

# Energy Policy in the European Union

An outline of EU's policies and strategy on energy related issues

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# Abbreviations

ACEA	European Automobile Manufacturers' Association
ACER	Agency for the Cooperation of Energy Regulators
CCS	Carbon Capture & Storage
CHP	Combined Heat & Power
COR	Committee of the Regions
CSE	Central Stockholding Entity
DSO	Distribution System Operator
EAP	Environmental Action Program
EC	European Commission
ECCP	European Climate Change Program
ECSC	European Coal and Steel Community
EEA	European Environment Agency
EED	Energy Efficiency Directive
EEP	Energy Efficiency Plan
EEPR	European Energy Program for Recovery
EERA	European Energy Research Alliance
EIB	European Investment Bank
EMAS	Eco-Management and Audit Scheme
ENTSO	European Network of Transmission System Operators
EP	European Parliament
EPBD	Energy Performance of Buildings Directive
ERA	European Research Area
ESC	European Economic and Social Committee
ESD	European Savings Directive
ETP	Energy Technology Platform
ETS	Emissions Trading Scheme
EU	European Union
EU-15	Germany, Italy, France, Belgium, Luxembourg, Netherlands (1951); Denmark, United Kingdom, Ireland (1973); Greece (1981); Spain, Portugal (1986); Austria, Finland, Sweden (1995)
EU-25	EU-15 plus Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia and Slovakia (2004)
EU-27	EU-25 plus Romania and Bulgaria (2007)
EU-28	EU-27 plus Croatia (2013)
FP	Framework Program
GHG	Greenhouse Gases

IEA	International Energy Association
IPCC	Intergovernmental Panel on Climate Change
IPEEC	International Partnership for Energy Efficiency Cooperation
ISO	Independent System Operator
ITER	International Thermonuclear Experimental Reactor
ITO	Independent Transmission Operator
JTI	Joint Technology Initiatives
LCP	Large Combustion Plant
NAP	National Allocation Plan
NEEAP	National Energy Efficiency Action Plan
NGO	Non-Governmental Organisation
NREAP	National Renewable Energy Plan
OU	Ownership Unbundling
OPEC	Organization of the Petroleum Exporting Countries
PFCs	Perfluorocarbons
PSO	Public Service Obligation
R&D	Research & Development
RE	Renewable Energy
RE-GOs	Renewable Energy Guarantees of Origin
RES	Renewable Energy Sources
RFCS	Research Fund for Coal and Steel
ROC	Renewable Obligation Certificates
SETIS	Strategic Energy Technologies Information System
SET-Plan	Strategic Energy Technology Plan
SME	Small Medium Enterprise
SRA	Strategic Research Agenda
TEN-E	Trans-European Energy Networks
TPA	Third Party Access
TSO	Transmission System Operator
VAT	Value Added Tax
VIU	Vertical Integrated Undertaking

# 1

## Introduction

In 1951 six European States decided to pool their interests in two key sectors of the economy, coal and steel, in order to create a Community that would replace conflict with cooperation and animosity with prosperity. The *European Coal and Steel Community (ECSC)* was formed and a cross jurisdictional control on the energy resources was applied. Thus a way to greater economic cooperation in general was paved.

At the same time however, it was recognized that coal could not be the driver of economic growth. The use of nuclear energy was predicted to replace coal and oil at the centre of the economy and fulfil the need for abundant energy at lower prices. The *European Atomic Energy Community Treaty (Euratom)* was introduced in 1957, aiming to guarantee the safety and control of radioactive materials and promote the development of nuclear energy for peaceful purposes.

Although it was realized that energy cooperation was an important tool towards European integration, divisions between Member States led to a focus on a national state level in the 1960s. Most Western European governments were promoting nuclear power development and were heavily based on the supply of oil, coal and/or natural gas. Renewable energy, with the exception of hydropower in countries having significant hydropower potential, attracted very little interest, as their initial cost was deemed too high.

A push for a common energy policy was triggered in the early 1970s with the oil crisis of 1973. At that time 63% of the European Community's energy needs were imported from the Middle East and its vulnerability to the geopolitical turmoil in the world energy markets was more than obvious. In the 1974 Copenhagen summit meeting, Member States agreed to a declaration on energy policy, adopting guidelines concerning energy supply and demand.

The Single European Act (1986), the Maastricht Treaty (1992) and then the Amsterdam Treaty (1997) widened the focus of energy related matters. Security of supply was the main issue but not the only one. Energy market deregulation, environmental protection and climate change problems became more prominent. However this didn't yet translate into European legislation, especially as climate change was not yet high on the agenda.

The first assessment report of the Intergovernmental Panel on Climate Change (IPCC) in 1990 and "Earth Summit" in Rio in 1992 together with the adoption of the Kyoto protocol in 1997 led to a more favourable atmosphere for ambitious goals since climate change and thus energy issues came strong on the global agenda.

In December 1995, the European Commission (EC) issued the White Paper, *An Energy Policy for the European Union*<sup>1</sup>. In issuing the paper, the Commission established an official basis on which to build a common, community-wide energy policy. In the Commission's view, a common energy policy will further economic integration within the European Union (EU) and contribute to the realisation of a single European market. According to the white paper, energy policy must form part of the general aims of the EU's economic policy, which focuses on market integration and deregulation, aiming to minimise its policy interventions.

In the early 2000s the EC started developing a common position regarding important strategic issues for climate change and the future of energy security. After many years of limited success legislation in the area of energy policy, a mandatory concept of energy policy was approved at the meeting of the European Council on October 27, 2005 in London.

In 2007, the Commission's *An energy policy for Europe* strategy<sup>2</sup> marked the beginning of a more integrated European energy policy, which gained considerable momentum since then. The action plan laid out the three major challenges for European energy policy, which form the core of the common energy policy till today: *sustainability, security of supply, and competitiveness*. In order to reach these goals, the EC also laid out quantifiable targets, the famous *20/20/20 targets up to 2020*. The action plan was complemented with changes in legislation shortly afterwards with the Lisbon Treaty (2007) finally including specific provision on energy.

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<sup>1</sup> An energy policy for the European Union, COM(95) 682 final, 13/12/1995.

<sup>2</sup> An energy policy for Europe, COM(2007) 1 final, 10/1/2007.

## 1.1. Towards Sustainability

*“Sustainable energy development should provide adequate energy services for satisfying basic human needs, improving social welfare and achieving economic development throughout the world while it does not endanger the quality of life of both current and future generations and does not threaten critical ecosystems.”*

(Definition according to H. Rogner and A. Popescu)

Policy options are adopted to address different kind of barriers. Some are technical in nature, some related to human behaviour, others are due to flaws in the ways markets operate and others related to public policies and institutions. Taken as a whole these barriers are inhibiting the transition to a more sustainable energy future.

The policy options can be grouped into the next categories: *Research & Development (R&D), Financing schemes, Financial incentives, Accurate pricing, Voluntary agreements, Regulations, Information dissemination & training, Procurement, Market reforms, Market obligations, Capacity building, Planning techniques and Supporting tools*<sup>3</sup>.

The appropriate mix of policies in any particular situation depends on technological attributes, the barriers that exist and market conditions. This conceptual framework is referred to as the *innovation system*. The innovation system consists of a wide range of factors including the knowledge base, prices and relative performance of competing technologies, the behaviour of different actors in the marketplace, the networks among these actors, institutions that can foster or impede innovation and finally, cultural context [46].

EU's energy policy aims at addressing growing environmental concerns associated with the energy sector, such as global climate change, and to transform this growing concern for sustainability into opportunities for global economic and technological leadership. This overarching goal is supported by activities in three main energy policy areas: market liberalisation, energy security, and protection of the environment and climate.

*Market Liberalisation:* One of the most important energy and economic policy goals of the European Commission is the creation of a single, integrated European energy market. Currently, each of the EU's Member States is at a different point on the path to the liberalisation of its energy industries, and each State has a unique set of energy institutions and regulatory structures. The EC aims to

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<sup>3</sup> Measures established in order to support or/and supervise the progress of implemented policies and help the stakeholders involved in the energy market through actions like coordination of efforts or financing.



further each of its three main energy policy concerns, competitiveness, supply security and environmental protection, through the creation of trans-European energy networks. A key action facilitating the development of these networks will be the Community-wide reduction of existing regulatory barriers and the introduction of competition in the energy industries, especially gas and electricity.

*Security of energy supply:* Ensuring energy supply security is a second key objective of EU energy policy. The EU is currently approaching 54% import dependence and this trend appears likely to continue for the foreseeable future [1]. The EU is also seeking to enhance its energy security through a variety of policy actions aimed at diversifying both Europe's internal fuel mix and its external sources of energy supply. The Commission considers all major fuel types (fossil, nuclear, renewable) and energy efficiency as important elements of long-term energy security and is encouraging Member States to maintain a broad portfolio of energy supply options and to ensure that there is a broad internal energy resource base.

*Protection of the environment & climate:* The third major objective of EU energy policy is the environmental protection. The Commission believes that the goals of greater economic competitiveness and environmental protection are not necessarily in conflict, and that policies that move the industry to invest in new, cleaner, and less energy-intensive technologies (principally in the energy efficiency and renewable areas) will prove an advantage rather than a penalty to European firms in the long term [45].

## 1.2. Energy Policy Development

EU policy development follows important political principles expounded in the Treaties and political statements, notably:

- *Subsidiarity:* in the EU context, this means taking EU action where it adds value, and leaving alone matters best done at national level.
- *Proportionality:* not going beyond what is necessary to achieve the objectives.
- *Better regulation:* avoiding burdensome legislation, consulting widely on all proposals, and assessing the full impact of proposals before they are made, is a principle which has a prominent place in the Lisbon Reform Agenda for Growth and Jobs and is also an important guide.

The aim is to ensure that policies are developed in the most democratic, representative, transparent and consensual way possible with clear justifications and balanced assessment of options. All legislative proposals are accompanied by "impact assessments" which outline the

advantages/benefits and drawbacks/costs of different policy actions, and justify the course taken in the proposed policy.

Reflecting these requirements, new energy policy proposals are prepared on the basis of wide stakeholder consultations, including national authorities, regional bodies, industrial associations, individual companies, consumers and their associations and non-governmental organisations (NGOs). A number of consultation groups also exist, including the Madrid and Florence Forums (for gas and electricity markets, respectively), the Gas Coordination Group, the Oil Supply Group, the Amsterdam (Sustainable Energy) Forum, the Berlin (Fossil Fuels) Forum and the Prague/Bratislava (Nuclear) Forum.

Internet consultations may also take place, while *Eurobarometers* and other surveys are also used. This means that proposals made by the EC have already been largely tested for their relevance, appropriateness and timeliness. Additionally, significant consultations, undertaken by the EC, take place when required or on an informal level. Independent studies may also be commissioned into specific issues in order to help develop and implement policy initiatives.

Consultations also take place within and between the different EU institutions. Within the European Commission, Inter-Service Groups and formalised Inter-Service Consultations (involving representatives of all interested Directorates-General) smooth the preparation of new initiatives.

There is also close contact between the European Commission and the European Parliament (EP) committees, specifically for energy with the Committee on Industry, Research and Energy and Environment Committees as well as the temporary Climate Change Committee. Together with Member States, the Council's Energy Working Group provides the framework for examining the Commission's proposals. Informal coordination is carried out by the regular meetings of the Energy Directors-General group of the Commission, although this is not an institutional body.

The Commission's role as watchdog is important to ensure the implementation of policy across the EU. At the same time, national regulatory authorities (set up under relevant directives) also have a role in ensuring that national legislation applying EU rules is properly implemented in the Member States.

The Council of Ministers, comprising members of national governments, together with the EP, whose members are directly elected by EU citizens, are, broadly speaking, the bodies which jointly take legally binding decisions in the EU (though the Commission has sometimes delegated powers to act autonomously). The European Economic and Social Committee (ESC) and the Committee of the Regions (COR) are also consulted and give their opinions on policy statements/proposals. Currently, under the Lisbon Treaty, national parliaments have a stronger role, something that ensures a full democratic oversight.

Acknowledging the sensitivities regarding some aspects of energy policy in Member States, EU energy policy actions have respected, and will continue to respect, two principles:

- Member States are ultimately responsible for their national energy mix.
- Indigenous energy resources are a national, not European, resource.

Notwithstanding this, Member States have in the past accepted legally binding, although non-enforceable EU targets for specific energy sources, such as renewables. Importantly, the EU has for more than a decade agreed legal provisions for the opening-up of energy networks within the internal energy market and encouraging cross-border collaboration, interconnection and energy flows.

