EU Policies and Regulation on CO_2, Renewables and Energy Efficiency: A Critical Assessment of Recent Experiences

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Abstract For over 20 years, the EU has taken on a clear role of international leadership in energy and environmental policy, with a strong commitment to bringing down CO_2 emissions, promoting renewable energies and enhancing energy efficiency. Regulatory experience has been very varied, with several different kinds of regulatory, fiscal and command-and-control instruments, etc. being implemented. The analysis conducted in this chapter shows that there have been "lights and shadows" but it can be concluded that, in general, priority has been given to meeting targets rather than to economic efficiency considerations. Two main tools have been used to bring down CO_2 emissions at EU level: the EU ETS and taxation. On the first issue, our main conclusion is that despite the fact that CO_2 goals have been achieved, the role of CO_2 prices as a low-carbon investment driver has been of relatively little importance. In relation to the second issue, the need to analyse energy and environmental taxation from a broad conceptual perspective, including the extraordinary costs derived from energy, environmental and social policy decisions needs to be highlighted. In the Spanish context, an environmental tax reform needs to be undertaken to address the challenges faced by the energy model: strong incentives are required in favour of technologies which are more efficient and which have lower environmental impacts. In relation to renewables, experience shows good and bad points in each of the supporting frameworks and the general conclusion is that these frameworks should also take into account the characteristics of each technology (particularly its competitiveness). Energy efficiency should be one of the cornerstones for attaining EU energy and environmental goals. Price instruments, standards and information instruments are very useful in overcoming the "energy efficiency gap". In this regard, the Directive on Energy Efficiency will establish the policy framework for the medium/long term.

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1 Introduction

This chapter aims to analyse the main energy and environmental policies at European level, and the way in which these policies are interlinked. It also looks at the targets set and the regulatory instruments in place to attain them. The idea is to draw conclusions that may be of assistance in improving energy policy going forward. This is particularly important in the current scenario, in which the EU is reviewing the framework of targets and instruments for its long-term energy policy. This review commenced at the time of the launch of the Green Paper "A 2030 framework for climate and energy policies", in which the European Commission asks stakeholders questions in order to gather their opinions and future proposals on the European energy model, and continued with the Communication adopted on 22 January 2014 and presented in Brussels by the Commission President jointly with the European Commissioners for Climate Action and for Energy.

Energy policy may be defined as the set of goals, targets and tools that determine the role to be played by energy in society. In this policy framework, regulatory instruments are the tools defined by the regulator with a view to effectively reaching the targets set. In recent years, the regulatory framework for energy and environmental affairs in Europe has been defined by what are referred to as the 20–20–20 targets, to be attained by the year 2020, as follows:[1]

- A 20 % reduction in greenhouse gas (GHG) emissions from 1990 levels.
- Raising the share of final energy consumption supplied by renewable resources to 20 %; including raising the use of renewable energies in the transport sector to 10 %.
- 20 % improvement in primary energy consumption compared to the baseline scenario, via energy efficiency.

In order to achieve these goals, on the one hand various European Directives have been passed[2] , and on the other the Member States have developed regulatory instruments at internal level and to transpose the relevant EU Directives.

As regards instruments aimed at reducing **emissions**, our analysis needs to differentiate between two main groups: first the industrial and energy sectors subject to the European Emission Trading System (EU ETS), which sets a cap on emissions in Europe and lays out a roadmap for meeting those targets by 2020; and then what are referred to as the "diffuse sectors" (transport, R&D&I, etc.). In the latter case,

[1] On 22 January 2014, the European Commission presented a new framework of goals for 2030 at EU level: a 40 % reduction of greenhouse gas emissions from 1990 levels and a 27 % share of EU energy consumption for renewable energy.

[2] The Emissions Trading Directive [5] (2003/87/EC), as amended by Directive [6] 2009/29/EC, the Directive on the Promotion of the Use of Energy from Renewable Sources (2009) (2009/28/EC) and the recently passed Energy Efficiency Directive [7] (2012/27/EU).

the Member States have specific targets for reducing emissions and may on a discretionary basis define whatever policies and instruments they wish to implement to achieve those outcomes.

As the EU ETS has been in operation for some years now, conclusions may be drawn as to its effectiveness and efficiency and proposals for improvement may be made. The same is true of the strategies adopted to reduce emissions in the diffuse sectors, among which taxation has played a key role.

Support for the development and roll-out of **renewable energies** has been organised mainly at national level. However, targets and basic regulations have been defined at European level. These targets are allocated to countries according to the potential for developing renewables and the wealth of each country. The Member States were given total discretion to define the supporting frameworks to be implemented in order to meet their national targets for renewable energies. European experience in this area enables the degree to which targets have been met to be pinpointed, along with the level of efficiency of the instruments and the consequences arising from the mistakes made.

Unlike the two previous cases, the 2020 **energy efficiency** target was not defined on a binding basis. This is another indication of the role to which targets and regulatory instruments for improving energy efficiency have been relegated. Despite the fact that various regulations have been passed in the field of energy efficiency, this aspect has not traditionally been given the same political importance as reducing emissions or promoting renewable energies. In fact, it may be said to be one of the issues that remain pending in European energy policy.

There are significant differences in the regulatory instruments applied by the various Member States, although the drafting of standards for equipment and processes and the adoption of plans to upgrade equipment have been widely implemented throughout Europe.

The Energy Efficiency Directive passed in October 2012 specifies binding energy efficiency targets and a broad range of regulatory instruments that will form the foundations for the energy efficiency regulations in the Member States by 2020. The drafting of this Directive was surrounded by animated debate, reflecting the different opinions of the various Member States in relation to the level of efficiency and effectiveness of each regulatory instrument. These discrepancies were particularly strong in the case of quantity instruments (energy-saving targets for suppliers), which have been in place for several years in some countries but for which no accurate diagnosis is yet available.

The lessons learned from the rights and wrongs of the existing regulatory frameworks are very useful in a context such as the present scenario of debate on the essential aspects of the targets, policies and regulatory instruments beyond the 2020 horizon, in a situation of economic crisis with extreme pressure to improve competitiveness and drive economic growth.

In this regard, the European Union has already started work by proposing the Energy Roadmap 2050,[3] which is considered as a point of departure for advancing towards a sustainable energy model. In this document, Europe aims to reduce GHG emission levels by 85–90 % from 1990 levels.

This chapter comprises an introduction and sections on five main aspects of energy policy:

- The second section is devoted to policies designed to bring down CO_2 emissions, focussing on the EU ETS.
- The third section looks at the environmental and energy tax framework in Europe.
- The fourth section addresses the frameworks in place for supporting renewable energies.
- The fifth explores regulations to promote energy efficiency.
- The last section summarises main conclusions of the previous sections.

2 Analysis of the Main European Regulatory Instruments on Energy Issues

2.1 Description of the EU ETS

The European Council of March 2007 set a target of reducing EU GHG emissions by 20 % from 1990 levels by 2020, i.e. a 14 % reduction on 2005 levels. This was to be split between the sectors subject to emissions trading,[4] which committed to a 21 % reduction target, and the remaining sectors (also referred to as "diffuse" sectors) for which the target was 10 % at European level. In this case, a Decision[5] by the European Commission allocated the targets to Member States according to the Gross Domestic Product (GDP) of each one.

In industry the key regulatory instrument for reducing emissions is the EU ETS, which was set up in 2005 under the terms of the Emissions Trading Directive [5] (2003/87/EC).

This first Directive laid the foundations for emissions trading, defining the basic emissions limits authorised in order to create scarcity, defining what activities were

[3] This document is under review because many of the economic and technological scenarios described are now out of date and probably no longer apply.

[4] This framework includes energy generation industries and industrial sectors with a high level of energy consumption, e.g. power plants over 20 MW, hydrocarbon refineries, coke ovens, steel production facilities, cement production facilities, paper manufacture operations, glass manufacture operations, ceramics plants, etc.

[5] Decision 406/2009/EC of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020.

included in the scheme, establishing the methodology for allocating emissions and leveraging the possibilities for flexibility afforded by the clean development and joint implementation mechanisms (CDM and JIM, respectively) created by the Kyoto Protocol.

Basically, companies received emissions allowances free of charge under national allocation plans (NAPs), which were designed by national authorities on the basis of the emission reduction ceilings set by governments at national level and the prospects for development over time in each particular sector and installation. At the end of the year, each company then had to submit to the relevant administrative authority emissions allowances equivalent to the volume of CO_2 emissions (in tonnes) released into the atmosphere.

The experience gained by the European Commission in the early years of the EU ETS was taken into account when drafting Directive [6] 2009/29/EC, of 23 April 2009, so as to improve and extend the GHG emissions scheme of the Community. One significant change was the fact that a European emissions ceiling was defined and a centralised emissions allowance allocation system was set up with the same norms applying throughout Europe. Under the new scheme, the auctioning of allowances was established as the basic methodology for allocation in the electricity sector, with some exceptions being made in the case of certain particular circumstances, mostly affecting former Eastern Bloc countries.

In short, Directive [6] 2009/29/EC constitutes the basic framework for regulating the trading of GHG emissions allowances from 2013 onwards (referred to as Phase III). Some of the main changes are as follows:

- The allocation of emissions allowances to all of the installations included in the scheme is centralised at European level (European ceiling) and binding target quotas are set at national level. As mentioned previously, this allocation is generally carried out by means of an auction.
- Allocation free of charge is only envisaged in production sectors at risk of "carbon leakage" (i.e. at risk of relocation outside the EU).
- The possibility is also envisaged of an activity with intensive electricity consumption being affected by carbon leakage as a result of electricity becoming more expensive due to the implementation of the emissions allowance trading scheme.
- For efficiency reasons, Member States are allowed to exclude small installations from the EU ETS.
- The use of allowances derived from the use of mechanisms linked to project development under the terms of the Kyoto Protocol—i.e. JIM and the CDM—is limited in accordance with the principle of complementarity: the total volume may not exceed 50 % of the reduction.
- 5 % of the total allowances is reserved for "new entrants". 2 % of this amount must be allocated to fund pilot projects involving generation from renewable energy sources and carbon capture and storage.

The years since the launch of the climate change package (understood to mean the emissions reduction targets for 2020, the EU ETS and the Decision with country-allocated targets for diffuse sectors) have revealed two fundamental issues.

First of all, the EU ETS has proven to be effective in bringing down emissions, thanks to the structure of the regulatory instrument ("cap and trade"). However, the economic crisis and its consequences for production and demand in the economy have resulted in the prices per tonne of CO_2 plummeting and thus weakened one of the main drivers envisaged by the regulator: a technological shift towards a low-carbon economy, which is the second main goal (albeit implicit) for which this framework was defined.

The second fundamental issue is the difficulty of achieving reductions in emissions in the diffuse sectors, particularly in transport and building. In these sectors, the lack of concrete commitments by stakeholders and the technological difficulties in introducing low-carbon technologies jeopardise progress towards the decarbonisation of the economy beyond the 2020 horizon.

