PROGRESS ASSESSMENT ON RENEWABLE ENERGY ACROSS THE EUROPEAN UNION: POTENTIAL AND CHALLENGES OF REACHING THE TARGETS OF THE 2020 HORIZON

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Abstract

This paper is trying to offer an overview on EU member states' efforts to comply with the 2009/28/EC Directive and to reach the targets set for 2020. We have discussed regulatory framework, support instruments and investment incentives, and reviewed the development potential of renewable energy sources across the EU and the challenges they have to face in order to be a sustainable alternative to hydrocarbons. Conclusion is a balance sheet of problems spotted and the potential that needs to be exploited for the strategic objectives to be met.

Abbreviations: *SED – Sustainable Energy Development, RES – Renewable Energy Sources, EU – European Union, NREAP - National Renewable Energy Action Plan, EC – European Commission, UNDP - United Nations Development Programme, REN21 – Renewable Energy policy Network for the 21st century;*

Keywords: *renewable energy, sustainable development, energy strategy, energy security.*

JEL Classification: O13, Q01, Q28, Q42

1. INTRODUCTION

Traditional energy resources are not sustainable for future development of the global economy, this idea has turned into an axiom as countless studies have proven that we will eventually run out of fossil fuels if current energy consumption behaviours do not change. In order to save these resources, we must address our needs to other sources that can be regenerated in a short period of time, the renewable energy sources. By renewable energy, the European Commission means, as stated in an official press release issued on January 31st 2011: "renewable sources include wind power (both onshore and offshore), solar power (thermal, photovoltaic and concentrated), hydro-electric power, tidal power, geothermal energy and biomass (including biofuels and bio liquids). As alternatives to fossil fuels, their use aims at reducing pollution and greenhouse gas emissions. Another role of renewable energy is the diversification of our energy supply, with the potential to reduce the dependence on oil and gas." (European Commission, 2011).

2. LEGISLATION FRAMEWORK FOR SUSTAINABLE ENERGY DEVELOPMENT

2.1. SED – a new emerging paradigm of the energy industry

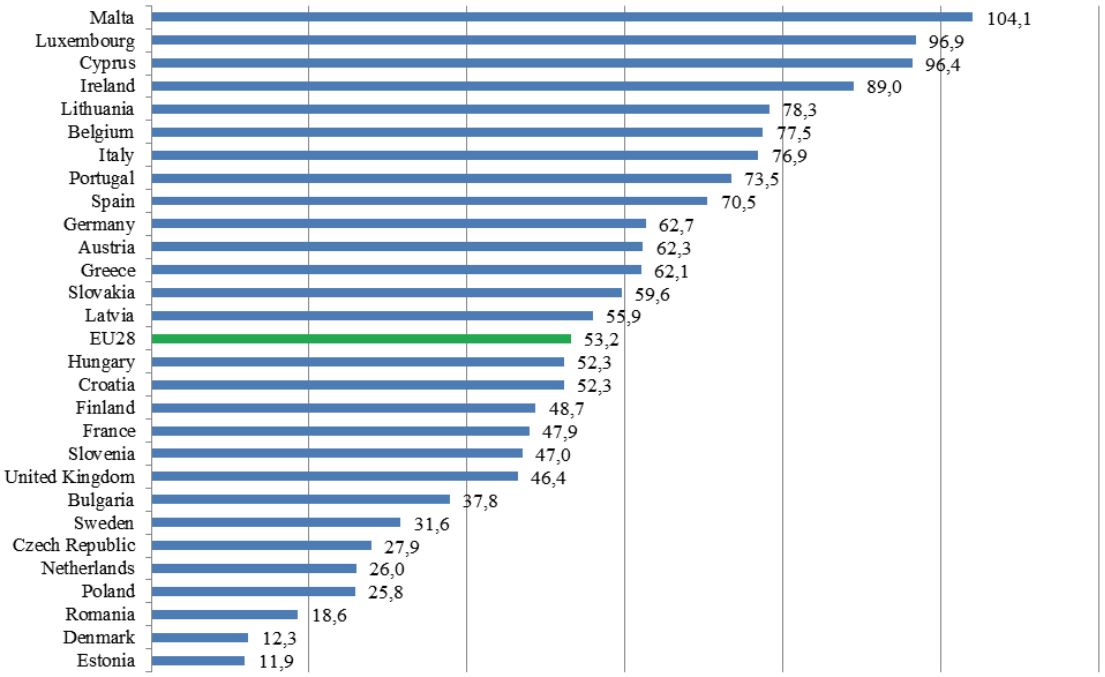
According to (Davidsdottir et al.; 2015, p392), SED is a new emerging paradigm of the energy industry that is aiming to reduce negative effects on the environment and our health, whilst also ensuring or increasing access to energy, affordability as well as energy security and efficiency of use. Although it requires a much wider assessment, SED is primarily related to renewable energy resources. RES are a necessary but not a sufficient requirement for SED (UNDP; 2002, p34).

