



# KEP energy REPORT

Volume 1

## EU energy and climate strategy: "20-20-20" target



**Autore: ing. PhD Lorenzo Leoncini & KEP energy research staff**

**Anno di Pubblicazione: 2016 / Anno di Editing: 2016**

## EU energy and climate strategy: “20-20-20” target

Ing. PhD Lorenzo Leoncini

*research.area@kep-energy.com*

### Introduction

The main targets of the European Union (EU) strategy in the climate and energy fields are the Green House Gases GHG emissions cut and the energy dependence reduction. Aim of this strategy is ensure the supply security on the medium and long term and fulfil the international commitments, in compliance with both the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC). The final energy demand reduction is, together with the fuel-switching from fossil fuels to Renewable Energy Sources (RES), one of the main cards available to the EU to influence the global energy market, and to ensure the supply security on the medium and long term.

The final energy demand reduction is suitable for the targets established from the EU in 2020 through the “20-20-20 Package”: 20% GHG emissions cut in comparison to 1990; 20% RES share in gross final energy consumption; 20% energy efficiency increase (that is 20% reduction of the annual primary energy consumption respect to the 2007 baseline, equal to – 368,5 MTOE).

The report “Energy 2020 – A strategy for competitive, sustainable and secure energy” indicates the energy efficiency as the fulcrum of the EU strategy towards 2020. This strategy is aimed to decoupling the energy demand from the economic growth. The report “Action

plan for energy efficiency: realising the potential” highlights the relevant energy efficiency potential suitable in a cost-effective manner. The energy efficiency target achievement, under the condition of economic suitability, is a relevant topic across the overall EU strategy in the climate and energy fields.

Aim of the paper is introduce the “2020 Package”, “2030 Framework” and “2050 Roadmap” concepts. Particularly, the main environmental/energy parameters are analysed from a technical-statistic point of view, in order to describe the current trend towards the “20-20-20” targets. A following paper will deep the impact of this targets both on the global and local energy systems, specifically analysing the energy sector modification both on the supply side and on the demand side.

## 1. - EU strategy in the climate and energy fields

The “20-20-20 Package” is the first deep widespread action carried out from the EU in the climate and energy fields. It originates from the complex and controversial topic of the climate change. Climate change means a series of meteorological, biological, geographical observations that, in combination among them, show a global drift of the natural ecosystems equilibrium. The majority of the international scientific community indicates the anthropic activities as the fundamental reason of the climate change. The EU is in agreement with this perspective.

The climate change, its effects and its consequences, are currently widespread debated topics. Is not aim of this paper contribute to this debate. So, in the following is considered only the point of view expressed from the EU.

The carbon dioxide (CO<sub>2</sub>) atmospheric concentration is one of the main parameters to assess the climate change. The CO<sub>2</sub> is a greenhouse gas that hampers the reradiation to the cosmos of the sun energy reflected or absorbed and reradiated from the earth surface. The greenhouse effect generates an increase of the earth surface global average temperature. For this reason, the CO<sub>2</sub> has been detected as greenhouse gas. During the 1960-2015 period has been observed a 30% increase of the CO<sub>2</sub> atmospheric concentration, and its trend shows as

probable a further increase. It is estimated that the CO<sub>2</sub> generates about two-thirds of the global warming due to anthropic activities. One of the main sources of the CO<sub>2</sub> emission in atmosphere is the fossil fuels burn, whilst the deforestation reduces the natural ecosystem ability to storage CO<sub>2</sub> in the plants. The nexus between fossil fuels burn and CO<sub>2</sub> atmospheric concentration increase is evident considering that during the 1950-2000 period the fossil fuels consumption is increased about 300%.

The global action for the GHG emissions cut has as fundamental commitment the Kyoto Protocol. It regulates the emissions of six chemical compounds: carbon dioxide, methane, nitrogen dioxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

The global average temperature of the earth surface is increased of 0,85 °C from the beginning of XIX century. The GHG emissions due to anthropic activities are the main reason of the global warming. The awareness of the risk due to the global warming induced the international community to set as limit a 2 °C increase respect to the global average temperature during the 1850-1990 period. However currently, if does not take place drastic measures for GHG emissions cut, the temperature increase could reach 5 °C by the end of XXI century.

Some evident consequences of the global warming are the glaciers melting, the sea level rising and the extreme meteorological occurrences. These occurrences produce direct dangers for the population health and safety, whilst the properties and infrastructures damages force high societal and economic costs. Under the natural ecosystems perspective, the climate change happens so fast that many animal and vegetable species have adaptation problems. It is estimates that a warming ranging 1,5 – 2,5 °C beyond the current temperature could expose in extinction danger about 20 – 30% of the animal and vegetable species.