An analysis focussed on emissions allowance trading shows that the basic characteristic of the end of the previous stage (2008–2012) and beginning of this third stage is a slump in the price of CO_2 emissions allowances, as a result of the major economic crisis, which has reduced industrial activity and the demand for allowances. This is further compounded by the increasing penetration of renewables as a result of specific support schemes (Fig. 1).

Despite the fact that the emissions allowance market is working smoothly (bear in mind that the emissions target is being met and that the price is in keeping with the basic factors), many analysts claim that the price of CO_2 in the European market has fallen so low, and at the same time shown such a high level of volatility, that it is no longer providing an incentive for the investments required to decarbonise the economy (since January 2013, the price of the EUA has remained below €5/tonne CO_2). In fact, without the banking effect (i.e. companies with the highest emissions taking advantage of the current low prices to buy allowances as an optional hedging mechanism in case CO_2 prices soar after 2020 for any reason), the price of CO_2 might well have dropped to almost zero.

In the light of this situation, in July 2012 the Commission published a draft for the amendment of the auctioning rules for the EU ETS, according to which the allocation of a particular number of emissions allowances would be postponed. To be more specific, the Commission proposed reducing the number of emissions allowances to be auctioned between 2013 and 2015 by 900 million and increasing by the same amount the volume auctioned at the end of the third stage (this is referred to as "backloading" in EU jargon).

By implementing this postponement strategy (which basically means changing the slope of the curve for maximum emissions allowed in the early years at the expense of increasing the maximum emissions allowed at the end of the period), the European Commission seeks to restrict the offering of emissions allowances in short-term auctions, thus raising the short-term price. It will then offer more allowances at the end of the period, when demand is expected to have recovered.



Fig. 1 EUA (Emission Unit Allowance) prices in the European market *Source* Bloomberg

Assuming that the effect of this increase in emissions as a result of backloading at the end of the period will be more than offset by the aforementioned increase in demand, the CO_2 price will go up. It is, therefore, a measure basically intended to reduce the volatility affecting the price of allowances, and thus reduces the risk perceived by potential investors.

This backloading proposalwas adopted in February 2014.

2.2 Proposals

With a view to strengthening the CO_2 signal price as a driver for decarbonising the economy and reinforcing effectiveness and efficiency in bringing down emissions, two kinds of measures are possible: structural and cyclical.

These measures should also ensure a certain CO_2 price level and stability, in order to achieve the volume of investment that is needed to attain the targets specified.

- Structural measures. These measures will help consolidate the improvements introduced since the EU ETS began and lay the foundations for reducing emissions in the long term. Some of the main measures are summarised below:
  - Set post-2020–2030 targets at the earliest possible opportunity to provide certainty to investments and increase current CO_2 prices through banking. This intervention will unilaterally increase carbon and energy prices to 2020, but there is unlikely to be a significant impact on investment decisions without visibility of the longer term carbon price.

  - Bring forward the announcement of the widening of EU ETS sector coverage, raising the CO2 price through banking leverage. It would be sensible to extend the scope of the EU ETS to other sectors including economy-wide fuel consumption. This extension will improve the efficiency of the scheme, as an efficient market mechanism is applied to more sectors in the economy. Applying the EU ETS only to industrial sectors leaves a very important part of the economy out of the effort for efficient emission reduction. This measure could avoid the promotion of expensive emission reductions in current non-EU ETS sectors while less expensive reductions are available in the EU ETS sectors (or vice versa).
  - If the EU ETS is to be extended to all end consumers of fuel, it is important to coordinate these measures with fuel tax measures in order for the combination and interaction of each measure to reflect the external cost.
  - Set additional limitations on the use of international credits in the EU ETS.
- Cyclical measures for rapid implementation, such as the backloading proposal. We do not believe that backloading will be an added handicap to the competitiveness of European industry if the necessary additional measures to preserve that competitiveness are adopted, e.g. strengthening the support measures that are already set under existing EU State Aid Guidelines which allow compensation for ETS-related increases in electricity prices to prevent the risk of carbon leakage.

3 Environmental and Energy Taxation

3.1 Description of the European Framework on Environmental and Energy Taxation

'Environmental taxation' is understood to mean a form of taxation that internalises an environmental cost that is reflected in the price of the manufactured good; a theoretical framework has been developed around this concept.[6] However, in defining this term it must be remembered that there is an ongoing debate as to what exactly an environmental tax is, or should be, and whether the tax should seek to internalise the environmental cost incurred or alter the behaviour of the stakeholders.[7]

[6] See, for example, OECD [25]. *Environmentally Related Taxes in OECD Countries. Issues and Strategies*, Chap. 1.

[7] For an argument in favour of the need for the tax to alter behaviour, see Joskow (1992), p. 54, for example.

In analysing European experiences in the field of environmental taxation, OECD reports are very useful[8] as they take a broad statistical basis into account and carry out a thorough review of both academic literature and the legislation in force.

An analysis of a significant number of OECD publications on energy and environmental taxation, as well as of the statistics drawn up by the OECD in this field ,[9] leads to at least two significant conclusions.

First, the indicators used to compare the burden of environmental taxation in different countries should be carefully scrutinised, as in many cases they may be dependent on final energy consumption trends, how consumption is structured or how taxes are designed. For example, the overall revenue value of an *ad valorem* tax (e.g. the tax on electricity in Spain) is not as dependent on energy consumption trends as a tax levied at a rate based on units of energy (e.g. liquid hydrocarbons in transport).

Second, an analysis of energy and environmental taxation should be supplemented by the introduction of regulatory concepts that impose charges on energy consumers in order to finance energy-related, environmental or social policies. This is the case, for example, of the costs incurred by electricity consumers in order to finance the meeting of the renewable energies target in many European countries, i.e. a public policy target that is derived from European regulations.

In October 2003, the European Commission passed Directive [5] 2003/96/EC on energy taxation, which came into force on 1 January 2004. This Directive sets the minimum levels of taxation applicable to energy products intended for the production of motor and heating fuels, as well as for the production of electricity, although in the latter case the Member States may introduce exemptions on a discretionary basis. They may also apply exemptions to biofuels, among others, and to special sectors. The Directive acknowledges the political and structural particularities of each Member State, meaning that there are also exceptions for specific cases.

The tax base, according to Directive [5] 2003/96/EC, is the volume consumed in the case of petroleum-based products, and the energy content is the case of coal, gas and electricity.

Some dysfunctions were detected in this system. For example, there is no clear price signal for CO_2 emissions or energy content; nor are there sufficiently strong incentives for the development and use of alternative energies. There is also double taxation in the case of the industries that are subject to the European emissions trading market. In view of this, the European Commission issued a draft Directive in 2011 for which the appraisal process is still open.

In order to correct the inefficiencies found in the previous Directive, the most important addition in the new proposal is to divide the energy tax into two parts: one based on CO_2 emission levels and the other on energy content, both of which are to be equally applied to all energy products (apart from some exceptional cases).

[8] The following reports are of particular interest: (1) OECD [23] Environmentally Related Taxes in OECD Countries. Issues and Strategies. Paris; and (2) OECD [24] Taxing Energy Use. A Graphical Analysis, Paris.

[9] OECD [24] Taxing Energy Use. A Graphical Analysis, Paris.

This separation implies that energy products with zero emissions will be exempt from paying the tax, which therefore provides an incentive for alternative energies. On the other hand, a tax on energy content creates a clear signal in favour of saving energy.

The new proposal also includes the gradual phasing-out of subsidies that are not justified from an environmental viewpoint, and does away with the double taxation in the case of the EU ETS mentioned above. It also includes a gradual increase until 2018 in all the minimum tax levels already described in the current Directive, through most of the exemptions, reductions and exceptions contemplated in the 2003 Directive for special sectors (e.g. agriculture) and specific national or regional situations are maintained.

Total environmental taxes in the European Union currently account for between 2 % and 3 % of the GDP of Member States, peaking at 4 % in Denmark and Holland (followed by 3.4 % in Slovenia). In the case of Spain, France, Lithuania, Romania and Slovakia, however, they remain below 2 %.[10] Energy taxes account for most of this amount, but there are broad-ranging differences between countries, as shown in the bar chart below. Denmark, Luxembourg[11] and some of the new Member States[12] have the highest tax revenue. The countries with the lowest income from energy taxes are Belgium, France, Ireland and, in last place, Spain. In any case, it is important to note that in the case of the new Member States the high tax revenue is not so much because of high taxation levels but rather because of their high energy consumption. Thus, in a comparison of two countries with the same GDPs but different levels of energy intensity the one with the higher intensity would have a higher revenue/GDP ratio than the other, even if the latter has been making more efficient use of its energy (Fig. 2).

The bar chart above also reveals that transport appears to be subject to a considerably higher tax burden than other energy sectors. This disparity is clearly explained in the next section.

3.2 Proposals: Sending the Right Signal on an Economy-Wide Basis

3.2.1 The Need for a Sectoral Approach

It is highly complex to analyse energy and environmental taxation on a sectoral basis in a group of countries as broad and heterogeneous as those of the EU. Oversimplification could distort the general conclusions regarding the fiscal pressure to which consumers in each sector are subject.

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[10] Eurostat (2013), p. 41.

[11] However, as explained in OECD [24], Luxembourg is biased in this regard because of its high revenues from fuels for cars to be supplied to many non-residents.

[12] Extensions from 2004 and 2007.

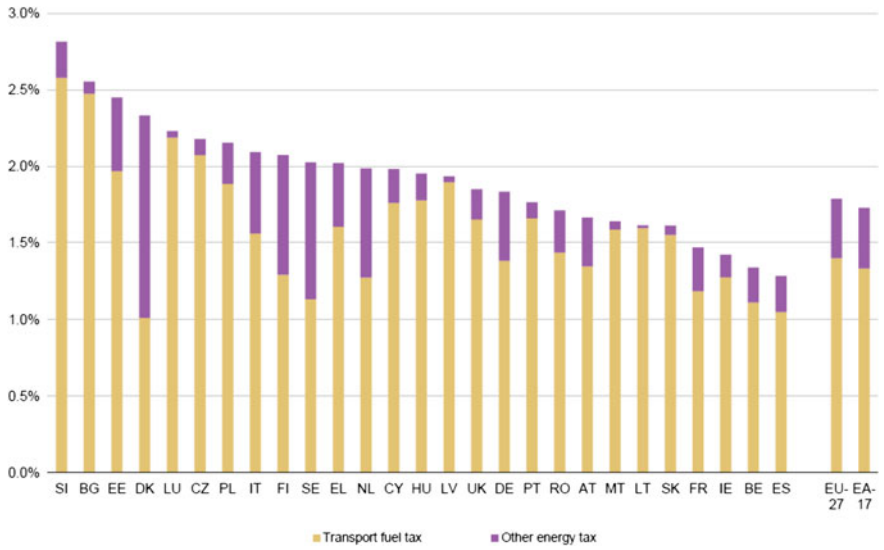


Fig. 2 Energy tax collection per Member State in 2011, expressed as % of GDP

This section sets out to draw some general conclusions on the basis of the ideas expressed in some recent OECD reports on energy taxation[13] and our own analysis based on experience in energy and environmental policy in the EU. To complement these conclusions, we mention various issues that should be taken into account when exploring how each sector contributes to the funding of energy and environment policies.