2.2. Energy security provided by energy independence

Although SED is a very important strategic objective, the implementation of a RES-based energy industry also comes as an imperative for assuring energy security of EU member states. Energy security, as an important part of national security (Băhnărean; 2010, p10) is a key geopolitical tool that ensures a country's ability to supply a bigger share or even total energy needs from domestic production, thus limiting dependence on imports and implying stable prices, es-

pecially with a fossil fuel market that has a very large price volatility. For the moment, the European Union uses mainly fossil fuels and has a high dependency on imports, especially oil and gas from the Russian Federation, and still holds a tendency of increasing its import dependence on the long run if no changes are to be made (Colesca & Ciocoiu; 2013, p149). According to Eurostat, "energy dependence shows the extent to which an economy relies upon imports in order to meet its energy needs. The indicator is calculated as net imports divided by the sum of gross inland energy consumption plus bunkers." For 2013, energy dependence figures for EU member states are pictured in Figure 1. EU28's energy dependence for 2013 was 53,2, close to the average, but countries like Cyprus, Luxembourg and Malta have very high values (over 96). The most energy independent EU member states seem to be Romania, Denmark and Estonia.

Figure 1 Energy dependency of EU member states in 2013



Source: Eurostat, Energy dependence (tsdcc310), 2015.

2.3. Legislation framework setting the 2020 objectives

In order to ensure and enforce orientation towards SED, policy-makers have to conceive regulations and set clear targets to be met: diversification of energy sources by increasing investments for RES yielding and a tighter control on consumption through energy efficiency (Zamfir; 2011, p36). The EU, through

the European Commission started its renewable energy policy in 1997 with the adoption of the White Paper, and legislation framework was established by the 2001/77/EC and 2003/30/EC Directives with targets set for 2010 and later on, Directive 2009/28/EC targeting 2020. The latter sets mandatory goals regarding energy efficiency and a EU overall share of renewable energy consumption in total energy consumption of 20% by 2020 (Table 1). In reaching this strategic objective, each member state has received a individual target, according to the specifics of local energy markets, as well as a common target of 10% share of renewable energy for the transport sector.

Table 1 Share of RE in gross final energy consumption - 2004-2013 evolution and 2020 targets