The actions carried out from the European Commission are aimed to transform the EU in a high energy efficiency and low carbon intensity economy. The main topics of the EU strategy are:

- EU Emission Trading System (EU ETS);
- action in the RES sector;
- action in the building and industrial products energy efficiency sector;
- action in the vehicles CO<sub>2</sub> emissions sector;

- Carbon Capture and Storage (CCS) of the CO<sub>2</sub> emissions produced from power plants and industrial plants.

As financial support measure, almost 20% of 960 euro billions budgeted during the 2014-2020 period will be spent on actions related to climate change.

The EU action in the climate and energy fields is structured in three sequential phases, having different time horizons:

- 2020 Package;
- 2030 Framework;
- 2050 Roadmap.

In the following paragraphs, the most relevant aspects of these phases are described, in order to focus the “20-20-20” targets within a wide strategic and programmatic vision.

#### *a) 2020 Package*

The “2020 Package” is a set of binding commitments, aimed to assure that in 2020 the EU achieves the following targets:

- 20% GHG emissions cut in comparison to 1990;
- 20% RES share in gross final energy consumption;
- 20% energy efficiency increase.

Currently, in EU takes place an evolution towards a high energy efficiency and low carbon intensity economy. The “20-20-20 Package” represents an integrated policy vision in the climate and energy fields, aimed to mitigate climate change, assure the EU supply security and strengthen its competitiveness at global level. Moreover, it is the fulcrum of the “Europa 2020” strategy, oriented towards an intelligent, sustainable and inclusive development.

The four main pillars that structure the “2020 Package” are:

- i) reform of the EU ETS: the EU ETS is the key-driver to reduce the industry sector GHG emissions in a cost-effective manner. The “2020 Package” establishes an overall reform of this system, as well as the deepening of the 2009/29/EC Directive “Emission Trading”. The fundamental innovation is the introduction of a single EU cap in place

- of the current country caps. The free emissions allowance should be progressively replaced by an auction mechanism, starting from the power sector;
- 2) country targets for the GHG emissions from non-ETS sectors: through the 406/2009/EC Decision “Effort Sharing” the Member States have taken as commitment a set of country binding targets, aimed to reduce its GHG emissions from non-ETS sectors, as the buildings and the transport sectors. About 60% of the overall EU emissions is generated from non-ETS sectors. The country targets are differentiated among them;
  - 3) country targets for the RES: through the 2009/28/EC Directive “Renewable Energy Sources” the Member States have taken as commitment a set of country binding targets, aimed to increase its share of energy consumption supplied from RES. These targets reflect the different starting points and the different RES production potentials among Member States. They should allow to the EU the achievement of an overall target of 20% in 2020;
  - 4) Carbon Capture and Storage: the 2009/31/EC Directive “CCS” establishes a reference framework for an environmental safety CCS technologies implementation. The CCS happens through the industry sector emitted CO<sub>2</sub> capture, and its storage in underground sites, thus avoiding the impact on the global warming.

#### ***b) 2030 Framework***

The “2030 Framework” is aimed to make the EU economy and energy sector more competitive, safe and sustainable. It confirms the three targets established from the “2020 Package”, and raises their deepness:

- 40% GHG emissions cut in comparison to 1990;
- 27% RES share in gross final energy consumption;
- 27% energy efficiency increase.

The GHG emissions cut is considered as a priority, because the increment between 2020 and 2030 is equal to 20 percentage points in comparison to the same reference year (1990), that is from 20% to 40%. Instead, the others two targets slightly rise from 20% to 27%. The priority is due to the desirable convergence with the ambitious target set in 2050,

described in the following point C). The GHG emissions cut is the only one among the three targets for which have been established thresholds beyond 2030. The 2030 targets take in account the necessary agreement between environmental needs and economic needs, that is, the targets achievement in the energy and climate fields should not hamper the EU economy development and competitiveness.

