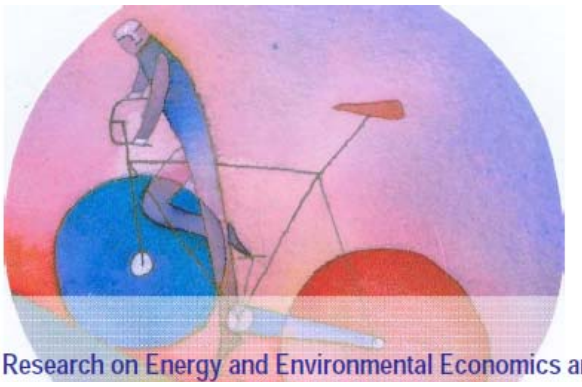

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The Support Schemes for the Growth of Renewable Energy

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The support schemes for the growth of renewable energy

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The paper deals with the efficiency and effectiveness of renewable energy support in Europe in order to achieve the target of 20% of final consumption in 2020. The reconciliation of subsidisation of carbon free energy sources and competition in the energy sector creates serious problems to the coherence of the European energy policy. At the same time, it is important to give value to the taxpayer or consumer money used to promote renewable energy, maximising the result achieved in terms of greenhouse gas emission reduction, technological development and competitiveness of the European industry. The paper gives an overview of the support schemes adopted in the different European countries, evaluating their performance according to the policy targets and investigates the possibility to start a trading of the national quotas among EU member States, aware that the efficient achievement of the long term target requires a form of trading of quotas. It is focused mainly on renewable electricity (RES-E), even of it acknowledges the importance of renewable heat (RES-H) to achieve the long term target of 20% of final consumption from renewables.

Keywords: Renewable Energy, Green Certificates, Feed in Tariff

Jel Codes: H23, L98, Q42, Q48

1. Introduction

The European Union made a choice in favour of Renewable Energy Sources (RES) in 2001, when a Directive was issued concerning the support to these energy sources and the creation of a fair playing field. Since then, the political commitment towards RES has steadily grown to give birth to a new Directive issued on April 23rd 2009 (2009/28/EC), thanks also to the good results achieved in terms of technological innovation and cost reduction in the last decade and before.
The new Directive on renewable promotion has the following definition:

> "support scheme" means *any instrument*, scheme *or mechanism applied* by a Member State *or a group of Member States*, that *promotes the use of* energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased; *this includes, but is not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and premium payments.*

A successful policy for RES can not be limited to financial support and to the choice among these different incentive mechanisms. It implies setting a coherent policy in terms of targets, administrative procedures and business environment that can be only achieved with a clear political commitment.
The present policy for RES in Europe involves many different levels of Government. While the targets are more and more set by the European Union, the choice of instruments for the promotion of RES remains responsibility of individual States on the basis of the subsidiarity principle. But in most EU Member States, it is the local government (regional or even municipal) that is entitled to give the authorisation to new projects. There is in other words an overlap of administrative responsibilities that often slow down the investment process and makes it difficult to find an overall coherence with other policies.
In order to function properly, effective support mechanisms need a stable, long term and credible regulatory setting. Lack of commitment capacity by the governments can hamper environmental policies and calls for alternative solutions for an efficient risk allocation among interested parties.
Renewable energy means electricity (RES-E), heat (RES-H) and fuels for transport (RES-T), even if most of the policies are focused on electricity generation. In economic terms this is not correct, as many profitable applications of renewable energy are in the field of heat generation and fuel production. The evolution of the car market towards multi-fuel engines open interesting perspectives to biofuels. Similarly, new flexible heat generators are designed to integrate biomass, solar thermal and heat pumps in buildings, with the possibility to generate warm and cold fluids at competitive costs. This paper deals with RES-E, but this does not mean the other applications are of lesser extent.

2. The rational for promoting renewable energy

In every European countries RES have their detractors on the basis of the subsidised regime and the cost for electricity consumers. Nevertheless, a long term view and a look to the supply side of the sector show that these technologies can really change the economy towards sustainability and industrial competitiveness.
Due to the very low elasticity of demand, in the energy sector the price signal passed to the consumers is heavily distorted by taxes and subsidies, that rarely balance the externalities typical of the energy conversion processes. The present policies are aimed at correcting as far as possible these distortions, re-addressing the investments towards the technologies that can minimise the social cost of energy. In this perspective a target has been given to renewable energy contribution,