GEO/TIME	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2020 Target
EU28	8,3	8,7	9,2	10,0	10,5	11,9	12,5	12,9	14,3	15,0	20
Belgium	1,9	2,3	2,7	3,4	3,8	5,2	5,7	6,1	7,4	7,9	13
Bulgaria	9,5	9,4	9,6	9,2	10,5	12,2	14,1	14,3	16,0	19,0	16
Czech Republic	5,9	6,0	6,4	7,4	7,6	8,5	9,5	9,5	11,4	12,4	13
Denmark	14,5	15,6	15,9	17,8	18,6	20,0	22,0	23,4	25,6	27,2	30
Germany	5,8	6,7	7,7	9,0	8,5	9,9	10,4	11,4	12,1	12,4	18
Estonia	18,4	17,5	16,1	17,1	18,9	23,0	24,6	25,5	25,8	25,6	25
Ireland	2,4	2,9	3,1	3,6	4,1	5,1	5,6	6,6	7,3	7,8	16
Greece	6,9	7,0	7,2	8,2	8,0	8,5	9,8	10,9	13,4	15,0	18
Spain	8,3	8,4	9,2	9,7	10,8	13,0	13,8	13,2	14,3	15,4	20
France	9,4	9,6	9,5	10,3	11,2	12,3	12,8	11,2	13,6	14,2	23
Croatia	13,2	12,8	12,8	12,1	12,1	13,1	14,3	15,4	16,8	18,0	20
Italy	5,6	5,8	6,4	6,4	7,3	9,1	10,5	12,1	15,4	16,7	17
Cyprus	3,1	3,1	3,3	4,0	5,1	5,6	6,0	6,0	6,8	8,1	13
Latvia	32,8	32,3	31,1	29,6	29,8	34,3	30,4	33,5	35,8	37,1	40
Lithuania	17,2	17,0	17,0	16,7	18,0	20,0	19,8	20,2	21,7	23,0	23
Luxembourg	0,9	1,4	1,5	2,7	2,8	2,9	2,9	2,9	3,1	3,6	11
Hungary	4,4	4,5	5,1	5,9	6,5	8,0	8,6	9,1	9,5	9,8	13
Malta	0,1	0,2	0,2	0,2	0,2	0,2	1,0	1,4	2,7	3,8	10
Netherlands	1,9	2,3	2,6	3,1	3,4	4,1	3,7	4,3	4,5	4,5	14
Austria	22,7	23,9	25,5	27,5	28,4	30,3	30,8	30,9	32,1	32,6	34
Poland	6,9	6,9	6,9	6,9	7,7	8,7	9,2	10,3	10,9	11,3	15
Portugal	19,2	19,5	20,8	21,9	23,0	24,4	24,2	24,7	25,0	25,7	31
Romania	17,0	17,6	17,1	18,3	20,5	22,7	23,4	21,4	22,8	23,9	24
Slovenia	16,1	16,0	15,6	15,6	15,0	19,0	19,3	19,4	20,2	21,5	25

Slovakia	5,7	5,9	6,3	7,6	7,7	9,3	9,0	10,3	10,4	9,8	14
Finland	29,2	28,8	30,0	29,6	31,4	31,5	32,5	32,9	34,5	36,8	38
Sweden	38,7	40,5	42,6	44,1	45,2	48,2	47,2	48,9	51,1	52,1	49
United Kingdom	1,2	1,4	1,6	1,8	2,4	3,0	3,3	3,8	4,2	5,1	15
Norway	58,1	59,8	60,3	60,2	61,8	64,8	61,2	64,7	65,9	65,5	67,5

Source: Eurostat, Share of renewable energy in gross final energy consumption (t2020_31), 2015.

By observing Table 1, we can see that some of the EU member states have already reached or surpassed their 2020 targets in 2013 (Bulgaria, Estonia, Lithuania and Sweden) and a few are relatively close to achieving them (Czech Republic, Denmark, Italy, Latvia, Austria, Romania and Finland), but the wide majority still have to build up efforts in this matter. From the evolution trend point of view, overall EU and most of the individual member year-to-year evolutions are positive, with a few exceptions (e.g. Netherlands 2009-2010 or Portugal 2009-2010). These drawbacks can possibly be explained by incentive cuts for solar energy in several European states in 2010 due to economic recession (Lee & Zhong; 2014, p761).

2.4 National Renewable Energy Action Plans

To achieve the 2020 goals, each member state has adopted an individual National Renewable Energy Action Plan as a strategic policy framework for promoting investments in RES that are directly linked to three basic principles of energy security, environmental awareness and economic growth (Pîrvu & Rovinaru, 2014; p36). These frameworks can contain regulatory policies such as: feed-in tariffs, feed-in premiums, utility quota obligations, net metering, obligation or mandate, tradable renewable energy certificates; fiscal incentives: capital subsidy, grant or rebate, tax incentives or exemptions, energy production payment; and public financing: public investment, loans, public competitive bidding (REN21; 2014, p89-91). A more comprehensive overview of these support instruments was made by (Gaigalis et al.; 2014, p424), as seen in Table 2. The analysis is based on the 6 main types of support instruments used in the EU, from A to F: a) feed-in tariffs – "a fixed and guaranteed price paid to the eligible producers of electricity from RES"; b) feed-in premiums – "guaranteed premiums paid in addition to the income producers receive for energy being sold on the market"; c) quota obligations – an artificial demand created by governments by forcing consumers or suppliers to obtain a certain amount of

their energy from renewable sources(Gaigalis et al.; 2014, p424); d) investment grants – offered by governments for investments in RES; e) tax exemptions; f) fiscal incentives – other fiscal tools of support for investors in the renewables market.