### *c) 2050 Roadmap*

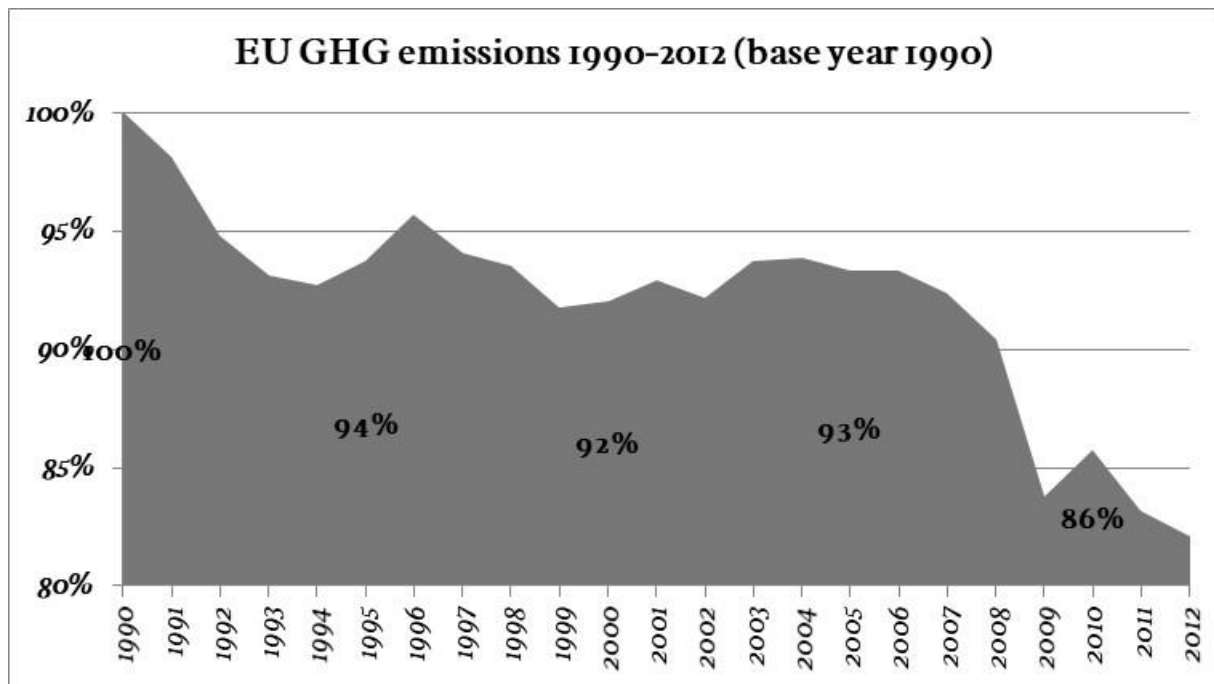
Through the document “Roadmap for moving to a competitive low-carbon economy in 2050”, the European Commission has look beyond the short term period, and has put in place a cost-effective vision aimed to achieve in 2050 a 80% GHG emissions cut in comparison to 1990 (40% in 2030 and 60% in 2040). The emerging scenario indicates a complex but unavoidable evolution towards a “Low Carbon” society. According to the projections, this evolution should strengthen the EU economy, due to the growth in innovations and “green” technologies. In a perspective of agreement between environmental needs and economic needs, the GHG emissions cut should be allocated among the macroeconomic sectors in a cost-effective manner. That is, each sector should contribute as a function of its technological and economic potential.

## **2 – “20-20-20 Package” parameters**

In the following are analysed the trends of the three “20-20-20 Package” main parameters: GHG emissions; RES share in gross final energy consumption; primary energy consumption. The graphics are drawn starting from Eurostat statistical data. The data availability period extends from 1990 to 2013 for the first and the third parameter, and from 2004 to 2013 for the second one. The trends are analysed both at EU level and at Italy level.

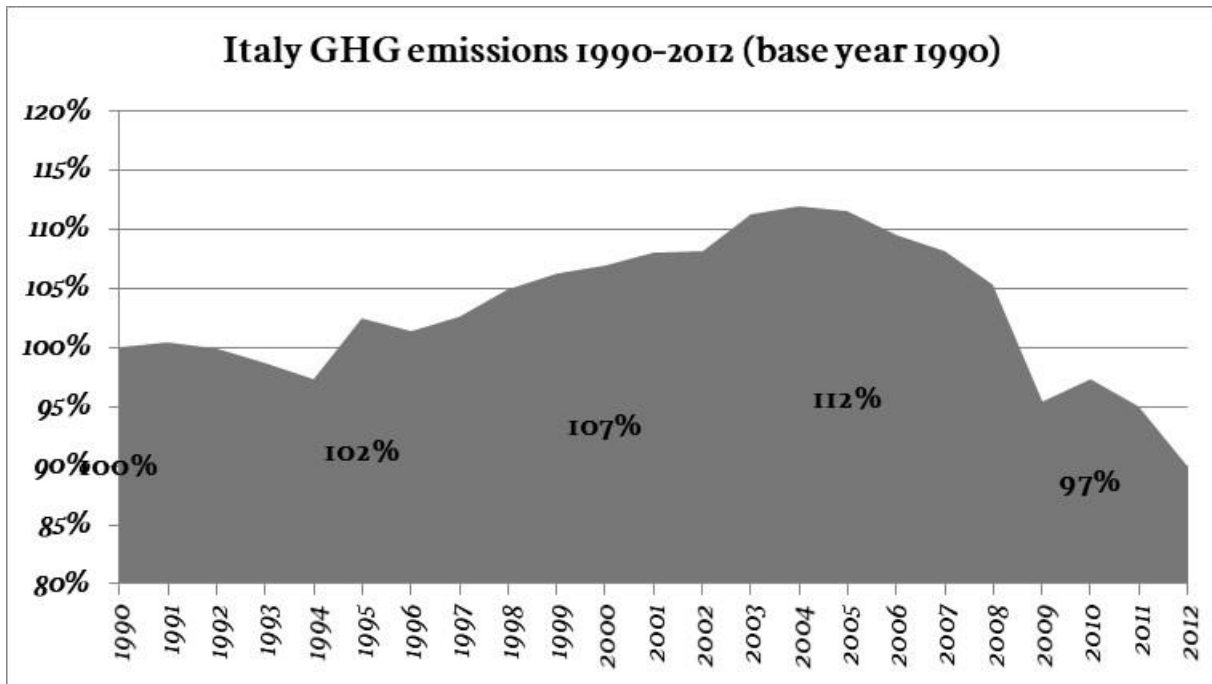
The overall GHG emissions in EU are decreased from 100% in 1990 (conventional reference year) to 82,13% in 2012, as shown in Figure 1. So, the 2020 target achievement is close. At the same time, the overall GHG emissions in Italy are decreased from 100% to 89,93%, as shown in Figure 2. The Italy situation is lagging behind the EU average, and the 2020 target

