Czech Republic passed through an overheating period in the RES industry during 2009 – 2010. The first step for calming down the market was the introduction of a tax on revenue for a three year period for all PV ground-mounted system built in 2009 and 2010 and exceeding 30 kWp capacity through a legal act enforced in January 2011. The tax level was between 26 and 28%, depending on the support system applied. Even in the same time, the new FITs were cut 50%, especially for the larger than 100 kW systems.

The government's sudden move faced acid reactions from the industry players, moving up to a suit in the Constitutional Court, street protests and intense lobby at EC authorities, without results. The market got frozen for more than one year. One of the most powerful counter-arguments of the affected PV operators was the one related to the retroactivity of the measure, which may disrupt for a longer term the trust in the legal environment stability.

As a result of the transposition of EU Directive (2009/28/EC) on the use of the renewable energy sources, the Czech Parliament enacted on 31 May 2012 new legislation on renewables - ”New Renewables Act” - following to come into force on January 1st, 2013. The new law addresses not only the promotion of renewable electricity and heat and biomethane but also regulates the support of secondary energy sources and combined heat and power.

The most important provisions of the new regulation are the following:

- The FITs will be preserved only for the small capacities while for the others market premium prices will be applicable;
- The TSO will be the entity to settle the transactions with the large power producers while the DSOs will deal with the fixed price payments to small generators;
- The annual allocation of financial resources will be made following a National Action Plan, under annual subsequent legislation (planning). The RES-E producers will have to compete amongst themselves for fulfilling the production quota since the targetet production will be lower than the production potential;
- One aim is the support unification for all the promoted energy sources (RES, secondary sources, CHP);
- The biomass co-firing in large power plants support will be extended until 2015, etc.

Reading through the Parliament’s bill goals, it is easily readable the Czech authorities’ determination to put an end to uncontrollable market developments and to open the doors for market competition, even if some voices advocate that such measures are too early for the current market maturity stage. Moreover, same voices say that many provisions are aimed at consolidating the CEZ’s (national coal and nuclear monopolistic company) status quo in the market, calling the law as “CEZ support bill”[6], although CEZ has acted in the last years like a multinational opportunity hunter, with huge investments abroad in greenfield RES generation facilities. It is possible to sound like a protectionist set of measures, although most of the provisions are in line with the new RES market regulatory needs.

5.2. Lessons to be learned

In the country analyses above we found very particular support systems which vary in complexity, magnitude of support level, different objectives for various technologies, mainly linked to the country specific conditions, grid access

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[6] CEE Bankwatch Network, “The day renewable energy was killed in the Czech Republic”, November 14, 2011

conditions, type of investors supported, but all have in common two things: first, basic instruments are similar in design, that is, feed-in tariffs, premium prices, quota obligations, tendering procedures, investment subsidies, loan subsidies or tax incentives, and, second, application of such instruments follows similar objectives, such as achievement of assumed country RES share, market development, control of additional costs for the electricity consumers and, as a last moment driver, relief of the public budgets burdens.

The analyzed country profiles are relevant to get a clear picture of EU's main achievements and challenges in the RES sector. We will try to enlarge in the following on the main findings.

5.2.1. Which type of support scheme will prevail?

It is clear that most of the technologies have not reached yet the full market maturity and grid parity. The problem of further subsidizing the sector still remains on the agenda for the coming years. The two major competitors in the race for supremacy seem to be the fixed-price system (FPS) and the quota obligation system (QOS). All the others appear now to be complementary or insulated measures. Theoretical essence of FPS is the revenue long-term predictability for investors while for QOS is the price competition amongst investors and technologies. Let us see the picture after recalling the EU countries' perceptions over the last two decades.

Both schemes started their applicability almost in the same time, in the mid of 1990s. Traditionally oriented towards market stability and predictability, Germany, Spain or Austria gave the start for FPS applicability, closely followed by other countries. In time the system has proved its advantages, substantiated by domestic sector development in terms of capacity commissioned. Revenue stream security for investors remains the most important advantage. Linked to it, there is the enhanced attractiveness for financial institutions to invest in the sector, provided that the political stability is a backing strength.

FPS gives appropriate tools for fine-tuning the support level for each individual sub-technology and system size, as well as a proper adaptation to the quality of local resources. As the prices are adjustable periodically, the level of FIT may accurately reflect the evolution of the investment or generation costs. Another important advantage is that it allows for the development of a large panel of technologies and sub-technologies, in conjunction with the local natural pre-requisites, thus not only helping the new entry technology but also diversifying the energy mix supply.

Again in theory, the FITs do not imply government spending. They do not rely on annual public budgets to be supported.

Qualified voices in EU said that FPS does not encourage competition. We think it is a wrong statement. The long term stability have proven in many countries excellent results not only in terms of generation capacities created but also in a strong spillover effect in the economy through job creation and consolidation of businesses. Germany, Spain, Italy and Denmark are good examples where powerful multinational inputs manufacturers have gain significant international market shares, especially in wind and photovoltaics industries which are able to support themselves even after domestic market regression.

The system has some drawbacks as well. Most important is the phenomenon of tariff decoupling from the energy market prices. The consequences are an increased unfair competition for the conventional fuels based electricity generators, an increased retail price burden on the end consumers as well as financial difficulties for the TSOs and DSOs in charge with redeeming the RES operators at the fixed price, in most of the cases without adjustments to the base load or peak load prices. It happened in Spain and Italy that the system operators de facto refused to take over in their books the additional costs with the price gap, the governments being forced to develop tools beyond the principles stated in the EU directives to take over the burden on the public budgets deficits.

Although an easy task in theory, most of the governments failed to adapt the FITs to the quick market developments in terms of technology costs, thus giving room to windfall profits for the operators, especially in PV and, to a lesser extent, in wind industries. As opposed to the QOS, where the free market forces may automatically correct the over-compensation, implementation of a FPS requires pro-activity from the market authority. In many countries the governments' reactions were precipitated, under the public deficits crisis circumstances. The severe price reductions or additional taxation, in some cases with retroactive consequences (see Czech Republic), actually closed the markets for a certain period.

The **QOS** was designed to let the market help de authorities to better achieve the RES targets at lower costs. In a free trading market, with a balanced demand and offer, the goal must have been realizable. But in practice the system has shown its limitations.

At this point it is worth separating two sub-systems: a uniform quota-based and a technology specific quota-based. The first one, like in case of Poland, encourages the deployment of low cost technologies, competing on costs, like co-firing biomass and onshore wind, while the immature ones remain away from the profitability areas. Different TGCs allocation per technology is a more useful tool providing that the country's goal is to enlarge the spectrum of implemented technologies. All the same, even if differentiated in remuneration of technologies, QOS has other drawbacks compared to FPS:

First, it does not provide for same predictability for the investment parameters, making the projects less attractive for investors and financiers as well. In trading the certificates, we identified three types of risks:

First one, let's name it the type 1 risk, is strictly linked to the market price per certificate. Although in theory we refer to free market floating prices, in practice in each of the applicant country there are price caps or pegged prices: in Poland we identified a pegged-type price linked to the annual penalty fee, set by law, minus the wholesale electricity price; in Sweden there is also a price cap related the previous year's quota obligation fee and a floor price guaranteed by the state; in Romania (we will see later on in this material) the legally limited price per GC is between 27 and 55 EUR, also guaranteed by the state. The price fluctuations are limited by some milestones and depend on the differences between the annual allocation and actual power production.

Type 2 risk is derived from the leverage applied on the operator's revenues by the number of certificates (see Romania) or by the percentage amount of power generated corresponding to 1 MWh ROC (renewable obligation certificate – see United Kingdom). The higher the "rights/1 TGC" ratio the higher the potential gain in a bullish market or the potential loss in a bearish one.

Type 3 of risk introduced is the political one, materialized in the downward change of the rights for RES-E generation, but is a common risk for all support schemes, considered by financiers in their risk analyses.

Compared to FPS, QOS has the advantage of being more connected to the electricity market price since the revenues from sale of certificates are on top of sale of electricity in the wholesale market.

Supporters of QOS may argue that the system is a cheaper one compared to FITs. The experience has shown that in countries where the effective annual RES-E production is below the quota, the TGCs prices narrowly float close to the upper ceiling, thus becoming a costly approach to the power consumers. In case quota is lower or authorities have introduced an artificial market cap, the prices may go down to levels where the producers' profitability is put at danger.

Another disadvantage for QOS is the fact that it does not give by its own the policy makers proper instruments for distinctively support various sub-technologies. Let us imagine the difference between a series of FITs differentiated for the small PV systems, let's say smaller than 30 kWp, for roof-top (not)integrated, (not)replacing the asbestos, façade (not)integrated, public vs. private buildings, etc, compared for a single allocation of TGCs for the same system size. To achieve different support levels for different sub-technologies additional support schemes are needed to complement the QOS, and, consequently, additional bureaucracy.

Administrative complexity is another complaint addressed to the QOS. To implementing the scheme, the country needs a trading platform with clearance and depository services, under an institutional umbrella, in addition to the market regulator and system operator(s) as participants to the system implementation.

The concept of TGCs originally comprised also marketability features common to the financial instruments, like possibility of creating derivatives and collateralization. Unfortunately, the pressure for ensuring market liquidity, due to a couple of reasons, ended in the limitation of their validity period with consequences in their trading regime.