The report *Taxing Energy Use* (published by the OECD in January 2013) analyses for the OECD as a whole and for each member country how energy taxation is structured for three major sectors: transport, heating and electricity. The general conclusion is that of the three, the transport sector pays most taxes. This is confirmed both when analysing the information provided by the countries and when grouping their information together in the form of simple and weighted averages for the OECD as a whole. However, after this conclusion, the report also includes a significant number of very interesting additional reflections. We now sum up some of the main issues mentioned in the report in this regard, as well as some of our own ideas.

First of all, on the basis of the explanations provided in the report, it can be concluded that just because transport is affected by more taxes than other sectors, that does not mean that it is the sector that bears the highest energy or environmental tax burden. This is confirmed by the fact that the information from the sample of countries under consideration reveals that the tax rates established for transport address external issues that go beyond the energy or environmental

[13] OECD [23, 24].

sectors. For example, they address aspects such as congestion, public health problems derived from traffic accidents, problems associated with noise levels, etc. Moreover, the report indicates that most countries do not have an adequate framework for sharing out road use costs among users ("road pricing"), which means that governments have the incentive of using fuel consumption ("road fuel consumption") as a proxy for setting tax rates and thereby funding the costs of transport infrastructures (e.g. road construction and maintenance). In other words, most of the tax on transport is levied with the goal of funding transport infrastructures (although this is not the only goal pursued: as mentioned above, the tax collection goal plays an important role in energy taxation), i.e. for a purpose entirely different from energy and environmental policy.

One important indication of the lack of sustainability of the transport sector in the OECD countries is the rising trend in CO_2 emissions, which is often one of the factors that most hinder the emission reduction commitments undertaken by countries. Obviously, the tax on fuel used in transport is a major environmental signal. However, the fact that its origin, design and motivations fall entirely outside this scope mean that it is not often used to address the challenges faced in this sector.

Secondly, apart from the taxes in other sectors, such as electricity, consumers commit to costs, make contributions, and are even asked to provide funds with a view to funding compliance with environmental or energy targets set by governments. This phenomenon is can be clearly seen in the case of the European Union, where the electricity sector is subject to the EU ETS. Under this scheme, stakeholders have targets for bringing down emissions and incur a cost for every tonne of CO_2 that they emit in the electricity production process, which is then reflected in the market price for CO_2 emission allowances. This cost, which is not taken into account when calculating the energy or environmental taxation borne by electricity consumers, is equivalent to a tax on CO_2, which is not applied to the transport sector in the case of the EU. In addition to the cost of CO_2, as evidenced in the case of Spain, electricity consumers often fund most of the development of renewable energies with resources collected from their electricity tariffs.

Box 1. Quantitative analysis for Spain to illustrate the differences between the electricity and transport sectors as regards fiscal pressure and charges derived from energy and environmental policy

In Spain, the access tariffs payable by electricity consumers are used to fund many items not strictly linked to the power supply and which contribute to financing environmental or social policies (for example, premiums for renewable energies or support for domestic coal). To simplify our analysis, non-mainland compensation costs (paid by electricity consumers to compensate for the extraordinary cost that would apply to consumers for supplying electricity to island territories) and interruptibility costs are not included.

As well as the above, the price of electricity includes the cost of regulatory decisions that have given the electricity sector a special role in the

decarbonisation of the economy. A case in point is the cost of CO_2 emission allowances, to which the electricity sector is subject due to its inclusion in the EU ETS. It is obliged to reduce emissions and incurs a cost for every tonne of CO_2. In order to quantify this impact, the price of CO_2 futures and their repercussion on the market price are taken into account. Another energy and taxation policy decision that has an impact on the price of electricity is Act 15/2012 of 27 December on tax measures for energy sustainability, which introduces charges and fees that increase the cost of the technologies used for electricity generation. Although the exact extent of this impact is not yet known, a significant portion of the cost of these new tax rates will be internalised in the price of electricity in the wholesale market. As a conservative estimate, an increase in the whole market price of electricity of €5/MWh can be expected.
In analysing the hydrocarbons used in the transport sector[14] VAT, the special tax on hydrocarbons and the cost incurred by the sector for mixing biofuels are all taken into account. As regards income, it is assumed that there is an informal subsidy (net income), as the revenue from road and registration tax does not cover the total cost of infrastructures (which it should in theory cover), and there is no other tax whereby drivers take on this cost.
In view of the foregoing, the costs in Euros per gigajoule would be approximately as follows (Fig. 3):
The figures in the above table sum up most of the ideas set out in this chapter. Thus, by analysing energy and environmental taxation from a broad conceptual perspective—including the extraordinary costs derived from energy, environmental or social decisions—it is proved that electricity consumers (taking into account the aforementioned adjustments) pay for each unit of energy consumed almost three times more in charges that are unrelated to supply (€19.18/GJ) than consumers of petrol/gas-oil (€6.56/GJ) do.

Finally, most comparative analyses of energy and environmental taxation in different countries do not include regional taxes (e.g. *Taxing Energy Use*). This leaves out most of the fiscal pressure in countries with highly decentralised administrative structures, such as the US, Germany or Spain. In the latter country, exponential growth in new environmental taxes on electricity facilities and generation is a highly significant phenomenon.

The complementary analysis proposed in this section of the link between energy taxation applied to each sector and its economic contribution to meeting energy and environmental policy targets is completed with a numerical analysis in the section devoted to Spain. It combines the tax burden on each sector and its economic contribution via regulatory instruments (such as the CO_2 market, support frameworks

[14] This is simplified by considering petrol and gas–oil consumption.

€/GJ	Electricity	Petrol/gas-oil
VAT	7.70	6.65
Other taxes[a]	1.78	9.20
Other costs[b]	16.84	0.21
Other income	-7.14	-9.50
TOTAL	**19.18**	**6.56**

Fig. 3 Estimated extraordinary costs in electricity and transport sectors. **a** This includes tax on electricity in the case of the electricity sector and the special tax on hydrocarbons in the transport sector, **b** Costs not associated with electricity supply (premiums for renewables, etc.) and costs of biofuel mixture allowances for the transport sector

in place for renewable energies, pseudo-environmental taxes established by regions, etc.) to set up a level playing-field that enables the environmental burden on each sector to be determined.

3.2.2 Progress Towards a European Tax Reform to Include the Principles of Reform Raised in the Draft Directive: The Case of Spain

The impact assessment accompanying the proposal for a revised Directive, drawn up by the European Commission, acknowledges the need for tax harmonisation at European level to prevent distortion of the internal market due to the current situation with so many different taxes and concepts in each Member State. At national level there is a similar problem, leading to a scenario that might be described as "pseudo-environmental taxation".

Moreover, at state level there are few taxes that may be considered to be genuinely linked to the environment or to include the environment as a variable in any way. Corporation Tax, for example, provides for deductions in the case of investments that may be considered to be made in the environment, but beyond that these taxes are normally applied to the energy sector (transport and electricity). Therefore the transport sector is affected by various taxes that are sometimes at odds with environmental logic: for example, the Spanish IVMDH tax[15] is levied on bioethanol and biodiesel, both of which are renewable, but not on natural gas or LPG (liquid petroleum gas).

On the other hand, Spain's Autonomous Regions have compensated for the void in state-level environmental taxation: hence, most environmental taxes apply at regional and not at central government level [10]. However, regional taxes on the energy sector, and in particular on the electricity sector, have traditionally been based on a presumed environmental goal with the intention of increasing revenue from the regions. This category includes many charges and fees that are widely heterogeneous and geographically distant within the State. They mostly apply to electricity generation and distribution grids.

[15] Tax on the Retail Sale of Certain Hydrocarbons.



Fig. 4 Charges in the various Autonomous Regions. *Source*: own records

The lack of any true environmental goal in regional taxation is reflected in the fact that there is no provision for any form of tax benefits for investing in technologies that create less pollution and in the fact that there is no tax on CO_2 emissions, although other emissions (SO_X or NO_X) are taxed. Furthermore, as may be seen in the chart below, the taxes created have essentially penalised emission-free (nuclear) and low-pollution power plants (hydroelectric, wind), while favouring the types of generation plants that create more pollution (coal, gas, gas–oil) (Fig. 4).

There has been an alarming absence of coordination between the central government and the Autonomous Regions, which has created contradictory messages in the various legislations. On the one hand, the existence of different taxes in different regions has led to a break in the single market and the transfer of revenue between Autonomous Regions. Rather than environmental logic, the logic of revenue has been applied, meaning that the regions have ended up applying taxes to installations that already existed in their territories, regardless of their environmental impact, instead of preventing the creation of others that might create more pollution.

At national level, one recent example of legislation that was initially proposed on environmental grounds but ended up as a purely revenue-oriented instrument is Act 15/2012 of 27 December on fiscal measures for energy sustainability. This Act mostly consists of new charges and fees applied to the activities and assets of the Spanish electricity sector.

Lastly, it should be noted that this analysis does not look at the impact of other, non-fiscal regulations, which also have a certain effect on the environmental signal transmitted via energy prices. In contrast with more balanced plans, such as the

European Commission's recent 20–20–20 targets, the government has often mixed up the concepts of regulation and taxation, overlooking the indispensable complementarity between the two, and thus creating an uncoordinated system as far as environmental and energy legislation is concerned. Therefore, the current tax structure is not effective in addressing the challenges faced by the Spanish energy model, which requires strong incentives in favour of those technologies which are most efficient and have least environmental impact, and a stable framework to regulate activity regardless of regional preferences, so as to avoid pseudo-environmental taxation. Moreover, *ad valorem* taxes and subsidies on fossil fuels, or on the list of prices applicable to the various energy products, fail to comply with the optimal fiscal design principles set out at the beginning of this chapter as they do not reflect the actual damage produced by each energy source. The main challenge faced by regulators in Spain as regards matters of taxation is thus precisely how to establish a taxation framework that is capable of guaranteeing the long-term sustainability (in the broadest sense of the word) of our system.

4 Supporting Frameworks for Renewable Energies

4.1 Existing Supporting Frameworks for Renewable Energies

Directive [9] 2001/77/EC on Renewable Energies marked one of the first milestones in the promotion of renewable energies in the EU. The Directive was based on the 1997 White Paper on Renewable Energy Sources, which set a target of having renewable energies account for 12 % of the gross energy consumption in EU-15 by 2010 and the electricity generated from those renewable sources account for 22.1 %. The 2001 Directive gave the Member States total freedom to establish their own supporting frameworks. Therefore, the EU has basically committed to a combination of an indirect method—, the EU ETS, which penalises generation facilities that produce CO_2 emissions compared to those that do not—with direct methods at national level. Direct methods are dependent on the fact that the indirect method is insufficient to guarantee the competitiveness of using renewable rather than conventional energies. There are various different types of direct method.

