MSc Program Environmental Technology & International Affairs

The role of Energy Efficiency within the EU's Energy and Climate Change Package

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Affidavit

I, **URBAN JAKOB PEYKER**, hereby declare

1. that I am the sole author of the present Master's Thesis, "THE ROLE OF ENERGY EFFICIENCY WITHIN THE EU'S ENERGY AND CLIMATE CHANGE PACKAGE", 76 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted this Master's Thesis as an examination paper in any form in Austria or abroad.

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Abstract

The European Energy Policy has entered a new era. Driven by concerns about Europe's long-term energy security and warnings about global warming, the European Union has recently launched an integrated Energy and Climate Change Package.

This thesis provides an ex-ante evaluation of the policies that constitute the Energy and Climate Change Package with regard to reaching the ambitious targets for the share of renewables and for energy efficiency: 20% renewable energies and 20% less energy consumption by the year 2020. The potential for renewables is as yet far from being exploited, providing a sound rationale for concerted efforts focusing on supply-side measures to promote the expansion of renewable energy sources. The historical legacy of Europe's electricity markets supports continued state intervention. This thesis however argues that the policy agenda fails to give energy efficiency sufficient attention and that there is an inherent misperception about the factual nature of energy efficiency. Simplistic assumptions about energy efficiency have led to a partially inadequate policy design that exacerbates the risk of the EU falling short of the ambitious targets contained in the Energy and Climate Change Package. Even assuming low overall macroeconomic rebound effects, decreasing rates of energy intensity alone cannot buffer the decline in domestic production. Four main categories of barriers are identified: financial and market impediments, political and regulatory obstacles, cultural and behavioural barriers and aesthetic and environmental challenges. Compared to a set of related policy benchmarks it could not be proved that there is a conceptual neglect of energy efficiency within the current legislative framework, yet both the direction and the potential momentum of the policies are questionable. Price signals are the single most important cause both for investments in energy efficiency and electricity from renewable sources of energy. However, the two most pressing policies - removing subsidies for conventional energies and pricing electricity accurately - are not sufficiently touched on by the Energy and Climate Change Package. It is concluded that energy conservation on a macro level has to be placed at the top of the political agenda, but that cannot occur without seriously discussing strategies about de-growing.

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Abbreviations

Abbreviation	Explanation
CCS	Carbon Capture and Sequestration
CDM	Clean Development Mechanism
CO2	Carbon Dioxide
DSO	Distribution System Operator
EEA	European Environment Agency
EU	European Union
ETS	European Trading Scheme
GDP	Gross Domestic Product
GHG	Green House Gas
GOS	Guarantees of Origin
GWh	Giga Watt Hours
JI	Joint Implementation
Mtoe	Million tons of Oil Equivalent
MW	Megawatt
NEEAP	National Energy Efficiency Action Plans
OECD	Organisation for Economic Co-operation and Development
RES-E	Electricity produced from renewable sources of energy
R&D	Research and Development
TSO	Transmission System Operator
TWh	Terra Watt Hours
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

The European Energy Policy has entered into a new era. Driven by concerns about Europe's long term energy security and warnings about global warming, the European Union has - for the first time in its history - launched an Energy and Climate Change Package in a truly integrated manner. Within Europe, as within the international community alike, expectations are high not just with regard to the ambitious goals set but as well due to the symbolic character of the EU in this regard. symbolic character.

The EU has set new ambitious targets for the share of renewables and for energy efficiency: 20% renewable energies and 20% less energy consumption until the year 2020.
This paper provides an ex-ante evaluation of the policies that coin the Energy and Climate Change Package with regard to reaching the aim for renewables and energy efficiency. It scrutinises whether there is an imbalance towards supply side measures to the detriment of energy efficiency.

The public perception and the mindset of policy makers originate from a common logic that stipulates that renewable energy potential can be endlessly increased. The connotation of "renewable" as an bottomless source of energy suggests that there is almost no absolute limit, which at least holds true for the temporal undertone of this term. Energy fluxes both from radiation and gravitation are however curtailed by transmission and distribution.