We already observed in Poland case that there is actually no significant price fluctuation in the market. We will also see in a subsequent section, when treating largely the Romanian case, that the TGC prices on a given market have the tendency to stay either at cap or at the floor level according to legal framework in force. ***It appears that a TGC system is rather a two level - FIT system.***

With all the above arguments, it appears that the FPS has already gained the race against QOS. The last two years administrative developments in those countries who traditionally were applying QOS, consisting of partially of totally shifting to FIT or premium price systems is a strong argument in favor of the conclusion.

In fact, the QOS would have had an overwhelming advantage to shadow all the drawbacks if the initial concept were put in practice. It was in early 2000s a powerful state of mind at European level in favor of introducing unitary QOS in all MS with the possibility of creating a ***single trading platform for TGCs***. The role of the mechanism would have been to timely relief at lower cost the financial pressure on those countries unfulfilling the annual quota while the countries exceeding the quota obligations would have had the possibility to externalize part of the costs. The wave of thinking seems to have vanished, the objective being fulfilled with another mechanism known as “statistical exchanges”.

We thoroughly looked at the market dominating support schemes while two other instruments have proved a well performing standing in the market.

A kind of a “raising star”, the **feed-in premium system** seems to be a more adequate solution to the shortcomings of the above systems. Compared to FITs, FIPs have a couple of advantages: they are coupled to the market prices, the risk for investor is introduced to a limited manner in such a way that to make the operators more responsible about marketing the power production in terms of the specific consumption loads, they reduce the cost of RES-E support through the price cap and downward market movements.

Nevertheless, the system implies more complex administrative tools, compared to the FITs. Therefore, in Netherlands the premiums are supported from the public budget which in turns is supplied by the end-users through a green energy surcharge. In Denmark, the grid operator is in charge with collecting a similar tax from power consumers and transferring it to the state which will ultimately redistribute it to the system operators as premiums.

An even more shadowed scheme, **tendering** has been applied at limited scale in Europe. Tendering has helped the governments to keep the industry development under certain stability, strictly linked to the annual RES quota planned and without uncontrolled pressure on electricity retail prices. Competition on profit margins means cost savings for the payers but, without carefully designed terms of reference, may bring in operation less perfomant installations at lower investment costs. Also, a low frequency of tenders for the same technology may turn into a poorer assimilation of technological innovation. Designing itself the terms of reference is a challenge for the authorities responsible for keeping the balance between the principle of non-discriminatory access to all interested investors and the need to promote novelty in the technology. From this perspective, it seems to us that the Dutch approach described in a previous section is more appropriate to pass the compromise.

Investments subsidies, **loan subsidies** and **tax incentives** are typical instruments that complement the main support scheme, present in many EU countries. Their application gives an advantage in those countries confronted with scarcity of financial resources or gives the smaller investors, particularly the households, better incentive to apply for a RES-E installation. Usually, the investment loans are sourced from EU-funded programs like in most of the NMS.

Nevertheless, the authorities should pay careful attention in avoiding project over-compensation based on high state aid rates. Sometimes, pro-active mechanisms to avoid windfall profits may be difficult to implement, whereas even more difficult mechanisms to recover the upfront support down to non-discriminatory levels are difficult to apply.

After analyzing the most relevant support schemes throughout EU, some conclusions may be drawn. Ideally, such a mechanism should meet some basic requirements: be effective in terms of RES capacity installed, be stable, reasonably profitable and predictable for investors, be less costly for the public budgets and/or final payers, be adaptive to capacity planning needs, be administratively simple and costless to implement, be able to keep pace with the grid development and stability needs, create significant spillover effect in the economy. Of course, none of the schemes reach all the requirements, but after careful analysis and taking into account the actual economic realities in EU, we would choose for a premium price based system combined with a tendering procedure similar to that currently implemented in Netherlands.

5.2.2. Towards a harmonization of support schemes in EU?

Debates on harmonization of support schemes has started even in early 2000s, when, based on the first concrete result of every domestic policy, many analysts and decision makers started to question about the effectiveness of each of the scheme. Thinking about harmonization is a natural follow-up in the modern European Union of thinking about prevailing scheme.

Arguments have been raised in favor of both harmonization and preservation of actual heterogeneity.

A unitary EU support system was assumed to bring about lower technology costs through a couple of factors. First, this would bring a better allocation of resources by choosing the best locations in terms of natural potential. Second, levelising the actual complexity and uncertainty accompanying the investment decisions would reduce the capital costs. Third, a uniform administrative system would generate a learning curve effect in the scheme administration costs. And forth, the most important argument arises from the increased cross-border competition and an easier access for consumers to the most competitive tariffs.

The advocates of the actual status-quo argues that by giving each country the possibility to choose for the best fitted system the results are maximized through the best allocation of resources. They say that the vectors of effectiveness of RES sector development are so numerous and vary so largely throughout the MS in such a way that a unitary promotion system is practically impossible to implement. Moreover, mixing the actual panel of instruments may create an even more complex and difficult to manage support system. An extremely important counter-argument in front of the harmonization followers is that the concentration of green energy generation capacities in certain areas would create heavy imbalances to the local grids in particular, and to the EU energy infrastructure in general. A local concentration of RES power production necessarily needs increased local balancing capacities, system services and longer distance transportation lines, in other words, a re-designing of the actual European energetic infrastructure still remained at the older, conventional based generation patterns.

Another chorus of experts suggests a compromise between the two visions in the sense of creating regional cross-country unified systems, in those regions where the political, social, economic and technological patterns show similarities while the natural resources allow for a uniform spreading of the generation capacities and the grid infrastructure permits an easy integration.

As I mentioned in the previous section, it was a Europewide thinking about a continental trading system with green certificates, much similar to the ETS for CO2 emissions certificates but the idea was built on the vision that a unitary quota obligations system would have been implemented. For many reasons the approach was abandoned.

The arguments brought by the pro-harmonization supporters are valid but not sufficient. Let us assume that tomorrow an EU Directive will enforce a harmonized system with the same instruments, same prices. The Black Sea coast wind has similar parameters like the Baltic. Would it be enough for an investor to left Germany for Romania? Surely not. For plenty of reasons, from the power infrastructure capabilities, administrative system, local power demand (in the absence of long distance pan-European electricity “highways”), post-commissioning services, political and social stability, local expertise, etc. For such reasons (all mentioned by the opposers of harmonization) equal remuneration for investors at the same amount of capital is not possible.

To a certain extent, similar instruments would be possible to be agreed upon. But the capital costs, national energy mix natural and historical pre-requisites and development needs, administrative systems, infrastructure development, political, economic and social situations, altogether create a huge adverse pressure ending in differentiating the instruments.

Conclusively, a harmonized system in the near future is not possible. At least not throughout the whole EU territory. I would raise the following question: is it necessary to think furthermore at this topic since the grid parity is very close for the most widespread RES technologies, much closer than the moment of full integration of power transmission systems? Surely not, again.

What should do the European Commission instead? Maybe the most recommendable approach, in order to put further pressure on RES generation cost reduction, is to elaborate a best practices guide. There is sufficient experience accumulated over the most part of the various RES supporting instruments lifecycle (if we treat them as products) to enable the central body to make customized recommendations. It is advisable for both central and local administrations to closely monitor for the coming period the evolution of the generation costs in a timely and transparent manner to be able to avoid the mistakes from the past and to play from now on a pro-active role in designing the energy market policies. Naturally, the MS will be able to orient their support policies to the most effective and efficient directions.

6. Romania, a new experiment? Country profile

6.1. Romanian power sector – key facts and figures

With a population of roughly 20 million inhabitants and a GDP of 121 billion EUR in 2011, Romania inherited from the communist regime an apparently well balanced primary energy production mix and a relatively well developed grid infrastructure. Over the last 20 years little has been done in terms of investments in energy generation sector. Figures below depicts power generation breakdown by primary sources in both a normal year and a year with drought:

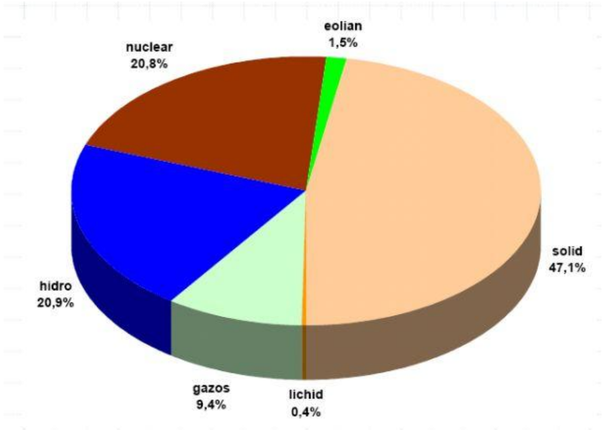


Fig.19 - Electricity generation structure 2010 by primary sources – normal year

(Source: ANRE)

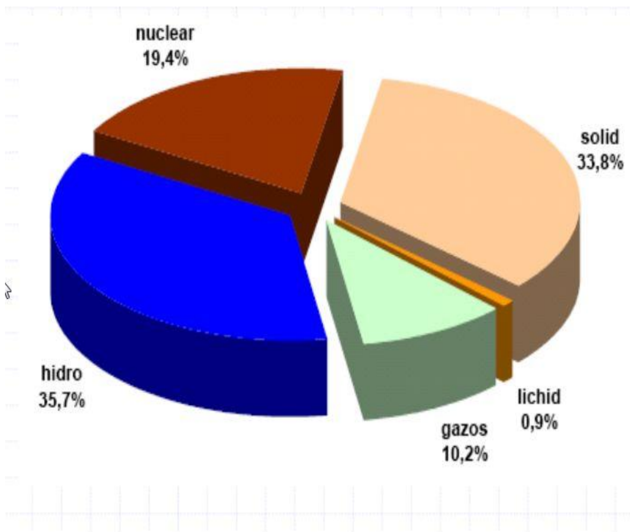


Fig.20 - Electricity generation structure 2011 by primary sources – droughty year