thanks to the multiple dividend associated to these investments, in terms of lower environmental impact, involvement of local resources (work, capital and knowledge), technological development, competitiveness of the domestic industry.
Investing in renewable energy technologies makes sense in economic terms first of all, as it helps innovation in new sectors where big steps forward can be done and new solutions can be found to old problems. The fact that Germany, the EU Member State with the biggest manufacturing sector was the promoter of binding targets for 2020, clearly explains the industrial logic of the policy.
The energy market in Europe is heavily subsidised, but only about 5 on a total of 30 billion Euros per year of direct and indirect subsidies went to renewable energy sources in 2001 (data from the European Environmental Agency, http://www.eea.europa.eu). It is immotivated the opposition to RES based on the extensive use of public money. The energy market appears to be distorted and the search for the maximisation of social benefits necessarily involves a new taxation of energy products, as stated by the 2003/96/EC Directive.
Similarly, the idea sometimes heard about renewables, that any sector if heavily subsidized, can give economic results is clearly wrong. Could other sectors allow to Spain or Denmark to contribute to their trade balance with the same success, even if heavily subsidised at home? Hard. The growing size of the world market for renewable technologies can assure a demand potentially enormous for competitive products developed in the domestic market. This industrial opportunity creates a competition among European Member States in developing support systems effective in strengthening the industry without restraining competition.
The American States do face a challenge similar to the European one, sharing a common target and many different approaches to the support of renewables. The strong commitment towards market liberalisation has pushed the american regulators to opt for Renewable Portfolio Standards in many States even before the Obama era (Holt, Wiser, 2007).

A considerable potential to substitute fossil fuels with RES is available in Europe, often with costs that can become competitive in the long term. An efficiency driver require that investments privilege lowest cost resources and this means that new projects will not be necessarily in the countries with high obligation, considered that the 20% quota was split among member states according to an income criteria. The minimisation of the cost for achieving the target thus require proper trading mechanisms inside and outside Europe. A fair trading for supported goods is all but trivial and avoiding cross subsidies, unnecessary rents and double remuneration can be made easier with some sort of harmonisation. As acknowledged in recent EU policy documents, (EC, 2008c) in an integrated single European electricity market, some degree of harmonization of support schemes for renewable sources would be needed to avoid market distortions.

3. The instruments to support renewable electricity growth

If a motivation exist to support renewable electricity, the instruments adopted to promote investments are of different types (Mitchell et al. 2006, based on price (feed-in tariffs) and premiums or based on quotas (green certificates, green tenders), with very different results in terms of production growth and effectiveness of the support (EC, 2008b). With the first set of instrument, the price for the electricity supplied to the grid is set, but the quantity is not known, with quota mechanisms a certain quota of the market is reserved to RES and a specific market price should arise from the free comparison of demand and supply. The main instruments can be described as follows:

- **Feed-in tariffs** are characterised by a specific price, normally set for a period of several years that must be paid by electricity companies, usually distributors, to domestic producers of green electricity. The additional costs of these schemes are paid by suppliers in proportion to their

sales volume and are passed through to the power consumers. A variant of the feed-in tariff scheme is the **fixed-premium** mechanism, that can combine security of cash flows and optimal allocation of the electricity produced. Under this system, the government sets a fixed premium or an environmental bonus, paid above the normal or spot electricity price to renewable electricity generators.

- Under the **green certificate** system, currently existing in many Member States, renewable electricity is sold at conventional power-market prices. In order to finance the additional cost of producing green electricity, and to ensure that the desired green electricity is generated, consumers (or in some countries, producers) are obliged to purchase a certain number of green certificates from renewable electricity producers according to a fixed percentage, or quota, of their total electricity consumption/production. Since producers/consumers wish to buy these certificates as cheaply as possible, a secondary market of certificates develops where renewable electricity producers compete with one another to sell green certificates.
- Pure **tendering** procedures existed in two Member States (Ireland and France), but have been abandoned. Under a tendering procedure, the state places a series of tenders for the supply of renewable electricity, which is then supplied on a contract basis at the price resulting from the tender. The additional costs generated by the purchase of renewable electricity are passed on to the end-consumer of electricity through a specific levy.
- Systems based only on **tax incentives** are applied in many States. In most cases, however, this instrument is used as an additional policy tool.

In spite of the long literature available on RES support instruments, it is not easy to give a comprehensive evaluation of their effectiveness and efficiency. Table 1 shows the main elements in favour and against the two approaches, but as clearly shown by the EC evaluation (EC, 2008b), many other factors influence the performance of the regulation of the sector and a generalevidence can not be drawn from the past experience.

Table 1: advantages and disadvantages of feed in tariffs and quota based support systems (CEER, 2008)

	Advantage	Disadvantage
Quota system with Tradable Green Certificates	• Flexible and market oriented; • Stimulate technological innovation; • Coherent with competition policy; • Easy to enlarge to other countries.	• Higher insecurity for investors; • Volatile prices; • Higher transaction costs.
Feed-in Tariff	• Effective in promoting new investments; • Low transaction cost; • Stable framework; • Low investment risk.	• Non cost efficient, hard to avoid high profits; • Non market oriented; premiums better than fixed prices

Looking to the recent history in Europe the growth of RES-E contribution is largely attributable to feed in tariff schemes; this mechanisms enabled a large number of small and medium entrepreneurs to build power plants based on renewable energy sources at a time when the large, deep-pocket incumbent utilities were still reluctant to endorse renewable energy. Quota systems probably underestimated the role of risk perception for investor and the need to create favourable playing fields to start new technologies. The delay in investments, even if heavily subsidised, is not due to economic reasons, but rather to the weak institutional framework that is not able to remove non financial barriers (Lorenzoni, Bano, 2008). Gaining local consensus, avoiding discrimination in grid connection, shortening permitting process still are the real obstacles to RES growth in many EU countries, even in presence of generous supports.