The EU has also developed an external energy policy, acting in areas of its own competence, such as economic, technical and financial cooperation, with agreements covering trade, investment, infrastructure development (e.g. Energy Community Treaty, Energy Charter Treaty) etc. Energy issues also come up in the framework of political cooperation under the EU's Common Foreign and Security Policy (Title V, Treaty on European Union). While the Common Foreign and Security Policy is somewhat involved, most of the Commission's external competence derives from the EC Treaty.

Energy policy developments at EU level have gained momentum in 2005 when a new political will emerged among Member States to work together more closely in energy matters and to strengthen the common policy in certain fields.

This was first expressed at the 31<sup>st</sup> G8 Summit, in July 2005, in an action plan covering climate change, clean energy and sustainable development, and this theme was taken up during the United Kingdom presidency of the EU in the second half of 2005. The next major step was taken at the Hampton Court informal summit of EU leaders in October 2005, when heads of EU states and governments called on the Commission to urgently set out how the EU could work together in energy matters. Climate change, international geopolitics and the establishment of the internal energy market were important drivers of these political changes [45].

### ***1.3. Legal Basis***

Energy policy proposals are discussed and introduced through *Green* and *White Papers* and are entering into force through the European legislation, (*Directives*, *Regulations* and *Decisions*) which is based on the European Union Treaties (including Euratom), since the creation of the Union.

*Directives* are directly binding on Member States, but often flexible to take into account different national and administrative traditions. This implies States have discretion to decide how they align

legal and administrative systems. Directives can contain requirements that take into account the specific conditions of a Member State. Provisions requiring Member States to gather information and report do not have to be transposed into binding national legislation. The term framework directives are used for directives setting out general principles, procedures and requirements for legislation in different sectors.

*Regulations* are directly binding on Member States and superior to any conflicting national law. They are not transposed into national law since they are to be applied directly by national courts and national administrative body. This form is usually used when a unified system is needed; the purpose is precise, as are the requirements to the Member States.

*Decisions* are individual legislative acts directly binding for the parties to whom they are addressed. They are usually very specific in their scope and can be used for specifying detailed administrative requirements or update technical aspects of regulations or directives.

Before the Lisbon Treaty entered into force in 2009, the founding Treaties of the EU did not include a specific provision on EU intervention in the field of energy with the energy-related legislation introduced under the following legal basis:

- *Environment* (Art 175);
- *Approximation of laws* (Art 81-97);
- *Trans-European networks* (Art 154);
- *Difficulties in the supply of products* (Art 100);
- *Research* (Art 166);
- *External relations* (various articles).

The Lisbon Treaty introduces a *specific legal basis* for the field of energy with the creation of *Article 194* of the Treaty on the Functioning of the EU. It states that the energy issues fall within competence both EU and Member States and stresses the context of EU energy policy against the background of the internal market and the environment.

In a spirit of solidarity between the Member States, this policy aims to establish and ensure the functioning of the EU's energy market and the security of supply in the EU; to promote energy efficiency and energy saving, the development of new and renewable energies and the interconnection of energy networks.

# 2

## EU Energy Policy

The EU and the world are at a cross-road concerning the future of energy. Climate change, increasing dependence on oil and other fossil fuel, growing imports, and rising energy costs are making our societies and economies vulnerable. These challenges call for a comprehensive and ambitious response.

In the complex picture of energy policy, the renewable energy sector is the one energy sector which stands out in terms of ability to reduce greenhouse gas emissions and pollution, exploit local and decentralized energy sources, and stimulate world-class high-tech industries. The EU has compelling reasons for setting up an enabling framework to promote renewables. They are largely indigenous, they do not rely on uncertain projections on the future availability of fuels, and their predominantly decentralized nature makes societies less vulnerable. It is thus undisputed that renewable energy constitutes a key element of a sustainable future.

Significant developments have taken place in European energy policy since 2000, driven by increasing concern about global warming, and the effect of rapidly increasing energy prices on competitiveness and security of supply in EU. The European Commission has risen to the challenges, proposing a range of policies in order to address them. While there have been concerns, for example by some Member States regarding some of the policies, overall the

proposals by the European Commission are sound. They correctly reflect the energy challenges faced by the world today, and their implementation will bring global benefits.

In particular, the Commission's goals in the field of energy and environment are highly ambitious, but pursuing them will be necessary not only to ensure the EU contribution to the mitigation of climate change, but also to send a global signal that meaningful action can and ought to be taken now. To ensure that the very ambitious targets are being achieved in a balanced manner, regular reviews and constant tracking of the implementation of the whole policy package need to be performed.

The implemented energy policies can be classified into the next seven broad categories, each consisting of two parts – a brief introduction / historical background followed by the currently implemented policies:

- *Renewable Energy*
- *Energy Efficiency & Savings*
- *Internal Energy Markets*
- *Security of Energy Supply*
- *Environmental Protection & Climate Change*
- *Nuclear Energy and*
- *Research & Development*

## ***2.1. Renewable Energy***

Back in 1986 a Council resolution highlighted the promotion of Renewable Energy (RE) as one of the Community's energy objectives. Efforts concentrated on R&D programmes and the European Parliament continuously argued for an action plan to promote RE. In the Commission *White Paper* from 1995<sup>4</sup> the three main objectives for the Community energy policy were identified: improved competitiveness, security of supply and protection of the environment. RE was recognised as a factor to help achieve these objectives and a strategy for renewables was finally proposed in 1997.

The Community strategy for renewables was presented in the 1997 *RE White Paper*<sup>5</sup> and confirms an indicative target of a 12% share of Renewable Energy Sources (RES) in total final energy consumption by 2010.

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<sup>4</sup> An energy policy for the European Union, COM(95) 682 final, 13/12/1995.

<sup>5</sup> Energy for the future: Renewable energy sources of energy - White Paper for a Community Strategy and Action Plan, COM(97) 599 final, 26/11/1997.

Besides the RE White Paper, main drivers behind Community initiatives on RE are the energy strategy set in the 2000 *Green Paper* on the security of energy supply<sup>6</sup> and the climate change strategy set in the *European Climate Change Programme*, launched in June 2000.

At the end of 2001, the *RES Directive* on electricity production from RES was adopted<sup>7</sup>. In accordance with the RE White Paper, the overall indicative target of this directive was to increase the share of RE in final energy consumption to 12% by 2010. An indicative target was set for the electricity to 22.1% of total EU-15 gross consumption from RES in 2010.

In the Accession Treaty, published in April 2003, national targets were adopted for the new Member States. The total renewable electricity target for EU-25 was 21% of overall electricity consumption by 2010. To reach this goal the directive set *indicative targets* for the share of renewable electricity production per EU Member State.

Not before 2003 was the *Biofuels Directive* adopted<sup>8</sup>. It stipulated that Member States should set national indicative targets to raise the share of biofuels in their transport fuel market. These should be based on the reference values of an increase to 2% by 2005 and 5.75% by 2010 of the share of biofuels in diesel and petrol for transport purposes calculated on the basis of energy content.

In March 2007, the heads of states and governments of the 27 EU Member States adopted a *binding target* of 20% renewable energy from final energy consumption by 2020. Combined with the commitment to increase energy efficiency by 20% until 2020 and to reduce greenhouse gas emissions by at least 20% within the same period (or respectively 30% in case of a new international agreement), Europe's political leaders paved the way for a more sustainable energy future for the European Union and for future generations.

In January 2008, the EC presented a draft directive on the promotion of the use of energy from RES which contains a series of elements to create the necessary legislative framework for making the 20% share become a reality. The directive sets the legislative framework that should ensure the increase of the 8.5% RE share of final energy consumption in 2005 to 20% in 2020 and, if properly transposed into national law, will become the most ambitious piece of legislation on RE in the world.

The *new RES Directive* was approved by the EP in December 2008, by the Council at the end of March 2009, published in the Official Journal in June 2009 and will then need to be transposed in national law<sup>9</sup> [45].

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<sup>6</sup> Towards a European strategy for the security of energy supply, COM(2000) 769 final, 29/11/2000.

<sup>7</sup> Directive 2001/77/EC of the European Parliament and of the Council, "On the promotion of electricity produced from renewable energy sources in the internal electricity market", 27/10/2001.

<sup>8</sup> Directive 2003/30/EC of the European Parliament and of the Council, "On the promotion of the use of biofuels or other renewable fuels for transport", 17/5/2003.

<sup>9</sup> Directive 2009/28/EC of the European Parliament and of the Council, "On the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC", 5/6/2009.

In January 2014, the *2030 policy framework* for climate and energy was presented by the EC in order to drive continued progress towards a low-carbon economy<sup>10</sup>. The Commission proposes an objective of increasing the share of RE to at least 27% of the EU's final energy consumption by 2030. If get into force, the new target will be an *EU-wide binding target that would not be translated into national targets* in order to give Member States flexibility to transform the energy system according to their national preferences and circumstances.

The implemented policies on renewable energy are:

### *2.1.1. National Targets*

As mentioned above, up to 2009 the targets set were *indicative*. Each Member State had its own share target for RE in electricity and all Member States had an overall 5.75% share target of biofuels and other renewable fuels in transport by 2010.

Currently there are *binding national targets* for RE shares of final energy consumption in 2020, (including a 10% renewables in transport target for all Member States). These are calculated on the basis of the 2005 share of each country plus both a flat rate increase of 5.5% per Member State as well as a GDP-weighted additional increase. Furthermore, the new RES directive closed the legislative gap for the heating and cooling sector which is expected to grow rapidly in the next decade.

Also interim targets per country are set for 2011/12, 2013/14, 2015/16 and 2017/18 as a percentage share of their 2020 target. These interim targets are crucial for monitoring the progress of RE development in a Member State, although they are only of indicative nature.

### *2.1.2. National Renewable Energy Action Plans*

The *National Renewable Energy Action Plans (NREAPs)* were introduced in 2009 and are considered crucial towards the 2020 mandatory targets. They must be adopted by all Member States and they outline their targets for the shares of energy from RES in transport, electricity, and heating & cooling by 2020 as well as adequate measures to achieve these targets.

NREAPs should provide two things: to give Member States the flexibility to decide for themselves how they want to meet their national targets, but at the same time to create investor security and help to mobilize private capital by setting clear goals and mechanisms on a national level.

NREAPs should include detailed mandatory outlines and targets for the different renewable energy sectors (heating/cooling, electricity and transport fuels), which show the way ahead on a national level. In addition, support measures to meet the national targets must be outlined.

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<sup>10</sup> A 2030 framework for climate and energy policies, COM(2013) 0169 final, 27/3/2013.



### 2.1.3. Cooperation Mechanisms

*Cooperation mechanisms*, introduced in 2009, can be used by Member States in order to reach their RE targets. Member States are allowed to make arrangements for the *statistical transfer* of a specified amount of energy from RES from one Member State to another. The cooperation between two or more Member States and also with one or more third countries is allowed, on all types of joint projects regarding the production of electricity, heating or cooling from RES. Private operators can also be involved.

The basic idea of the cooperation mechanisms is to fulfil part of a Member State's RES target in another country by providing financial support, with the potential advantage of accessing cheaper RE production in other countries.

### 2.1.4. Renewable Energy Guarantees of Origin

The *Renewable Energy Guarantees of Origin (RE-GOs)* were introduced with the first renewables directive in 2001. Member States had to establish a system under which RE-GOs were to be issued to all producers of renewable electricity, where it was required to prove the share or quantity of energy from RES in their energy mix. This can be on response of a request by a central body from 23 October 2003 and thereafter.

They are accompanied by a unique identification number. Some of the information specified in a RE-GO are the energy source from which the energy was produced, the starting and ending dates of production, whether it relates to electricity or heating or cooling, the date and country of issue etc.

The expectation at the time of the introduction was that the establishment of the RE-GO system would eventually enable trade between Member States and it was seen as necessary to facilitate trade and increase transparency for consumers. The directive did not require Member States to accept RE-GOs purchased in another Member State as counting towards the national indicative target, but it left open the possibility for any Member State to allow this.

The option of trade of RE-GOs between Member States issues concerns about the risk of trade being detrimental to the development of renewables. The reasons for allowing restrictions in tradability of Guarantees of Origin are that:

- The development of higher-cost renewables would be stifled.
- Trading RE-GOs and existing support systems in most Member States may be incompatible.
- Windfall profits may accrue to existing producers of (low-cost) RE because of the existence of considerable non-economic barriers, and governments may have less incentive to eliminate non-economic barriers to the large-scale diffusion of renewables.