achievement is far. It should be underline that the overall EU value derives from the Member States average. In some countries, as Portugal and Spain, the emissions are increased in comparison to 1990 (115-120% in 2012). In others countries, as France and Italy, they are slightly decreased (about 90% in 2012). In more others countries, as Germany and United Kingdom, they are heavily decreased (about 75% in 2012).



**Figure 1 – EU GHG emissions 1990-2012 (base year 1990).**





**Figure 2 – Italy GHG emissions 1990-2012 (base year 1990).**

The 20% RES share in gross final energy consumption is an overall EU average target. The starting points are different among countries. For example, in 2005 the RES share was 40,5% in Sweden, 1,4% in United Kingdom and 5,8% in Italy. Similarly, the growth potentials are different among countries, due to geographic, climatic and economic conditions. The Annex I of the 2009/28/EC Directive allocates among Member States the overall EU average target. For example, in 2020 the RES share should be 49,0% in Sweden, 15% in United Kingdom and 17% in Italy.

The 17% RES share in gross final energy consumption is an overall Italy average target. The starting points are different among Regions. In the reference year (virtual year resulting from the combination of the values during the 2005-2009 years) the RES share was 51,6% in Valle d'Aosta, 2,0% in Emilia-Romagna and 6,2% in Toscana. Similarly, the growth potentials are different among Regions, due to geographic, climatic and economic conditions. The Decreto 15 marzo 2012 “Burden Sharing” allocates among Regions the overall Italy average target. For example, in 2020 the RES share should be 52,1% in Valle d'Aosta, 8,9% in Emilia Romagna and 16,5% in Toscana. The RES penetration in EU is progressively growing at 0,74% annual rate, as shown in Figure 3. The Italy is approximately in line with the EU, as shown in Figure 4.

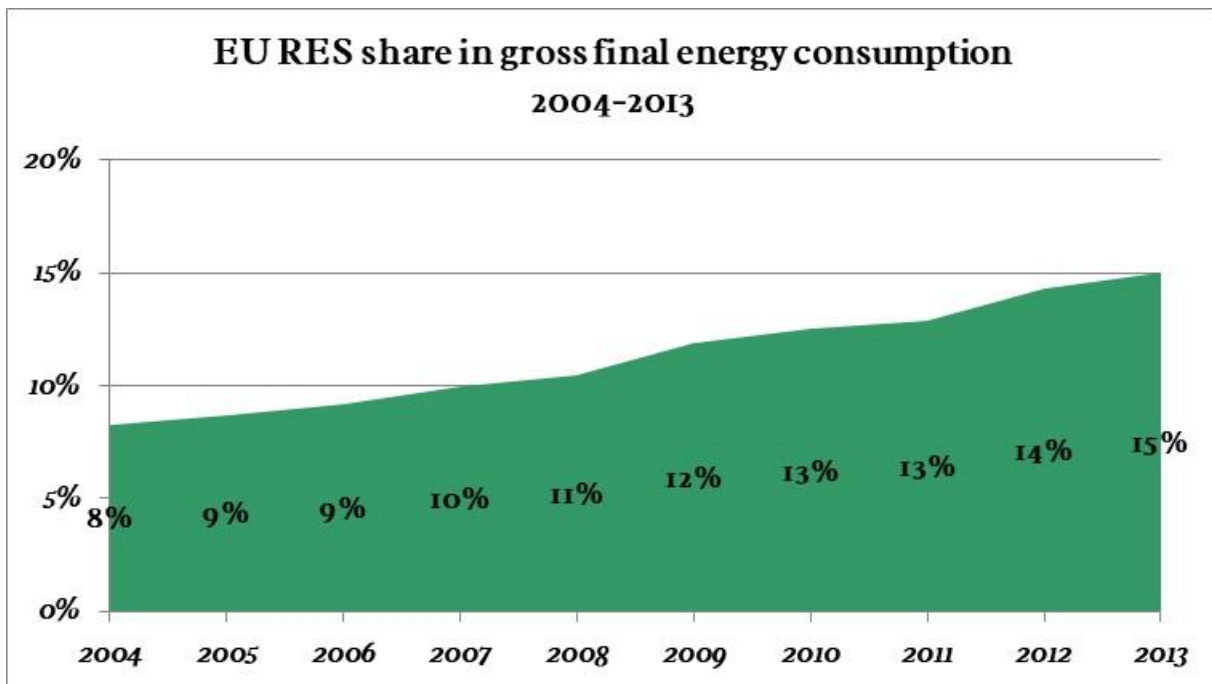


Figure 3 – EU RES share in gross final energy consumption 2004-2013.