In the short run, the potential for renewables is yet far from being exploited which provides a sound rationale for concerted efforts to promote the expansion of renewable energy sources.
Saving energy still implies a reduction of comfort and wealth, thus providing a second political rationale for focusing on supply side measures rather than on energy conservation.

This paper however argues that energy efficiency is firstly not addressed with ample attention and secondly that there is an inherent misperception about the factual nature of energy efficiency. The neglect of both micro as well as macro scale rebound effects consequently results in a partially inadequate policy design that poses a high risk of the EU falling short of the ambitious targets that have been set in the Energy and Climate Change Package.

In Chapter 1, the European Energy Policy is explained in a nutshell against the background of sustainability, the security of supply and competitiveness. The historical legacy of Europe's electricity markets supports continued state intervention. Following this, an analysis as to why the European Union is a legitimate actor between the poles of supranational coordination and subsidiarity, between decentralised and centralised generation systems and between micro and macro levels of efficiency incentives.
Furthermore, the term "energy efficiency" is considered with regard to conceptual and methodological confusions and contradictions that are encountered in political discussions on this topic. The common misperception that energy efficiency on a micro scale will finally emerge to energy savings on a macro scale is tested, thus providing evidence that a total reduction in final energy consumption is inevitable.
Finally, energy production, consumption and intensity are displayed hence setting the frame for the later policy analysis of the Energy and Climate Change Package.

In Chapter 2, the necessity of comprehensiveness in promotion policies for RES-E and energy efficiency is stressed, highlighting four policies in particular. Four main categories of barriers are classified: financial and market impediments, political and regulatory obstacles, cultural and behavioural barriers, and aesthetic and environmental challenges. In response to these, the four most substantial policies are identified and established as benchmarks for the actual analysis of the Energy and Climate Change Package: Remove subsidies for conventional energy, price electricity more accurately, enact a harmonised feed-in tariff and finally educate the public, protect the poor and fund demand side measurement.

Chapter 3 undertakes the actual analysis by hermeneutically comparing the underlying legal instruments with policy benchmarks. The idea that policy benchmarks "enact a harmonised feed in tariff" did not hold true for a complex Union of nation states and therefore had to be adapted, but has nevertheless been analysed with regard to the process of harmonisation.

Price signals are the single most important driver both for energy efficiency and RES-E investment. However, the two most pressing policies are not sufficiently evaluated by the Energy and Climate Change Package: removing subsidies for conventional forms of energy and pricing electricity accurately.
It cannot be proven that there is a conceptual neglect of addressing energy efficiency within the current legislative framework, yet both the direction as well as the potential momentum of

the efficiency policies is questionable. However, matters are more complex and it has been shown that simplistic assumptions about energy efficiency have led to incorrect political conclusions that are partly reflected in the Energy and Climate Change Package. Even in view of overall low macro scale rebound effects, decreasing rates of energy intensity cannot buffer the decline in the domestic production. The European Union both increases its import dependence and runs a high risk of falling short of the ambitious targets that have been set in the Energy and Climate Change Package.

It is concluded that energy conservation on a macro level has to be set on top of the political agenda, which can not be carried out without seriously discussing strategies about de-growing.
The Commission, can nevertheless mainly coordinate action, but this depends largely on the willingness of the Member States to interpret the subsidiarity principle in a constructive way.

Chapter 1 - Energy policy in the European Union

1.1 Policies

In general the European Communities' policies on energy issues are based upon three pillars: sustainability, the security of supply and competitiveness. This pattern has been predominant since the beginning of a common energy policy, as it was originally laid out in the 1997 White paper on "Energy for the future: Renewable Sources of Energy" (COM(97)599 final).

Whereas the logic of integrating sustainability and the security of supply into a common EU wide energy policy is more straightforward, there is a running debate as to whether too much competitiveness might not even be harmful in the long run.