These supporting systems can function by regulating the sale price of the electricity generated from renewable sources, either by introducing a fiscal or financial benefit per kW of installed capacity, or by deciding in full or in part what tariffs must be paid for each kWh generated and uploaded to the grid from a renewable source. In both cases, the market is accountable for the result in terms of the capacity to be installed. In other cases, the supporting framework is based on establishing a target power or generation level to be reached, in absolute or relative terms, and letting the market decide the price payable to generators for the renewable energy produced (Table 1).

Table 1 Direct methods for supporting renewable energies

	Regulated price	Regulated quantities
Based on investment	Investment subsidies Tax credits	Auctions
Based on production	Tariff/Premiums	Quota system and green certificates

According to the information gathered by the Council of European Energy Regulators (CEER) for its report of June 2013,[16] the majority system in the European Union is based on feed-in tariffs or feed-in premiums. Under this supporting framework, generators of electricity from renewable sources are entitled to sell all of their output. They do so at prices that are either fully decided (total regulated tariff) or only partially decided by law (regulated premium or incentive added to the price per kWh in the electricity market).

Another supporting framework that widely used in Europe is the quota and green certificates system, which has been running with variations in some EU countries for several years (e.g. Italy, Belgium, UK). It is essentially based on legally obliging electricity consumers, suppliers or generators, depending on the case, to obtain a particular percentage or quota (which generally increases over time) of their electricity supply or output from renewable energy sources. At the end of each consecutive period under consideration (usually a year), the parties bound by the quota must prove their compliance by submitting to the relevant National Regulatory Authority a number of green certificates equivalent to the quota specified. One green certificate is usually equivalent to one MWh of renewable energy.

Lastly, another supporting system that has been implemented to a certain degree, notably in France and Portugal, is based on an auction system. In this case, developers are invited to submit bids for a limited quantity of power or energy in a given period. The companies that offer the supply at the lowest cost are awarded long-term contracts, generally for a period of between 15 and 20 years.

The 2001 Directive was amended and replaced by the Renewable Energies Directive [6] 2009/28/EC, which has been consolidated as the basic regulatory framework for promoting renewable energies in Europe. It sets compulsory national targets that are consistent with achieving the European target of having renewable account for 20 % of final energy consumption in the EU by the year 2020 and 10 % in the case of the transport sector. This Directive has introduced elements designed to simplify the administrative regimes applicable to renewable and regulatory improvements that facilitate access by electricity systems to electricity generated from such sources. It also provides for an overall sustainability system for biofuels and bioliquids, with obligations as regards monitoring and information.

Apart from these basic elements, the Renewables Directive, as it is known, maintains countries' freedom to define their own supporting frameworks.

[16] CEER [3] "Status Review of Renewable and Energy Efficiency Support Schemes in Europe". 25 June 2013.

The following table summarises the main supporting frameworks in place, listed by country and by the type of technology involved (Table 2).

In what follows the main results of these supporting frameworks are analysed from an empirical perspective and in terms of their effectiveness and efficiency, using the progress reports issued by the European Commission (Renewable Energy Progress Report COM [27], p. 175) and the Status Review of Renewable and Energy Efficiency Support Schemes in Europe of 25 June 2013, published by the CEER. This information serves as the basis for the conclusions drawn and for justifying the proposals made in Sect. 2.2.

The report drawn up by the European Commission starts by analysing the extent to which the targets that marked out the course of the Directive for the years 2012/2012 were reached. It then goes on to analyse the prospects for future growth in terms of meeting the target for 2020. In this latter case, it looks at the gap between what was planned for each technology (targets) and the estimated future roll-out, in terms of the current regulatory and economic conditions.

As regards diagnosing the extent to which targets are now being met, the Commission seems optimistic. As a result of the implementation of the Renewables Directive and the national measures defined in the plans of action on renewable energy, most Member States have witnessed significant growth in renewable energy since the previous report on the matter was drafted by the Commission.[17] In fact, the quota for renewable energies in twenty Member States and in the EU as a whole in 2010 was the same as or higher than the commitments for that year stated in their national plans and higher than the first intermediate target for 2011/2012.[18] As can be seen in the following bar chart, most of this success is due to the high degree of implementation of renewables in the electricity sector. In the transport sector, 22 Member States failed to attain their indicative target of 5.75 % for 2010 (Fig. 5).

Looking ahead, the Commission appears to be less optimistic. The economic crisis, the current obstacles in terms of administrative issues and infrastructure and changes in policies and supporting frameworks all suggest that a fall-off in future investments is highly likely, compared to the levels of investment planned in the renewable energy plans of the Member States. Nonetheless, there are differences in this trend depending on the technology. While wind power (onshore and offshore), biomass and biofuels predictably fail to attain the levels planned for them, solar photovoltaic is set to exceed its planned level as a result of disproportionate growth due to a supporting framework that has offered incentives not linked to changes in costs for this technology.

In the case of wind power, the European Commission report points out that according to the Member State plans, wind power capacity should reach 213 GW in 2020 (169 GW on land and 44 GW offshore). This capacity would lead to wind

[17] Renewable Energy: Progressing towards the 2020 Target (COM (2011), p. 31 and SEC(2011), p. 130).

[18] The interim targets are included in the indicative trajectory provided in Annex I, Part B, of Directive [6] 2009/28/EC. The interim target for the EU for 2011/2012 was 10.7 %.

Table 2 Types of supporting frameworks in Europe, arranged according to technology (2012) *Source*CEER (2013) Status review of renewable and energy efficiency support schemes in Europe

	Hydro	Wind	Biomass and waste	Biogas	Photo-voltaic	Geo-thermal
Austria	Investment grants, Feed-in tariff	Feed-in tariff	Feed-in tariff	Feed-in tariff	Investment grants, Feed-in tariff	Feed-in tariff
Belgium	Green certificates with guaranteed minimum price	Green certificates with guaranteed minimum price	Green certificates with guaranteed minimum price	Green certificates with guaranteed minimum price	Green certificates with guaranteed minimum price	Green certificates with guaranteed minimum price
Czech Republic	Feed-in tariff Feed-in premium	Feed-in tariff Feed-in premium	Feed-in tariff Feed-in premium	Feed-in tariff Feed-in premium	Feed-in tariff Feed-in premium	Feed-in tariff Feed-in premium
Estonia	Feed-in premium	Feed-in premium	Feed-in premium	Feed-in premium		
Finland	Excise tax return	Excise tax return	Excise tax return	Excise tax return		
France	Feed-in tariff	Feed-in tariff Call for tenders	Feed-in tariff Call for tenders	Feed-in tariff	Feed-in tariff Call for tenders	Feed-in tariff
Germany	Feed-in tariff, Direct marketing Feed-in premium	Feed-in tariff, Direct marketing Feed-in premium	Feed-in tariff, Direct marketing Feed-in premium		Feed-in tariff, Direct marketing Feed-in premium	Feed-in tariff, Direct marketing Feed-in premium
Hungary	Feed-in tariff	Feed-in tariff	Feed-in tariff	Feed-in tariff	Feed-in tariff	Feed-in tariff
Italy	Green certificates Feed-in tariff	Green certificates Feed-in tariff	Green certificates Feed-in tariff	Green certificates Feed-in tariff	Feed-in premium	Green certificates Feed-in tariff
Lithuania	Feed-in tariff	Feed-in tariff	Feed-in tariff	Feed-in tariff	Feed-in tariff	
Luxembourg	Feed-in tariff Feed-in premium	Feed-in tariff Feed-in premium		Feed-in tariff Feed-in premium	Feed-in tariff Feed-in premium	
Netherlands	Feed-in premium	Feed-in premium	Feed-in premium		Feed-in premium	
Norway		Investment grants				

(continued)

Table 2 (continued)

	Hydro	Wind	Biomass and waste	Biogas	Photo-voltaic	Geo-thermal
Portugal	Feed-in tariff	Feed-in tariff Tendering process	Feed-in tariff Tendering process	Feed-in tariff	Feed-in tariff	
Romania	Green certificates	Green certificates	Green certificates	Green certificates	Green certificates	
Slovenia	Feed-in tariff	Feed-in tariff	Feed-in tariff	Feed-in tariff	Feed-in tariff	
Spain	Feed-in tariff or Feed-in Premium (optional)	Feed-in tariff or Feed-in Premium (optional)	Feed-in tariff or Feed-in Premium (optional)	Feed-in tariff or Feed-in Premium (optional)	Feed-in tariff (PV) and Feed-in tariff or Feed-in Premium (CSP)	***
UK	Green certificates Feed-in tariff	Green certificates Feed-in tariff	Green certificates		Green certificates Feed-in tariff	

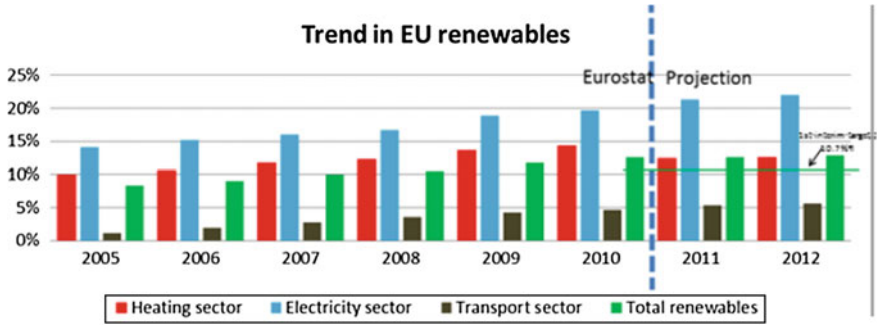


Fig. 5 Sectoral and overall growth of renewable energies in the EU (Eurostat) *Source* Renewable Energy Progress Report COM [27], p. 175 final. 27 March 2013

power generation amounting to almost 500 TWh in 2020. However, estimates based on current trends indicate that there is a risk that wind power may only reach around half the capacity planned, at 253 TWh.

For biomass in general the trend is also negative, although less so than in the case of wind power.

As regards solar photovoltaic energy, the situation and the expectations are very different, as the scheduled targets have been exceeded at practically every stage in the period. The strong growth in recent years has created a surplus that will continue for quite some time. The EU's verdict in the report is very clear: "An optimistic and secure EU market helped lead to a build-up of global PV production capacity, as China, India and the US entered into a new, EU-triggered global PV market. The resulting overcapacity has brought production costs down significantly. However rigid national support schemes were generally unable to adapt rapidly enough to such falling costs, raising profits and creating a rate and scale of installations in some countries almost excessive in a time of general economic crisis (Figs. 6, 7)."[19]

As stated previously, to gain an understanding of the differences in the stages of implementation of the various renewable technologies it is useful to analyse the levels of support received by each one. The table below (taken from the CEER report) shows how solar photovoltaic energy has received levels of support far in excess of other technologies. Moreover, bearing in mind that in most cases that support has been provided in tariffs that guarantee the tariff for the installation over very lengthy periods, it is easy to understand why there has been a disproportionate response (or "bubble") surrounding the roll-out of this technology in countries such as Spain, Italy and Germany (Table 3).