(Source: ANRE)

The next figure shows the national transport infrastructure, along with the annual power consumption:

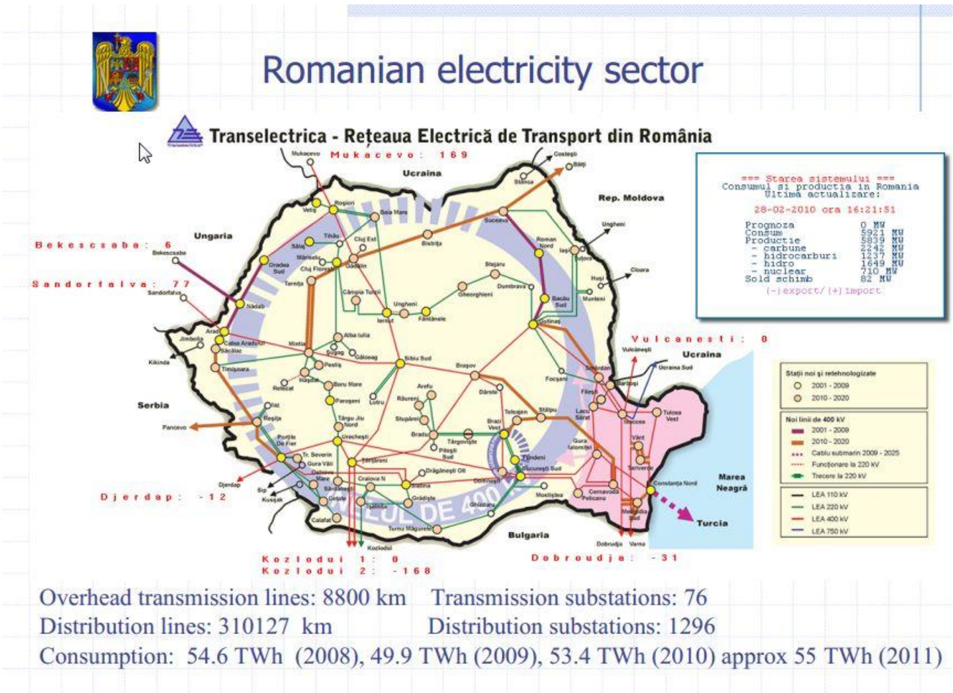


Fig.21 - Romanian power sector – national grid (Source: Transelectrica SA)

After 1990, the country underwent a long and difficult process of reforming the fully integrated state owned at that time RENEL – National Electricity Regie Autonome, which used to control in early 1990s the whole electricity sector. In the years to com, it was repeatedly split until a full separation of power generation distribution, transmission and supply was reached. The year 2007 marked, in terms of regulation, a separation between the power-related activities (including CHP) and the centralized thermal systems. The grid distribution was split into eight regional companies, of which five are fully privatized to the moment and three have the state as major shareholder. Transelectrica, the TSO, is a listed company with the state owning close to 60% of share capital.

The most delicate and controversial issue remains the way the power generation sector was transformed. Following successive reorganizations, the conventional generation sector is still divided in state owned companies by type of energy source, namely nuclear, thermal (coal or gas based) and hydro. Such a structure creates market competitive advantages to hydro and nuclear while the coal based sector is at disadvantage in terms of generation costs. Moreover, the light coal generation (recently reorganized by merging the mining sector with the largest thermo-power producers in the area) seems to be more competitive than the hard coal based capacities.

Another hot topic hanging for years due to political and social reasons is the full electricity price liberalization. A law from 2007 categorizes the consumers into "eligible" (they have the possibility to choose the supplier, having direct access to grids) and "captive". The industrial consumers benefit of a regulated tariff for a certain percentage of their power consumption while for the rest they are obliged to buy from the free market. The captive consumers buy electricity at fixed, nationwide tariffs, set and adjusted periodically by ANRE. Under the recent negotiations with the IMF, the government committed to fully liberalize the market, gradually, until end of 2013 (for industrial consumers) and end of 2017 for households.

The market regulator (National Agency for Energy Market Regulation – ANRE) was established in 1998. In 2005, ANRE was merged with the National Agency for Gas Market Regulation, resulting in a new governmental institution. In 2000, the market operator – OPCOM- was born, as an affiliate of Transelectrica. Currently, OPCOM operates the day ahead Market, forward market, green certificates market, CO2 allowances market and the clearing system. The balancing market is operated directly by Transelectrica.

6.2. Recent history and evolution of legal framework

Romania became an EU Member State on January 1st, 2007. The accession negotiations started in 2000 and ended in 2004. In order to fulfill the obligations related to Kyoto Protocol and to EU Directive 2001/77/EC, Romania started to prepare its legislation for promotion of RES even since the pre-accession period, namely in 2003, through the government decision (GD) 443/2003. In 2004, a new GD (1892) provided for the TGC as the instrument for promotion of RES-E.

Until 2008, when the Law 220 on energy efficiency and on promotion of use of RES-E was promoted, the approach was for a uniform quota-based TGC system. All RES-E projects started to receive one GC per MWh even since 2005, but the capacities were insignificant. The new law introduced the technology specific TGC support scheme, with a different number of GCs per MWh per technology. All available technologies were supported, no matter the capacity size, with a definition of small hydro as being up to 10 MW. Large hydro was not promoted.

After the EC Directive 2009/28/EC, the Romanian authorities adapted the provisions of Law 220/1998 through a new law (139/2010) provided that the proposed support scheme would be subject for EC approval. The EC Decision for approval of state aid RES support scheme for Romania was released in July, 2011. Based on that, the Romanian authorities enforced a new law (134/2012) for amending and completing the previous versions of Law 220/2008, which is the actual legal basis.

At the time of preparation of the legal framework (in 2003 – 2004), the Romanian authorities, without expertise in the field, were assisted by foreign consultancy companies, mainly by a well known multinational expert in the energy sector, headquartered in Netherlands. In view of the recent developments at European level, it is somehow weird that the foreign consultant proposed at that time a quite new support scheme since little experience and proof of effectiveness was achieved from other countries with similar schemes, limited in number. It seems that a current of opinion was spreading during the mid 2000s in Europe in favor of a harmonized RES support system based on GCs tradable on a pan-European platform similar to ETS. Moreover, the Romanian politicians liked the idea of a free trading market and risk taking by the investors in return to higher revenues, instead of a fix-price system.

What happened between 2004 and 2008 was an increasing awareness about the need to differently stimulate each technology based on their specific investment cost, doubled by an extensive lobby for increasing the investments remuneration from the potential investors in mainly wind and PV projects, most of them foreign companies with experience in more mature markets.

The main provisions of the legal framework in force are the following:

i) The support system is based on a compulsory annual quota of RES-E for the power suppliers and a TGC for the RES power generators;

ii) Romania's yearly RES targets until 2020 and budget estimates are set by the law. The mandatory quota may be adjusted annually by ANRE provided that the certified producers fail to meet the power production corresponding to the quota. The total estimated budget for 2010 – 2020 is EUR 19.5 billion.

Table 7 – National RES-E quota 2011 - 2020

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Quota (%)	10	12	14	15	16	17	18	19	19.5	20

(Source: Law 220/2008)

iii) The suppliers' obligations are set annually by ANRE based on the total power consumption estimates for the year to come and on the market share of each supplier for the previous year;

iv) One GC corresponds to one MWh electricity produced; the guaranteed cap and floor values per GC are EUR 27 and 55, respectively. The values are indexed annually with the CPI index for Eurozone for precedent year published by EUROSTAT;

v) The GCs are issued by the TSO. The validity period for a GC is 16 months from the date of issuance. The unsold certificates (under the condition that RES-E production is lower than annual quota) are bought by the market operator at the minimum guaranteed price of EUR 27, inflatable.

vi) The beneficiaries of GC allocation are the RES-E producers which deliver the output either to suppliers or directly to end consumers, as well as those using the electricity for own needs, except for the technological consumption of the plant.

vii) The plants using imported residues, the pump-up storage hydro plants and the biomass co-firing plants using more than 10% conventional fuel are not eligible for support;

viii) The GC allocation is a technology-related scheme, as follows:

Table 8 – TGC allocation per technology

Technology	Eligibility	No of GCs	Period
Landfill and sewage gas	New plants	1	15 yrs
Biomass and biogas	new plants (all types of residues)	2	15
	new plants (energy crops and forest residues)	3	15
	High efficiency CHP (additionally)	1	15
Onshore wind	New	2 until 2017 1 beginning with 2018	15
	Second hand	2 until 2017 1 beginning with 2018	7
Geothermal	New	2	15
Solar PV	New	6	15
Small hydro	New (commissioned starting with 2004)	3	15
	Upgraded	2	10
	Commissioned before 2004 and not upgraded	o.5	3

ix) The suppliers failing to acquire the number of certificates corresponding to their annual quota pay penalties amounting to EUR 110/ MWh. The penalties are collected by the market operator and transferred to the Environment Fund Administration for supporting the RES-E capacities smaller than 100 kW to be awarded under the *de minimis* EC regulation;

x) The certificates are issued monthly by the TSO and sold by producers on a specialized market operated by OPCOM. For own cash flow reasons, the electricity suppliers have the preference for acquiring certificates towards the end of the year, thus generating cash flow difficulties for the producers. Therefore, the amended version of Law 220 stipulates for the suppliers' obligation to quarterly report to ANRE the quota fulfilment, thus levelising the market volume of transactions throughout the whole year.

xi) The TSO and DSOs have the legal obligation to give priority to taking over into the national power grid the electricity generated from RES. Only in special cases when the grids stability or security is endangered, and only upon the notification to ANRE, the RES-E capacities may be limited or disconnected.

xii) The RES-E producers qualifies as dispatchable units and participate at the balancing market (Ord 33/2012).

xiii) RES-E producers with an installed power larger than 125 MW shall be subject to EC qualification for support scheme.