As policy makers are becoming increasingly aware of the threats of climate change, the term "sustainability" in the energy context has been widely replaced with the term "climate change". Energy transformation is the single most important source for global warming. Apart from saving energy, replacing existing CO2 emitting technologies with renewable sources of electricity generation is the most concrete way to tackle climate change.

It is also apparent that domestic sources of energy can contribute to balancing the dependency on the import of non-renewable raw materials coming from politically unstable regions. Given the decline of Europe's indigenous sources of oil, gas and coal the importance of renewables will augment drastically if import dependency is meant not to increase dramatically. Nevertheless the idea of security of supply is twofold: in the first instance, it addresses concerns about the long term availability of energy resources such as oil, gas, coal and uranium. Secondly, the security concept focuses on short term security of supply - namely safety -addressing the risk of accidents and political instability (Jäger-Waldau, A. 2007).

The main argument for the promotion of higher competitiveness in the European energy market is that this should guarantee the most cost effective investment strategy. Given the fact that the potential for renewable energies is diverse across Europe, in some countries investments in renewables are comparatively cheap. As a consequence, it would be necessary in a European-wide strategy to first invest in those regions where options for renewable energies are abundant, thus guaranteeing that the overall costs would be kept low. This kind

of “regional” competitiveness is considered to be “static”. “Dynamic” competitiveness refers to the competition between technologies as such. A lack of investment into innovation of new technologies might occur as investments predominately go into already developed ripe technologies placed in areas with a high renewable potential. In the light of the ambitious aim from to increase the share of RES-E up to 22,1% by 2010 (as outlined in Directive 2001/77/EC), it is argued that improvements in learning curves have to be subsidised, hence artificially increasing the “dynamic” competitiveness of technologies that are still in the phase of innovation and commercialisation. The example of large scale hydro power shows that within the renewable fraction previously developed functional RES-E technologies exist as well.

There is uncertainty as to whether cost-efficiency should be the single most important guiding principle for strategic decisions in energy. Long term social welfare pay-offs such as climate protection and security of supply cannot be fully considered by private investors.
The implementation of the Directive 2001/77/EC is seen by many as a failure with regard to promoting the most efficient deployment strategy. However, it has done considerably well in terms of effectiveness. With regard to the long term aims of energy security and sustainability, it is perhaps more adequate to see the outcome of the Directive 2001/77/EC in the light of a negotiation process, where at the end learning effects and a balanced and more diverse generation have to be valued as well. This is, however, more difficult to evaluate economically (Verhaegen et al., 2007).

1.2 Why to take action on the European rather than on the national level

The European Union evolved out of The European Coal and Steel Community in 1951 thus having had energy cooperation at the core of the political agenda. Over time, the institutional development of the European Community supported an increased supra-national responsibility for energy policies.

Against the background of increasingly liberalised markets, why are states or supra-state-like organisations such as the European Union are considered to be responsible to take action in energy issues at all?

The historical role of states in energy policies particularly in Europe was to decrease investment risks related to long amortisation spans and to set common rules for market investors . Consequently, there is a historical reason for states to keep on being involved both in setting rules as well as in promoting investment. This is commonly done with tailored low interest rates and investment guarantees. All over Europe, conventional power and distribution systems developed through massive financial and organisational support from the governments, or have otherwise been directly owned by the government. This development started in the beginning of the last century, but witnessed a boost in the booming times after the Second World War. Not only socialist countries, but also Western Germany, France and the UK considered state owned energy providers as warrantors to strategic national economic development. There are strong ongoing links between these now mainly privatised companies and policy makers and their influence remains to be strong. (Serrallés 2006)

As conventional energy providers have not had any economic incentive to develop the generation of electricity from renewables for a long time, investment into research and innovation of renewable technologies would not have taken place if the state would not have stepped in with financial support.