The impact assessment estimates the costs of not allowing trading at up to € 8 billion per year by 2020 [45]. As a consequence of this cost assessment, the proposal includes the provision for

trading RE-GOs despite the risks outlined above, but in some instances restricts it in cases where the Member States have achieved their interim targets and entered into a bilateral agreement enabling this trade, or allows Member States to restrict it in order to give themselves control over the use of the renewables potential within their borders, to avoid the risks outlined above.

#### *2.1.5. Grid Priority Access & Operation*

Since 2001, Transmission System Operators (TSOs) and Distribution System Operators (DSOs) all over the EU must guarantee the transmission and distribution of electricity produced from RES. When dispatching electricity, TSOs are to give *priority* to installations using RES as far as the secure operation of the national electricity system permits it to happen.

Additionally, steps towards the development of the transmission and distribution grid infrastructure, intelligent networks and storage facilities must be taken, in order to facilitate the secure operation of the electricity system as it accommodates further development of electricity production from RES.

#### *2.1.6. Support Schemes for Electricity Production*

General provisions on *support schemes* for electricity production were provided since 2001. There are seven main categories of support instruments in the EU for RES deployment in the electricity production: *feed-in tariff, feed-in premium, quota obligations, investments grants, tax incentives or exemptions, fiscal incentives and tenders* [47].

*Feed-in tariff* is a fixed and guaranteed price paid to the eligible producers of electricity from RES, for the power they feed into the grid. Feed-in tariff systems have been historically and currently still are the main instruments of support in the EU.

The advantage of tariffs lies in the long-term certainty of receiving a fixed level support, which lowers considerably the investment risks. The costs of capital for RES investments observed in countries with established tariff systems have been proven to be significantly lower than in countries with other instruments that involve higher risks of future returns on investments. Also, the weighted average costs of capital are notably higher in countries with quota obligations, compared to tariff-based systems. By guaranteeing the price and providing a secure demand, feed-in tariffs reduce both the price and market risks, and create certainty for the investor regarding the rate of return of a project. The lower cost for the investor result lower average support cost for society.

The cost-efficiency of tariffs for society decreases when policy makers overestimate the cost of producing renewable electricity. This is because the level of tariffs is based on future expectations of the generation cost of renewable electricity. When these turn out lower than expected, producers receive a windfall profit. It is therefore important that tariffs are reviewed regularly in order to adjust the system to the latest available generation cost projections and to stimulate technology learning.

Furthermore, payments should be guaranteed for a limited time period (approx. 15-20 years) that allows recovery of the investment, but avoids windfall profits over the lifetime of the plant.

In tariff systems, RES generators do not sell the produced electricity on the power market, but a single buyer, e.g. the TSO, fulfils this role. Therefore the producers are not stimulated to adjust their production according to the price signals on the market (i.e. electricity demand), unless it is provided by other means. This may be a disadvantage in terms of market compatibility.

In a *feed-in premium* system, a guaranteed premium is paid in addition to the income producers receive for the electricity from RES that is being sold on the electricity market. Feed-in premium systems have gained ground over the last years and can be used as main support instruments or in parallel with feed-in tariffs for a selection of technologies. The flexibility and coverage of the systems differs from country to country.

Premium systems provide a secure additional return for producers, while exposing them to the electricity price risk. Compared to feed-in tariffs, premiums provide less certainty for investors and hence, imply higher risk premiums and total costs of capital. There are different design options for premium systems. Premiums that are linked to electricity price developments, e.g. limited by cap and floor prices, provide higher certainty and less risk of over-compensation than fixed premiums.

The level of premiums is based on future expectations regarding the generation costs of renewable electricity and the average electricity market revenues. Therefore premium systems also embody the risk of inducing additional costs for society and windfall profits for producers when production costs are over-estimated, or electricity prices and learning rates are underestimated by policy makers.

Time limits and a regular review of cost projections and adjustment of premiums based on these projections is therefore also important in feed-in premium systems. Both Denmark and the Netherlands have applied such practices. Denmark has put a cap on the overall return for producers, thereby limiting societal costs. In the Netherlands the level of the premium is determined annually and an overall cap is set on the total cost of the support.

In premium systems, the renewable electricity producer participates in the wholesale electricity market. The advantage of premiums is therefore that producers of renewables are stimulated to adjust their production according to the price signals on the market (i.e. electricity demand), at least if they have fuel costs. This can be beneficial for power system operation.

In *quota obligations* system, governments impose minimum shares of renewable electricity on suppliers (or consumers and producers) that increase over time. If obligations are not met, financial penalties are to be paid. Penalties are recycled back to the suppliers in proportion of how much renewable electricity they have supplied.

Quota obligations are combined with Renewable Obligation Certificates (ROCs), also called Green Certificates, which can be traded. Hence, ROCs provide support in addition to the electricity price and are used as proof of compliance. It represents the value of renewable electricity and facilitates trade in the green property of electricity. Quota obligations with certificates expose producers to market signals and the support they provide is automatically phased out once the technology manages to compete. However, uncertainty about the current and future price of certificates increases financial risks since the risk of the certificate market is added to the risk of the electricity market.

*Investments grants* for electricity and heating & cooling are available in several Member States and are often devised to stimulate the take-up of less mature technologies.

*Tax incentives or exemptions* often complement other types of RES incentive programs. They are powerful and highly flexible policy tools that can be targeted to encourage specific RES technologies and to impact selected RE market participants, especially when used in combination with other policy instruments. A wide range of tax incentives are present in the EU. Tax incentives can be related to investments or provide income tax deduction or credits at a set rate per unit of produced RE, thereby reducing operational costs. Investment and production tax exemptions are most prominently present in the EU.

The *fiscal incentives* include soft or low-interest loans. Soft loans may also provide other concessions to borrowers, including longer repayment periods or interest holidays.

Finally, *tenders* are used for larger-scale projects and most commonly for offshore wind utilization. Advantages of this scheme include the amount of attention it draws towards RE investment opportunities and the competitive element incorporated in its design.

Currently, the support schemes in the EU for electricity production are summarized below [1][2]:

- 22 countries (Austria, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Germany, Greece, France, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, Spain and UK) use feed-in tariffs or premiums. In most cases, feed-in tariffs are time-limited.
- Premiums are used in Denmark, Estonia and in the Netherlands. Czech Republic, Germany, Luxembourg, Slovenia and Spain offer the choice between feed-in tariffs and premiums.
- Green certificates are used in Belgium, Italy, Poland, Romania, Sweden, Norway and UK.
- Denmark (offshore wind farms), France (wind, biomass and biogas), Latvia (wind over 0.25 MW) and Portugal (wind and biomass) also use tenders.
- Finland excise tax return.
- Austria, Malta and Norway offer grants.

### *2.1.7. Restrictions on Biofuels & Bioliquids*

The binding nature of the 10% share target from renewable fuels in the final energy mix of the transport sector, has forced the Commission to adopt *restrictions and sustainability criteria* of energy deriving from biofuels and bioliquids. They apply from the cultivation of raw materials up to the greenhouse gas emissions in the end use.

Member States have to take steps in order to verify that sustainability criteria have been fulfilled whether the biofuels or bioliquids are produced within the Community or imported.

### *2.1.8. Renewable Energy Technologies in Buildings*

The *integration of RE technologies in buildings* was introduced in 2009. Member States must embed, in their building regulations and codes, appropriate measures in order to increase the share of all kinds of energy from RES in the building sector. Through these measures, by 31 December 2014, Member States must require the production of a minimum amount of energy from RES in new buildings and in existing buildings that are subject to major renovation (especially RE technologies that achieve a significant reduction in energy consumption like heating and cooling systems). RE technologies' integration in buildings is one of the major pillars towards the *nearly zero-energy buildings* concept which will be implemented from 2018 onwards (see p.20).

### *2.1.9. Information & Training*

It is up to each Member State to take steps towards the dissemination of information on support measures and make it available to all relevant actors, such as consumers, builders, installers, architects, and suppliers of RE technologies. In cooperation with local and regional authorities, they must develop suitable information, awareness-raising, guidance or training programs in order to inform citizens of the benefits and practicalities of developing and using energy from RES.

### *2.1.10. Reporting & Monitoring*

Extensive reporting and monitoring is applied in the EU. Member States must submit reports to the Commission on progress considering the promotion and use of energy from RES. The first report was submitted in 2011 and the next every two years thereafter, up to 2021. The reports will provide detailed information on the whole progress of RE penetration and the framework for their promotion.

On the basis of these submitted reports, the Commission will report every two years to the European Parliament and the Council in order to evaluate and comment on the progress of Member States' renewable policy implementation.

## 2.2. Energy Efficiency & Savings

Energy efficiency is the most cost-effective and fastest way to increase security of supply and reduce the greenhouse gases emissions responsible for climate change. Thus, it has been identified as a cornerstone in the EC's energy policy and is one of the pillars of the Commission's 20/20/20 by 2020 targets. If the 20% efficiency target was achieved, the EU would use approximately 13% less energy than today, saving € 100 billion and around 780 million tonnes of CO<sub>2</sub> each year, around 20% of the current emissions, by 2020 [45]. It would also make the RES target easier to attain.

The Commission has over time launched a large array of energy efficiency policies and directives that affect energy efficiency across many sectors. In 2006 the *Energy Efficiency Action Plan* was adopted<sup>11</sup>, establishing the overall framework for the future development of the energy efficiency policy in the EU. Also the 2006 *Energy Efficiency & Services Directive*<sup>12</sup> (ESD) was another essential part of the framework for those sectors that are not covered by the *Emissions Trading System (ETS)*.

However, the Commission's recent estimations on the national energy efficiency targets for 2020, suggest that the EU will achieve only half of the 20% target in 2020 [9]. Thus, a new ambitious strategy on energy efficiency should be adopted. In 2011 the Commission put forward a new *Energy Efficiency Plan (EEP)* setting out measures to achieve further savings in energy supply and use<sup>13</sup>.

The new legislative proposal transforms certain aspects of the EEP into *binding measures* (not binding targets) in order to strict the framework towards the 2020 energy efficiency target. It also looks beyond the 20% target and seeks to set a common framework to promote energy efficiency in the EU beyond 2020. In April 2012, a *non-paper* on the ESD was presented, supporting the discussions on the proposal about a new energy efficiency directive<sup>14</sup>.

The *new Energy Efficiency Directive (EED)* entered into force on 4 December 2012. It is meant to fill the gap between existing framework directives and national/international measures on energy efficiency and the 2020 EU target for energy savings. It covers all sectors except transport, and includes, for the first time in an "energy efficiency" directive, measures for supply side efficiency. Most of its provisions will have to be implemented by the Member States by 5 June 2014.

Implemented policies on energy efficiency & savings sector are:

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<sup>11</sup> Action plan for energy efficiency: Realizing the potential, COM(2006) 545 final, 19/10/2006.

<sup>12</sup> Directive 2006/32/EC of the European Parliament and of the Council, "On energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC", 27/4/2006.

<sup>13</sup> Energy efficiency plan 2011, COM(2011) 109 final, 8/3/2011.

<sup>14</sup> Non-paper of the services of the European Commission on energy efficiency directive, Informal Energy Council, 19-20/4/ 2012.

### 2.2.1. EU-Wide Quantified Target

The new EED provides the *legal definition* and *quantification* of the 20% energy efficiency target by 2020. The EU-28's energy consumption should not exceed the 1483 Mtoe primary energy or the 1086 Mtoe of final energy in 2020.

### 2.2.2. National Targets

According to the 2006 ESD, each Member State should take measures designed to contribute towards achieving an overall *national indicative energy savings target* of 9% by 2016.

The new EED states that each Member State must set an *indicative national energy efficiency target* (aligned with the EU-wide target) in any form they prefer (primary or final energy consumption, primary or final energy savings, or energy intensity) and express it in terms of an absolute level of primary energy and final energy consumption by 2020 in order for the Commission to be able to assess and compare them with the EU-wide target.

Also, each Member State is required to set up an energy efficiency obligation scheme to ensure that certain energy distributors or retail energy sales companies achieve a *cumulative annual end-use energy savings target* of 1.5% over the obligation period (01 January 2014 – 31 December 2020) or take other alternative policy measures to achieve equivalent energy savings.

### 2.2.3. National Energy Efficiency Action Plans

A key aspect of the energy efficiency strategy is the requirement for Member States to prepare *National Energy Efficiency Action Plans (NEEAPs)*. They are important because they articulate in detail the strategy each Member State intends to take to pursue and monitor progress in achieving their energy efficiency target. Every following NEEAP must include a thorough analysis and evaluation of the preceding. This policy was introduced in 2006 and all Member States were to submit to the Commission three NEEAPs in the period between 2007 and 2014. From April 2014, NEEAPs must be submitted every three years.