Law 134/2012 is based on the provisions of Commission Decision C (2011) 4938 authorizing the Romanian state aid scheme for RES-E. It brings a couple of important clarifications in implementation of the scheme, compared to more vaguely Law 220/2008.

Thus, an important accent is put on avoidance of over-compensation of RES-E producers. Significant funds have been allocated as investment subsidies for RES projects financed from both EU and national funds, under different programs, starting with 2009 – 2010. The law provides that those producers are entitled to receive the number of GCs for the power produced, according to the technology, diminished with a corresponding number of GCs valued at the arithmetical mean between cap and floor until the concurrence of the amount of subsidy.

The reduction is done by determining a correction coefficient computed as a result of the specific investment reduction rate (ratio between the investment aid value and the specific investment reference value expressed in EUR/MW) and a correction factor (Fcor) determined for each technology, so that the considered internal rate of return remains unchanged by the cumulating.

Although the methodology raises some questions about accuracy (i.e. using arithmetical mean values for GCs, not considering the time value of money of future repayments against a down payment), it is important that there is a solution to combine the two support schemes and avoiding over-compensation. All the same, the 2012 law stipulates that the projects that have benefited of investment subsidies and commissioned until end of 2012 will be exempted from the described GC value correction.

It seems to me a highly unfair provision since the applicants qualified for funds in 2010 – 2011, under the Sectoral Operational Program financed from Cohesion Fund benefited of highly generous percentage subsidy from total project value (i.e. 70% for small enterprises, 60% for medium enterprises, 50% for large enterprises and 95% for public authorities).

Regarding the investment subsidies support schemes, three are the most important programs:

- Sectoral Operational Program (POS-CCE) financed from European Cohesion Fund;
- National Rural Development Program (PNDR) financed from European Rural Development Fund;
- Environment Fund, financed from local sources collected through various environment related charges and managed by the Environment Fund Administration.

The last one was directed mainly towards energy efficiency and energy saving, but during the last years it was severely limited in financing sources as most of the collected charges was redirected to support the public budget.

The PNDR finances small RES-E projects (in general, no larger than 1 MW) in connection to agricultural and farming operations, so basically it has financed biomass/ biogas plants or PV roof-top systems to help enterprises achieve energy self-sufficiency or to valorise the residues available.

Instead, more generous and, in my opinion, more questionable in objectives, is the POS-CCE program. Most of the funds were committed to wind projects and, to a much lesser extent, to PV, at a time when the wind projects developers were overcrowding the transmission and distribution grids with connection applications. The program itself (referring to the program axis related to RES sector) has proved to be very poor in objectives and tools, as in fact it was a clear overlapping of support addressed to an overheated market (wind). Furthermore, since almost every project in development is structured on an SPV – special purpose vehicle, a newly established small company with no prior activity, most of the projects have received 70% subsidy.

The POS-CCE performance:

2008 call: 50 projects received, 14 projects selected, allocation EUR 70 mil.;

2008 call: 50 projects received, 14 projects selected, allocation EUR 70 mil.;

2010 call: allocation EUR 100 mil.

According to the Law 134/2012, ANRE is entitled, amongst other responsibilities, to license the RES-E producers for benefiting of the TGC support scheme and to monitor the generation cost evolution by technology in order to prevent over-compensation. They yearly issue a report on over-compensation and, based on findings, they propose to the government legal amendments to make corrections diminishing the level of TGCs support (number of GCs).

The monitoring procedure is linked to the average internal rates of return (IRR) per technology. During the negotiations with the EC (in 2011) for approval of state aid scheme, the Romanian authorities submitted a situation with LCOE by technology, according to the business conditions at the moment of calculation (more or less deducted from the feasibility studies already filed with ANRE by applicants). On the revenues side, there were used projections of electricity wholesale prices and green certificates prices. With those figures, average IRRs per technology were computed. Those (see Table 9) IRRs were introduced into the Commission Decision as reference rates for further monitoring the market. In case that resulted IRRs show a positive variation larger than 10% of the reference rate, correction measures should be proposed.

The reference rates are the following:

Table 9 – Reference IRRs per technology, as agreed with EC through the Decision C (2011) 4938

Technology	IRR (%)
New wind plants	10.9
Second hand wind plants	9.9
New SHP	10.2
Refurbished SHP	10.3
Existing SHP	2.1
Biomass CHP	10.5
Biomass electricity only	10.6
Biomass electricity only (energy crops)	11.3
Landfill gas and sewage sludge electricity only	11.8
Solar PV	11.6

The mechanism seems to be genuine. At least I cannot understand the differences in IRR, set by law, between technologies. Economically speaking, it cannot be justified why a biomass CHP project should generate an IRR close to 10.5% while a PV 11.6% just because some calculation at a certain moment resulted in those figures. It makes more sense to cap the IRR to a certain value for all RES supported projects or to set a certain gross profit margin between the subsidized revenues and the generation cost, obviously as average figures.

ANRE President's Order 6/2012 provides that for the purpose of monitoring, ANRE will use as source of information for assessing the specific investment cost both the feasibility studies submitted to ANRE by applicants as part of licensing procedure and the IEA website/WEO (World Energy Outlook) model/investment costs or another similarly credible source of data, if WEO is not published. The least values offered by the mentioned sources will be used in IRR computations.

In practice, in the absence of a cross-check of figures included in the applicants' financial statements (for example, with invoices), the applicants tend to overestimate the costs. The solution is to access the IEA database. Unfortunately, IEA publishes the WEO report usually at the end of year and contains statistical data from the previous year consequently there is a gap in updated information of more than one year. For example, the newly released first edition of annual report on over-compensation, ANRE used IEA figures from 2010 (WEO, 2011). This means, and the recent developments in the European market have proved, that the market regulator fails to timely take legal measures in case of quick technology cost downturn. Let us take an example of momentum: a PV project recently commissioned receives 6 GCs, times 53 Euros the actual market price, plus 40 Euros the average wholesale electricity market price per MWh (see also *Annex 3*), in total it is remunerated with an unbelievable 358 EUR/ MWh, at a time when all around Europe the FITs were decreased below 150 EUR/ MWh for ground-mounted systems. Furthermore, no distinction is made between roof-top and ground-mounted in terms of subsidy.

The law stipulates that the TGC scheme will be revised no later than 1st of January 2014 for solar PV and 1st of January 2015 for all other technologies. Since the national quota is expected to be achieved and exceeded in 2016, the GC market will continue to be dominated by sellers, the prices are expected to remain in a small bandwidth variation around the cap limit and such a provision does not make anything else than to generate windfall profits for the existing operators.

Other important modifications to the previous version of Law 220/2008 and Law 139/2010 on promotion of RES, brought about by Law 134/2012, are the following:

The electricity suppliers have the possibility to distinctly invoice to end-consumers the unit cost of RES-E acquisitions. Until the enforcement of new law, the suppliers used to sell the power to captive consumers at tariffs regulated by ANRE which in turn considered that the tariff levels included the additional costs with RES-E quota. Obviously, the actual costs were much bigger than ANRE assessments, consequently the suppliers were forced to internalize the cost differences.

Although an older provision of law without being put in practice, the new law opens the window for feed-in tariffs by giving the possibility to industrial plants under 1 MW, or 2 MW for high energy efficiency CHP biomass plants to choose between GCs and regulated prices. Also, for installed capacities smaller than 100 kW, the law introduces the concept of “net metering” in relation to the power suppliers (further regulations to be enforced by ANRE in both cases).

Finally, the legislator starts showing concerns about the difficulties created to grid operators by the RES generation capacities and give them more intervention tools to ensure grid stability.

Due to imperfections in the existing RES sector governing laws, part of them described above, it is an increasing current of opinion that the actual framework should be amended in a short time.