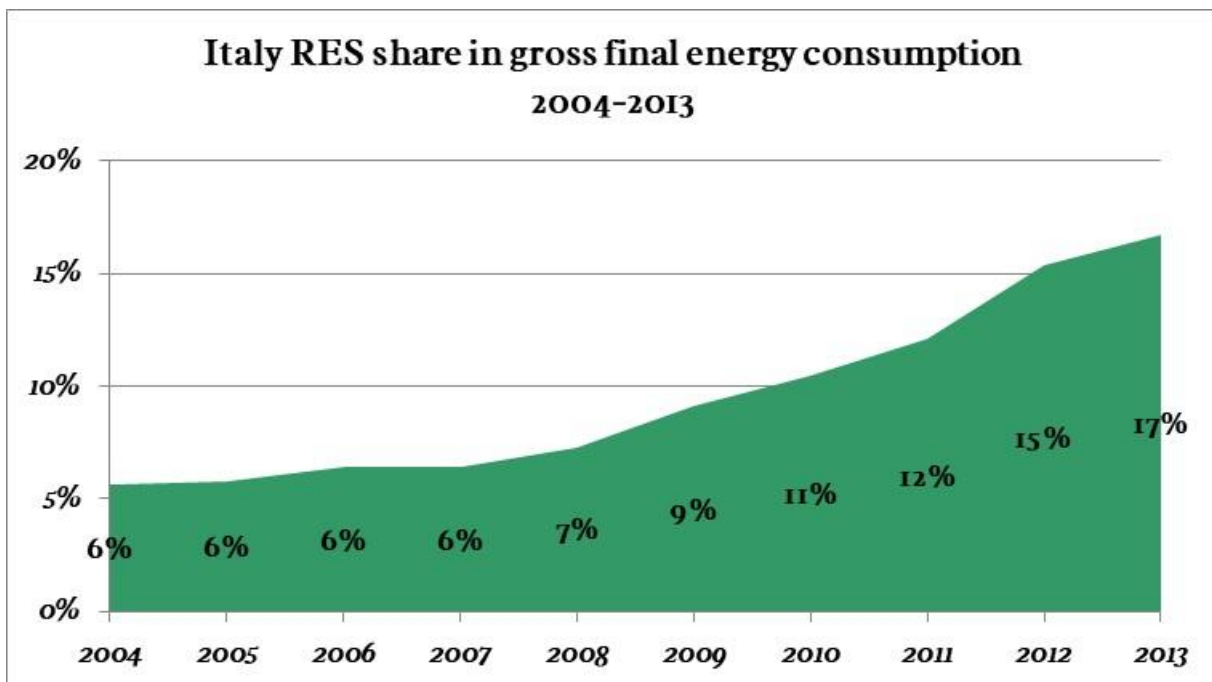


Figure 4 – Italy RES share in gross final energy consumption 2004-2013.

The energy efficiency increase corresponds to an annual primary energy consumption reduction. For this reason, the Eurostat publishes only EU overall data, and not Member

States split data. The EU primary energy consumption is progressively decreased from 2005 (reference year) at  $-1,04\%$  annual rate, as shown in Figure 5. However, the 2020 target achievement seems still far.