An analysis of the supporting frameworks for renewable energies leads to very interesting conclusions on the basis of experience in Europe, with various success stories and failed initiatives.

[19] COM (2013), p. 175 final.

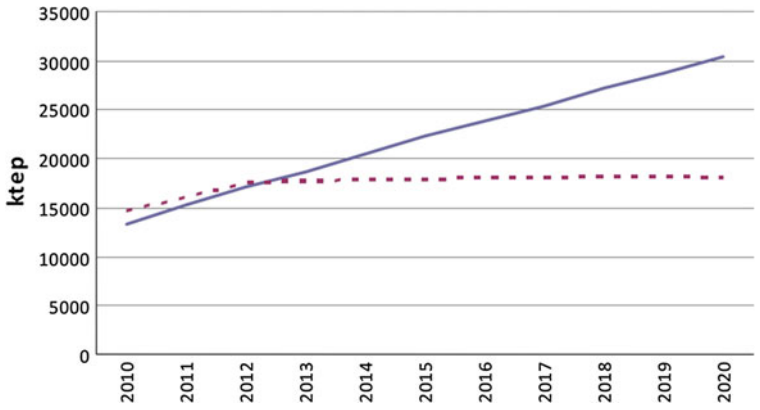


Fig. 6 Planned (*blue*) versus estimated (*red/dotted*) trend in EU onshore wind power

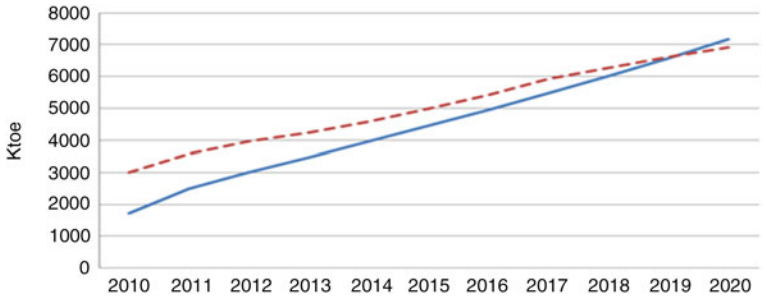


Fig. 7 Planned (*blue*) versus estimated (*red/dotted*) trend in EU solar photovoltaic energy Source Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Renewable Energy Progress Report. COM [27], p. 175 final. Brussels, 27 03 2013

In general terms, experience shows that systems which work for one type of technology do not necessarily work for others based on very different cost levels or levels of technological development. Empirical evidence also reveals that supporting frameworks have in general been effective in promoting the roll-out of renewable energies in Europe. However, enough priority has not been given to efficiency, which is set to become an increasingly important issue as the share of renewable energies in the energy mix grows.

Premium systems in particular may be considered to have been effective in the light of the expanding roll-out of renewable energies in European electricity systems. However, from the point of view of efficiency, there have been major drawbacks. One very significant consequence of the disproportionate development of some renewable technologies is the increasing need for support, which is funded in most systems by electricity consumers (via the revenue collected from electricity tariffs). This has increased the cost of the electricity supply even more in those

Table 3 Weighted average support level (on electricity supported) by technology (€/MWh)

	Hydro	Wind	Biomass	Biomass And waste	Photo-voltaic	Geo-thermal	Total
Austria	1.13	21.55	81.12	98.20	263.64		46.49
Belgium	45.17	94.58	96.57		407.42		142.04
Czech Republic	57.08	63.56	55.06	107.50	432.33		196.32
Estonia	51.61	53.68	53.68	56.25			53.66
Finland	4.20	11.97	6.74	4.20			6.93
France	13.17	33.04	54.85	41.45	477.22		116.00
Germany	48.66	45.43	143.74	25.97	353.82	157.59	130.77
Hungary	71.78	111.48	112.97	108.77			107.33
Italy	70.30	69.00	119.90		367.20	80.00	153.69
Luxembourg	79.33	36.38		70.46	543.43		138.21
Netherlands	103.93	68.47	75.11	41.33	385.88		70.89
Norway		11.27					11.27
Portugal	40.54	42.68	49.16	39.51	291.78		47.03
Romania	59.81	65.17	63.77		78.74		64.39
Slovenia	23.47	95.38	87.24	126.76	343.07		81.05
Spain	39.02	40.94	75.11	31.26	356.76		84.80
Sweden							21.47
UK	64.81	72.71	58.48	62.80	290.37		59.92
Minimum support	1.13	11.27	6.74	4.20	78.74	80.00	6.93
Maximum support	103.93	111.48	143.74	126.76	543.43	157.59	196.32

Source Status review of renewable and energy efficiency support schemes in Europe
Ref C12-SDE-33-03. 3 December 2012 . Revised: 19 February 2013

countries where the bubble is largest. The following graph illustrates the extent of the support paid for by electricity consumers in each country for each MWh of electricity consumed in relation to the share attained by renewables. It is noteworthy that Spanish and Portuguese consumers lead the cost ranking (Fig. 8).

In theory auction systems (or tendering processes) provide advantages (they generate competition between developers that maximises efficiency, enables the amount of installed capacity that corresponds to renewable to be monitored, offers stable returns, etc.). However, not enough have been conducted for it to be possible to compare all of these advantages properly.

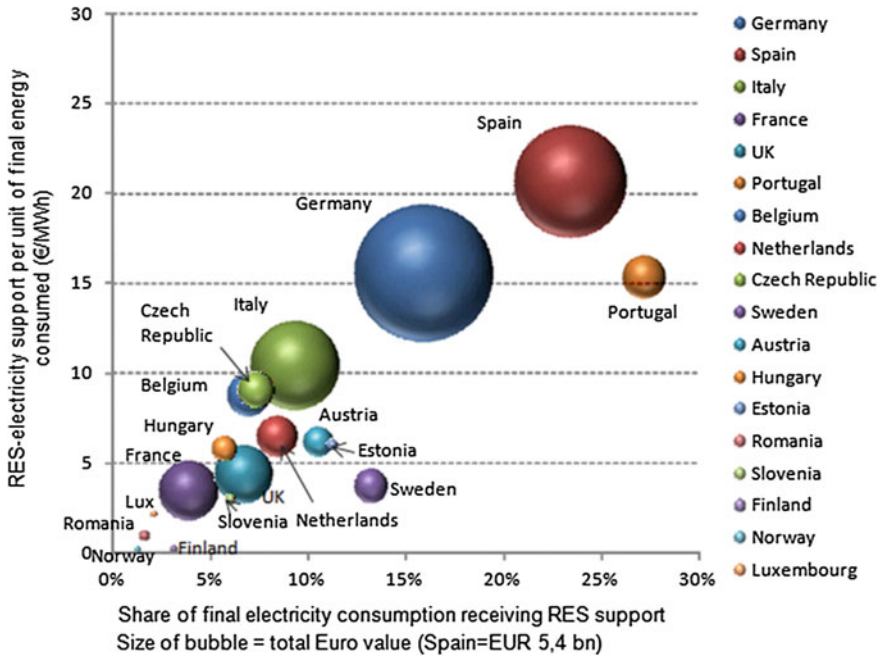


Fig. 8 Costs derived from support for renewable energy per unit of electricity consumed versus share in final energy consumption *Source* Status Review of Renewable and Energy Efficiency Support Schemes in Europe. Ref: C12-SDE-33-03. 3 December 2012. Revised: 19 February 2013

The analysis carried out in this section points to two main basic conclusions. As regards the premium and tariff systems, experience shows that although they have proved effective in attaining the targets set there is no control over the quantities being installed, and therefore in the case of technologies that evolve quickly bubbles may develop when levels of support are decoupled from costs. On the other hand, the fact that it is electricity consumers who for the most part finance support for renewable energy means that the increase in the roll-out of these technologies has a major impact on electricity bills and hence on the cost of electricity, making it relatively less competitive compared to other types of energy (natural gas, fuel-oils, etc.).

Box 2. Lack of control in the installation of solar technologies: the case of Spain

In Spain the generous tariffs and premiums assured by RD (Royal Decree) 661/2007 for solar technologies encouraged disproportionate growth in the installation of solar photovoltaic and solar thermoelectric technologies, meaning that the targets set in the Renewable Energies Plan (and RD 661/2007) for 2010 were significantly exceeded (Figs. 9, 10 and 11).

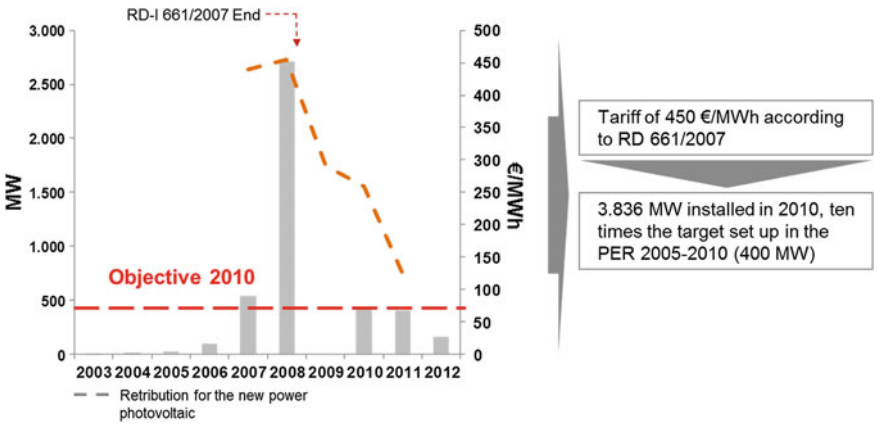


Fig. 9 Trend in installed solar photovoltaic capacity (MW). Remuneration PV type II (€/MWh) *Source* CNE

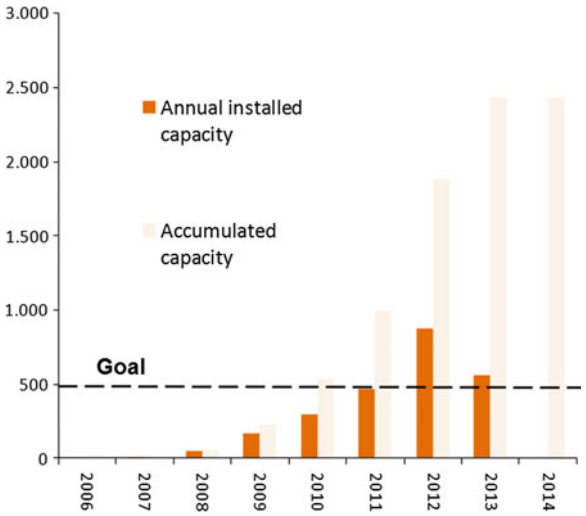


Fig. 10 Trend in installed concentrated solar capacity (MW) Source: CNE

4.2 Proposals

In the medium (2020) and long term (2030/2050), the challenge is to meet renewable energy targets in an efficient manner. In this regard, it is important to remember that many technologies are becoming increasingly competitive and it is to be expected that many of those that are not there yet will become competitive within a few years. This means that it will be necessary on the one hand to decide what kind of targets should be set, and on the other to adapt the supporting frameworks to the characteristics of each technology: premiums for those that are already mature, pilot