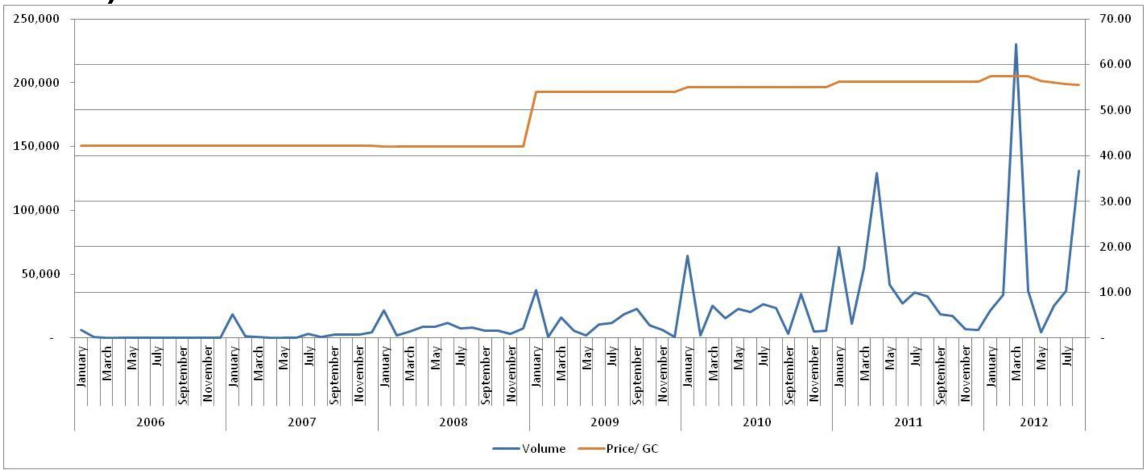
6.3. Market developments and perspectives

The TGCs are traded on a regulated market administered by the market regulator – OPCOM. Until September 2011 all RES-E producers received one GC per MWh based on the provisions of Government Decision (GD) 958/ Sept. 2005 (first GCs were awarded in November 2005). Based on EC Decision for approval of Romanian RES support scheme in July 2011, the Government Ordinance (GO) 88/ Oct. 2011 gave the legal basis for granting technology-specific support.

The law provides for the possibilities of either trading the GCs on the PCCV (centralized market for green certificates) or buying/selling GCs under bilateral over-the-counter contracts.

The graph below depicts the volumes/price evolution from the beginning of PCCV:

Fig 22 - Price/volume evolution of GCs on PCCV (centralized market for GCs)



(Source: OPCOM)

The initial legal framework (GD 958/2005) provided for a EUR 24 to 42 floor and cap limits. The applicable lei/EUR exchange rate was fixed to the central bank's quotation of the last trading day of the previous year. Law 220/2008 changed the limits to EUR 27 to 55, the reference exchange rate becoming the monthly average central bank's quotation of the last month of the previous year.

It is worth noting that the only variation is given either by the change of limits by law or by the inflation rate in the Eurozone since the limits are inflatable. Only starting from May 2012 the average prices have shown a slight variation downward of around 3%.

The GC bilateral contracts market, after a shy and not clearly regulated start in 2011, has started to grow in importance in 2012. To the date, the market operator has not provided a specialized platform so that limited information to the public is available. In general, the power suppliers are interested in large transactions with the big RES generators but the uncertainties about the legal framework limited the contracts validity periods to maximum one year. The only figure posted by OPCOM on the issue is the number of GCs traded on a bilateral contract basis, namely 1,863,055 from those GCs issued between January – October 2012. Since the total number of GCs traded on the centralized market for period January – October 2012 was 685,567 (no second session of September included), of which 499,277 were issued for the RES-E produced in 2012, we can draw the conclusion that bilateral contracts heavily overcome in importance the centralized market in 2012. In 2011 the centralized market trades accounted for less than 40% in total GC market.

Although no public data available, information from large players in the market say that the actual prices of bilateral contracts closely follow the market cap price with some minor discounts of 3 to 7% while the validity period still remains maximum one year. The small scale generators go for selling GCs in the centralized market.

The Romanian authorities are currently making efforts to make this market transparent by providing, through the market operator, a specialized registration platform. All transactions in both markets are registered into a unique register held by OPCOM.

The last two years of growth in trading volumes have shown that the market price for GCs has remained at the upper limit allowed by law. Though, variations may occur, along with the growth in confidence in the stability of the mechanism, on the bilateral contracts market, since fixed or pegged mean prices will try to overcome the imbalances between national RES quota and effective RES-E production.

ANRE estimates the GC price evolution, without making an assessment of impact of the bilateral contracts on market average prices (it is worth mentioning that the small differences in annual average prices, at both cap and floor, are due to indexation):

Table 10 - RES-E sector development forecast, see also Annex 2

	UM	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Effective quota of supported E-RES in gross final consumption	%	7.40%	10.69%	13.96%	15.53%	17.33%	18.53%	18.00%	17.46%	16.95%	16.46%
Mandatory quota of supported E-RES in gross final consumption	%	10.00%	12.00%	14.00%	15.00%	16.00%	17.00%	18.00%	19.00%	19.50%	20.00%
Green Certificates price	Euro	55	56	57	28	27	27	62	63	64	66
Yearly budget of the scheme	mil Euro	454	720	847	579	583	662	1343	1316	1152	1175
Final consumer price rising as a result of the scheme	Euro/MWh	10.02	15.51	17.83	11.91	11.73	12.83	25.13	23.76	20.07	19.77
Total budget	mil Euro	8829.21									

(Source: ANRE, 2012)

A multiannual bilateral contract will try to establish a price calculated as a weighted average mean, considering the following factors:

- estimated supplier's market share corroborated with the national mandatory quota and, again, corroborated with the gross final power consumption, resulting in its annual obligation expressed in number of GCs to be acquired;
- estimated RES-E generator's annual output expressed in number of GCs to be sold;
- the market cap and floor prices, depending on the balance between national mandatory quota and actual RES-E national production forecast.

Another important factor that may influence the market prices is the future number of unsold certificates that will be cancelled. This type of risk will try to be overcome by concluding long term contracts before 2014. Obviously, the smaller producers will be put at disadvantage as they will have limited possibilities on bilateral contracts market.

But the most important influence on the market that may contradict all predictions will come from the market domination that will be created through the existence on the same market of both large suppliers and sellers belonging to the same mother company or group of interests. Anticipating the Romanian RES market developments, the supply companies bought large RES-E projects even from the stage of development, and are now in the construction or operation phase. For example, CEZ acquired the largest wind farm project in Europe, a 600 MW in Dobrogea region, of which 460 are already operational. The same did ENEL, E-ON, Alpiq and others.

Their business behaviour will be towards maximizing the profits at group level (in the hands of RES producers) by keeping the GC prices as high as possible, since the costs with RES-E will be recovered by suppliers from the end-consumers.

Although there is legislation in EU regulating the transfer prices between companies of the same holding, the market regulator will have to tackle the issue extremely carefully in order to keep the level of competition unaltered and to protect the small scale operators. Every EU country that implemented the TGC scheme confronted with the same phenomenon of market domination by a pool of integrated operators. Under such conditions, doubled by a poor regulation and supervision of the market, the prices may not reflect competition and, ultimately, affect the retail electricity prices.

6.4. Effectiveness and efficiency of TGC support scheme

In the economics science the effectiveness means the level of achievement of an objective while efficiency is given by the ratio between outputs and inputs or between returns and costs.

After years of hesitation about the model to implement, once the 2008 law on promoting RES was passed the market started to boil. In the first row was the wind technology. Well connected entrepreneurs started to develop large size projects hoping that they will be ultimately sold to investors at very remunerative prices. The first big such trade was concluded in 2008 when CEZ acquired from developers the 600 MW wind park near Constanta. Before that, only a couple of wind turbines were generating power throughout the country. A real boom in terms of project development occurred during 2008 – 2011, dramatically overcrowding the grids with connection applications.

The data from August, 2012 show an unbelievable amount of applications for grid connection, both in size of rated capacity and in number. The figures published by Transelectrica (national grid operator) show that projects totalling 14,045 MW, mostly in wind plants (399 MW in PV), have already connection contracts signed while other 8,413 have already technical connection agreement obtained (a permitting phase prior to connection contract), of which 683 MW in PV.

Furthermore, there is an important number of applications submitted to DSOs (usually, for plants smaller than 10 MW, mostly in PV). CEZ published in

September 2012 the figures: 437 MW projects with valid technical connection agreement and 146 MW projects with the connection contract signed, in total 683 MW. Considering that CEZ accounts for a 20% distribution market share, we may extrapolate and obtain some other 3,400 MW applications, this time mostly in photovoltaics.

At national electricity system level there would be a hypothetical 24,800 MW installed capacity from RES plants (based on existing applications), which would rank Romania the second in EU, after Germany and before Spain.

The existing Romania's conventional power installed capacity is only 17,000 MW while the recent years' peak consumption was only 8,000 MWh.

The actual RES-E capacity that could be installed by the end of 2020 is presented in the following table (note that the figures refer to RES except for large hydro):

Table 11 – RES-E installed capacity projection until 2020

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Renewables installed capacity (MW)	1,797	2,559	3,331	3,902	4,349	4,677	4,677	4,677	4,677	4,677
Wind -new equipment	1,250	1,850	2,450	2,880	3,200	3,400	3,400	3,400	3,400	3,400
Wind - reused	12	14	16	18	20	20	20	20	20	20
Hydro - new	117	167	217	267	317	367	367	367	367	367
Hydro - upgrade	34	59	84	109	134	159	159	159	159	159
Hydro - existing	286	261	236	211	186	161	161	161	161	161
BiomassCogen - new	45	83	126	150	175	210	210	210	210	210
Landfill/SewageGas - new	5	8	11	14	17	20	20	20	20	20
BiomassE - new	20	37	56	70	85	100	100	100	100	100
BiomassECropsE - new	20	37	57	70	85	100	100	100	100	100
Solar - new	8	43	78	113	130	140	140	140	140	140

(Source: ANRE, October 2012)

The projection was made based on the actual grid capacity limitations, its forecasted development until 2020, gross electricity consumption evolution and the national quota obligations.