It has not to be forgotten that the instruments adopted for the promotion of renewable technologies are strictly related to the goals of policies at national level, which can range from the development of a national industry, the maximisation of RES production, the gain of environmental benefits and the maturation of young technologies. Giving priority to one or another of these aspects leads to the choice of different policy instruments. The pillars of the European Strategy for the development of RES can be identified on the following targets:

- **Increasing legislative stability and reducing investment risk**. One of the main concerns with national support schemes is any system's stop-and-go nature. Any instability in the system creates high investment risks, normally taking the form of higher costs for consumers. The design of a support mechanism must minimise unnecessary market risks. Increased liquidity could improve the option of long-term contracts.
- **Reducing administrative barriers,** including the streamlining of administrative procedures. Clear guidelines, one-stop authorisation agencies and lighter procedures are encouraged.
- **Addressing grid issues** and the transparency of connection conditions. Transmission reinforcement needs to be planned and developed in advance with appropriate financing.
- **Encouraging technology diversity**, by giving differentiated support not to exclude younger technologies.
- Better use the possibilities of **tax exemptions and reductions** offered to renewable energy sources under the Directive on the taxation on energy products (2003/96/EC).
- **Ensuring compatibility with the internal electricity market.** This task is critical when most of the new capacity installed in Europe in the next decade will have to be based on renewable technologies. How far market forces can play, if all investments will have to be supported by public money?
- **Encouraging employment and local benefits.** A substantial part of the public benefits pursued by policies supporting renewables relate to employment and social policies, and rural development, while other national policy goals should be respected and duly taken into account.
- **Twinning actions on energy efficiency and demand management**. The progress of renewable electricity generation is being offset by excessive growth in electricity consumption and must be avoided. Only a combination of RES-E support measures and electricity end-use efficiency measures will bring Europe further in its energy policy goals.

4. The European policy

Since the creation of the European Union a great effort has been done to create single markets for goods and services. This task was relatively easy in some sectors, while it implies a long process of convergence in others, namely energy, for its important implications at the strategic level.
The European energy policy is inspired by three main targets: environment, efficiency, security of supply. Their priority changes with time, but they always remain the top priority of public intervention.
The European Union has chosen to introduce competition in the energy sector to enhance its overall efficiency since the mid-Nineties. This decision creates some difficulties for the growth of renewable energy, which is supported for its environmental benefits, but can hardly participate in a competitive market. Thus, one of the challenges for the European energy policy is the conciliation of competition and the promotion of new technologies. A great effort has to be made to give coherence to the national regulatory approach of the EU Member States, which are very different for historical and political reasons. In this perspective, the EU energy policy has to be seen as a process towards common long-term goals rather than a short-term uniform policy.

A series of Directives have been issued in the last years addressing the EU policy for renewables and energy efficiency, aimed at driving the national policies towards common targets:
- directive 2009/28/EC, substituting directive 2001/77/EC, on the promotion of renewables;
- directive 2002/91/EC on certification of energy performance of buildings;
- directive 2003/30/EC on promotion of biofuels;
- directive 2004/8/EC on the growth of cogeneration
- directive 2006/32/EC on Energy efficiency in final uses.

All these documents set a favourable framework for new investments in the sector of renewable energy and energy efficiency, even if the EU policy remains fragmented and constrained by many different targets. As an exmple, the present tax systems are quite diverse and this can harm the competition among companies at the EU level. Directive 2001/77/EC required from the EU Member States a minimum level of taxation related to the environmental impact of different fuels, in order to reduce the effect of environmental externalities, but a coherence can be hardly found.
With the 2009 set of Directives issued on April 23, a new reference picture has been designed, trying to give coherence to the intervention on energy and transport policy, energy research and environmental regulations.

The overall share of renewables in EU Member States electricity generation highlights substantial differences among countries. In 2001, renewables provided 70% of electricity in Austria and 1.4% in Belgium and played a modest role in the electricity supply profile of most EU Member States. The disparity in renewable sources availability is the main reason for these differences in utilization, countries like Austria and Sweden, for example, benefit from large hydro resources. However, other factors influence each country's RES deployment. In the wind power sector, for instance, although wind in Germany does not blow as strongly as in the UK or Ireland, or on the west coasts of France or Portugal, the country has seen an enormous increase in wind generated electricity. Wind energy development in country with better wind conditions is much more limited. Clearly other factors play an important role. Diverging RES percentages on total electricity consumption derive also from the implementation of more or less efficient support mechanisms and from the existence of the right supporting environment in terms of administrative framework and grid access. The rate of growth depends also on support, but on overall regulation first.