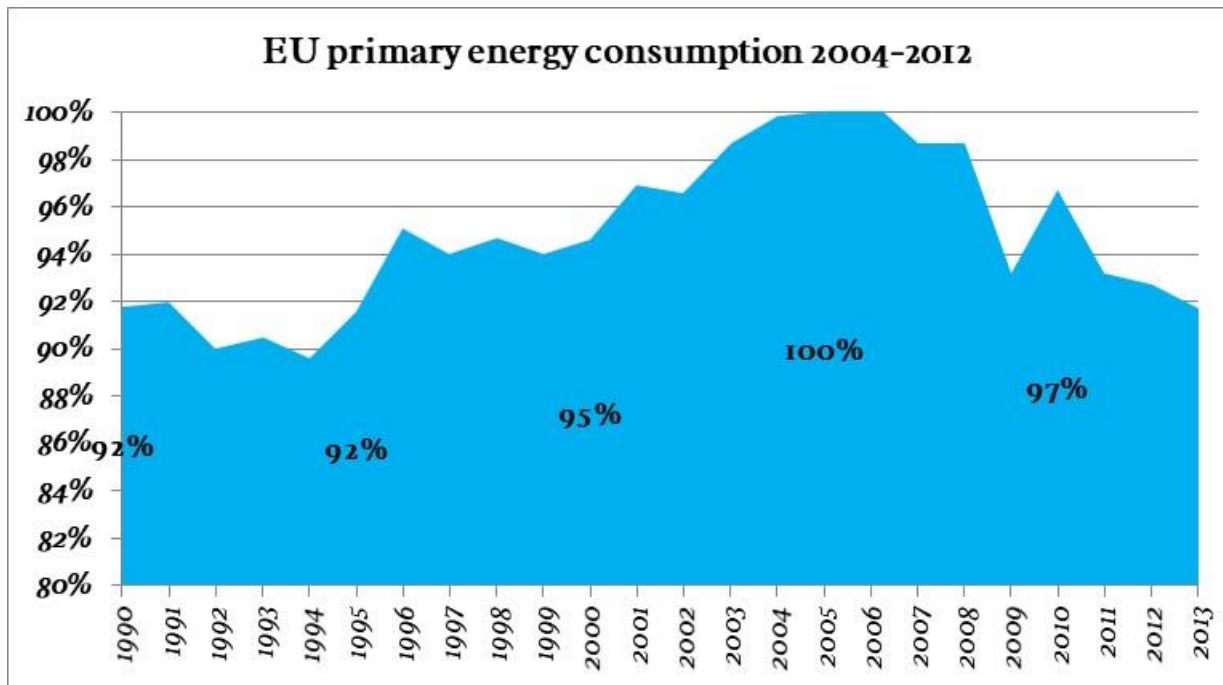


Figure 5 – EU primary energy consumption 2004-2012.

In summary, the statistical data analysis shows that the GHG cut target is the closest, whilst the energy efficiency increase target is the farthest. Since the “2020 Package” does not regulates directly the energy efficiency issue, it has been necessary a specific EU action, which has led to the 2012/27/EU “Energy Efficiency” Directive publication.

### 3 – Energy efficiency

The report COM 2010 639 final “Energy 2020 – A strategy for competitive, sustainable and secure energy” is the background of the 2012/27/EU Directive publication. The report underlines that: 1) the energy interconnection among Member States must be managed through an overall EU action; 2) despite the aims of the EU energy-policy measures, there are

many implementation problems. The report delineates five actions in order to converge towards an energy efficient use, such as it allows the energy efficiency increase set in 2020:

- 1) implementation of EU energy efficiency measures;
- 2) realization of an EU integrated energy market;
- 3) improvement of the end users responsibility and awareness;
- 4) widening of the EU leadership in energy technologies and innovations;
- 5) strengthening of the EU energy market over the extra-EU countries.

The “Energy Efficiency” Directive implements these five actions.

According to Eurostat data (available in 2015), during the 2001-2013 period the EU energy dependence has increased of 6%, as shown in Figure 6. That is, the annual growth rate has been equal to + 1,03%, and its trend foresights a further increase. At the same time, during this period the gross inland energy consumption has decreased of 60.522 MTOE, as shown in Figure 7. That is, the annual de-growth rate has been equal to - 0,24% and its trend foresight a further decrease. From these trends it results that, until now, the energy dependence increasing prevailed on the gross inland energy consumption decreasing, and therefore that the implemented energy efficiency measures have not been deep enough.