From the provided Table 2 below we can observe that the most popular support instrument across the EU are the feed-in-tariffs; only a few members like Germany, Netherlands, Poland, Romania, Finland and Sweden do not offer this kind of incentive for RES-Electricity. The other stimulants are heterogeneously spread throughout EU member states, each one of them having the freedom to choose its own support system. It is important to notice that none of the countries uses all 6 instruments.

As for RES heating and cooling, the most popular support tools are investment grants, Germany and Romania along with Spain and Italy are the only exceptions to the EU27 rule of implementing a investment grants system. Tax exemptions and fiscal incentives are not so widely spread, and France is the only member state to apply all 3 systems of support.

A more homogeneous spread of national support schemes exists for RES biofuels, most of the countries studied offer both quota obligations and tax exemptions to help investors in renewable biofuels.

Table 2 Overview of main RES support instruments in the EU27

Geo/Support instruments	RES Electricity						RES heating and cooling			RES biofuels	
	A	B	C	D	E	F	D	E	F	C	E
Belgium	×		×	×	×		×	×			×
Bulgaria	×					×	×	×			×
Czech Republic	×	×		×			×			×	×
Denmark	×					×	×		×	×	×
Germany		×						×		×	×
Estonia	×	×				×	×		×	×	×
Ireland	×						×			×	×
Greece	×			×	×		×	×			×
Spain	×	×			×					×	×
France	×						×	×	×	×	×
Italy	×		×					×			×
Cyprus	×			×			×			×	×
Latvia	×			×	×		×			×	×

Lithuania	×			×			×	×		×	×
Luxembourg	×			×			×			×	×
Hungary	×			×			×				×
Malta	×			×		×	×				×
Netherlands		×			×	×	×	×		×	
Austria	×						×	×		×	×
Poland			×		×	×	×			×	×
Portugal	×						×		×	×	×
Romania			×							×	×
Slovenia	×	×				×	×			×	×
Slovakia	×				×		×			×	×
Finland				×	×		×			×	
Sweden			×		×		×	×			×
United Kingdom	×		×		×		×	×		×	×

Support instruments: A – feed-in tariffs, B – feed-in premiums, C – quota obligation, D – investment grants, E – tax exemptions, F – fiscal incentives.