There is widespread agreement that significant additional policy efforts are required to reach the targets and to meet each country's objective. Even if most Member States have implemented a support scheme, the development of renewable energy sources is blocked by several commitments regarding the administrative and grid connection procedures. This part of the implementation of new investment patterns is the most difficult to be monitored, as most of the Member States are formally respecting the requirements, while in practice the investors find many difficulties.
The new Member States energy system has an high and increasing import dependency on fossil fuel. Renewable energy accounts for a small percentage of the energy mix; hydro represents most of the installed capacity; the other renewable energy sources (wind, biomass and other) being minor. The contribution of electricity from renewables to total electricity consumption shows a regular increase over the period 1990 – 2000, mostly from hydro plants (97% of RES electricity in new member States in 2000).
Meeting the Directive requirements needs a large growth of installed capacity in a relative short period. Most of the new Member States have set up their targets, some of which seem to very ambitious. This situation reflects somehow the inconsistency of the policies. Most of the New Member States may not be able or willing to reach self –set targets on RES-E without major policy changes. An intensification of current policies can help to meet the RES targets, but the costs of this policy could be very high because of the short time available.

In spite of the different paths followed in the past, the idea is today that challenging medium term targets can compact EU member states in a common project. The targets given to the EU for RES in

2008 for the year 2020 come from various studies (Ragwitz, 2005), (Haas, 2004) made on European countries, which identify a large potential for electric and thermal RES in Europe. As Table 2 show, already in 2005 there was a consensus among research groups about the 20% RES target in the medium term.

As clearly stated in the official documents of the European Commission and in many EU research projects (Green-X, Forres, OptRes) , the technical potential of renewable electricity in Europe exceeds the target of 20% of final consumption. What is more complicated to evaluate is the cost of such a mix of primary sources. The simulations made in preparation to the European policy, based on Primes model (EC, 2008), show that also in economic terms the choice to bet on renewable energy is winning in the long term. In light of this, the achievement of the target seems to be constrained by economic factors rather then technical ones. Changing the investment patterns in the energy sector requires strong political will and not new discoveries or technological breakthrough. But the cost counts and a strong political commitment requires the reasonable expectation that in the long term this choice will be also convenient, taking into account the multiple dividend of renewables, in terms of security of supply, lower emissions, job creation, stability of the market.

Table 2: Projected RES primary energy production in EU-25 under the 2020 scenarios (adapted from Ragwitz et al, 2005)

Total Primary energy (Mtoe)	2001	2006	2020	
			Business as usual	Policy
Total renewables	101	123.8	212	351
Total demand	1680	1764	1900	1700
Share of demand	6%	7.1%	11,1%	20,6%

It is interesting to note that the 20% quota can be achieved both for thermal and electric uses, while it seems very difficult to increase the RES share in transport.

Table 3: Projected RES heat energy generation in EU-25 under the 2020 scenarios (source Ragwitz et al, 2005)

Heat (Mtoe)	2001	2020	
		Business as usual	Policy
Biomass	46	53	78
Geothermal	1	5	18
Solar thermal	0.5	3	7
Total RES-Heat	48	60	103
Share of Demand	11.2%	12.3%	21.1%

It is interesting to note in Table 4 that most of the increase in electricity generation comes from wind power, biomass and biogas, while other technologies, even under the policy scenario can give a minor contribution.

Table 4: Projected RES electricity generation in EU-25 under the 2020 scenarios (source Ragwitz et al, 2005)

Electricity (TWh)	2001	2020	
		Business as usual	Policy
Wind	34	385	461
Hydro	326	337	354
Photovoltaic	0.2	8.8	17.9
Solar thermal	0	12.7	21.7
Wave & tide	0	8.4	33.2
Biomass & biogas	37	141	338
Geothermal	6.3	7.5	8.2
Share of Demand	13.6%	22.5%	34.4%

From the economic point of view, the forced growth of RES in the coming decade seems to be critical when related to the competition policy introduced with great efforts in the last decade. How far can competition be pushed under such strong environmental constraints? In case of low energy demand growth, barely all the new investments in the energy sector have to be in renewable technologies. But a forced growth can be hardly made under competition.
After the economic crisis of 2008 – 2009, with a reduction of the electricity demand in some cases important (-6.7% in 2009 in Italy), a problem arise related to the future investments. The required growth of renewable energy puts at risk traditional investments, especially in the gas sector where take or pay contracts are the industry standard.
The support schemes adopted in the EU countries in 2008 for RES-E are summarised below (CEER, 2008). Even after many years since the issue of the first EU Directive on renewable energy, many different approaches are still in use in Europe and a short term homogeneisation seems to be difficult.