Apart from this historical legacy and the lack of incentive for private investment into RES-E, there is also a structural problem that only governments can help to overcome. Electricity generation has been, and still is, strongly oriented towards large-scale centralised systems. Only if the structures of production, transmission and distribution are changed, will renewables have a chance to create a real difference in the generation of electricity. (Hammons, T.J. 2008)

The position of the European Union towards the responsibility of states to govern energy issues is shortly summarised in the Second Strategic Energy review: "*..., energy security is a public good and public authorities bear the responsibility for market design that is conductive to ensuring that sufficient power will be on offer in order to meet future demand. In other words, private actors will make the necessary investments but public authorities are ultimately responsible for a market design that fosters energy security and encourages investment"* (SEC (2008) 2871 p. 38).
Nevertheless, as energy issues do not fall under the exclusive competence of the Community, the subsidiarity principle applies. Thus, the reasons for combined action on Community level

are factual in nature. With regard to the objective of the Energy and Climate Change Package, the Directive COM (2008) 19 final on the promotion of renewable energies highlights the fact that only after common targets have been set with common deadlines (e.g. Directive 2001/77/EC) a real progress in the deployment of renewable energy technologies took off. The Directive points out as well that an equitable distribution of the efforts to reach the common goals would not be achieved and would as well create investor uncertainty if left to the Member States alone (COM (2008) 19 final p. 9).

1.2.1 Historical Development

Before going into a more detailed analysis of the latest Energy and Climate Change Package, a review of the political and legislative developments earlier to this latest legislation is undertaken in the following section. This allows for the provision of a basis upon which the main drawbacks of the policies from 1997 to 2001 can be examined and therefore present a better understanding as to the design of the current legislation.

One might be surprised that a common EU wide energy policy started to become apparent no earlier than 1996. Nevertheless, legislation on energy issues, either directly or indirectly through other policies, was evidently already in force in earlier years. Due to the fact that the European Energy Policy has been fractionised within different policies on external relations, the internal market and the environment resulted in a lack of transparency for politicians, interest groups, investors and industry (de Alegría Mancisidor et., 2007).

For a long time the US undertook the role as a world leader in promoting the use of renewable energies and in terms of integrated promotion policies, the European Community was initially not very active. If there has been such a thing as a common strategy, it would have been merely focused on the support of R&D for renewable energies more or less equally distributed over photovoltaic, wind and bio-energy technologies (Blok, 2006).

Only in the year 2007 did the European Council reach an agreement on an integrated climate and energy policy, thus finally taking into account the fact that anthropogenic climate change can only be tackled in an integrated approach, particularly while simultaneously addressing the energy issue. In line with the policy of the European Union of the last decade, the current energy commissioner, Mr Andris Piebalgs, continued to focus on sustainability, business

competitiveness and security of supply as main pillars of an integrated energy policy. In political communication the term sustainability has been increasingly replaced by the term global warming.

After the first major attempts to move towards a more harmonized legislation with the Directive 2001/77/EC (which was the legislative coming into force of the White Paper on renewable electricity in the European Union from the year 1997), it soon became apparent that several shortcomings of this legislation had to be addressed in a more integrated and cross-sectoral matter (Rowlands, 2005).

In terms of legislation regulating energy efficiency - still widely separated from other policy fields - the earliest regulation on the rational use of energy dates back to the 1970s, where environmental concerns were about to develop and climate change was not yet an issue. Developments towards a new more integrated methodology were to follow and slowly certifications systems were developed. The most important regulations in regard to energy efficiency are the Buildings Directive (2002/91/EC) and the Directive on Energy End-Use Efficiency and Energy Services (2006/32/EC). The latter is of particular importance with regard to a standardised and integrated approach towards energy efficiency as it finally provides a framework of definitions, instruments, mechanisms and schemes for energy efficiency measurements (M. Roggenkamp 2007 p.309). A first assessment of the Directive 2006/32/EC based upon Member States' National Action Plans was published in 2007. The outcome of this assessment will be critically analysed in section 3.3.2.