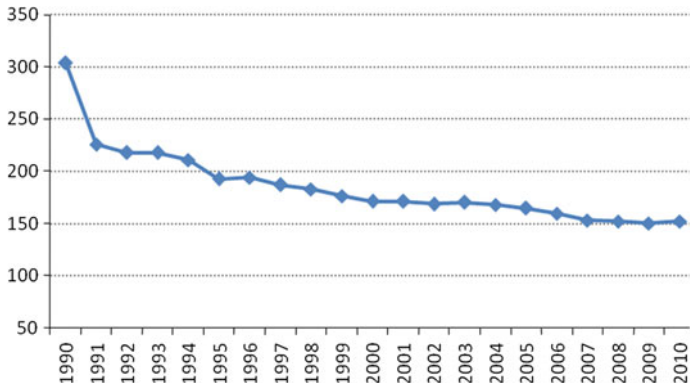


Fig. 11 Trend in energy intensity in EU 27 (ktoe/€1000) (Energy intensity of the economy—Gross inland consumption of energy divided by GDP (chain-linked volumes—reference year 2005)—kgoe (kilogram of oil equivalent) per €1000) Source Eurostat

projects for those that are immature. From the point of view of targets, experience with the 2020 goal confirms that setting various different targets has led to interference between them and, in turn, to inefficiencies. The European Commission's Green Paper asked stakeholders about this issue with a view to designing the framework for targets beyond 2020. Many of the stakeholders that responded to this public consultation revealed that they were in favour of setting a single target for reducing CO_2 emissions, so as to transmit a clear signal to encourage investments in zero-emissions technology, among which renewable energy will play a very significant role. This CO_2 target could be accompanied by indicative targets for renewables and by support for R&D&I in less mature technologies.

Bearing in mind the experience gained from the various policies to support renewable energies that have been implemented in Europe, some recommendations can be made with a view to improving the environmental and economic soundness of these policies and their compatibility with the competitiveness of the electricity supply. The main proposals can be summed up as follows:

- In order to set targets, it is necessary to perform a thorough analysis of current and future demand, in accordance with the elements that characterise the current and future context. The economic situation means that there is a need for a realistic outlook so as not to set overambitious targets when public support is required.
- A suitable role needs to be allocated to each renewable technology. The most cost-effective will be of key importance in meeting the targets and those with the greatest potential for cost reduction in the future will require smart support based on R&D or industrial policies funded by the general state budget. It is also crucial to analyse the potential for and cost of development in all energy sectors —heat and cold, electricity and transport—as they are all responsible for meeting the target of 20 %.

- Supporting frameworks should be adapted to the characteristics of each technology. Providing incentives for mature, stable technologies is not the same as providing them for energies which may be more expensive but which have great potential for cost reduction.
- As regards the allocation of cost overruns incurred in renewable development, although it is efficient to concentrate more renewable development in the electricity sector because it is the most cost-effective, it does not make sense to expect electricity consumers to bear the full cost. Therefore, the cost of renewables should be allocated to consumers of all final types of energy (heating, electricity, gas and oil), as it is they who generate the need for development.
- The timeline for roll-out should be adjusted in order to minimise the cost of compliance with the Renewable Energies Plan. It is important to adapt the development of renewables to meeting targets in 2020 and not before, so that it is possible to develop a spin-off industrial sector that is sustainable over time.

As well as the foregoing, if renewables are to penetrate the electricity sector efficiently it is vital to acknowledge the support/back-up provided by firm, flexible conventional technologies (particularly hydro power plants and natural gas combined cycles). It is also essential to boost the levels of interconnection in Europe from the current situation. A penetration rate of some 40 % by renewables in 2020 might in some cases mean very high coverage for electricity demand: higher than is currently the case. Obviously this would generate significant risk because the demand could not be guaranteed with non-firm energies such as those referred to as "intermittent" renewables (wind and solar power). There is also the issue that there needs to be sufficient capacity to deal with fluctuations in demand and fluctuations as a result of those technologies that cannot be controlled.

5 Regulations to Promote Energy Efficiency

5.1 A General Approach to the Regulation of Energy Efficiency in the EU

The European Union is among the economic areas that have spearheaded improvements in energy efficiency. This is due to the following factors: on the one hand the major structural changes in the economy of this group of countries (in general terms, the economy has been outsourced, and the most energy-intensive industries have been relocated to other economic areas), and on the other the implementation of various different policies and regulatory instruments designed to improve energy efficiency (Figs.11, 12).[20]

[20] This section is based on Muñoz Rodríguez et al. [22] WP 12/2013. "Reflexiones sobre los esquemas de obligaciones de ahorro energético (certificados blancos) en Europa". *Economics for Energy*.

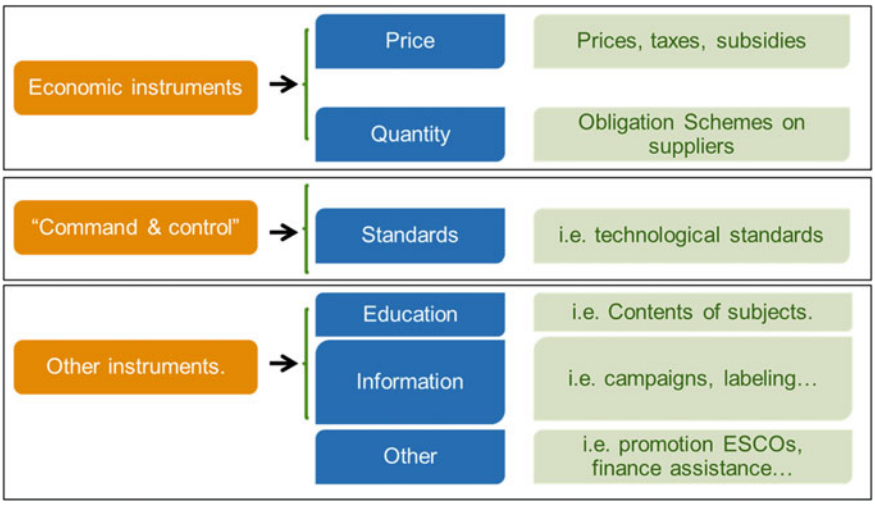


Fig. 12 Main regulatory instruments for improving energy efficiency *Source* own records

In fact a large proportion of the improvements achieved in energy efficiency are due to the application of policies and regulatory instruments to overcome barriers and correct the market failures that prevent investments in efficiency from attaining optimum levels. The huge variety of regulatory instruments that have been developed in the European context can be grouped into four main areas: economic instruments affecting price and quantity, "command-and-control" measures, measures designed to enhance information, awareness and the possibilities available to consumers, and "other measures".

Economic measures based on the introduction of price signals are implemented by governments in order to attain an energy efficiency target, under the assumption that the price signal will have a major impact on consumption. Highlights of these measures include prices that reflect the costs of energy and external issues, energy and environmental taxation and redefining the tariff structure.

The second group of economic instruments involve setting efficiency targets. This makes them quantity-based economic instruments in which governments impose targets on distributors and/or energy suppliers to get them to bring down their customers' consumption within a certain period. In general, the companies themselves can decide what procedures to carry out in order to meet these obligations. This type of instrument is used in various EU countries (UK, France, Italy, etc.) and was granted a special role in the recently passed Energy Efficiency Directive. A more detailed analysis of these instruments is therefore presented in this section.

One instrument is described in the literature in the section on "command-and-control": it consists of setting minimum compulsory norms and standards for consumer equipment (vehicles, buildings, electrical appliances and other electronic devices). This is usually considered to be a highly suitable measure for achieving structural improvements in energy efficiency and it has been rolled out to a high

degree throughout Europe. In many cases, these standards have been set on a centralised basis for the EU as a whole.

There are also measures designed to enhance information, heighten awareness and improve the possibilities available to consumers. These measures include information campaigns, energy labelling for equipment, energy audits and the funding of investments in energy efficiency (mostly reductions in taxation, though there are also subsidies). There are also special benefits for low-income families, e.g. in the United Kingdom. Despite the importance of achieving a high degree of awareness in society regarding energy efficiency and of improving the possibilities available to consumers when making decisions on consumption and investment with a view to reducing their energy consumption, the efficiency of this type of measures is diminished if energy prices fail to incorporate all the costs of supply or if consumers are unable to estimate all the costs associated with their energy consumption.

The group referred to as "other measures" comprises provisions of various kinds that are instrumented in all of the countries examined. Chief among them are the adoption of standards for the construction and refurbishment of buildings, the promotion of energy service companies (ESCOs), stricter regulations for the public sector as regards building and supplier approval, voluntary agreements with companies and funding for R&D. In general, it is hard to predict how effective this type of provisions will be, and they depend on the existence of a regulatory framework containing the right economic instruments to encourage investments in efficiency.

The European debate on the suitability of the various policies or regulatory instruments for helping to improve energy efficiency was further boosted with the passing in October 2012 of the Energy Efficiency Directive, which is now in the process of being transposed into law in the various Member States, and which includes or builds on most of the instruments analysed in this section.

5.2 The Energy Efficiency Directive

The Energy Efficiency Directive [7] 2012/27/EU (EED) proposes overall as well as sectoral targets, regulatory instruments, measures to promote funding for efficiency measures and a conceptual framework for monitoring and supervising the progress made in this regard.

In relation to targets, the overall goal at European level is to achieve a 20 % reduction in primary energy consumption in the EU by 2020 compared to the projection for the year made in 2007. This means that primary energy consumption in the EU should not exceed 1,474 Mtoe (1,078 Mtoe in terms of final energy consumption) in 2020.

On the basis of this overall target set for the EU, the Directive provides that each Member State should set an indicative target for energy efficiency based on energy consumption (primary or final) or on energy intensity.

The regulatory instrument with the greatest impact is described in Article 7, which details an energy efficiency obligation scheme with targets for the Member

States and regulatory alternatives for achieving them. These obligations on suppliers or distributors (commonly referred to as "white certificates") have sparked the most debate, as a result of different positions regarding their characteristics and impact in terms of cost and results.