### 2.2.4. Cogeneration

*Cogeneration* not only can increase energy efficiency and savings, but also improves security of supply. In order to promote and develop high efficiency cogeneration, measures similar to RE systems have been adopted: *guarantees of origin* for electricity produced from *Combined Heat & Power (CHP)*, *support schemes* and *grid priority access* to CHP power plants (including small-scale and micro-cogeneration units). In order to achieve high efficiency energy production, a methodology for determining the efficiency of the process with cogeneration technologies is also provided.

### 2.2.5. Public Procurement

Requirements for the public sector to follow for the purchase of high performing energy-efficiency products, services and buildings have been established. Central governments are required to set the example for other purchasers through the purchase of high energy-efficiency products, services and buildings. Member States can also apply these public purchase requirements to other public bodies, included at the regional and local levels.

The first time that the Council and the European Parliament have set *mandatory energy efficiency criteria* for public procurement was in July 2007 when the European Council adopted a new regulation for implementing the *EU-US Energy Star program* in the EU. Recognising that the procurement of energy-efficient equipment and appliances by public institutions is one way to stimulate a market for energy-efficient products, the EU institutions and relevant Member State government authorities are required to use energy efficiency criteria, no less demanding than those defined in the Energy Star program, when purchasing office equipment. The Commission has also developed a handbook for guiding energy-efficient public procurement [45].

### 2.2.6. Improvement of Building's Energy Performance

Buildings account for 40 % of total EU energy consumption [13]. Thus, significant energy savings can be achieved in this area. Towards the promotion of the improvement of the energy performance of buildings the next significant policies have been adopted:

- *Energy performance calculation & requirements.* Each Member State has adopted a methodology for calculating the energy performance of buildings and setting the minimum energy performance requirements (requirements may differ between new and existing buildings and between different categories of buildings) according to the general framework set out in the *Energy Performance of Buildings Directive (EPBD)*<sup>15</sup>.
- *Long-term renovation strategy.* Member States must establish a long-term strategy for investment in the renovation of residential and commercial buildings both public and private (including deep renovations), with the aim of improving their energy efficiency. Central governments must set the example by ensuring that 3% of the total floor areas of heated or cooled public buildings are renovated each year (from the beginning of 2014 onwards) to meet national minimum energy performance requirements. The 3% rate is calculated on the total floor area of buildings with a total useful floor area over 500 m<sup>2</sup> and as of 9 July 2015, over 250 m<sup>2</sup>.
- *Energy performance certificate & display.* When buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant. The validity of the certificate cannot exceed a period of 10 years. For a building

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<sup>15</sup> Directive 2010/31/EU of the European Parliament and of the Council, "On the energy performance of buildings (recast)", 18/6/2010.



that is occupied by public authorities and frequently visited by the public, with a total useful floor area of over 500m<sup>2</sup>, the energy performance certificate must be *displayed* in a prominent place clearly visible to the public. On 9 July 2015, this threshold of 500m<sup>2</sup> will be lowered to 250m<sup>2</sup>. Also, according to the last EED, large enterprises are subject to regular, high-quality energy audits at least every four years, starting 5 December 2015 at the latest. Small and medium sized enterprises (SMEs) are exempt from regular mandatory audits but Member States must promote and encourage the use of energy audits in all enterprises, even SMEs, households and other small end users.

- *Nearly zero-energy buildings.* In order to increase the number of nearly zero-energy buildings, Member States must draw up national plans which include targets differentiated according to the category of building. After 31/12/2018 all new buildings occupied and owned by public authorities are to be nearly zero-energy buildings and from 31/12/2020 onwards all new buildings are to be nearly zero-energy buildings. Towards this target the potential integration of CHP and RE systems will have a major contribution. For this transition Member States must take appropriate steps to provide *financial incentives and address market barriers*. By 30 June 2011, they should draw up a list of existing and proposed measures and instruments including those of a financial nature. The list must be updated every three years.
- *Individual meters.* As far as it is technically possible and financially reasonable, final energy consumers must be provided with individual meters. These meters reflect accurately the final customer's actual energy consumption and provide information on actual time of use, aiming at better energy management from the consumers.

For better identification of cost-optimal levels of minimum energy performance requirements, a *binding comparative methodology framework* was established in January 2012<sup>16</sup>. It specifies rules for comparing energy efficiency measures and lays down on how to apply these rules to selected reference buildings from 2013 onwards.

### 2.2.7. Improvement of Energy Related Products

In order to maximize the environmental benefits from improved design of the energy related products and improve their energy efficiency, the *eco-design requirements* and the *labelling and standard product information* system have been adopted.

In 2009, a framework for the integration of environmental aspects in the design and development of energy-using products (*eco-design requirements*) was established<sup>17</sup>, in order to ensure the free

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<sup>16</sup> Commission Delegated Regulation (EU) No 244/2012, "Supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings by establishing a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements", 21/3/2012.

<sup>17</sup> Directive 2009/125/EC of the European Parliament and of the Council, "Establishing a framework for the setting of ecodesign requirements for energy-related products (recast)", 31/10/2009.

movement of these products within the internal market. It defines the principles, conditions and criteria for setting environmental requirements for the products and applies to all energy-using products which are placed on the market. It also covers parts which are intended to be incorporated into products which are placed on the market as individual parts for end-users, the environmental performance of which can be assessed independently.

A year after, the framework for the harmonisation of national measures on end-user information, particularly by means of *labelling and standard product information*, on the consumption of energy, was established, allowing end-users to choose more efficient products<sup>18</sup>. The system of labels and fiches applies to energy-related products which have a significant direct or indirect impact on the consumption of energy and other essential resources during use (e.g. household appliances). The introduction of the system of labels and fiches concerning energy consumption or conservation is accompanied by educational and promotional information campaigns aimed at promoting energy efficiency and more responsible use of energy by end-users.

#### 2.2.8. *Eco-Management & Audit Scheme*

The *Eco-Management and Audit Scheme (EMAS)* is a voluntary EU initiative designed to promote continuous improvements in a company's or other organization's environmental performance. It was developed by the EC in 1993 and became available for participation only for companies of industrial sector in 1995. In 2001 EMAS was opened to all economic sectors including public and private services. The last updated framework that improves the applicability and credibility of the scheme, entered into force in January 2010 and provides in detail the registration procedure as well as the obligations of the registered organization<sup>19</sup>.

#### 2.2.9. *Taxation*

Taxation is seen as a powerful tool for providing incentives for energy efficiency. The current energy taxation framework was adopted at the end of 2003, started as an internal market harmonization instrument<sup>20</sup>. It defines the taxable energy products, lays down the minimum rates that are to be applied to each according to their use (motor or heating fuel) and sets up the conditions for exemptions or reductions to minimum levels of taxation.

Energy products and electricity are only taxed when they are used as motor or heating fuel and the tax to be paid is calculated according to the quantity of fuel that is consumed. Member States are

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<sup>18</sup> Directive 2010/30/EU of the European Parliament and of the Council, "On the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products (recast)", 18/6/2010.

<sup>19</sup> Regulation (EC) No 1221/2009 of the European Parliament and of the Council, "On the voluntary participation by organizations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC", 22/12/2009.

<sup>20</sup> Council Directive 2003/96/EC, "Restructuring the Community framework for the taxation of energy products and electricity", 31/10/2003.

allowed to differentiate between commercial and non-commercial use of gas-oil used as propellant in order to reduce the gap between the level of excise duty applicable to non-commercial gas-oil used in cars and that applicable to petrol.

Differentiated rates of taxation, total or partial exemptions or reductions can also be applied in other cases specified by the directive. Additionally, Member States can refund, fully or in part, taxes paid by businesses that have invested in the rationalization of their energy use. This refund can be up to 100 % in the case of energy intensive businesses, and up to 50 % for others.

However, the existing framework has become *outdated* and *inconsistent* and cannot address EU's energy and climate change targets. It also fails to set economic incentives to foster growth and stimulate job creation [18]. Thus, a *proposal* to overhaul the outdated rules on the taxation of energy products was presented in April 2011 by the EC<sup>21</sup>. The new rules aim to restructure the way energy products are taxed, to remove current imbalances and take into account both their CO<sub>2</sub> emissions and energy content.

Taxes on energy would be split into 2 *components*: one based on *CO<sub>2</sub> content* (a single minimum rate for CO<sub>2</sub> emissions would be introduced for all sectors not covered by the ETS) and the other based on *energy content* rather than the volume. Both CO<sub>2</sub> and energy content elements would be combined to produce the overall rate at which a product is taxed. Member States would retain flexibility to apply reduced taxes for certain businesses but above the Community minima and design their own structure for these taxes. Taxes below minima could apply just for sectors under risk of carbon leakage.

Despite the fact that the existing energy tax framework needs to be changed, in April 2012 the EP voted *against the draft Energy Taxation Directive* stating that this is not a good moment to increment energy taxes. Since the vote of the EP *is not binding*, it's now up to Member States to decide if they will follow the Parliament or the proposal from the Commission.

Finally, the EC set also limits to how EU Member States can raise Value Added Tax (VAT) rates. In general standard rates are applied but Member States can apply lower rates for some special products and services. Among products that can benefit from low VAT rates are natural gas, electricity and district heating. Overall, VAT rates should rather favour the most environmental products and they should in no case give the most environmental products a disadvantage.

### 2.2.10. Fiscal Incentives

Direct fiscal incentives for energy efficiency purposes are, or have been, used in a number of EU Member States. In most cases they take the form of a subsidy or rebate provided after the purchase (Netherlands) or paid directly at the check-out (Spain, Hungary, Denmark), in some cases delivered

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<sup>21</sup> Proposal for a Council Directive amending Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity, COM(2011) 169/3, 2011.

only in case of replacement of the old appliance (Spain, Hungary). In Italy the consumers receive a tax credit for the purchases of energy-efficient refrigerators and freezers (delivered only in case of replacement of the old appliance). The purchases of condensing boilers are promoted in France through a tax credit and Austria through region-specific subsidy schemes. There is also a wide range of programs, including various subsidy schemes, promoting the purchases of compact fluorescent lamps in EU countries [45].

Direct fiscal incentives address the same policy objective as reduced VAT rates, thus represent in this sense an alternative instrument. They have a number of advantages compared to reduced VAT rates though [49]:

- First, subsidy schemes can be better targeted to specific consumer groups, e.g. low income households. This helps to address distributional concerns of energy taxation. Targeting may also alleviate the free-rider problem, namely the fact that the benefit of a reduced VAT rate also goes to the consumers, who would purchase an energy-efficient appliance in any case. Hence the same target can be achieved more cost-effectively. In addition, direct fiscal incentives are likely to be more visible to consumers and thus may have a stronger signalling effect than reduced VAT rates.
- Second, contrary to direct tax incentives VAT reduced rates are not effective in the case of taxable economic agents which can deduct VAT paid on inputs.
- Third, direct fiscal incentives would not probably create the risk of distorting cross-border trade in the same way as reduced VAT rates, if they are targeted only to the residents of a country.
- Fourth, subsidies delivered at the check-out or as income tax credits to consumers are more certain to reach the consumer than reduced VAT, which may not be entirely passed through to retail prices. The same does not apply, however, to corporate tax credits given to the manufacturers.
- Fifth, direct subsidies can be more calibrated to the product characteristics:
  - Some products need higher subsidies than others to motivate consumers. Reduced VAT may not sufficiently bridge the upfront price gap (which is the most relevant market failure for VAT to tackle) in case of large price difference between energy efficient and less efficient products and of (downward) price effects on the old stocks of less efficient products.
  - Some products to be promoted also often have other better standards (of luxury) than the ones the specific policy wants to promote.
  - The VAT instrument lacks flexibility in terms of tackling a possible rebound effect (e.g. it cannot be required that a purchase subject to a reduced rate concerns a replacement of an old appliance).

On the other hand, compared to reduced VAT rates, the creation of a subsidy scheme can be administratively more complex than the differentiation of rates in an existing tax regime (VAT) and

thus may entail higher administrative costs. Finally, it must be taken into consideration that direct fiscal incentives, unlike reduced VAT rates, belong to the sole competence of the EU Member States and that therefore their use remains inevitably dispersed if the Member States do not coordinate their action in this regard.