To complete the picture, the table below gives the real TSO's potential to take over new capacities into the grid until 2020:

Table 12 – National grid development forecast

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Power*	3,000	3,250	3,350	3,500	3,550	4,300	4,450	4,500	5,500	5,550
NCPG BIO**	-	850 MW OMV*** 90 MW LHP****	100 ME LHP	140 MW LHP	40 MW LHP	750 MW TP Braila*****	130 MW LHP	1,000 PSLHP****** Tarnita	-	-

(Source: Transelectrica SA)

Notes:
* Rated power from RES to be connected to grid (MW)
** New conventional power generators brought into operation
*** CCGT plant
**** LHP – large hydro power
***** TP – thermo power
****** PSLHP – pumped storage large hydro power

The estimation above has little chances to be observed since the actual economic crisis delayed or froze most of the investment projects envisaged above. The same has happened with TSO's medium and long term investment plan in transmission lines and upgrading of the transformer stations or in the cross-country interconnections.

The unbelievable situation about the RES-E project applications shows that the support scheme looks highly attractive for investors in general. Yet, a big remark should be made: obtaining a technical connection agreement or even signing the connection contract does not guarantee automatically grid access and is just part of the project permitting procedure. Just a little number of projects can find financial resources locally, equity or debt, most of them being developed by local entrepreneurs with the hope of reselling to foreign investors at comfortable returns. Moreover, most of the paper projects stops before getting through the final stages, as such stages assume more financial implications from the developers, i.e. obtaining the construction authorization against a percentage fee from estimated construction value or paying the connection tariff to the grid operator. Without a buyer for the SPV, the projects generally end.

On the other hand, it is obvious that the Romanian authorities have been unable to tackle the market surge or, even worse, were unwilling to take adequate measures. Because of physical grid limitations, the final result in connected capacities will be the same, only that a huge amount of effort has been paid by both public administration and market participants as well as by entrepreneurs for running projects permitting, all materialized in costs.

A dramatic step should therefore be made by authorities to put an end to this non-sense queuing for grid access. Solutions may be either to set priorities in terms of project technical parameters or to tender the expected rates of return, in a manner much similar to the Dutch model. Other solution would be to impose a significant financial guarantee per MW for grid capacity reservation, this way only the financially sound applicants would remain on the waiting list. By all means, the authorities should set caps for annual deployment of RES installations, per technology (based on firm prioritization criteria like technical and financial soundness of the project proposal), in parallel with "cleaning" and stopping the continuous growth of waiting lists.

It is curious how come that with two years behind the RES boom in Europe, the Romanian authorities show that they have learned nothing. Moreover, after a two year domestic experience with the wind, nobody takes proper measures to calm down the actual PV market surge.

Setting caps or growth corridors per technology would mean to reduce the pressure from wind and PV and encourage, for example, the biological residues valorisation as Romania has a huge need for being cleaned from unused wastes. The new version of RES-E law introduced special provisions and increased support for valorisation of forestry residues as actually no one neat the land after wood harvesting, although the specific legislation has dedicated provisions.

Despite the excellent pre-requisites for RES-E sector growth in terms of investors' interest and applications, aforementioned factors like grid limitation, net electricity consumption and balancing capabilities will allow for a sector development as provided by the ANRE's forecast depicted in the following table:

Table 13 – RES-E production forecast

Yearly GEC (GWh)	56,230	57,283	58,356	59,449	60,563	61,697	63,524	65,405	67,343	69,337	71,390
Yearly obligation GEC quota from supported renewables (%)	**8.3%**	**10.0%**	**12.0%**	**14.0%**	**15.0%**	**16.0%**	**17.0%**	**18.0%**	**19.0%**	**19.5%**	**20.0%**
Renewables installed capacity (MW)	0	1,797	2,559	3,331	3,902	4,349	4,677	4,677	4,677	4,677	4,677
Supported renewable production (GWh)	0	4,239	6,237	8,301	9,404	10,689	11,772	11,772	11,755	11,752	11,749
Supported production as percent of GEC (%)	0	**7.4%**	**10.7%**	**14.0%**	**15.5%**	**17.3%**	**18.5%**	**18.0%**	**17.5%**	**16.9%**	**16.5%**
GC Budget (mill. EUR)		**8,829**									
	0	454	720	847	579	583	662	1343	1316	1152	1175
Expected average price/ GC (Eur)		55	56	57	28	27	27	62	63	64	66
Public support per MWh of renewable power (EUR)		107	115	102	62	55	56	114	112	98	100

(Source: ANRE)

A couple of conclusions should be drawn from the above forecast.

Due to late enforcement of legal support scheme, a lower installed capacity is operational at this stage compared to the quota fulfilment initial planning. The situation will reverse starting with 2013 when a large number of projects, mainly in wind and PV, are expected to become operational.

Because of physical limitation of the grid and delays in grid development projects, including cross-border interconnections and new balancing groups, starting with 2017 the connection of new RES capacities will be decelerated compared to the planned needs for achieving RES-E quotas.

The market price per MWh of electricity from renewables will reversely follow the ratio between planned quota and quota fulfilment.

If we look at the project applications, both in number and in MW size, that are queuing for approval, and we apply correction coefficients related to financing capability, technical feasibility and grid access, we still come up with outstanding figures that prove the support system attractiveness in terms of expected rates of return.

Though, from the reverse angle of quota objectives fulfilment the system proves partial effectiveness. In what it belongs to the financial system itself based on TGC, I could find some weaknesses in the Romanian particular case (apart from the general weaknesses outlined in the 5.2.1 section: encouragement of development of large ground mounted projects that prove to be difficult for financing in the actual economic context and difficult to connect to medium and high voltage grids, too large price fluctuation potential that may discourage financiers from getting involved, an already proven uncertainty about the legal environment.

A financial support system could not work properly independently from other systems involved in achievement of national objective. Such systems were already mentioned in the work: grid capacity, net electricity consumption as a result of overall economic development, bureaucracy, financial system and economic environment attractiveness.

Assessing *efficiency* in implementing RES financial support could be made from both the public expense and the investor's remuneration perspectives.

If referring to the support efficiency from an investor's point of view, a brief analysis of the Romanian environment is worth to be done. The table below would come up with some interesting findings:

Table 14 – Comparison between levelised generation costs per RES-E technology and average revenues per MWh under different scenarios

	Levelised cost*	Reference investment cost*	Levelised cost**	Reference investment cost**	Electricity price***	No of GCs****		GC price*****		Total revenues******			
						Scen 1	Scen 2	Scen 1	Scen 2	Scen 1	Scen 2	Scen 3	Scen 4
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Wind onshore new	38	1,570,000	38	1,570,000	35	2	1	55	27	145	89	90	62
PV	317	3,500,000	155	1,500,000	40	6	4	55	27	370	202	260	148
Biogas and biomass													
all types of residues	136	3,850,000	105	2,000,000	47	2		55		157			
energy crops and forest residues	180	4,250,000	150	2,600,000	47	3		55		212			
landfill and sewage gas	83	2,400,000	70	1,700,000	47	1		55		102			
Small hydro													
new	209	3,700,000	184	3,200,000	47	3		55		212			
upgraded	113	1,700,000	113	1,700,000	47	2		55		157			

Explanatory notes (all figures expressed in Euros)
:
* Figures currently used by ANRE for reference investment cost per MW as provided by IEA – WEO 2011 model
** Figures actually available in the market for investment costs, and the corresponding LCOE calculation; for wind, we kept the ANRE's quotation;
*** Compared to the current wholesale electricity price in the Romanian, the wind power and PV power are acquired by the power suppliers at discounts due to the balancing needs to keep constant the frequency bandwidth
**** As provided by law, the number of GCs for wind power producers will decrease from 2 to 1 starting with 2017; also, it is expected that modifications would be brought to PV scheme, in 2015 the earliest;
***** The floor and cap prices for GCs, as provided by law (without inflationary adjustments);
****** The four scenarios correspond to the combination of price and number of GCs scenarios.

The immediate finding is that the current support assessment model is completely outdated for photovoltaic and biomass based technologies, thus generating windfall profits in most of the scenarios. The wind technology is by far extremely generous under all scenarios. Such expected returns normally explain the rush for projects under the current support scheme.

All technologies are stimulated under the current support scheme. As the investment cost per MW varies significantly, to a larger extent for biomass and hydropower and to a lower extent for wind and PV, the best selected projects in terms of designing, natural conditions, grid access and technology supplier could be amongst the most remunerative investment opportunities available for the moment.

As an indicator of efficiency, Table 13 shows the evolution of the "public support per MWh of renewable power".

Weather from the investor's point of view the potential efficiency is clearly determined, the notion of public investment efficiency, measured by the spillover effect in the economy, may generate controversies. It is rather a "hot" topic that may raise divergences amongst the EU countries from a certain perspective.

In a very simple approach, it is a matter of how much money from the initial investment and, afterwards, from the operations cost of a RES-E capacity, remain in the national economy to justify the investment public support. The higher the share, the more attractive and competitive the support scheme should be, otherwise the additionally invoiced money paid by the end consumers for RES development will be simply exported to the project operators', equipment manufacturers' and service providers' countries of origin.

For our analysis, we will take an average investment budget for a wind park and a biogas plant projects to try to come up with some economic judgments.

Both budgets shown in tables 12 and 13 are average budgets, from real projects and contain recent quotations from real offers.