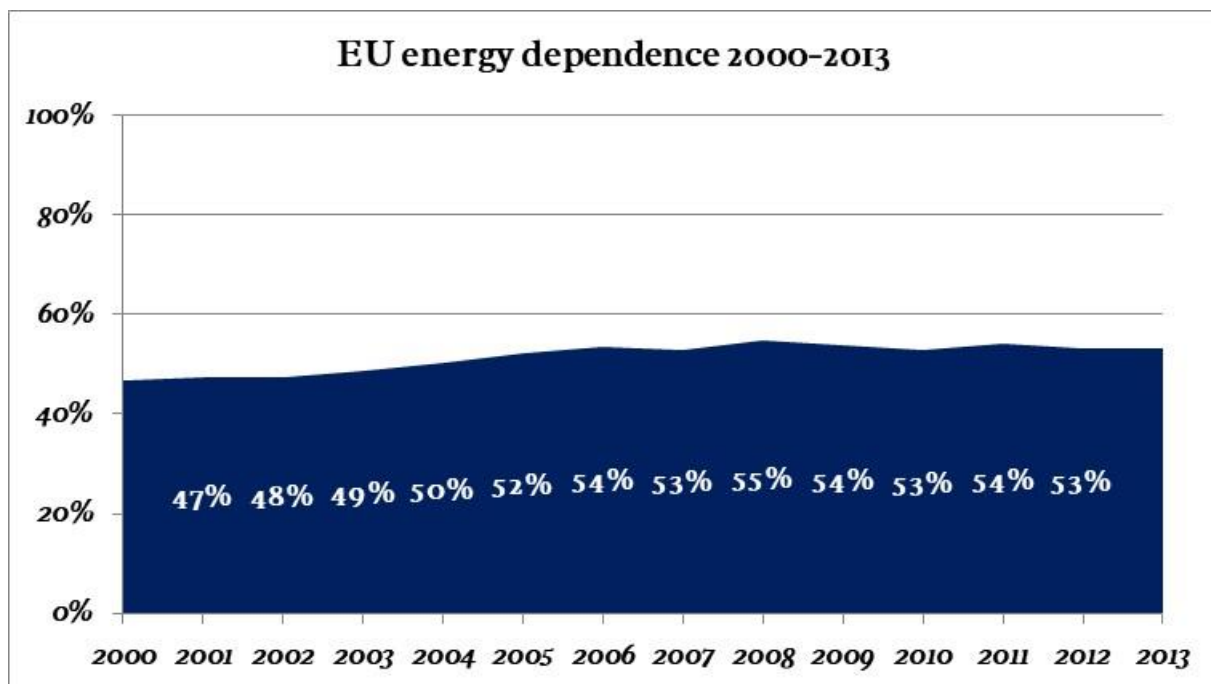


Figure 6 – EU energy dependence 2000-2013.

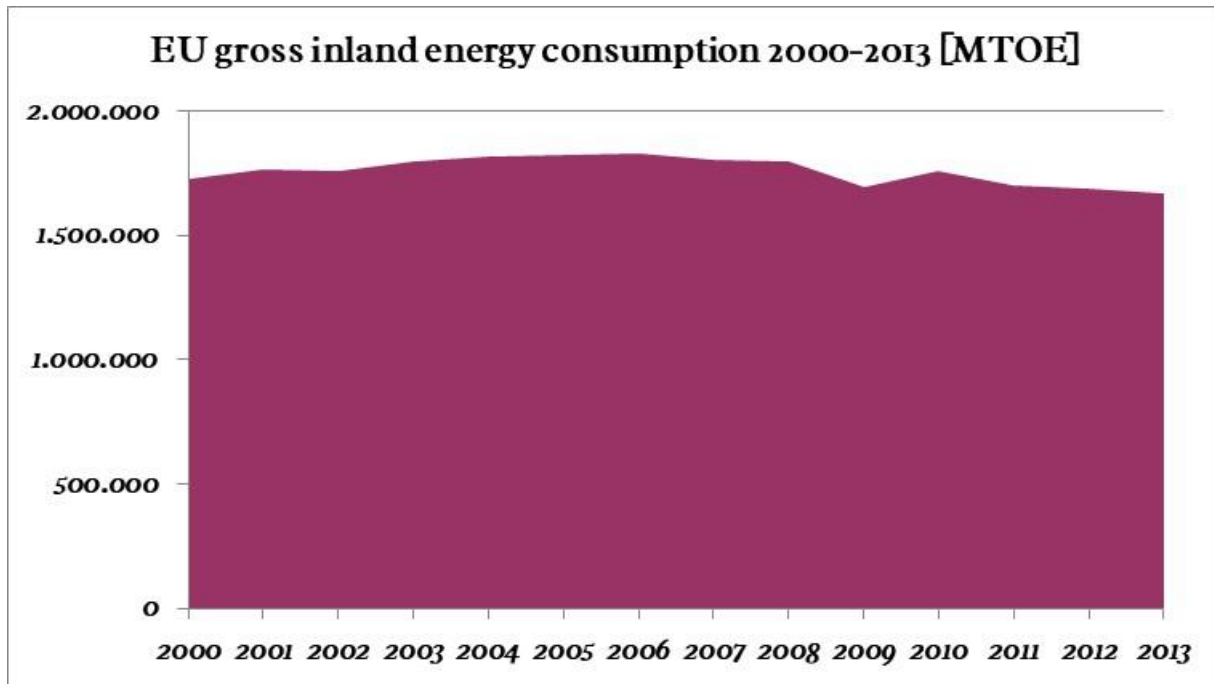


Figure 7 – EU gross inland energy consumption 2000-2013.

According to Eurostat data, in 2012 the fossil fuels represented the 74% of EU gross inland energy consumption, as shown in Figure 8. It is foresighted that they continue to be dominant in the medium and long term. The main worldwide confirmed reserves of fossil fuels are placed in extra-EU Countries, sometime involved from geo-political problems. Consequently, the supply security is not guarantee. The EU gross inland energy consumption of fossil fuels is basically unchanged, slightly decreasing, whilst the EU energy dependence increases.

Until now, the “fuel-switching” has affected almost exclusively the oil and its derivatives. The demand side is stable, whilst the supply side is moving from domestic production to import. This circumstance weighs down the EU economy competitiveness.