Box 3. Reflections on energy efficiency obligation schemes (white certificates) in Europe

An energy efficiency obligation system or "white certificate system" (when trading with certified savings is allowed) is a regulatory instrument that obliges the parties in question (generally energy companies) to achieve a certain degree of energy savings both in their own sector and elsewhere (other industrial sectors, the residential or commercial sector, etc.). These savings may be made by implementing various measures, which must be approved or acknowledged in some way by the competent authority. Such systems therefore require a way of verifying and measuring the effective implementation of measures leading to the specified savings.

The profile of "white certificate" systems has risen as they have spread to more countries. Frameworks of this kind are currently in place in Italy, France, Denmark and the United Kingdom, and in the Belgian region of Flanders. There are also plans for their implementation in Ireland and Poland. There are still many unanswered questions as regards their effectiveness and efficiency, given the limited experience in their application, the lack of transparency and the difficulties encountered in comparing relatively complex frameworks in very different commercial settings. These issues are developed in greater detail in the section on analysis.

One important element to be taken into consideration when analysing white certificate schemes is that they focus on the behaviour of the energy supplier (or distributor) but not on that of the consumer. In this regard, investments made by consumers (for example, improvements in insulation) do not necessary have an impact on their awareness or behaviour as regards energy savings. In fact, reducing the effective cost of energy (if efficiency is increased after the measures) could lead to a "rebound effect" to some extent. How big that "rebound effect" might be is still the object of considerable debate. However, there is a degree of consensus that it is unlikely to be big enough to mitigate the effect of the measure. The study by Greening, Greene and Defiglio [16], which reviews prior literature on the "rebound effect" and energy efficiency, does not overlook these problems but concludes that the effect is in any case lower than one unit (i.e. it does not exceed the savings achieved), meaning that energy efficiency is still a tool that can achieve positive results. Moreover, analysis of the existing frameworks has failed to provide conclusive evidence that white certificate systems promote the implementation of the most cost-effective and most efficient measures, or even that they meet the requirement of "additionality". This is partly because of the duration and characteristics of the obligation periods and partly because of the type of

measures that are liable to receive certificates. Rather, it seems that it is the easiest measures or the ones for which certificates are most likely to be received that are usually carried out, and that these are not necessarily the most efficient ones. When the obligation period is short, the tendency is likely to be to choose cheaper, more short-term measures rather than measures that would require greater initial investment but save more energy in the long term. Moreover, in some cases (for example, in France and Italy), some measures receive double support (both tax credits and certificates), which also raises doubts as to the efficiency of the system as a whole. In this regard, there are still unresolved doubts regarding the structural savings that can actually be achieved by these frameworks, as the data available are not clear or comparable enough to ascertain the actual volume of savings achieved.

5.2.1 Obligations on Energy Suppliers

Article 7 of the EED imposes on Member States the obligation to develop a system of energy efficiency obligations for energy suppliers, setting an annual savings target (for the period 2014–2020) equivalent to 1.5 % of the annual energy sales of all their retail energy distributors or suppliers, in volume, as the average for the three years before 1 January 2013. Some issues regarding this target are the following:

- The parties obliged to meet this target may be distributors, suppliers or both.
- There is no specification as to what energy sectors are to be subject to this system. For example, energy consumed in transport might not be included.
- From the point of view of additionality, the Directive implies that every Member State will be obliged to achieve further savings every year equivalent to 1.5 % of sales in the three years prior to 1 January 2013. For example, if the average sales were 100 Mtoe, then the savings progress required in the period would be as follows (Table 4):

Article 7 in fact means the imposition of an energy savings target for the Member States, which will be given significant flexibility as to how they meet it via

Table 4 Example featuring additional annual savings required under article 7 EED

2014	1.5 Mtoe
2015	3 Mtoe
2016	4.5 Mtoe
2017	6 Mtoe
2018	7.5 Mtoe
2019	9 Mtoe
2020	10.5 Mtoe
Total	42.0 Mtoe

various mechanisms, either as part of the obligation scheme or by implementing regulatory alternatives aimed at achieving the target. Both these alternatives are specified with the possibility of replacing the obligation scheme with an alternative regulatory framework (with taxes, standards, etc.) or with a national fund for energy efficiency to which stakeholders make contributions in order to fund energy efficiency measures.

5.2.2 Flexibility in Meeting Targets (Maximum 25 %)

As discussed above, article 7 of the EED offers flexibility[21] as regards how the target is met. However, it provides a closed list of flexibility measures and limits their application to a maximum of 25 % of the energy savings that would be derived from the original target of 1.5 %. The following are the main flexibility measures:

- Flexibility in target progress: 1 % (2014 and 2015); 1.25 % (2016); 1.5 % (2018, 2019, 2020).
- Exclusion of sales to sectors subject to the EU ETS.
- Possibility of including in the calculation savings derived from measures implemented since January 2009 (with effect in 2020).
- Inclusion in the calculation of energy savings derived from co-generation, tariffs, smart metres, etc.[22]

5.2.3 Degree of Discretion in Designing the Obligation System

In principle, the European regulation offers Member States considerable scope for manoeuvre as to the supplier obligations framework, listing a number of elements, many of which are commonly used in countries where this type of frameworks are in place, but not making their inclusion compulsory.[23] These elements include:

- Banking/borrowing of savings (for 3 or 4 years).
- Introduction of an obligation for parties subject to the regulatory framework to carry out measures for households in "energy poverty" or affected by certain types of social vulnerability.
- Inclusion of the transport sector. The possibility of the energy supplied to the transport sector also being subject to these targets is left open. One important example of a framework in which liquid hydrocarbons are subject to savings obligations is the French system.

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[21] "The application of the terms provided in Sect. 2 shall not lead to a reduction of over 25 % in the amount of energy savings referred to in Sect. 1". Article 3.

[22] "Allow energy savings achieved in the energy transformation, distribution and transmission sectors, … to be counted towards the amount of energy savings required…".

[23] See Appendix.

5.2.4 Possibility of Alternatives to the System of Obligations on Suppliers

This item in the Directive is very significant, because it grants Member States a degree of discretion as regards setting up a system of obligations on suppliers if equivalent savings are achieved through regulatory measures or energy and taxation policies such as the following:

- Taxes on energy or CO_2.
- Tax or financial incentives.
- Voluntary agreements.
- Standards and norms (not previously compulsory).
- Labelling.
- Training and awareness measures.

5.2.5 National Energy Efficiency Fund: Funding and Technical Support

As well as the alternatives listed in the previous item, there is also the possibility of creating what is referred to as a National Energy Efficiency Fund (Article 20), which allows a Member State to achieve savings equivalent to the 1.5 % target of a system of obligations on suppliers, by simply creating a fund towards which the obligated parties would then make financial contributions:

> 6. Member States may provide that obligated parties can fulfil their obligations set out in Article 7(1) by contributing annually to the Energy Efficiency National Fund an amount equal to the investments required to achieve those obligations.

In short, although the Directive defines obligations in relation to energy efficiency at supplier level for Member States, the energy efficiency obligation system may be partially or fully replaced by a regulatory framework that enables equivalent savings to be made or by a fund to which the stakeholders subject to the targets must contribute. The following diagram sums up the regulatory frameworks that could be used in order to attain the 1.5 % target (Fig. 13).

5.2.6 Role of the Public Sector

The EED considers the public sector to be one of the priority areas for savings. The proposals in this regard are based on European experience in this field, with the public sector becoming a major driver in the energy services market, because of the high significance of its investments and its purchasing power. It therefore sets as an explicit savings target for the public sector in each Member State the obligation

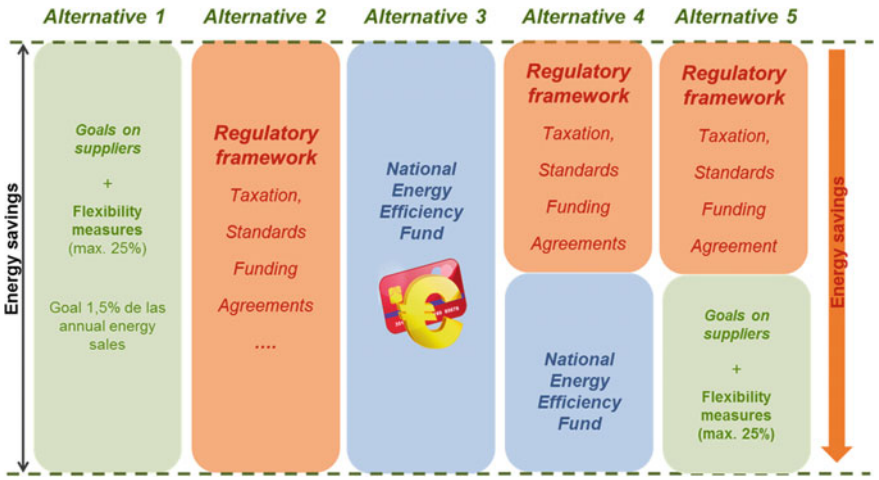


Fig. 13 Possible regulatory frameworks for energy efficiency under Article 7 of the Energy Efficiency Directive Source own records

to renovate 3 % per annum of the total floor area of buildings owned and occupied by central government in order to increase their energy efficiency:

- This obligation applies to buildings with a floor area of more than 500 m^2;
- The following are exempt from compliance with this target: buildings that have special historical merit or which are part of a designated environment; buildings serving national defence or religious purposes, etc.

As in the case of the obligations schemes on suppliers, public bodies may also meet this target by making financial contributions to an energy efficiency fund.

5.2.7 National Energy Efficiency Action Plans

By 30 April 2014, and every three years thereafter, Member States must submit National Energy Efficiency Action Plans providing details of national energy efficiency targets and measures taken to ensure that they are met.

5.2.8 Other Measures

The Directive provides a wide range of measures but their analysis lies outside the scope of this chapter. Most of them are focused on making the most of the great potential for savings in the heating sector, improving incentives for efficiency in the field of energy networks and promoting consumer information and awareness.

5.3 Analysis and Assessment of the Regulatory Framework for Energy Efficiency

The European regulatory framework, and the EED in particular, contains a broad spectrum of regulatory instruments which are commonly used to address the barriers and market failings that prevent full potential from being reached in the area of energy efficiency.

Energy prices are considered by many authors to be the most useful of all economic instruments in promoting energy savings and efficiency. In many cases, there is a need to act on them because they do not include external issues or are not high enough to encourage consumers to rationalise their consumption.[24] Some studies go beyond the use of prices to send signals that encourage energy savings and also consider the hypothesis of induced innovation, according to which an increase in energy prices leads to technological changes that enable improvements to be made in energy efficiency (Newell et al. 1999).

Price measures have the advantages of being easy to implement and of their low incremental cost for the administration, but they are unpopular because they mean an increase in the cost of supply for consumers. To reduce popular dissent, in some cases the revenue collected from these taxes is allocated to aims with an environmental or social component (measures to combat climate change, care for certain ecosystems, grants to low-income consumers, etc.). Although their impact may be limited, because there is less flexibility in the short term, international experience has proven them to be the most effective and efficient measures in attaining energy efficiency targets.