Table 15 - Wind project budget/ MW

Item	Amount (EUR)	%	Origin
Project permitting, designing	**20,000**	1.31%	domestic
Turbine / MW	**1,050,000**	68.63%	import
Turbine optional devices	**15,000**	0.98%	import
Acces roads	**50,000**	3.27%	domestic
Foundation	**175,000**	11.44%	domestic
Connection tariff	**30,000**	1.96%	domestic
Other electrical works	**10,000**	0.65%	domestic
Commissioning	**10,000**	0.65%	domestic
Taxes and additional permits	**10,000**	0.65%	domestic
Project management	**50,000**	3.27%	shared
Cabling	**25,000**	1.63%	domestic
Contingent expenses	**25,000**	1.63%	domestic
Premium paid to developer	**80,000**	5.23%	domestic
TOTAL (EUR)	**1,530,000**	**1**	**0**

On the extreme right column we mentioned the origin of the product. Considering only 50%, on average, external expertise for project management, we come to the percentage of 73% imports and only 27% locally absorbed funds.

A budget breakdown for a 1 MW biogas plant with agricultural substrates:

Table 16 - 1 MW biogas plant project budget

Item	Amount (EUR)	%	Origin
Project design	25,000	0.92%	domestic
Project permitting	30,000	1.10%	domestic
Project management	30,000	1.10%	shared
Equipment	1,090,000	40.04%	import
Construction	640,000	23.51%	shared
CHP unit	742,000	27.26%	import
Other electrical works	10,000	0.37%	domestic
Commissioning	10,000	0.37%	domestic
Taxes and additional permits	10,000	0.37%	domestic
Connection tariff	15,000	0.55%	domestic
Cabling	25,000	0.92%	domestic
Downstream heat use network	120,000	4.41%	domestic
TOTAL (EUR)	2,722,000	1	0

Assuming that for the items market with “shared” the local resources contribute on average with 50%, the percentage of imports is 79%. Anyway, the figure may slightly decrease, down to 67% whether all construction works are done by local companies whereas the digesters are made of concrete to be procured necessarily locally. But concrete solutions are less than half of the market, the rest are digesters from stainless steel or glass enamelled coated steel.

The situation becomes in favour of domestic contribution in case of a small hydropower plant, where the equipment (turbines, generators, automations) accounts for 25 – 35% while works, performed by local companies, for 50 – 60%.

The training effect should also be measured in case of operations expenditures. Here, the most advantageous are biomass technologies using various raw materials at a cost. For wind and PV, annual rent for land use should be accounted, although it is minimal, in percentage terms. The Romanian tax on profit is 16% and total charges to the state for one employee’s salary is around 40%.

The number of jobs created by a new RES project is minimal, if we talk about the project operation. Automated, remote systems minimize the need for human labour.

Based on the figures above, we can conclude that without development of a local manufacturing sector, the spillover effect in economy is minimal and hardly can justify an estimate budget of EUR 9 billion until 2020. Minimal steps have been made, a couple of local companies starting to assemble PV modules from imported cells, but the value added in pure assembling activity is reduced.

Although there some big industrial manufacturers capable of producing wind towers and rotor blades, the big companies like Vestas, Gamesa, GE or Enercon (the most present in the market) do not provide performance bonds without delivering themselves such items. We saw that France and Italy enforced some protectionist measures for encouraging the use of inputs produced in EU, but a similar restriction for Romania would not have an effect in economy without internal capacities, on the contrary, it might increase prices by reducing the cheaper Asian imports.

An easier approach to stimulate local companies would be to shift the support scheme focus from large plants to small installations. The cost structure in terms of domestic vs imported items would change dramatically, with a larger portion for mounting and civil works and small electrical devices that could be easily manufactures locally. Such a differentiation would also help introducing net metering, with positive influence on the energy saving.

6.5. What to be done

There are a lot of things to be done.

First, it is essential to perform a more in-depth evaluation on the opportunity of keep the actual TGC scheme versus shifting to feed-in premium tariff. We made a careful analysis in a previous section of the work and ***we recommended a FIP system with annual capacity cap***. Tendering, without a sound management, might become a riskier approach for Romania although the system itself is highly profitable for the state, especially the procedure in more steps, at increasing expected rates of return.

Second, the annual national RES quota should be also related to new RES capacity installation, not only to RES-E production. The law should introduce specific provisions and a multi-annual planning. The year of tendering should be linked, on a planning base, by the year of capacity commissioning.

Third, the law should better differentiate the sub-technologies and corresponding support.

Fourth, quit encouraging the large scale projects. They lead to market domination, have a lower impact on the local economy, consume large surfaces of land, develop a consistent lobby power.

Fifth, shift focus from wind and ground-mounted PV on other technologies in small scale projects, i.e. up to 1.5 - 2 MW for biomass, biogas, landfill and sewage sludge plants, SHP and geothermal (limited potential, in Western part of the country – Arad, Timis, Bihor counties), solar thermal and PV façade and roof-top solutions, i.e. up to 100 kWp. Advantages would consist in an increased spillover effect in economy, a greater grid stability, more businesses and job creation, more participants to the market as investors. In addition, PV and solar thermal building solutions would also contribute to increase energy savings and energy efficiency, would change the consumption behavior, would improve the architecture of many old, communist style buildings. The change should necessarily bring softening and shortening of the administrative procedures.

Sixth, generation cost should benefit of continuous monitoring tools and procedures while support adjustments should be made in a timely manner, maybe out of Parliament control, a place where the lobby from large RES-E producers, most of them international players, is most active.

Seventh, better control the TGC market. The prices of bilateral contracts should be linked to the centralized market prices in order to avoid market distortions. For example, in the Romanian stock market there is a provision limiting the price variation for “special trades” to +/-15% of the current market price. The market prices should also reflect the level of RES-E production in relation to the country annual target. Furthermore, in order to improve the small producers’ access to market, it is recommended to limit the acquisitions of GCs by suppliers based on bilateral contracts to a certain percentage from total obligations and to a certain percentage acquisitions from producers belonging to the same holding.

Eighth, introduce supplemental tax for the producers already generating windfall profits. This is the easiest way to correct abnormally high rates of return.

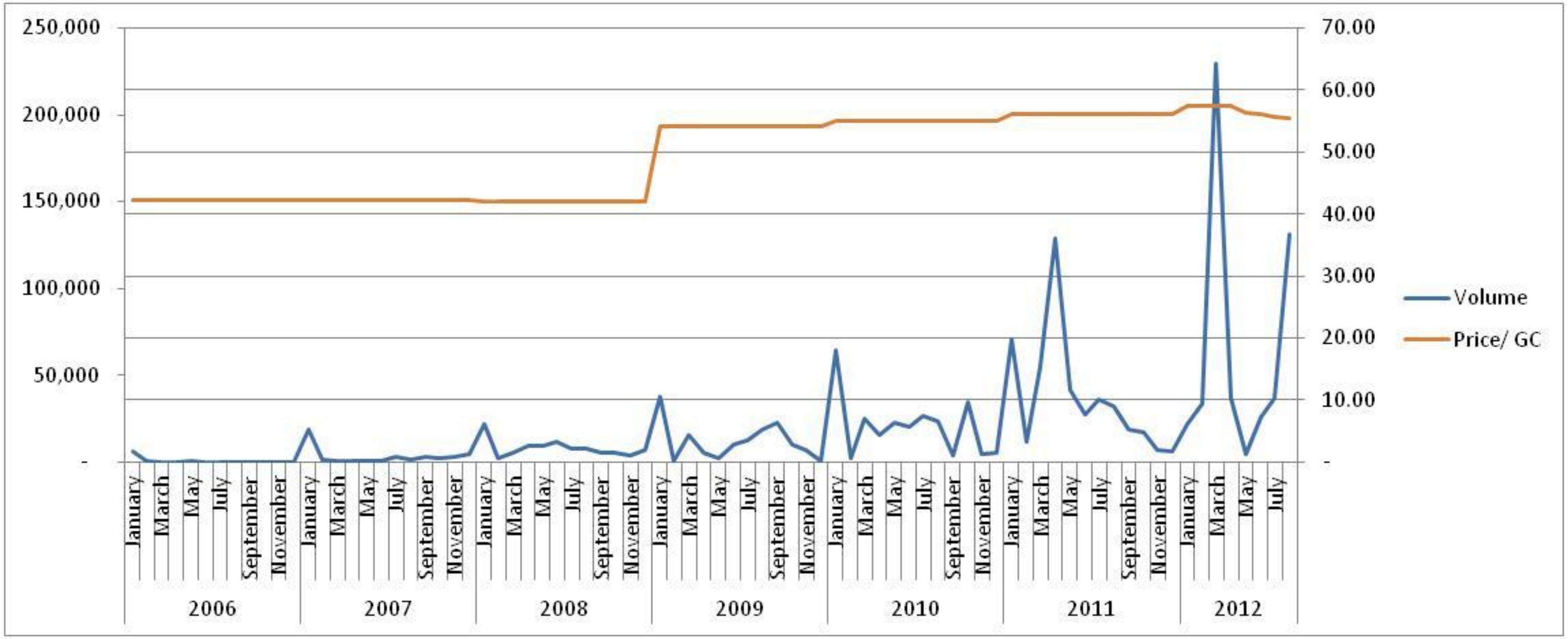
Ninth, TSO's and DSOs' waiting lists should be frozen and cleared. The issue was discussed in the previous section.

Tenth, Improve coordination between base support system (TGC) and investment subsidies programs (even amongst the programs), Avoid redundant support and develop sectoral strategies per technology. For example, on biomass the strategy should be developed with the active involvement of ministry of agriculture and ministry of environment. Involve also the industrial businesses that may participate with inputs into the RES-E projects. It is still an estimated 9 billion EUR business.