The EU strategy aimed to the energy dependence reduction and to the supply security guarantee can be synthesized in two “main concepts”, projected respectively the first one toward the short term and the second one toward the long term: the energy efficiency, in the 2020 perspective; the “fuel-switching” from fossil fuels to RES, in the 2050 perspective.

The energy efficiency concept is useful in order to decouple the energy demand from the economic growth. From this point of view, the main assessment parameters are the “energy intensity of economy” and the “economic productivity of energy”. The first one is the

yearly ratio between the gross inland energy consumption and the GDP (Gross Domestic Product), and it is measured in TOE/€. So, it represents the energy consumed producing 1 € of GDP. The second one is the yearly ratio between the GDP and the gross inland energy consumption, and it is measured in €/TOE. So, it represents the GDP produced consuming 1 TOE of energy. During the 2002-2013 period the energy intensity of EU economy has decreased of 15,9%. At the same time, during this period, the economic productivity of EU energy has increased of 20,3%. This occurrence underlines the progressive achievement of the decoupling target.

From an energy-policy point of view, the 2012/27/EU Directive is aimed to take the energy efficiency potential intrinsic to all economic macro-sectors, as outlined in the Energy Efficiency Plan published in 2011 from the European Commission. The “20-20-20” target should bring to a EU energy-mix reconfiguration. However, there are still some factors, as market and regulation drawbacks, that could hinder the effective achievement of the potential, because the market of products, building and services energetically efficient is not developing fast enough.

#### Main market drawbacks:

- the energy products costs not are representative of the overall societal costs due to environmental pollution, GHG emissions, resources consumption and geo-political problems;
- sometime the investor in energy efficiency is not the beneficiary of the investment;
- the market agents not push the end user toward the energy efficiency, in order to not curtail their trade volume.

#### Main regulation drawbacks:

- an overall energy-policy framework, integrated among Member States, lacks;
- the continuous variation of the regulation makes hazardous the energy efficiency investments;
- often the energy efficiency topic is considered only from a technical point of view, and not also from an economic point of view.

Furthermore, from the analysis of the current energy products market, and also of the configuration changes both on the demand side and on the supply side, it results that the

“rebound effect” is widespread. This means that the products energy efficiency increases, but at the same time the overall energy consumption due to their use also increases, since their use intensity grows. The “rebound effect” is due to the raise of the comfort and living standard of the end users, and to the modification of their behaviour. Consequently, the energy efficiency potential of some products and/or some sectors could be annihilated from this effect.

## Conclusions

The main targets of the EU strategy in the climate and energy fields are the GHG emissions cut and the energy dependence reduction, in order to fulfil the international commitments and to ensure the supply security in the medium and long term. The EU is on track to the “20-20-20” targets achievement, although the speed is different among Member States. Anyway, these targets aren’t the point of arrival, but only an intermediate stage, because already were established farther away time horizons, that is the “2030 Framework” and the “2050 Roadmap”.

The GHG emissions cut target achievement is the closest, whilst the energy efficiency increase target achievement is the farthest. The currently implemented measures aren’t deep enough to completely develop the EU energy efficiency potential (the main driver of the EU energy sector modification). For this reason, has been necessary the publication of a specific Directive, which should give all the economic macro-sectors towards the targets achievement in a cost-effective manner. However, have been found some market and regulation drawbacks. Currently, their overcoming is a priority in the Energy-Policy EU agenda.

## References

[ ] P. Watkiss, T. Downing, C. Handley, R. Butterfield, *The impacts and costs of climate change - Final Report*, 2005.

- [ ] D. Gros, F. Roth, *The Europe 2020 Strategy can it maintain the EU's competitiveness in the world?*, Centre for European Policy Studies (CEPS), 2012.
- [ ] *Green Paper - A 2030 framework for climate and energy policies*, COM (2013) 169 final, European Commission, 2013.
- [ ] *A Roadmap for moving to a competitive low carbon economy in 2050*, COM (2011) 112 final, European Commission, 2011.
- [ ] *Energy, transport and environments indicators – 2012 edition*, Eurostat, 2012.
- [ ] *EU energy in figures – Statistical pocketbook 2014*, European Commission, 2014.
- [ ] *Quantification of the effects on greenhouse gas emissions of policies and measures: Final Report*, AEA group, Didcot, 2009.
- [ ] *Progress towards achieving the Kyoto and EU 2020 objectives*, European Commission, 2014.
- [ ] *Energy 2020 - A strategy for competitive, sustainable and secure energy*, COM (2010) 639 final, European Commission, 2010.
- [ ] *Energy Efficiency – the first fuel for the EU Economy*, Energy Efficiency Financial Institutions Group, 2014.
- [ ] *Commission staff working document - Impact Assessment accompanying document to the Energy Efficiency Plan 2011*, SEC (2011) 277 final, European Commission, 2011.