#### *2.2.11. Education & Awareness*

The success of the energy efficiency policies is strongly influenced by the consumers' purchasing decisions. Therefore, a number of educational measures to raise public awareness of the importance of energy efficiency, including education and training programs (such as competitions to reward the most energy-efficient school in the EU) on energy and climate change issues are planned by the EC. Also, since it considers that public authorities should set an example, the EC itself plans to obtain EMAS certification for all the buildings it owns, and then to extend the initiative to all EU institutions.

#### *2.2.12. Monitoring & Evaluation*

Impact assessment, monitoring and evaluation are to be an integral part of the EU's energy efficiency policy. There is no general requirement to undertake an ex post evaluation of directives or policies. However, monitoring requirements are usually written into the relevant directives. For example, Article 24 in the EED outlines in detail the review and monitoring of the progress achieved by the Member States, towards their national energy efficiency targets.

#### *2.2.13. International Partnership*

The *International Partnership for Energy Efficiency Cooperation (IPEEC)* is a high-level international forum which aims to enhance global cooperation in the field of energy efficiency. It was established in 2008 as a result of an EU proposal for an international initiative on energy efficiency at the G8 Heiligendamm Summit in 2007. Its aim is to explore the most efficient way to promote energy efficiency worldwide, jointly with the *International Energy Agency (IEA)*. Other international initiatives related to energy efficiency in which the EC is playing an important role include the *Energy Community Treaty*, the *Euro-Mediterranean Energy Partnership* and the *Baku Initiative*.

#### *2.2.14. Supporting Tools*

The *Concerted Action EED* is a project launched in spring 2013 in order to support the effective implementation of the new directive throughout the EU. It is funded by the EC and is structured on eight groups, covering all the key requirements of the EED. Its main objectives are to enhance information and experience sharing between Member States, to help their national procedures converge as soon as possible in the EED and complement the work of the EED Committee.

## 2.3. Internal Energy Markets

EU efforts to reform electricity and gas industries started in the middle of the 1990s, and the aim to build a fully competitive internal market for gas and electricity was a principle embedded in the creation of the EU. Making the energy sector in Europe competitive and more efficient was seen as part of the response to growing concerns regarding the competitiveness of European industries in globalising markets.

Negotiations between the EU authorities, the Member States and the market stakeholders during the 1990s culminated in an *Electricity Directive* in 1996 and, in 1998, in a *Gas Directive*, that introduced a *first set of common rules* for the EU energy market<sup>22</sup>. With only relatively few and brief experiences with market liberalisation in Europe and in the rest of the world, and with relatively strong opposition from some EU Member States, the first market directive only included soft reform provisions. For example, the EC encouraged but did not mandate the establishment of an independent regulatory authority within each country to supervise the market.

With regard to electricity, the directive gave the largest customers the possibility to choose their supplier. It also included provisions to grant open access to the grids, but without a regulated access framework, and also included requirements to unbundle transmission system operator functions through accounting procedures from vertically integrated companies. It also introduced the concept of a single buyer, acting in the internal energy market but appointed to be the sole supplier in a specific domain.

For natural gas, the directive aimed at opening the gas networks to third parties (third-party access), and allowing free choice of suppliers for the largest customers. This was to be achieved through accounting unbundling of the vertically integrated gas operators, thus allowing competition for supplies and customers through the natural monopoly network. The reform was intended to create a more appropriate competitive framework, spurring gas-to-gas competition, thus increasing economic efficiency and lowering costs for the final consumers in markets frequently dominated by monopolies. At the time, wide divergences in prices paid by large industrial consumers, despite similar wholesale prices, highlighted the lack of competitiveness in EU gas markets in an era of low oil prices.

Even before the implementation of the first directives was completed, there was a push to accelerate gas and electricity market liberalisation. The reason for this was that the first directives did not provide much of the legislative framework necessary for comprehensive and targeted liberalisation, and had therefore led to uneven results [45]. When the inadequacies in the light-

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<sup>22</sup> Directive 96/92/EC of the European Parliament and of the Council, "Concerning common rules for the internal market in electricity", 30/1/1997 and Directive 98/30/EC of the European Parliament and of the Council, "Concerning common rules for the internal market in natural gas", 21/7/1998.

handed approach towards regulation and unbundling in the first market directives became clear, a new process was launched leading towards a second liberalisation package.

In March 2002, the European Council decided on market opening for all business energy users in 2004 and full market opening in 2005. In 2003, the *second market directives* were adopted<sup>23</sup> together with the *Regulation on cross-border exchanges* in electricity<sup>24</sup> and full market opening for all customers was agreed for 1 July 2007.

The directives were to be implemented by Member States by transposing them into their relevant national legislation by 1 July 2004, whereas the regulation was immediately applied. The main parts of the directive and the regulation were:

- A stepwise opening of retail markets towards full market opening for all customers by 1 July 2007.
- Stricter provisions for the unbundling of transmission networks, leaving only the options of legal separation (establishing a separate company) or full ownership unbundling.
- Provisions for the mandatory establishment of independent regulators.
- New detailed provisions on cross-border electricity trade.

In 2001 the European Council requested the Commission to provide detailed assessments of the implementation of the market directives on an annual basis, and these were required by the second market directive to be finalised by 2005. The series of annual benchmarking reports culminated in a comprehensive report in 2005. In general, they were very critical about *the lack of implementation of directives and regulations in a large number of Member States*. They pointed out that in many of them the provisions that are being implemented focus on the letter of the legislation and not on the spirit of creating a true internal market [45].

The further sector inquiry finally led the Commission to propose a *third liberalisation package in 2007*. This agreement materialised in proposals for a third market directive and for a new regulation on cross-border electricity trade. The proposals were mainly aimed at strengthening the requirements and provisions in the second market directive, and maintaining the vision for a truly competitive internal market. Thus, in 2009 a *third series of directives* for electricity and gas and *regulations* for establishing the Agency, cross-border exchanges in electricity and natural gas transmission networks were adopted<sup>25</sup>.

The implemented policies on market reforming are:

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<sup>23</sup> Directive 2003/54/EC of the European Parliament and of the Council, "Concerning common rules for the internal market in electricity and repealing Directive 96/92/EC", 15/7/2003 and Directive 2003/55/EC of the European Parliament and of the Council, "Concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC", 15/7/2003.

<sup>24</sup> Regulation (EC) No 1228/2003 of the European Parliament and of the Council, "On conditions for access to the network for cross border exchanges in electricity", 15/7/2003.

<sup>25</sup> Directive 2009/72/EC, Directive 2009/73/EC, Regulation (EC) No 715/2009, Regulation (EC) No 714/2009 and Regulation (EC) No 713/2009.

### *2.3.1. Designation of Independent Regulatory Authority*

All Member States must designate a single *national regulatory authority* at national level. The duties of the regulatory authority is to oversee and monitor the whole electricity and gas market in order to facilitate their regular function and the rights and obligations of each one of the legal entities and undertakings involved in the markets.

The regulatory authority must be independent and exercise its powers impartially and transparently. In order to achieve this, Member States must ensure that it is legally distinct and functionally independent from any other public or private entity. Its staff and persons responsible for its management act independently from any market interest and do not seek or take direct instructions from any government or other public or private entity when carrying out their tasks.

### *2.3.2. Promotion of Regional Cooperation*

A strong step towards the creation of a fully liberalised internal market is the Member States' and regulatory authorities' *cooperation* for the purpose of integrating their national markets at one and more regional levels. Regulatory authorities and Member States must promote and facilitate the cooperation of transmission system operators at a regional level, including on cross-border issues, with the aim of creating a competitive internal market in electricity and gas sectors.

### *2.3.3. Unbundling of Transmission System Operators*

From 3 March of 2012 and thereafter, each undertaking which owns a (electricity/natural gas) transmission system acts as a Transmission System Operator (TSO). The same person or persons are not to, directly or indirectly, exercise control over a TSO and at the same time to exercise control or any right over an undertaking performing any of the functions of generation or supply.

For the *unbundling* of the TSOs Member States are free to opt one of the three models determined: the Ownership Unbundled TSO (OU), the Independent System Operator (ISO) and the Independent Transmission Operator (ITO).

The OU model provides a strong legal and functional unbundling, separating totally a TSO from any undertaking performing any of the functions of generation or supply. The ISO model is an alternative to the OU model. The setting up of a TSO that is independent from supply and generation interests should enable a Vertically Integrated Undertaking (VIU) to maintain its ownership of network assets whilst ensuring effective legal unbundling. So, the ISO model maintains the assets to the VIU and requests a strong regulatory environment to function.

The ITO is the second main model set out by the electricity/natural gas directives. The main difference between the ISO and the ITO is the lack of the non-control obligation, which is a prerequisite in both the OU and the ISO models. The main rule for the function of the ITO is that it must be equipped with all human, technical, physical and financial resources necessary for fulfilling



their obligations under these directives, as well as carry out the activity of electricity/natural gas transmission.

So, these models provide different degrees of structural separation of network operation from production and supply activities and they are expected to be effective in removing any conflict of interests between producers, suppliers and TSOs.

#### *2.3.4. Unbundling of Distribution System Operators*

When a Distribution System Operator (DSO) is a part of a VIU, *legal* and *functional unbundling* measures must be applied. In particular, the DSO must be independent at least in terms of its legal form (legal unbundling) and organization and decision making from other activities not relating to distribution (functional unbundling).

However, it is not obligatory to separate the ownership of assets of the DSO from the VIU. In addition to these requirements, where a DSO is a part of a VIU, the VIU must be independent in terms of its organization and decision-making from the other activities not related to distribution (e.g. in the area of telecommunications).

For DSOs serving less than 100.000 connected customers or serving small isolated systems, both legal and functioning unbundling measures may not be applied.

#### *2.3.5. Unbundling & Transparency of Accounts*

Member States or any competent authority they designate, have the right of access to the accounts of natural gas and electricity undertakings if it is necessary to carry out their functions.

Electricity and natural gas undertakings have to comply with the rules of national law concerning the annual accounts of limited liability companies. They must keep separate accounts in their internal accounting for each of their transmission and distribution activities as well as for other electricity and gas activities not relating to transmission or distribution. Revenue from ownership of the transmission or distribution system must be specified in the accounts and where appropriate, they must keep consolidated accounts for other, non-electricity/gas activities. The internal accounts must include a balance sheet and a profit and loss account for each activity.

#### *2.3.6. Public Service Obligations*

One of the main rules about the organization of the electricity and gas sectors is the possibility of the Member States to impose on undertakings *Public Service Obligations (PSOs)*. PSOs belong to the universal services, which came as a consequence of the liberalization of the energy market, and are considered as the right of all households to be supplied at a reasonable, easily and clearly comparable and transparent price.

The main elements of the universal services are the obligation to connect, the quality and regularity of supply and prices. In the above ambit, the establishment of last resort, the protection of remote customers, the universal services to small enterprises and the environmental protection are included. Ensuring universal services may be one of the reasons for imposing a PSO, especially in less developed markets.

The PSOs may be related to security, including security of supply, regularity, quality and price of supply, environmental protection, including energy efficiency, energy from RES and climate protection. In the area of final customer protection, the protection of vulnerable customer is included. Supplying vulnerable customers is recognized as an important task.

### 2.3.7. *Third Party Access*

Member States must ensure the implementation of a system of *Third Party Access (TPA)* to the transmission and distribution systems based on published tariffs, applicable to all eligible customers and applied objectively and without discrimination between system users. Those tariffs, or the methodologies underlying their calculation, are to be approved and published prior to their entry into force.

However, the TSO or DSO can refuse access where it lacks the necessary capacity or where the access to the system would prevent them from carrying out the PSOs. Clearly specified reasons must be given for such refusal based on objective and technically and economically justified criteria. The system user who has been refused access can make use of a dispute settlement procedure. The TSO or DSO must provide relevant information on measures that would be necessary to reinforce the network.

### 2.3.8. *Dispatching & Balancing Criteria*

National regulatory authorities must determine the *criteria* on which the *dispatching of generating installations* and the *use of interconnectors* will be based. These criteria must take into account the economic precedence of electricity from available generating installations or interconnector transfers and the technical constraints on the system.

Dispatching priority must be given to generating installations using RES and CHP. For reasons of security of supply, priority can be given to the dispatch of generating installations using indigenous primary energy fuel sources, to an extent not exceeding, in any calendar year, 15% of the overall primary energy necessary to produce the electricity consumed in the Member State.

TSOs must comply with minimum standards for the maintenance and development of the transmission system, including interconnection capacity. They must adopt rules on balancing the electricity system and charging system users of their networks for energy imbalance.