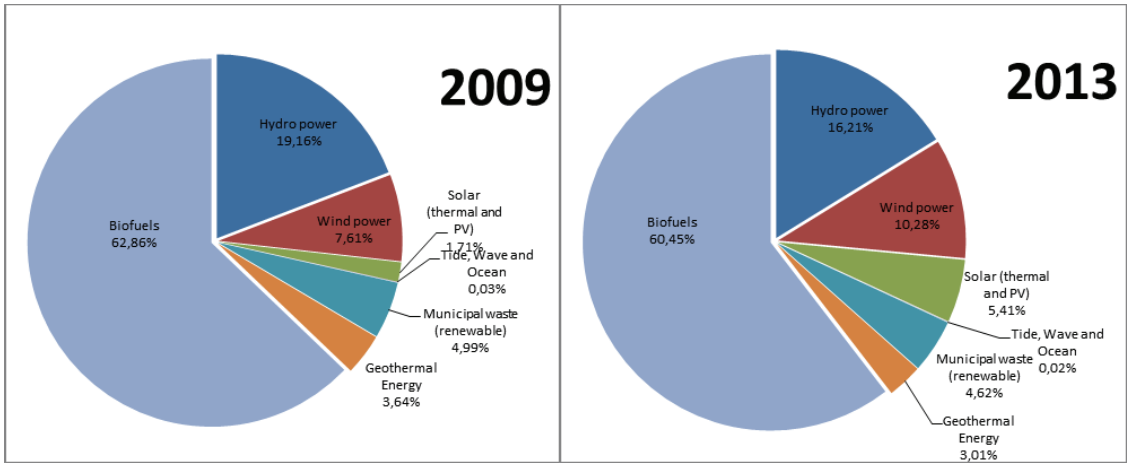
Source: Gaigalis et al. (2014), p424

3. DEVELOPMENT POTENTIAL AND CHALLENGES TO FACE

3.1. Development potential of RES in EU member states

Support instruments mentioned earlier, among with other auxiliary factors like ever-decreasing technology costs as it matures, have lead to a slight change in the renewable energy consumption mix across the EU from 2009 to 2013 (Figure 2). Wind and solar energy have gained importance, as wind power reached the 10% milestone in total renewable energy consumption, while Solar energy (thermal and photovoltaic) tripled its share from 1,71% in 2009 to 5,41% in 2013, also due to a drop in costs. In spite of small losses in percentage, biofuels and hydro power still remain the most important renewable sources in the EU in 2013, with a combined total of over ¾ of total consumption of green energy. Overall consumption of renewable energy has evolved in the same period from 150.474,8 thousand TOE (tonnes of oil equivalent) to 196.612,6 thousand TOE, revealing that support instruments were effective enough to influence this 30,66% overall increase in the use of energy yielded from RES in the EU (Eurostat, 2015; *nrg_107a*).

Figure 2 Shares of renewable sources in total renewable energy consumption. 2009-2013 comparison



Source: Eurostat, Supply, transformation and consumption of renewable energies - annual data (nrg_107a), 2015

There is even more potential for the development of RES usage in the EU, as pointed out by (Ernst&Young, 2015) in its latest analysis and RECAI -Renewable Energy Country Attractiveness Index- scoring. Methodology of the RECAI relies on three major drivers: i) macro drivers (macro stability and investor climate); ii) energy market drivers (prioritization and bankability of renewables) and iii) technology-specific drivers (project attractiveness). 16 different parameters and 53 datasets are converted into scores and weighted using their own un-public methodology to generate these parameter scores (Ernst&Young, 2015; p35). In the top 40 global rankings we can find 16 EU member states, with the highest ranked Germany on 3rd place and a RECAI score of 66,3. Top ten also hosts France and the UK ranked 7th and 8th with scores of 58,9 and 58,5 respectively (Table 3).

The same paper also reveals that Germany is working on containing or even improving its global rank by approving plans for a pilot program with a duration of three years to award 1,2GW of new ground-mounted solar capacity to investors, with 500MW being awarded this year (Ernst&Young, 2015; p16). France and the UK swapped places in the global ranking, partly due to France's long awaited Energy Transition Bill that will assure more certainty on the local market and on the energy strategy, but also due to concerns in the UK regarding potentially insufficient budget available for projects. Even the offshore sector, where the UK is EU's leader is facing project cancellations (Ernst&Young, 2015; p15).

Figure 3 RECAI scores and rankings of EU member states in top 40 (as of March 2015)

Country	RECAI score	Global rank	Previous rank
Germany	66,3	3	(3)
France	58,9	7	(8)
United Kingdom	58,5	8	(7)
Netherlands	54	13	(13)
Belgium	53,9	14	(14)
Italy	51,9	16	(15)
Denmark	51,8	17	(17)
Portugal	51,1	19	(18)
Sweden	51	20	(21)
Spain	49,1	24	(22)
Austria	48	25	(25)
Poland	46,9	28	(29)
Ireland	45,7	30	(31)
Greece	45,1	33	(33)
Romania	44,5	35	(32)
Finland	44,3	36	(37)

Source: Ernst&Young, 2015; p14

3.2 Challenges for the development of RES in the EU

Countries listed in this global 40 ranking certainly have potential, and they count for more than half of EU member states, but only just. Twelve of the other members have yet to develop a proper pipeline for RES yielding, or will probably never will (as in the case of Luxembourg or Malta) in order to be acknowledged with significant potential by researchers and investors worldwide. We believe that this will generate a new problem, that of growing gaps between different members states regarding RES. Governments of countries that have great potential will be very interested to make the best of this advantage by developing the framework for research and investments in renewables, thus attracting even more investors. A positive flow of capital will generate more revenue to finance technological advances which eventually lead to cost reduction by efficiency and also by scale economies. Reduced costs of investment will attract more investors and so on.