Austria: Feed in tariffs differentiated per source are available for electricity from small hydro (< 10 MW), solid biomass, biogas, photovoltaic and geothermal. Feed in tariffs are given for 10 years and then 75% for year 11 and 50% for year 12. New feed-in tariffs are announced annually and support is granted on a first-come first-serve basis. In addition investment grants are available for hydro under 20 MW and biomass plants.
Belgium: There are three regional markets for green certificates for small hydro, solid biomass, biogas and photovoltaic, with minimum guaranteed prices for the green certificates in the Flanders and Walloon regions.
Bulgaria: A green certificate system to support renewable electricity developments has been proposed. Tax breaks are available for investors and a target has been given, supported by feed in tariffs.
Cyprus: Government grants worth 30-55% of investment costs are available to support investments and Feed-in tariffs were introduced in 2006 with 15 years contracts.
Czech Republic: Feed-in tariffs are available for generation from small hydro (up to 10 MW), offshore wind, solid biomass, biogas, photovoltaic and geothermal. The length of the contract is variable according to the source. Producers can choose between a fixed or premium feed-in tariff.
Denmark: Feed in tariffs are available for renewable generation and fiscal measures are also in place.
Estonia: Feed in or premium prices are available for small hydro, onshore and offshore wind, solid biomass and biogas.
Finland: Investment subsidies are given to small hydro, onshore and offshore wind, solid biomass, biogas, photovoltaic and geothermal. Electricity tax returns are also available for small hydro, wind, solid biomass and biogas, with different sizes according to the generation type.
France: Small hydro, wind, solid biomass, biogas, photovoltaic and geothermal electricity are supported through fixed feed-in tariffs with varying levels. Moreover, business investors are permitted to write-off their equipment's costs in the first fiscal year and deductions of up to 33% are granted for overseas investments. Households have a tax credit of 50% for photovoltaic investments.
Germany: 20 years feed-in tariffs and investment grants are available for hydro, wind, biomass, biogas, photovoltaic and geothermal. Furthermore, soft loans are available.
Greece: 12 years feed-in tariffs are available for small hydro, wind, solid biomass, biogas, photovoltaic and geothermal; an extensions up to 20 years can be granted. Investment grants up to 40% are also available under some circumstances.
Hungary: A premium is given to small hydro electricity (under 5 MW) until a return on investment is achieved. Premiums are also given to wind, biomass, biogas, photovoltaic, geothermal and waste. Investment grants are also available for renewables as connection fee discount of up to 50%.

Ireland: A feed in tariff covers hydro (less than or equal to 5 MW), onshore wind, solid biomass and biogas. It is guaranteed for up to 15 years. A tax relief measure is also available for corporate investments in certified renewable projects until 2011.
Italy: A green certificate's scheme is in place since 2004 with a growing obligation on producers and importers (3.85% in 2008). Certificates are sold separately from electricity and are given for 15 years. Different renewable sources receive different quantities of certificates per unit of energy produced. Feed-in tariffs can be obtained in alternative by plants of capacity under 1 MW (under 200 kW for wind). Photovoltaic plants above 1 kW are entitled to receive premium feed-in tariff fixed for 20 years. VAT is reduced to 10% for all RES investments.
Latvia: At national level there are yearly quotas and an obligation to purchase RES electricity. The quota system, without certificated, defines small RES-E amounts to be installed.
Lithuania: Fixed feed-in tariffs for hydro (<10 MW), wind, biomass, for 10 years.
Luxembourg: Feed-in tariffs are given to hydro, wind and biogas.
Malta: a feed in tariff for solar investments is available.
Netherlands: A certain uncertainty has characterized the support system after the phase out of the certificates in 2003. It seems that premium payments will be acknowledged, while fiscal incentives for investments in RES are available.
Norway: Project specific investment grants are available for wind power. There are plans to establish a common green certificate scheme together with Sweden.
Poland: A tradable green certificate scheme has been in place since 2005 for hydro, wind, biomass, biogas, photovoltaic and geothermal generation types and there is an obligation on electricity suppliers with targets specified from 2005 to 2010 with penalties for non-compliance. Renewables are also exempt from an excise tax.
Portugal: Feed-in tariffs are given to small hydro (<30MW), wind, biomass, biogas and photovoltaic.
Romania: A quota system with tradable green certificates has been in place since 2005, with an obligation on suppliers to purchase a quota of their sales from renewables. Their compliance is proven by holding the requisite number of green certificates. Since 2008 new small hydro (capacity less than 10MW), wind, solid biomass, biogas, geothermal and photovoltaic power plants are supported for 15 years and old small hydro and wind power plants are supported for 5 years. In addition, renewable electricity is exempt from excise payments.
Slovak Republic: 12 years fixed feed-in tariff for renewable electricity was introduced in 2005. Tax incentives are also available.
Slovenia: Fixed and premium feed-in tariffs are available for qualified renewable producers including small hydro (under 10 MW), wind, biomass, biogas, photovoltaic, geothermal and municipal waste. The feed in tariff is reduced by 5% for projects in operation for more than 5 years, by 10% for plant more than 10 years old.
Spain: Investors can receive technology specific fixed or premium feed-in tariffs indefinitely, with a reduction after 15, 20 or 25 years (depending on the technology). Tariffs and premiums are updated according to the level of maturity and deployment.
Sweden: There is an obligation based on green certificates on electricity consumers. For wind energy, investment subsidies and a small environmental bonus are available.
United Kingdom: The Renewables Obligation requires suppliers to source an annually increasing percentage of their electricity sales from renewable sources. Companies can meet their obligation by presenting Renewable Obligation Certificates (ROCs) or in alternative paying into a buy-out fund, which is given back to suppliers in proportion to the number of ROCs they hold. In addition, exemptions from the Climate Change Levy (CCL) are available for less-polluting sources of energy. There are also various fiscal incentives such as a reduced value added tax rate for microgeneration technologies as well as exemption from income tax for microgenerated electricity among others. In 2010 a new feed in scheme has been introduced, with tariffs updated annually for inflation.