### 2.3.9. *Subsidies*

Under current EU legislation, it is possible to provide for *subsidies* in energy markets. Traditionally, the most important subsidies have been to support coal production, or its gradual phase-out. With the emerging policy objective of decarbonising energy supply, subsidies have become available to RE as well. For energy security and diversification of supply, Member States are also allowed to set PSOs, supporting the use of a particular fuel financially.

The design of subsidies varies by Member State. It is possible for subsidies to be paid largely in a manner that is compatible with an open energy market, or that the subsidy is paid in a way that precludes the active participation of the subsidised energy producer in the market. State subsidies which provide an economic advantage to certain undertakings and have the potential of distorting competition and which affect trade between Member States have to be approved by the EC. However, according to case law, measures (involving for example renewable electricity feed-in tariffs) which are designed according to the relevant legislation fall outside of the Commission's state aid control remit.

The Commission aims to persuade Member States to grant less state aid in general and to redirect spending to horizontal purposes of common interest, such as environmental protection and allow them, within certain limits, to continue to encourage state aid for renewable energy and energy efficiency [45].

### 2.3.10. *Monitoring & Reporting*

The Commission must monitor and review the application of the electricity and gas market directives and should submit an overall progress report to the EP and the Council for the first time by 4 August 2004, and thereafter on an annual basis. Every two years, the progress report must also include an analysis of the different measures taken in the Member States to meet PSOs, along with an examination of the effectiveness of those measures and, in particular, their effects on competition in the energy market. Where appropriate, the report may include recommendations as to kind of measures should be taken at a national level to achieve high public service standards, or measures intended to prevent market foreclosure.

### 2.3.11. *Supporting Tools*

Towards the difficult task of energy market liberalization, policy supporting tools seem to play crucial role. The *Agency for the Cooperation of Energy Regulators (ACER)* was established in 2009, in order to assist the regulatory authorities in exercising at Community level, the regulatory tasks and, where necessary, to coordinate their action. The types of the ACER's acts are to issue opinions and recommendations addressed to TSOs, regulatory authorities, the EP and the Council or the Commission, to take individual decisions in the specific cases and submit to the Commission non-

binding framework guidelines on conditions for access to the network for cross-border exchanges in electricity and natural gas transmission networks.

Also the *European Network of Transmission System Operators (ENTSO)* for electricity and gas was established, aiming at cooperation of the TSOs at Community level in order to promote the completion and functioning of the internal market in electricity/gas and cross-border trade. Additionally, it aims to ensure the optimal management, coordinated operation and sound technical evolution of the European electricity/gas transmission network. The execution of ENTSO's tasks will be monitored by ACER and then reported to the Commission.

## 2.4. Security of Energy Supply

The main pillar of a common energy policy since the very beginning of the European integration is the security of supply. The EU is dependent to varying degrees on energy imports of oil, gas, coal and electricity. Some individual Member States may be self sufficient in one of these energy sources, or overall net exporters.

The first incident which exposed the vulnerability of importing countries was the Suez Crisis in 1956-57. Following the crisis, the Council adopted the *Stockholding Directive* which obliged Member States to maintain emergency stocks of oil and petroleum products corresponding to 65 days of consumption<sup>26</sup>. A second wave of initiatives took place in reaction to the price and supply shocks provoked by the third (1967) and fourth Arab-Israeli conflicts (1973). Subsequently, the Council adopted, in 1972, *two regulations*, one requiring Member States to inform the Commission about their hydrocarbon importations, the other requiring them to report on investment projects in the oil, gas and electricity sectors<sup>27</sup> and the *second stockholding directive*, raising the emergency oil and petroleum stock requirement to 90 days of consumption<sup>28</sup>.

In 1977 the Community developed its own emergency system by adopting *two decisions* on the export of crude oil and petroleum products between Member States and to cut back consumption of primary energy resources in the case of supply difficulties<sup>29</sup>.

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<sup>26</sup> Council Directive 68/414/EEC, "Imposing an obligation on Member States of the EEC to maintain minimum stocks of crude oil and/or petroleum products", 23/12/1968.

<sup>27</sup> Regulation (EEC) No 1055/72 of the Council, "On notifying the Commission of imports of crude oil and natural gas" & Regulation (EEC) No 1056/72 of the Council, "On notifying the Commission of investment projects of interest to the Community in the petroleum, natural gas and electricity sectors", 25/5/1972.

<sup>28</sup> Council Directive 72/425/EEC, "Amending the Council Directive of 20 December 1968 imposing an obligation on Member States of the EEC to maintain minimum stocks of crude oil and/or petroleum products", 28/12/1972.

<sup>29</sup> Council Decision 77/186/EEC, "On the exporting of crude oil and petroleum products from one Member State to another in the event of supply difficulties", 5/3/1977 & Council Decision 77/706/EEC, "On the setting of a Community target for a reduction in the consumption of primary sources of energy in the event of difficulties in the supply of crude oil and petroleum products", 16/11/1977.

Recent events, including the rapid rise of fossil fuel prices since 2004, the interruption of gas supplies from Russia in January 2006 and the major electricity blackout in November 2006 affecting large parts of north-western Europe, turned the energy security policy into a major challenge for the EU.

Currently, in response to the political crisis in Ukraine, the EC released an EU *energy security strategy* on 28 May 2014<sup>30</sup>. In the short-term, energy security stress tests will be launched in order to provide information for strengthening existing European emergency and solidarity mechanisms and actions to address medium and long-term security of supply challenges are proposed.

All the previous mentioned policies in the fields of renewable energy, energy efficiency and internal energy markets aim at security of energy supply as one of their major targets. External energy relations are also crucial towards the suppliers' diversification. A few more specific policies in security of supply that must be mentioned are:

#### *2.4.1. Emergency Oil Stocks*

The current framework, under which Member States are obliged to hold, at all times, minimum emergency oil stocks, is the codification of older legislation dating back to 1968<sup>31</sup>. It was entered into force in December 2012 and is more compatible with the tested IEA emergency stockholding system, compared to the previous one.

Member States are obliged to adopt the appropriate laws and regulations in order to maintain total oil stocks (crude oil and/or petroleum products) of 90 days of average daily net imports or 61 days of average daily inland consumption, whichever of the two quantities is greater. Also, they must keep a continually updated and detailed register of all emergency stocks and send a copy to the Commission once a year.

Finally, it must be mentioned that when Member States are calculating their stockholding obligations, according to the provided methods and procedures, biofuels and additives are taken into account only when they have been blended with the petroleum products or when they are stored on the territory of the Member State and are to be blended with petroleum products.

#### *2.4.2. National Emergency Plans*

In the event of a major supply disruption Member States are to have *procedures* in place and *contingency plans* to be implemented. These procedures will enable competent authorities to release quickly, effectively and transparently some or all of their emergency stocks. They will also

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<sup>30</sup> European energy security strategy, COM(2014) 330 final, 28/5/2014.

<sup>31</sup> Council Directive 2009/119/EC, "Imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products", 9/10/2009.

impose general or specific restrictions on consumption in line with the estimated shortages, by allocating petroleum products to certain groups of users on a priority basis.

In case of a local crisis or fulfilling its international obligations, a Member State can release emergency stock. In doing so, Commission must be informed immediately of the amount released in order to assess the impact of that release.

#### *2.4.3. Central Stockholding Entities*

A new policy option introduced with the last framework on emergency stocks is the establishment of *Central Stockholding Entities (CSEs)*. A CSE is a body or service that maintains the oil stocks (including acquisition and management of these stocks). Each Member State cannot have more than one CSE, established at any location within the Community.

#### *2.4.4. Explicit Provisions on Security of Gas & Electricity Supply*

Provisions aiming at safeguarding the security of gas supply by ensuring the proper and continuous functioning of the internal market in natural gas were established in 2004 and updated in 2010<sup>32</sup>. Towards this direction a list of market and non-market based security measures is provided (e.g. infrastructure standards with reverse flows established in all cross border interconnections between EU countries), upon which, Member States must establish preventive action plans and emergency plans.

Respectively, a framework for the security of electricity supply concerning measures on operational network security, maintaining balance between supply and demand and network investments is also established<sup>33</sup>.

#### *2.4.5. Enforcing Infrastructure – The Trans-European Networks-Energy Program*

The *Trans-European Networks-Energy (TEN-E) program* aims at increasing the interconnections in both electricity and gas sector and enforce their infrastructure.

In the electricity sector, the primary aim of the TEN-E program is to establish additional internal interconnections to support trade of electricity within the EU, equivalent to cross-border transmission capacity corresponding to at least 10% of installed generating capacity, following a EC decision in spring 2002. This commitment recognises the importance of cross border transmission capacity in realising the vision of an internal electricity market. TEN-E identifies major transmission axes, major bottlenecks in these corridors and additional priority projects of regional importance; 196 priority

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<sup>32</sup> Regulation (EU) No 994/2010 of the European Parliament and of the Council, "Concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC", 12/11/2010.

<sup>33</sup> Directive 2005/89/EC of the European Parliament and of the Council, "Concerning measures to safeguard security of electricity supply and infrastructure investment", 4/2/2006.

electricity transmission projects were decided in 2003, 32 of them categorised as being of European interest and 164 of common interest.

In the gas sector, the main aim of the TEN-E programme is to provide additional routes and access to more sources of gas, to increase diversification. Projects can either be pipelines, or LNG import terminals, or storage [45].

#### 2.4.6. External relations

Co-operation with supplier and transit countries takes place within *multilateral* frameworks such as the World Trade Organization and the Energy Charter Treaty, through *regional initiatives* such as the Energy Community Treaty and in the *bilateral* context through Partnership & Co-operation Agreements and Free Trade Agreements, which provide legally binding rules for the energy sector.

The EU's key energy partners are Russia, Norway, the US, India, China and OPEC. The *EU-Russia Energy Dialogue* serves as the main vehicle of co-operation in the energy sector between the EU and its main external supplier. In the field of the *European Neighbourhood Policy*, Memoranda of Understanding have been concluded with producer and major transit countries such as Kazakhstan, Turkmenistan, Azerbaijan, and Ukraine, and through joint declarations with Morocco and Jordan.

Also, regional cooperation initiatives such as the *Black Sea Synergy*, the *Eastern Partnership*, the *Union for the Mediterranean* and the *Central Asia Strategy* contain energy components concerning security of supply.

#### 2.4.7. Supporting Tools

A *Gas Coordination Group* is established to facilitate the coordination of measures concerning security of gas supply. It is made up of representatives of the Member States and it is the main body to be consulted by the Commission in the context of the establishment of the preventive action plans and the emergency plans. Respectively, the *Coordination Group for oil and petroleum products* contributes to analyzing the situation within the Community with regard to the security of supply for oil and petroleum products and facilitates the coordination and implementation of measures in the oil stocks field.

In response to the 2008 energy and financial crises the *European Energy Program for Recovery (EEPR)* was established in July 2009<sup>34</sup>. It provides financial assistance to the energy sector, especially to the introduction of interconnection infrastructures (€2.3 billion out of the total budget of € 4 billion) enforcing the investments concerning the security of energy supply. The EEPR is considered as the key element of the *European Economic Recovery Plan*<sup>35</sup> and also focuses on RE,

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<sup>34</sup> Regulation (EC) No 663/2009 of the European Parliament and of the Council, "Establishing a program to aid economic recovery by granting Community financial assistance to projects in the field of energy", 31/7/2009.

<sup>35</sup> A European Economic Recovery Plan, COM(2008) 800 final, 26/11/2008.

energy efficiency and environment, funding offshore wind and CCS projects. So far, 59 projects have been co-financed: 44 on gas and electricity infrastructure, 9 on offshore wind and 6 on carbon capture and storage [1].

The *Europe 2020 Project Bond Initiative* is a recent policy decision which aims to increase debt financing availability for large scale infrastructure projects in energy (TEN-E projects can benefit from this initiative). It is an Initiative between EU and the European Investment Bank (EIB) that intends to complement the existing sources of project financing through bank loans or public sector grant programs. Its pilot phase started in August 2012 and the first transaction successfully took place in July 2013, in Spain, for the Castor underground gas storage project, which will provide storage for 30% of Spain's daily gas consumption [3].

## 2.5. Environmental Protection & Climate Change

Climate change was first recognized as an issue to be addressed by EC environmental policy in the EC's Fourth *Environmental Action Program (EAP)* covering the period 1987-1992. By the time the Community adopted its Fifth EAP for the period 1993-2000, climate change was identified as one of the seven priority areas for the Community's environmental policy. As more evidence for climate change effects resulted in more political awareness, Community action on climate change and environmental protection gained momentum.