In conclusion, the Romanian RES-E market is still at an experimental level. The authorities lack to a certain extent the vision. They seem to be driven by the market instead of driving themselves the market. Also, it seems at this stage that the choice for the TGC support system was not the happiest choice. So far, it has proven to be costly, difficult to manage and with a low impact on national economy, but future market developments will confirm or contradict this statement.

Annexes

Annex1 – Market evolution of TGC

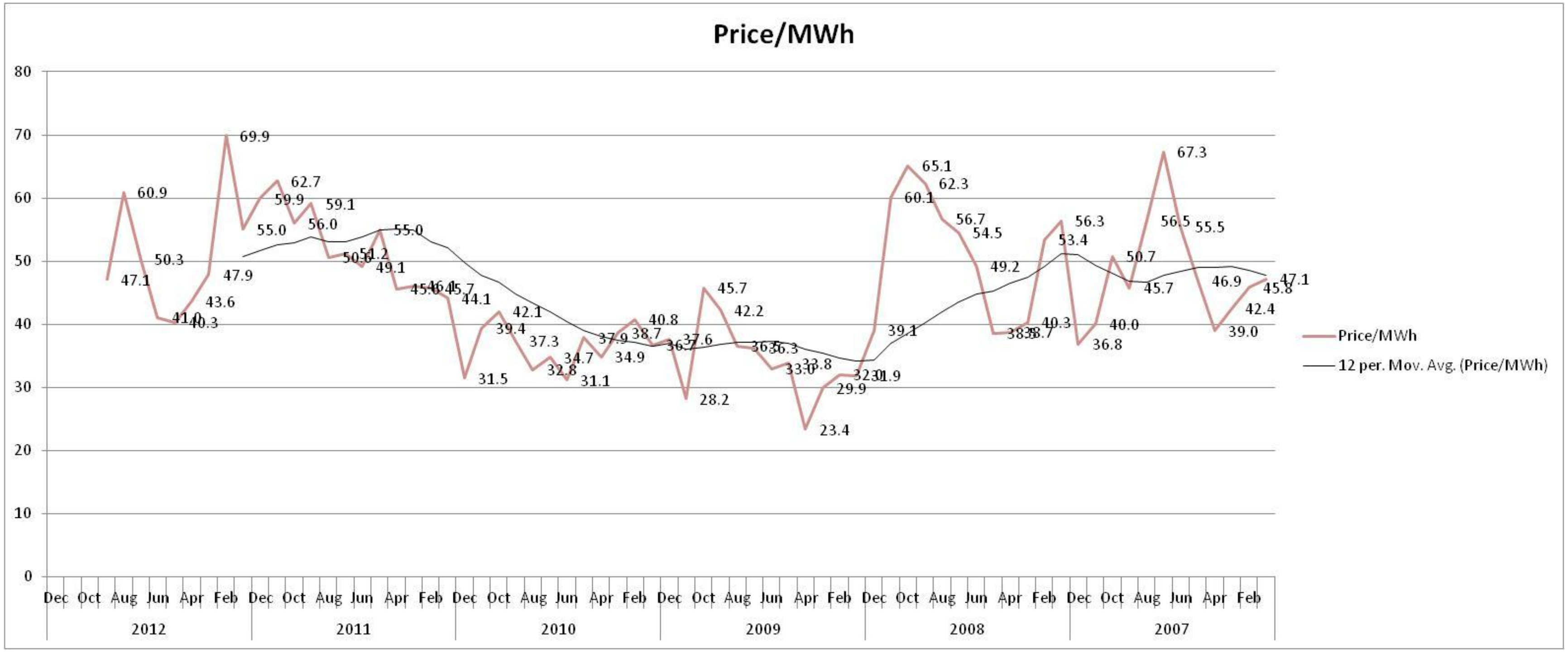


Note that for the period 2005 – 2010 the maximum price per GC was 42 Eur (according to GD 958/2005) while for 2009 onwards it was 55 Eur (Law 220/2008)

Annex 2 – RES-E sector development forecast

	UM	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gross final electricity consumption	TWh	57.28	58.36	59.45	60.56	61.70	63.52	65.41	67.34	69.34	71.39
Net final electricity consumption	TWh	45.32	46.40	47.49	48.60	49.74	51.56	53.45	55.38	57.38	59.43
E-RES generation	TWh	17.54	19.43	21.55	23.33	24.78	25.63	25.76	25.89	26.16	26.42
Supported E-RES generation	TWh	4.24	6.24	8.30	9.40	10.69	11.77	11.77	11.76	11.75	11.75
E-RES weight in gross final consumption	%	30.6%	33.3%	36.2%	38.5%	40.2%	40.3%	39.4%	38.5%	37.7%	37.0%
Effective quota of supported E-RES in gross final consumption	%	7.40%	10.69%	13.96%	15.53%	17.33%	18.53%	18.00%	17.46%	16.95%	16.46%
Mandatory quota of supported E-RES in gross final consumption	%	10.00%	12.00%	14.00%	15.00%	16.00%	17.00%	18.00%	19.00%	19.50%	20.00%
Green Certificates price	Euro	55	56	57	28	27	27	62	63	64	66
Yearly budget of the scheme	mil Euro	454	720	847	579	583	662	1343	1316	1152	1175
Final consumer price rising as a result of the scheme	Euro/MWh	10.02	15.51	17.83	11.91	11.73	12.83	25.13	23.76	20.07	19.77
Total budget	mil Euro	**8829.21**									

Annex 3 – Monthly average electricity price evolution on Romanian Day-Ahead Market 2007 - 2012



List of Acronyms

ANRE	rom. Autoritatea Nationala de Reglementare in domeniul Energiei (National Energy Regulatory Authority)
CCS	carbon capture and storage (or sequestration)
CHP	combined heat and power
CO_2	carbon dioxide
COM	(European) Commission
SCP	concentrated solar power
DSO(s)	Distribution and System Operator(s)
EC	European Commission
EEA	European Economic Association
EPIA	European Photovoltaic Industry Association
EU	European Union
EUR/ €	euro
EWEA	European Wind Energy Association
FIP	feed-in premium
FIT(s)	feed-in tariff(s)
FPS	fixed price system
GC(s)	green certificate(s)
GD	Government Decision
GHG	greenhouse gases
GO	Government Ordinance
GEO	Government Emergency Ordinance
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
IRR	internal rate of return
kW	kilowatt
kWh	kilowatt-hour
LCOE	levelised cost of electricity (generation)
MS	Member State
NMS	New Member Stare
MW	megawatt
MWh	megawatt-hour
O&M	operations and maintenance

OPCOM -	Romanian electricity market operator
PCCV	Centralized Market for Green Certificates
PNDR	National Plan for Rural Development (Romania)
POS-CCE	Sectoral Operational Program – Increase of Economic Competitiveness (Romania)
Ppm	parts per million
PV	photovoltaic
QOS	quota-obligations system
R&D	research and development
RES	renewable energy sources
RES-E	electricity from renewable energy sources
RES-H	heat from renewable energy sources
RES-T	transportation biofuels from renewable energy sources
ROC	renewable obligation certificate (UK)
RoR	run-off-river
SHP	small hydropower (plant)
SPV	special purpose vehicle
TLC	technology life sycle
TGC(s)	tradable green certificate(s)
TSO	Transport and System Operator
USD/$	United States dollars
WEO	World Energy Outlook (IEA)
yrs	years

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- RES LEGAL Europe;
- European Wind Energy Association (EWEA);
- European Photovoltaic Industry Association (EPIA);
- European Energy Exchange (EEX);
- OPCOM – Romanian market operator;
- ANRE – Romanian National Energy Regulatory Administration;
- Transelectrica SA, The Romanian Transport and System Operator;
- Ministry of Economy, Trade and Business Environment, Romania
- CEZ Romania Distributie.

Legal basis:

Romanian

- GD 443 /2003 for promotion of electricity generation from renewable energy sources;
- GD 1892 /2004 for establishing the RES-E supporting system;
- GD 958 /2005 for modification of GD 443 /2003 and for modification and completion of GD 1892 /2004 for promotion of electricity generation from renewable energy sources;

- Law 220 /2008 for establishing the RES-E supporting system;
- GO 22 /2008 on energy efficiency and on promotion of utilization of renewable energy sources by end consumers;
- GO 29 /2010 for modification and completion of Law 220 /2008 for establishing the RES-E supporting system;
- Law 139 /2010 for modification and completion of Law 220 /2008 for establishing the RES-E supporting system;
- GEO 88 /2011 for modification and completion of Law 220 /2008 for establishing the RES-E supporting system;
- Law 134 /2012 for approval of GEO 88 /2011 for modification and completion of Law 220 /2008 for establishing the RES-E supporting system.

Note: In the Romanian legal system, a Government Ordinance must be approved subsequently in Parliament by law. Until approval, the ordinance produces effects.

European Union

- EC Directive 2001/77/CE on the promotion of electricity produced from renewable energy sources in the internal electricity market;
- EC Decision 1230/2003/CE „Intelligent Power for Europe";
- EC Directive 2002/91/CE on energetic performance of the buildings;
- EC Directive 2004/8/CE on speeding up the technological development and use of combined heat and power systems;
- EC Directive 2003/30/CE on promotion of use of biofuels and other renewable fuels for transportation;
- EC Directive 2006/32/CE on energy efficiency at end consumers and energy services;
- Commission Communication COM(2004)366 on evaluation of RES contribution to the European energy sector and proposals for concrete actions;
- Commission Communication COM(2005)628, „The Action Plan on biomass";
- Commission Communication COM(2006)34, „An EU Strategy on Biofuels";
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