Table 5: A view of renewable electricity support in Europe

Country	Feed in tariff	Premium tariff	Quota or Green Certificates	Investment subsidies	Fiscal break	Tax exemption
Austria						
Belgium						
Bulgaria						
Cyprus						
Czech Republic						
Denmark						
Estonia						
Finland						
France						
Germany						
Greece						
Hungary						
Ireland						
Italy						
Latvia						
Lithuania						
Luxembourg						
Malta						
Netherlands						
Norway						
Poland						
Portugal						
Romania						
Slovak Republic						
Slovenia						
Spain						
Sweden						
UK						

The multitude of support schemes raises a concern from the perspective of the single market. Investors are confronted with different criteria for and levels of support as well as administrative procedures and grid access conditions, all of which could influence their production site location decisions. The harmonisation of support schemes could simplify the regulatory environment, allow industrial growth and boost economies of scale, and provide a clearer framework for the efficient exploitation of renewable energy across the Union.

However the Commission's reports in 2008 considered that harmonisation of support schemes would be premature, as there has not been sufficient experience accumulated to determine the best choice of support scheme. Instead the Commission recommended that Member States cooperate more and improve ("optimise") their existing support schemes. In fact several factors are likely to have an impact on any actual implementation of a common EU RES market:

- Availability of renewable energy resources,
- domestic energy prices and different factors which impact on these prices,
- past levels of development and deployment of renewables,
- planning policy,
- fiscal regimes,
- regulatory regimes,
- network constraints,
- definitions of RES,
- differences in additional framework RES support systems, such as tax benefits,
- local RES support schemes.

5. Equity, efficiency and the role of trading

Achieving an ambitious targets in renewables like the 20% of final consumption in 2020 requires effective policies, but these can be very expensive for low income high potential countries, like those that recently joined the Union. The policy makers preferred to follow equity criteria instead of an efficeincy one, giving higher targets to richer countries in the burden sharing of the 20% quota. The investment cost minimisation thus requires some trading arrangement among Member States, in order to deploy least cost renewable resources. Such trading arrangements are regulated under the Directive 2009/28/EC on renewables (EC 20008 c) and will be a real challenge for competition policies in the energy market of the next decade.

Nevertheless, efficiency also requires a reduction of risk. Giving higher prices to cover the high costs is inefficient. As well, in many EU countries stop and go policies have created scarce confidence in the investors and the risk perception is very high, so that higher returns are requested to invest. The EU policy acknowledges the "*a framework that includes mandatory targets should provide the business community with the long term stability it needs to make rational, sustainable investments in the renewable energy sector which are capable of reducing dependence on imported fossil fuels and boosting the use of new energy technologies***"** (EC, 2008)
The market conditions in 2009 have dramatically changed since any time in the past. A strong recession on all over Europe has reduced the cost of money as never before since the start of Euro.
The reduction of interest rates in 2009 can favour the investments in high capital cost technologies, but the reduction of the spread due to risk is highly desirable. The risk perceived by financial institutions in RES investments, in fact, is often higher than expected and this can penalise heavily initiatives potentially profitable.
Moreover, it has to be considered that too generous support systems, even if aimed at overcoming inefficiencies, create opposition against renewables. Renewable energy sources can become the target of campaigns created by incumbents against the waste of public money in sectors where financial rents are too high.
Even if it is hard to evince general evaluations about the suitability od support schemes, low volatility has been identified as important in risk reduction and cost abatement. Quota systems have demonstrated to be difficult to implement (Bano, Lorenzoni, 2008), (Verbruggen 2009), as they lack in reducing volatility and risk for the investors and thus or experience high investment costs or underperform in terms of installed capacity. RES-e investments need long term regulatory stability and feed in tariffs, in presence of ambitious targets, have performed better both on cost reduction and new installed capacity. Nevertheress, the aim to adopt competititive instruments to achieve efficiency gains in fast changing technologies is also to be considered. A step forward in reconciliating the apparently conflicting targets of competition and stable investment conditions could be achieved with the adoption of instruments common in other energy markets, like take or pay contracts proposed by Neuhoff (Butler and Neuhoff 2006).

6. Overcoming the classical instruments

Member States should be encouraged to pursue all appropriate forms of cooperation in relation to the objectives set by this Directive. Such cooperation can take place at all levels, bilaterally or multilaterally through the mechanisms ... foreseen by this Directive, i.e. statistical transfers between Member States, joint renewable energy projects and joint support schemes

(Directive 2009/28/EC)

As already stated, the EU preferred an approach based on equity for the burden sharing of the 20% quota agreed in the EU. This is reasonable in the frame of a Union where some member States

joined the Union just some years ago and the income is very different among them. This is the reason for the adoption of a criterion based on income.
An economic approach to RES production maximisation would imply to foster RES in the countries where the resource is abundant, preferring a burden sharing based on potential and extension.
In any case, a flexible system that allows some form of trading is necessary to keep costs low in such a long term programme. Any rigidity in the allocation of national targets can become an extra cost for the achievement of the European target.
All EU member States have challenging tasks in the field of RES and need to implement support instruments that can attract investments and keep the cost low for consumers at the same time, leaving open the option of trading of quotas with other countries. Meeting all the targets at the same time is all but easy. Many factors occur in the choice of supporting RES that could also push for other policy instruments. As a first requirement the coherence of RES support with the other energy and environmental targets should be evaluated. It is clear that only when a policy is properly conceived all the benefits listed above can be achieved. As a second step, the compatibility with competition policies has to be addressed. After the creation of a single energy market (and within that a single electricity market and a single gas market), it is hardly acceptable a support scheme which is not competition based, even for a short timelength. In any case it makes total sense to adopt instruments which fit in with the wider principle of a energy market, even if feed in tariffs have achieved the highest growth rates in Europe (EC 2008b).