In 2002 the Kyoto Protocol was ratified. It was committed to an 8% reduction of greenhouse gas (GHG) emissions during the commitment period 2008-2012, compared to base-year emissions, which vary between Member States. This target was distributed among the then EU-15 through a *burden-sharing agreement* in 2002<sup>36</sup>. The latest EU-12 were not subject to the burden-sharing agreement but instead had to fulfil their targets as signatories of the Protocol.

The burden-sharing agreement stipulated that no more than 50% of emissions reductions in any Member State could come from the use of the Kyoto flexible mechanisms (clean development mechanism and joint implementation), but otherwise left the development of national policies to reduce GHG emissions up to Member State governments. For the post-Kyoto regime, the EU would again aim to have a single target assigned to it, and redistribute it internally.

Until 2005, the Commission pursued climate change policy solely as a cooperative exercise within the Kyoto framework. The short period up to the date of expiry of this framework by 2013 and a perceived lack of urgency on the part of international partners, a policy change took place. As a

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<sup>36</sup> Council Decision 2002/358/EC, "Concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfillment of commitments thereunder", 15/5/2000.



consequence, in 2007 the EU agreed to pursue unilateral GHG emissions reductions of 20% by 2020, while offering to step these up to 30% in the case of a new global agreement being found. According to the 2030 policy framework for climate and energy, presented in January 2014, a reduction target of GHG emissions by 40% below the 1990 level by 2030 will be set in order to keep EU on track for the objective of cutting emissions by at least 80% by 2050.

Air pollution was also one of the early areas of the Commission's energy and environment policy, and pollution control legislation is now affecting transport and power generation in particular. Most affected are coal-fired power stations, in particular because of the legislation restricting SO<sub>2</sub> emissions. In the area of transport, NO<sub>x</sub> and particles are being controlled, with implications for diesel vehicles.

Policies mentioned in previous paragraphs, on RE and energy efficiency, aim at mitigating the climate change and environmental protection. Some more specific policies though are:

### *2.5.1. EU Emissions Trading System*

The *EU Emission Trading System (ETS)* is the first and biggest international scheme for the trading of GHG emission allowances. Currently, it operates in 31 countries (EU-28 plus Iceland, Norway and Liechtenstein) and covers approximately 45% of the EU's CO<sub>2</sub> emissions from about 11.500 installations (power stations, combustion plants, oil refineries, iron and steel works, factories making cement, glass, lime, bricks, ceramics, pulp, paper and board). Nitrous oxide (N<sub>2</sub>O) emissions from certain processes and Perfluorocarbons (PFCs) from aluminium production are also covered.

The system operates through the allocation and trading of GHG emission allowances throughout the EU. One allowance represents one tone of CO<sub>2</sub> equivalent. A "cap" is set on the total amount of emissions allowed from the installations covered by the ETS. The allowances are distributed to the installations in the system and operators of all these installations are then free to trade in allowances.

Thus, in the short term ETS works as a statistical transfer mechanism between the power stations and the industrial plants. Year by year, the number of allowances is reduced so that total emissions fall, with the aim to be *21% lower in 2020* than in 2005 levels (43% in 2030 according to the 2030 policy framework).

The ETS was launched in 2005. The *Phase 1 (2005–2007)* was a three-year pilot period of 'learning by doing' in order to prepare for the next phase of effective function. The system was covering CO<sub>2</sub> emissions only from power generators and energy-intensive industrial sectors with the penalty of non-compliance at €40/tonne. The caps were set on the basis of best guesses, since reliable emissions data were not available, and almost all allowances were given free of charge. In practice though, the number of allowances over exceeded demand and thus their trading price fell to zero.

However, the first phase succeeded in establishing a price for carbon, free trade of allowances across the EU and creating a data base on emissions.

In *Phase 2* (2008-2012) changes were introduced. The system was also covering nitrous oxide emissions (only from the production of nitric acid), the volume of allowances was reduced by 6.5% compared to the 2005 level with 90% of them given away for free and the penalty of non-compliance was increased to €100/tonne. Also, the aviation sector joined in, in January 2012. Despite the fact that the ETS became the biggest source of demand for clean development mechanism / joint implementation credits and the main driver of the international carbon market, the economic crisis that began in late 2008, over depressed the demand for allowances, leading to a large and growing *surplus of unused allowances and credits* which weighed heavily on the carbon price throughout the second phase.

Currently, the ETS is in *Phase 3* (2013-2020) with significant changes in place: more sectors and gases are included, a different cap system has been applied and auctioning is set as the default method for allocating allowances (more than 40% in 2013 were auctioned and the share will rise each year). The rest of allowances, given away for free, meet specific rules.

Finally, it must be mentioned that the 2030 framework proposes to establish a *market stability reserve* at the beginning of the *Phase 4* in 2021. The reserve would both address the surplus of emission allowances that has built up and improve the system's resilience to major shocks by adjusting the supply of allowances to be auctioned.

### 2.5.2. A Single EU-Wide Cap

In the first two phases of the ETS, caps were set through *National Allocation Plans (NAPs)* submitted by Member States. NAPs set out each State's allocation of CO<sub>2</sub> emission allowances under the EU ETS and fixed both the total of emission allocations available in each Member State and the allocation made to each installation covered by the system.

In the third phase though, a *single EU-wide cap system* is applied. The 2013 cap for the 31 countries of the ETS was set at 2,084,301,856 allowances. Each year the cap will be lowered by 1.74% in order to achieve the 21% emissions reduction in 2020 (and by 2.2% per year from 2021 in order to achieve the 43% reduction in 2030). The aviation sector cap remains the same in each year of the 2013-2020 trading period.

### 2.5.3. National Targets for Non-ETS Emissions

Since about 60% of the EU's total emissions come from sectors outside the EU ETS [1] (housing, agriculture, transport, waste management), binding annual GHG emission targets have been established for Member States in order to cover them. Targets concern the period 2013-2020 and they are expressed as percentage changes from 2005 levels. They are *differentiated according to*

*Member States' relative wealth*, thus they range from a 20% emissions reduction by the richest Member States to a 20% increase by the least wealthy.

The objective is to deliver a *reduction of around 10%* in total EU emissions and together with a 21% cut in emissions covered by the EU ETS, will accomplish the overall reduction goal of 20% in 2020.

#### *2.5.4. Emission Limit Values for Large Combustion Plants*

Large Combustion Plants (LCPs) whose thermal input is equal to or greater than 50 MW, irrespective of the type of fuel used, have to comply with the emission limit values for sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and dust. These values are fixed in the *Industrial Emissions Directive* which aims to reduce emissions of acidifying pollutants, particles, and ozone precursors<sup>37</sup>.

Existing LCPs have different options of commitment to the emission limit values depending on when they got permission. For example, LCPs licensed before 1<sup>st</sup> of July 1987 can either “opt in” by committing to the emission limit values or by participating to a transitional national plan, or “opt out” by committing to operate for a maximum of 20,000 hours from 1 January 2008 to 31 December 2015 and then close.

New LCPs, which are granted (or apply for) a permit within two years of the directive coming into force and which operate within three years of the directive coming into force will be subject to the emission limit values.

#### *2.5.5. Restrictions on Industrial Activities*

Specific measures for industrial activities are designed to prevent or reduce emissions in the air, water and land, including measures concerning waste, aiming to achieve a high level of protection of the environment.

In order to receive a permit, an industrial or agricultural installation must comply with certain basic obligations so that the companies themselves bear responsibility for preventing and reducing any pollution they may cause. Also, there are special provisions for waste incineration and co-incineration plants, installations and activities using organic solvents and installations producing titanium dioxide.

#### *2.5.6. Transport Labelling System*

For motor-vehicle it isn't electrical efficiency that is indicated through labelling but information on *fuel consumption* and *CO<sub>2</sub> emissions*. Car manufacturers and distributors are to display information on fuel consumption and CO<sub>2</sub> emissions of new passenger cars in showrooms and within any

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<sup>37</sup> Directive 2010/75/EU of the European Parliament and of the Council, “On industrial emissions (integrated pollution prevention and control) (Recast) (Text with EEA relevance)”, 17/12/2010.

marketing activity. The labels include mandatory data on CO<sub>2</sub> emissions (g/km) and fuel consumption (l/100km and/or km/l).

Vehicle labelling is a practical method to inform consumers about the fuel economy and environmental standards of the new cars, but as the buying decisions are strongly influenced by costs, size, power, manufacturer and safety of the car, the impact on the consumer decision remains quite low. For this reason, tax incentives and relative comparison methods on the labels are preferable in order to help shifting consumer decisions to more environmental friendly cars.

In 2012 the labelling system was also applied on tyres. The label provides information on fuel efficiency, wet grip and external rolling noise through pictograms.

### *2.5.7. Vehicle Emission Standards*

European emission standards define the acceptable limits for exhaust emissions of new vehicles sold in EU Member States. Currently, emissions of nitrogen oxides (NO<sub>x</sub>), total hydrocarbon (THC), non-methane hydrocarbons (NMHC), carbon monoxide (CO) and particulate matter (PM) are regulated for most vehicle types, including cars, lorries, trains, tractors and similar machinery, barges, but excluding seagoing ships and aeroplanes. For each vehicle type, different standards apply. New models introduced must meet current or planned standards, but minor lifecycle model revisions may continue to be offered with pre-compliant engines.

In order to limit the amount of CO<sub>2</sub> emitted by passenger cars sold in Europe, a voluntary agreement between the EC and European Automobile Manufacturers Association (ACEA) was signed in 1998. The ACEA agreement sought to achieve an average of 140 g/km of CO<sub>2</sub> by 2008 for new passenger vehicles sold by the association's cars in Europe with an ultimate EU target of 130 g/km for all new passenger cars by 2015.

### *2.5.8. Fuel Quality*

Since 1998 technical specifications on health and environmental grounds for fuels and a target for the reduction of life cycle greenhouse gas emissions have been adopted<sup>38</sup>.

Fuel suppliers are responsible for monitoring and reporting life cycle greenhouse gas emissions per unit of energy from fuel. From 1 January 2011 and every year on they must report to the authority designated by the Member State on the greenhouse gas intensity of fuel and energy supplied within each Member State. They must provide the total volume of each type of fuel or energy supplied, indicating where purchased and its origin and life cycle greenhouse gas emissions per unit of energy. Environmental specifications for market fuels to be used for vehicles equipped with positive

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<sup>38</sup> The Fuel Quality Directive [98/70/EC] which was amended by Directive 2009/30/EC and the Directive on the promotion of the use of energy from renewable sources [2009/28/EC].

and compression ignition engines are also provided, as well as rules for calculating the GHG emissions from biofuels.

### 2.5.9. Carbon Capture & Storage

In 2009 a legal framework for the environmentally safe *geological storage of CO<sub>2</sub>* was established, in order to contribute to the fight against climate change<sup>39</sup>. The purpose of environmentally safe geological storage of CO<sub>2</sub> is its permanent containment in such a way as to eliminate negative effects to the environment and human health.

The *Carbon Capture & Storage (CCS) Directive* provides extensive requirements for the selection of storage sites and storage permits. It also contains provisions on closure and post-closure obligations, and sets out criteria for the transfer of responsibility from the operator to the Member State. The EC has taken several initiatives to ensure the coherent implementation of the CCS Directive throughout the EU such as the establishment of an *Information Exchange Group*, to facilitate exchanges between the competent authorities and the adoption of a *Commission Opinion* on a draft storage permit, in February 2012<sup>40</sup>.

### 2.5.10. Supporting Tools

The *European Climate Change Program (ECCP)* was launched by the EC in 2000 and it is considered as the first comprehensive policy on climate mitigation. The goal of the ECCP is to identify and develop all the necessary elements of an EU strategy to implement the Kyoto Protocol, and it has led to the adoption of a wide range of new policies and measures (e.g. ETS). In its first phase (2000-2004) 11 working groups covering different areas examined an extensive range of policy sectors and instruments with the potential of reducing greenhouse gas emissions. The second phase was launched in October 2005 with new working groups established.

The *European Environment Agency (EEA)* was established in 1990 and it came into force in 1993<sup>41</sup>. Its purpose is to provide sound and independent information on the environment, being the major information source for those involved in developing, adopting, implementing and evaluating environmental policy. EEA helps the Community to make informed decisions on environmental issues towards sustainable development and coordinates the European environment information and observation network (Eionet).

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<sup>39</sup> Directive 2009/31/EC of the European Parliament and of the Council, "On the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006", 5/6/2009.

<sup>40</sup> Commission opinion relating to the draft permit for the permanent storage of carbon dioxide in block section P18-4 of block section P18a of the Dutch continental shelf, in accordance with Article 10(1) of Directive 2009/31/EC of 23 April 2009 on the geological storage of carbon dioxide, C(2012) 1236 final, 28/2/2012.