In the case of standards there is the risk of a "rebound effect", i.e. of energy consumption increasing in certain sectors. Therefore they must be designed very carefully. On the supply side, more efficient machinery may imply greater energy consumption in the production process. On the demand side, more efficient electrical appliances may be kept on for longer (e.g. air-conditioning).

One of the main barriers traditionally been identified in the diagnosis by the European Commission and aggravated by the economic crisis is a shortage of funding due to the diminished financial capacity of public bodies, companies and households alike. The need to raise economic resources in order to make investments was probably behind the proposal for a framework of obligations on suppliers as the main regulatory instrument included in the Directive, in the light of European experience in this field. However, there are still many unanswered questions as to its effectiveness and efficiency, given how limited its application has been to date, its lack of transparency and the difficulties encountered in comparing

[24] Richmond and Kaufmann (2006) conclude that including energy prices in the analysis of energy intensity helps to explain its changes over time in many countries. Other authors Metcalf (2008) claim that enhanced energy efficiency appears to have followed improvements in the energy efficiency of processes, partly led by prices and not by structural changes.

relatively complex frameworks in very different commercial settings. Those questions include the following:

- There are significant costs associated with system administration and transactions (which may be avoided with other schemes). The transaction costs in the British system are estimated to account for 18 % of the total. In the case of Denmark, the transaction costs payable by obligated distributors represent about 15 % of the total. However, the lack of transparency as regards implementation and administration costs is noteworthy.
- In general, they are not designed to implement those measures which are most cost-effective, most efficient, or even those that meet the "additionality" requirement, but rather only those that provide the most credit or the most certificates. This is a critique that has been made regarding all the schemes of this type set up in Europe, and it was the main reason behind the recent review of the British scheme.
- They are associated with a high degree of regulatory intervention. In fact, all the systems set up in Europe have been the object of frequent reviews during their validity period, with the consequent regulatory risk for investors.
- In many cases the gains in efficiency derived from the trading of savings are not leveraged. One of the virtues usually associated with obligations of this kind is the possibility that they may be traded in order to reduce the cost of compliance. However, international experience indicates that only in Italy have the possibilities for exchange been properly leveraged (elsewhere stakeholders have shown an inward-looking self-supply strategy).
- There are doubts as to the structural results that can be obtained from these frameworks and as to a possible rebound effect. The frameworks do not act on consumer behaviour (only on that of the energy supplier or distributor), which means that if energy becomes cheaper as a result of savings measures higher energy consumption may result.
- A very significant portion of the potential for savings cannot be realised. The fact that the transport sector is excluded from most such frameworks means that opportunities for savings are wasted in a sector that often accounts for around 40 % of energy consumption.
- The structure of these frameworks may have a negative effect on equity. In general, consumers affected by energy poverty have no possibility of saving, so although the costs of implementing the measures are paid out of the tariffs charged to all consumers, only those that have the possibility of reducing their consumption can benefit from them.

5.4 Proposals

No energy efficiency policy can work if the price signals received by consumers are distorted. This is the conclusion reached in most studies that analyse energy

efficiency measures.[25] Therefore, before setting up a scheme of obligations on suppliers, it is necessary to analyse the regulatory framework for energy efficiency as a whole and determine whether the prices of the various energy products reflect the production costs in each particular time period,[26] including any negative external issues that they may cause.

In order to reinforce the price signal for the various energy products and include the necessary external issues, it is necessary to carry out a reform of environmental taxation as follows:

- A reform in which rates are set according to the environmental damage generated by each energy source, thus allowing the costs generated by the energy consumption to be internalised in the price signal. This will help to make many energy efficiency measures more profitable.
- A reform that takes the role being played by each energy sector in funding energy and environmental policies into account, focussing accordingly on the transport sector (which accounts for 40 % of final energy consumption) so that its economic contribution towards the funding of policies in this field is increased (e.g. renewable energies).

A well-designed framework for environmental taxation would achieve the following aims: on the one hand, it would be a useful tool in achieving structural improvements in energy efficiency with a positive impact on competitiveness, and on the other it would set up a solid revenue basis with the possibility of raising resources to fund policies geared towards ensuring the economic and environmental sustainability of the energy model.

Together with a suitable framework for taxation, empirical evidence gathered in countries that have achieved significant improvements in energy efficiency points towards the appropriateness of using a combination of additional measures progress towards energy efficiency is hindered not by price but by problems linked to information. This could be the case of the residential sector, where labelling, standards, information and awareness campaigns, are widely used measures which have proven in the past to be effective in achieving savings.

Among the alternatives to a framework of obligations on suppliers or distributors, the promotion of co-generation (which could receive resources from funds obtained from CO_2 auctions) also plays a significant role. In this field, care should be taken to ensure the efficiency of investments and that costs are allocated to those that benefit from the savings.

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[25] See, for example, World Energy Council (2010): *Energy Efficiency: A Recipe for Success*, and World Energy Council (2008): *Energy Efficiency Policies around the World: Review and Evaluation*.

[26] In other words, it is not just that the price of energy products should cover all costs incurred, including environmental costs, but also that the price system needs to be sufficiently advanced to allow for price signals that can be differentiated in time, taking into account the situation of the market.

6 Conclusions

For over 20 years, the EU has taken on a clear role of international leadership in energy and environmental policy, with a strong commitment to bringing down CO_2 emissions, promoting renewables and enhancing energy efficiency. Regulatory experience has been very varied, and several kinds of regulatory, taxation and command-and-control instruments, etc. have been implemented. The analysis performed here shows that there have been hits and misses but that, in general, priority has been given to meeting targets rather than to economic efficiency considerations.

This situation was initially sustainable because it coincided with a period of strong economic growth. However, the scenario has changed radically: the economic crisis has drawn attention to Europe's difficulty in maintaining inefficient environmental and energy policies, which affect the competitiveness of industry and the welfare of society, in a context in which other economic blocs have either failed to set those same targets or managed to attain them in a more cost-effective manner.

In this new scenario, if the EU wishes to uphold its commitment to environmentally sustainable energy development it needs to find ways to reach targets more efficiently, without jeopardising the competitiveness of its economy.

One of the fundamental issues is whether one or more targets is required. In the European debate on the framework of targets and policies for the long term, we would support the setting of a single target for reducing emissions, so as to send the necessary signals for investments to be made in energy efficiency and renewable energies. This target could be supplemented by indicative targets in other fields and supportive policies, such as R&D&I schemes.

Another key issue is energy taxation: our conclusion is that this is one of the crucial elements in achieving sustainability in the energy sector. Taxation analysis should be broad in scope, taking into account the burdens that are borne by all sectors for the cost items imposed by environmental and social policies.

The benefits that renewable energies provide to society as a whole mean that their supporting frameworks should be funded from public budgets or by the energy sector as a whole. The supporting frameworks should also take into account the characteristics of each technology (particularly its competitiveness).

We believe that energy efficiency is the key vector and that it should continue to be the main commitment in the field of energy in the EU, an economic block that is highly dependent on energy and lacking in new resources. From the regulatory perspective it is a complex issue, but it is crucial to attain goals effectively and avoid the mistakes that have sometimes been made in some contexts when rolling out renewable energies.

Appendix

See Table A.1.

Table A.1 Characteristics of frameworks of obligations on energy suppliers/distributors in Europe

	Flanders region	Italy	France	Denmark	United Kingdom	
Name of scheme or programme	Rationeel Energieverbruik (Rational Use of Energy—RUE Law, in English)	Titoli d'Efficienza Energetica	Certificats d'Économie de l'Énergie	Energiselskabernes spareindsats	Green deal	ECO
Year scheme started	2003	2005	2006	2006	2013 (end of 2012)	2013
Current period	Annual targets. For 2010–2011 savings of 3.5 % (over 2,500 customers). No targets were set in 2012, as it was decided to implement compulsory measures	2013–2016	Pending launch; expected in 2013–2016	2010–2020	2012(end)–2020	2013–2015 (March)
Current target	–	Baseline year T-2 0[a]	600 TWh *cumac* (estimated; pending launch of new period)	10.3 PJ in 2010 and subsequent adjustments	Savings amounting to 4.5 million tonnes of CO_2	
Obligated parties	Only electricity distributors (16 companies in total)	Gas and electricity distributors (final consumption obligations)	Suppliers of gas, electricity, air-conditioning (cold and heat), heating oil and fuel distributors for the car sector	Distributors of electricity, natural gas, piped gas and oil traders (the latter entered the scheme voluntarily)	Gas and electricity suppliers	

(continued)

Table A.1 (continued)

	Flanders region	Italy	France	Denmark	United Kingdom	
Name of scheme or programme	Rationeel Energieverbruik (Rational Use of Energy—RUE Law, in English)	Titoli d'Efficienza Energetica	Certificats d'Économie de l'Énergie	Energiselskabernes spareindsats	Green deal	ECO
Participating institutions	Vlaams Energieagentschap (VEA)	GSE, GME, ENEA, AEEG	ADEME, DGEC, PNCEE, ATEE	Danish Energy Agency	Department of Energy and Climate Change—*Advisors, suppliers, installers and electric utilities*	Ofgem
Measures	Discretionary (mostly in residential sector)	At least 50 % in sector	Discretionary. 270 standardised measures (other proposals assessed by ADEME)	All sectors except transport, any kind of activity. May be carried out by subsidiary suppliers	45 standardised measures, mostly in residential sector.	Residential sector
Banking	Yes	Yes	Yes	No	–	–
Trading with savings	No	Yes	Allowed, but not substantial.	No	–	Yes
Penalties	€0.10/kWh	1 year to correct, economic penalty in case of recidivism	€0.02/kWh	Not defined; no cases of non-compliance reported	–	

(continued)

Table A.1 (continued)

	Flanders region	Italy	France	Denmark	United Kingdom	
Name of scheme or programme	Rationeel Energieverbruik (Rational Use of Energy—RUE Law, in English)	Titoli d'Efficienza Energetica	Certificats d'Économie de l'Énergie	Energiselskabernes spareindsats	Green deal	ECO
Costs	€60 million (figures for 2009, sum of budgets of electricity distributors)	"Unit tariff contribution" for 2009 was €92.22/toe	Public bodies: €700,000/year; Companies (figures for period 2006–2009): M€ 210 (€c0.39/kWh).	€c5.6/kWh (incl. administrative and implementation costs)		€1.5 billion per annum (estimated cost for companies)
Cost recovery scheme	Partly subsidised by regional government and partly in the form of electricity tariffs for consumers	Possibility of suppliers transferring costs to tariffs	Electricity tariffs (since 2005; tax breaks before that, and subsidies for natural gas)	Via tariffs	Complex funding system.	Suppliers are free to internalise cost into their prices

Source Own records, drawn up on the basis of information obtained from regulators and companies

[a] The Italian targets are set on an annual basis for each company with baseline year T-2. In other words, the targets for a particular company for 2013 are set according to that company's total output in the year 2011

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