Mechanisms like the one applied in Spain based on premiums can be a good idea to enhance feed in towards competition and combining market prices and high revenues. The combination of the different mechanisms is an interesting approach to balance the benefits and disbenefits of competitive and fixed price mechanisms.

The green certificate markets have shown their limits in promoting new investments for the high risks perceived by investors, that feel not save enough their projects in the stormy environment of the market. RES technologies are still too young to operate under merchant conditions and require long term contracts to persuade investors to put the money, as any price volatility can destroy the financial plan of projects dominated by investment costs.

It is widely recognised that the introduction of one harmonised system could create a lot of uncertainty and disruption in the market for renewables, as it would abolish well-established national support schemes. Moreover, valuing at the marginal cost all EU RES generation could give unmotivated rents, while it might be difficult to differentiate costs, technologies and countries.

A critical step in is also concerned with the different targets of the incentive programmes at the national level. Given the environmental benefits, some are aimed at providing secure and diverse energy supply, others want to support innovation and new technologies, others are targeted to support the domestic industry for technologies, others simply wish to maximise the RES production. Creating a common playing field under these different approaches is not simple in political terms, also in light of the subsidiarity principle that drives european policies. It seems really hard to have investments in one country supported by money of citizens of another country, missing the link to the local values of renewable energy.

Reducing the level of future trade disparities could help to bring renewable generation into line with the development of the internal market. The trading of quotas under State Agreements for statistical transfers as stated in the new Directive is a good compromise between free trade of renewable energy and insulated renewable support systems, that can keep monitoring costs down and avoid the development of the fake projects feasible under a fully liberalised system. This approach based on statistical transfer of quotas could work in economic terms, but needs to be implemented with great attentions not to miss the consensus towards RES policies. If an expensive action is not fully understood, it can not be accepted and for RES it could mean to fail the achievement of the 2020 target.
The reconciliation of investment security and competition suggests that feed in tariffs or annual green certificates could be substituted by long term (15 years) bilateral contracts between an

obligated operator (fossil producers or suppliers) and RES-e producers. Instead of an annual obligation like under green certificates in present quota systems, a long term path of quotas could be designed, requiring a coverage with long term bilateral contracts. These contracts could be freely traded on the market, but they should be yearly redeemed to fulfil the obligation. They could give the stability and long term security required for financing new schemes, but would leave the market to set the premium over conventional electricity.
Moreover, in the design of the future policies it has to be taken into account that the European Union is birthplace of some of the most innovative technologies in the field of renewable energy and hosts some of the best manufacturers in the world. A proper renewable policy can be a wise instrument to support the domestic industries in facing international competition and in pushing innovation. The 2020 target is ultimately the inspiration for an industrial policy catalysing many positive dividends on social, environmental and competitive grounds.

7. Conclusions

Most of the policy actions in Europe are targeted to renewable electricity, RES-E, as it is easy to monitor the investments and the number of operators involved remains manageable. Moreover, transaction costs can be kept at bay. Thermal energy from renewable energy sources (RES-H) instead has not found the favour of policy makers for a number of reasons: fragmentation of the action in many small investments, high transaction costs, risk to displace investments in gas distribution infrastructures, interaction with local rules and the impossibility to set common approaches.
Nevertheless, the potential for the replacement of fossil fuels is quite high in many European countries. In Italy, 13 out of 18 Mtoe of incremental renewable energy potential in 2005 – 2020 comes from thermal generation from biomass, solar thermal and geothermal energy.
Some European Member States show that it is possible to push RES-H at quite high penetrations: it is the case of solar thermal in Greece, biomass in Austria, experiences that can be successfully replicated in other European countries.
So for most European countries the contribution of renewables to cover thermal energy demand can be decisive in meeting the target for 2020. New instruments have to be adopted in order to force the involvement of households and the civil sector and a new culture of final energy consumption must be created among European consumers.
Europe is called to enhance its policy intervention in favour of renewable energy to achieve the target it has set for 2020. This challenge can play a key role in the support to the domestic manufacturing industry, that is today struggling in the international markets.
The non homogeneous distribution of renewable resources calls for some flexible mechanism for matching the quota of different member states with the minimum cost resource exploitation and the text of the Directive adopted in April 2009, with the possibility for States to exchange quotas under statistical transfers seems to be fair in creating opportunities for European companies inside and outside the EU market.