<sup>41</sup> Regulation (EC) No 401/2009 of the European Parliament and of the Council, "On the European Environment Agency and the European Environment Information and Observation Network", 21/5/2009.

## 2.6. Nuclear Energy

Although nuclear power accounts for roughly one-third of Europe's overall electrical generation [1], pronounced differences in national nuclear energy policies have prevented the EU from developing a common nuclear energy policy. Within the EU there are widely differing attitudes to the acceptability of nuclear power and it is up to each Member State to choose to include it as part of its energy mix. Similarly, *nuclear regulation is a national responsibility*.

Given the substantial costs of putting a nuclear reactor on line and the controversial nature of nuclear waste, it appears unlikely that Europe will see a resurgence of new nuclear reactors in nations where nuclear power does not already play a role. At best, those nations that already utilize nuclear power could be expected to either replace or upgrade existing reactors.

During the last years, nuclear power generation was gaining favour within Europe due to the fact that it enhances EU efforts to reduce GHG emissions and clean air initiatives as it is a low-emission technology with no direct emissions of CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub>, ozone and particulate matter. It also enhances EU security of energy supply, since uranium is widely distributed and about 50% of global mine production comes from reliable, politically stable trading partners (Canada, Australia, US).

However, the accident in Fukushima in March 2011 restarted the debate on the future of this controversial energy source with several countries immediately called into question their nuclear programs. The different responses were quick to emerge and demonstrate the heterogeneity of national situations in EU.

Germany has permanently shut down eight of its reactors and plans to close the rest nine by 2022 at latest. Switzerland and Spain have banned the construction of new reactors while Italians rejected the restart of a nuclear program, abandoned in the 1980s, in the popular referendum of June 2011.

Other EU countries have announced that their programs will continue, while emphasizing the need to take lessons from the accident in order to make future plants safer. Poland restated its ambition to build a reactor. France defended its choice of nuclear power, while ordering an audit of its plants. The United Kingdom declared that it was too early to question the future of its planned new plants (four EPR reactors are due to enter service in 2018). Finland simply committed itself to heeding the lessons of Fukushima during the continuing construction of the French EPR at Olkiluoto [48].

EU nuclear policy aims to establish a European framework for nuclear safety through the obligation of Member States to adopt a legislative and regulatory framework which ensures the existence of national safety measures (system of licenses, inspecting and assessing nuclear facilities, management and storage of radioactive waste, crisis management mechanism, damage reparation guarantees in case of an accident). It also aims to greater international cooperation, for example

through the *Multi-National Design Evaluation Process* and the activities of the *Western European Nuclear Regulators' Association*. Moreover, the EU contributes financially to the development of nuclear energy and the promotion of nuclear safety.

So, in 2014, safety still remains at the top of the EU's nuclear energy policy agenda. Member States will have to continue implementing the recommendations of the safety reassessments (stress tests) process carried out following the Fukushima accident and the EC is expected to publish a report on their implementation. The EC's Proposal for a revised *Safety Directive* published in June 2013 should be adopted by the European Council<sup>42</sup>. Other developments are in the pipeline like the publication of a proposal on nuclear insurance and liability, the environmental and energy state aid guidelines and the EU 2030 climate and energy framework [4].

## 2.7. Research & Development

Energy R&D has a long history in the EU. It is considered as a top priority policy sector and a key element in the Commission's low-carbon strategy, with significant contribution towards the energy efficiency and RES penetration. The EC is traditionally preparing and developing programs, aiming at both achieving R&D results and creating an integrated European research landscape.

Since 1984, the main instrument for the implementation of European energy research policy and for the provision of funding R&D activities is the multi-annual *Framework Program for Research and Technology Development (FP)*. It covers almost all aspects of European research and is the EU's main financial and legal instrument to the European R&D implementation.

An important milestone for the energy R&D in the EU was the creation of the *European Research Area (ERA)*. It was proposed by the EC in January 2000 and shortly afterwards (at the March 2000 Lisbon European Council) it was endorsed by the EU. It is composed of all R&D activities, programs and policies in Europe which involve a transnational perspective and its aim is to become the "common internal market" of the EU R&D sector. The development of ERA is crucial in order to overcome the fragmentation of research in EU along national and institutional barriers and achieve a high multinational cooperation<sup>43</sup>.

In March 2008, the European Council emphasized the need for sustained investment in R&D. Thus, considering its crucial role, investment in R&D is at the heart of the *Europe 2020 strategy*<sup>44</sup>.

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<sup>42</sup> Draft proposal for a Council directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations, COM(2013) 343 final, 13/6/2013.

<sup>43</sup> A reinforced European Research Area partnership for excellence and growth, COM(2012) 392 final, 17/7/2012.

<sup>44</sup> A strategy for smart, sustainable and inclusive growth, COM(2010) 2020, 3/3/2010.

### 5.7.1. The Framework Program

As mentioned above, The FP is the main instrument for the implementation of European energy research policy. The *Seventh Framework Program (FP7)* was running from 2007 to 2013. Under its structure, energy research is split into nuclear, with the program running from 2007 to 2011, and non-nuclear energy research, from 2007 to 2013.

Under the energy theme of the *FP7 Cooperation Program*, nine subject areas for non-nuclear energy research have been identified: *Hydrogen & fuel cells, Renewable electricity generation, Renewable fuel production, Renewables for heating & cooling, CCS technologies, Clean coal technologies, Smart energy networks, Energy efficiency and savings, and Knowledge for energy policy making*. The bulk of nuclear spending in FP7 is allocated to the ITER fusion reactor project at Cadarache in France with priority activities on waste management, development of reactor systems and radiation protection.

In December 2013 the *Eighth Framework Program* was launched under the name *Horizon 2020*. It runs from 2014 to 2020 and it is the biggest EU R&D program ever. Energy research consists of the non-nuclear energy program "Secure, clean and efficient energy" which focuses on *Energy Efficiency, Competitive Low Carbon Energy* and *Smart Cities & Communities* areas and a separate but complementary program for nuclear energy research activities, adopted under the Euratom Treaty. In terms of budget, Horizon 2020 will dedicate €5.931 billion for non-nuclear energy research for the period 2014-20 and €1.603 billion for nuclear research for the period 2014-18 [1].

### 5.7.2. Strategic Energy Technology Plan

The European Council agreed on an *Energy Policy for Europe* in March 2007, backing the Commission's proposals on energy and climate change, and underlining the need to strengthen energy research, in particular to accelerate the competitiveness of sustainable energies, notably RE and low-carbon technologies and the further development of energy efficient technologies. The Council decision acknowledged that low-carbon technologies will play a crucial role in reaching the EU's energy and climate change targets.

Because of the timing of the start of FP7 it had not been possible to reflect the need to strengthen energy research in RE, low-carbon and energy efficient technologies, the Commission adopted the *Strategic Energy Technology Plan (SET Plan)* in November 2007<sup>45</sup>. Its main goal is to accelerate the development and implementation of low-carbon technologies, and strengthen industrial participation in energy R&D through the European industrial initiatives. SET Plan includes the initiatives of wind, solar, bioenergy, CCS, European electricity grid, fuel cells & hydrogen, smart cities and sustainable nuclear fission.

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<sup>45</sup> A European strategic energy technology plan (Set-plan) - 'Towards a low carbon future' {SEC(2007) 1508} {SEC(2007) 1509} {SEC(2007) 1510} {SEC(2007) 1511}, COM(2007) 0723 final, 22/11/2007.



Its time horizon includes both a 2020 perspective and a long-term vision to 2050; it sets out the key EU technology challenges to meet the 2020 targets and also the technology challenges that will have to be addressed to put the EU on course to achieve the 2050 vision. The SET-Plan also includes the next supporting tools:

The *SET-Plan Steering Group (SET-Group)*, which coordinates the implementation of the SET-Plan by providing a high-level discussion platform and a flexible framework for strategic planning and implementation. It works to maximize the cost-effective contribution that technology can make to achieving Europe's energy goals.

The *European Energy Research Alliance (EERA)*, which aims to accelerate the development of new energy technologies with the help of Joint Research Programs supporting the SET-Plan by concentrating activities and resources, combining national and EU sources of funding and maximizing complementarities and synergies.

The *SET-Plan Information System (SETIS)*, which supports the implementation and strategic planning of the SET-Plan. It makes the case for technology options and priorities, monitors and reviews progress regarding implementation, assesses the impact on policy, and identifies corrective measures if needed. SETIS works in close collaboration with European stakeholders such as the ETPs, industrial stakeholders, trade associations, international organizations and the finance community [50].

### 5.7.3. Research Fund for Coal & Steel

The industry-focused research program of the *Research Fund for Coal and Steel (RFCS)* was created when the ECSC Treaty expired in July 2002 and entered into force in 2008<sup>46</sup>. It is complementary to and managed outside the FP. It supports research projects in the areas of coal and steel, financed by the interests accrued each year by the assets of the ECSC, about €55m/year. As the world relies and will rely on steel, more sustainable and clean production techniques must be developed and implemented. Also, since coal remains one of the main energy sources, clean coal technologies are to be developed.

### 5.7.4. Supporting Tools

The *European Technology Platforms (ETPs)* were created by the European Council, in March 2003, for strengthening the European research and innovation area. ETPs are fora which bring together industry-led stakeholders in order to define medium to long-term R&D objectives on a number of technological areas where achieving EU growth, competitiveness and sustainability requires major research and technological advances. There are seven ETPs relative to energy issues: *Hydrogen*

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<sup>46</sup> Council Decision 2008/376/EC, "On the adoption of the research program of the Research Fund for Coal and Steel and on the multiannual technical guidelines for this program", 20/5/2008.

and Fuel Cells (established in 2003), Solar Photovoltaics (2005), Zero-Emission Fossil Fuels (2005), Smart Grids (2006), Biofuels (2006), Solar Thermal (2006) and Wind (2006). ETPs help the stakeholders establish long-term Strategic Research Agendas (SRAs), and contribute directly to the FP work plans, ensuring that EU-funded R&D is relevant for users.

The *Joint Technology Initiatives (JTIs)* have been developed by some ETPs. The concept of JTIs was introduced in FP7 as a way of creating public-private partnerships in European R&D. They are a means to implement the SRAs of a limited number of ETPs of which the scale and scope of the objectives is such that cannot be supported by the regular instruments of the FP. To help identify such cases identification criteria have been developed by the EC. While ETPs allow public and private stakeholders to jointly define research needs, JTIs are a way of implementing large-scale applied and industrial focused research activities, based in part on the needs identified by ETPs.

# Conclusions

As this report has tried to illustrate, the breadth and complexity of energy-related issues are increasing in a globalised world with economic and environmental constraints. The EU is called to face an increasing dependence on fossil fuels, growing energy imports and rising energy costs although recent drastic changes due to unconventional worldwide discoveries of oil and gas reserves may change the latter.

These challenges are making European societies and economies vulnerable and in order to deal with them, progress towards a sustainable energy development seems the only way. The European Commission has risen by proposing a range of policies that aim to address these challenges and transform them into opportunities for global economic and technological leadership.

The Union's energy policy started with the first steps of the European integration and the first initiatives took place in order to address the security of the Community's supply. It took few decades since 1950s for a common energy policy with ambiguous targets to be achieved, because of Member States' differing interests. Energy-related issues such as environmental protection and energy efficiency gradually gained in importance, therefore the need for a common EU position and concrete action grew stronger and finally led to the shift of energy policy from an entirely national matter to a supranational policy initiative.

From 2005 onwards, the EC is developing and driving a strong energy policy at EU level. It recognizes the increasingly pressing challenges of growing imports of energy, while addressing the environmental impact of energy production and use. The development of this strategy is built upon three intrinsically linked elements: sustainable low-carbon development, actions to achieve the goal of a single energy market in order to lower energy costs and promote competitiveness, and energy security and external relations. These closely interlinked challenges are very difficult to resolve.

While the overall policy development is commendable, there is room for improvement in the policy making of the Commission. The combination of energy policy with climate policy objectives has led to a suite of measures (notably the '20/20/20 energy and climate package') that has been criticized for not passing the cost benefit test [52]; and the contradiction between climate policies and internal energy market initiatives may endanger the competitiveness of the European economy [53].

Therefore, the EU energy policy should be reassessed in order to reconcile the basic priorities mentioned above, taking account of recent global events such as the financial crisis, the negotiations on climate policy agreements and the technological advances in fossil fuel exploration and renewable technologies.

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