By following this reasoning, Northern countries like the UK, Germany or Denmark for example can specialize in wind energy, especially offshore, whereas Southern countries like Greece or Spain will be able to focus on solar energy. Geographical position is causing natural comparative advantages that eventually lead to a specific inter-EU members division of labour. In terms of efficiency, it is a good thing, but it will generate extra costs with long distance transmission (Trainer, 2013; p846) for the less RES-developed EU member states that won't be able to source their own internal demand of energy. This phenomenon will then contribute to the replacement of the dependence on fossil fuels from the Russian Federation or the Middle East with dependence on renewable energy provided by fellow EU member states, with negative effects on national energy security. Even if we consider this problem as being solved by the guarantee of EU membership and close cooperation between states, the problem of costs still exists. Renewable energy is already more expensive than traditional energy sources, mainly because renewable energy also embodies costs (with fossil fuel-derived energy) for building infrastructure and other equipment needed to operate the new facilities and plants, as mentioned by (Trainer, 2013; p846). Of course, environmental awareness slightly reduces the actual sustainability costs (Gaigalis et al., 2014; p423), narrowing the gap between traditional and renewable energy in terms of expense.

In his rather sceptical paper, (Trainer, 2013) finds another argument that we will refer to as a challenge to the development of a sustainable energy system in the EU: the "intermittency problem" (Trainer, 2013; p847). Quoting (Oswald et al., 2008), (MacKay, 2008) and (Jefferson, 2008), the author gives examples of periods of low wind or solar light in Europe. If something like this would happen, renewable energy plants would not be able to be productive enough to keep up with the demand and energy systems across Europe would have to rely on other energy sources. Of course, these examples are extreme, but the energy grids all over the world don't operate only on average figures because we have to bear in mind the fact that building plants that will be able to only sustain average consumption will create serious problems in peak times, as the energy consumption is highly cyclic.

4. CONCLUSIONS

Important progress has been made in the implementation of renewable energy strategies across EU28 member states, many of them being able to successfully pursue their positive trend needed in order to reach 2020 Horizon targets, some of them already exceeded those objectives. More than half of the member states have been acknowledged to have high potential for RES, the other ones need to closely re-assess their NEAPs and try to give extra support in areas that lack development. Support schemes are active in each member state; feed-in tariffs, as well as grants or fiscal incentives are the main tools used to attract capital inflows into local energy markets.

It is a worrying fact that only a handful of countries in the EU28 are relatively energy independent, whilst EU average energy dependence is quite high. We think this problem needs urgent solutions because energy independence will have more and more significance in today's and tomorrow's geopolitical climate. By keeping the path of the 2009/28/EC Directive, EU member states can resolve most of their energy dependence problems.

Legislation framework provided by the European Commission regulating 2020 targets is optimistic but not impossible to achieve, especially if structural funds are also directed towards investments in RES for countries that struggle to successfully implement the renewable energy strategy. Solar and wind energy have had a positive evolution in the last years, although biofuels and hydro power continue to be the main renewable energy sources used across the EU.

There are a lot of challenges that EU member states have to face in order to achieve or exceed goals set for the 2020 Horizon, like cutting costs of production and transmission, the problem of intermittency or building capacity that can withstand peak consumption. We will not adopt a sceptical approach, nor a very optimistic one. We believe that periodical re-assessments of NEAPs and EC Directives to correspond to a fast-changing market are needed in order to have a better control on inputs and outputs. We also believe that investments in research and development, supported by public grants will have a great impact on speeding young technologies' reach of maturity, eventually leading to growth in efficiency and cost reductions.

Acknowledgement

This work was co-financed from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/159/1.5/S/134197 „Performance and excellence in doctoral and postdoctoral research in Romanian economics science domain".

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