It is noteworthy to consider that Member States do not like idea of paying for benefits which may accrue to another Member State. With the statistical transfers allowed by the Directive, this kind of agreement will be monitored and will bring advantages to both parties: the exporting country will gain the investments, the importing one will reach the target at a lower cost. It is true that part of the multiple dividend of investments, in terms of local development, will be displaced in the paying country, but this loss could be compensated by the improved overall efficiency.
The level of homogeneisation of the the support instruments, even if desirable, does not represent a priority at the moment. It is crucial to set at the earliest the penalties for States which will not reach the 2020 target, to create an opportunity cost for investments and help the political commitment.

It should be clear that the benefits of this policy will be fully available only in the long term, when the benefits on the stability and security of the system will be achieved and the maturity of new technologies will have driven down costs. It is a long term path that seems to be feasible, when we consider that in the last five years many targets for RES have been modified upwards. This is clearly the sign that technology is responding better than expected to the growth of investment volumes. And for sure the process has not come to an end in many fields.
In any case, a flexible market design is necessary to adapt the level of intervention to the rate of investments. For this purpose the implementation of the new Directive for renewable energy requires that proper monitoring procedures are put in place in order to create accountability. Other ancillary actions play key roles in the success of the future policy, like the introduction of appropriate incentives to Transmission System Operators and distributors to integrate RES and carry the grid renovation and extension costs. The 20% RES commitment can not be credible without adequate investments in the electricity grid. The target is achievable, but the whole system must be redesigned. And if this is reputed only a cost, it means that are not seen the consequences in terms of innovation, technological leadership, security of supply, competitiveness of the EU energy sector. That are so clear to us.

References

Butler, L. and Neuhoff, K. (2004, updated 2006*). Comparison of Feed in Tariff, Quota and Auction Mechanisms to Support Wind Power Development*. Cambridge Working Papers in Economics CWPE 503.

EC (2008) (a), *Commission staff working document Impact assessment Document accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020* (SEC(2008)85/3.

EC (2008) (b), Commission Staff Working Document, *The support of electricity from renewable energy sources. Accompanying document to the Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources* {COM(2008) 19}, Brussels, SEC (2008), 57.

EC (2008) (c), *Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*, Official Journal of the European Union L 140/16-62, 5/6/2009.

CEER (2008) *Status Review of Renewable and Energy Efficiency Support Schemes in EU* Ref: C08-SDE-05-03; 10 December 2008.

Chen C., Wiser R., Bolinger M. (2007), *Weighing the Costs and Benefits of State Renewables Portfolio Standards: A Comparative Analysis of State- Level Policy Impact Projections*, report LBNL-61580, March.

Coenraads R. et al. (2008*), PROGRESS, Promotion and growth of renewable energy sources and systems*, Contract no.: TREN/D1/42-2005/S07.56988, Final report, March.

Haas R. et al. (2004), *Green-X Final Report*, EC Contract No: ENG2-CT-2002-00607.

Haas R., W. Eichhammer, C. Huber, O. Langniss, A. Lorenzoni, R. Madlener, P. Menanteau, P. -E. Morthorst, A. Martins, A. Oniszk, J. Schleich, A. Smith, Z. Vass, A. Verbruggen, (2004), *How to promote renewable energy systems successfully and effectively*, Energy Policy, Volume 32, Issue 6, Pages 833-839, April.

Holt E.,Wiser R. (2007), *The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards*, LBNL-62574 report, April.

IEA (2008), *Deploying renewables, Principles for Effective Policies.*

Johnston A., Kavali A., Neuhoff K. (2008), *Take-or-Pay Contracts for Renewables Deployment* CWPE 0723 & EPRG 0707

Langniss O., Diekmann J., Lehr U., (2009) *Advanced mechanisms for the promotion of renewable energy - Models for the future evolution of the German Renewable Energy Act*, Energy Policy 37 (2009) 1289–1297.

Lorenzoni A., Bano L. (2008*), Il costo dell'elettricità prodotta da fonti rinnovabili in Italia: una stima dei costi delle "inefficienze" del sistema*, Economia delle Fonti di Energia e dell'Ambiente, FrancoAngeli, n. 1/2008.

Menanteau, P., Finon, D., & Lamy, M.-L. (2003). *Prices versus quantities: Choosing policies for promoting the development of renewable energy.* Energy Policy, *31*(8), 799-812.

Mitchell, C., Bauknecht, D., Connor, P.M., (2006), *Effectiveness through risk reduction: a comparison of the renewable obligation in England and Wales and the feed-in system in Germany*, in Energy Policy 34 (2006) 297-305.

Ragwitz M. Et al. (2005), *Analysis of the EU renewable energy sources' evolution up to 2020 (FORRES 2020)*, contract financed by the European Commission, Energy and Transport DG, under tender no TREN/D2/10-2002.

Rickerson W., Grace R. (2007), *The Debate over Fixed Price Incentives for Renewable Electricity in Europe and the United States: Fallout and Future Directions*, The Heinrich Böll Foundation Report, February.

Verbruggen A. (2009), *Performance evaluation of renewable energy support policies, applied on Flanders' tradable certificates system*, Energy Policy 37 (2009) 1385–1394.