In terms of legislation regulating renewable energies, there have been attempts since the early 1990s to agree on community level on specific targets for the renewables-based generation capacity and production. Mainly due to the pressure from the European Parliament, a first milestone for targets for electricity generated from renewables differentiated by Member States could be reached by the year 1997. This coincided with the coming into force of the first White Paper for a Community Strategy and Action Plan, establishing EU targets of increasing the share of renewable energy to 12 per cent of total energy consumption by the year 2010. The agreement on the White Paper also marked a policy transition away from an emphasis on technology development and towards a focus on technology implementation. On a national level, initiatives for market penetration of renewable energy were intensified. The European Union's policy continued to be limited to supporting technology R&D, setting

targets for renewables and providing common boundary conditions like reporting schemes and a unified guarantee of origin (Blok, 2006).

With regard to RES-E, non-binding legislation has already been in place since 1988. These measures were still strongly fragmented and were mainly meant to place a limited amount of pressure on the Member State to give priority to renewables, and combined heat and power when dispatching electricity generating installation. The effects of the 1997 White Paper on renewable energy resulted in a moderate boom in the renewable industry throughout Europe and the Member States started to subsidise and support the promotion of renewables mainly with quotas and feed-in tariffs (Roggenkamp, 2007).

Although the debate on whether it would be necessary to create an EU-wide standardised feed-in system is still going on, the EU-Council has until recently refused to accept a coordinated promotion scheme, mainly fearing a violation of the principle of subsidiarity and doubts about the economic efficiency of supranational measures (COM (2005) 627) and (SEC (2008) 57).

1.3 Conceptual and methodological deliberations on Energy Efficiency

Although Energy Efficiency is an established and broadly used term, there are confusing and partly contradicting meanings to it.

The most simple and intuitive indicator for energy efficiency is to establish a ratio between the output of a process and the energy input for a process. In general, this is precise enough for the day-to-day usage of the term. Usually, the output of a process is divided into and useful and a useless fraction and can either be again energy, a product or a service. The confusion with the term energy efficiency starts with how to define what useful means. Patterson has suggested a division into four classes of indicators: thermodynamic, physical - thermodynamic, economic thermodynamic and pure economic indicators (Patterson, 1996).

The pure thermodynamic indicator is not used in political discussion. It only relates thermodynamic measurements and the output of the indicator is a thermodynamic unit.

Nevertheless all other indicators may be encountered in the political discussion, sometimes without sufficient awareness of the inherent differences.

A physical thermodynamic indicator uses thermodynamic units to measure the energy input whereas physical units are used to measure output, thus measuring the service delivery such as tonnes, transport kilometres or electric energy of the process. Physical thermodynamic indicators only measure the end use service that consumers require without taking into account actual market prices. Measuring energy efficiency this way has interesting political implications. If the end use service "inner city transport" is measured by taking passenger kilometres as physical units for example, driving a car compared to cycling would result in a completely different political perspective. Apart from having the advantage of a pure energy-focused basis upon which different services can be compared, physical – thermodynamic indicators also allow for very long-term comparisons of services. In practice, energy efficiency is measured and compared within certain economic sectors and there is an ongoing process of standardisation, which at least allows for a mid-term comparison.

Economic thermodynamic indicators add market prices to the service delivery and leave the energy input measured in thermodynamic units. As market prices change, it is more difficult to compare energy efficiency over very long time stretches. The indicators have to be discounted in order to get a reasonable basis of comparison. The clear advantage of such an indicator is that it can be used to describe aggregate indicators, from a process to the whole economy using GDP as a measurement of output. This indicator is commonly encountered in the political discussion.

Another common term is energy productivity or energy intensity. Energy productivity describes how many goods can be produced with a certain amount of energy input. Nevertheless, when labour is for example substituted with energy, the energy productivity ratio might decrease, although it does neither describe the development of wealth nor does it reflect actual technological development. Although energy productivity is measured with the same entities, it might result in different policy implications. Patterson therefore suggests that instead of simply using the energy productivity to describe technological efficiency, marginal energy productivity ratios should be used as they better reflect the output effects (Patterson, 1996).

Finally, a pure economic indicator illustrates the relationship of the market price of energy input and the market price of the service delivery. This indicator is however not very present in political discussions on this topic.

1.3.1 The Rationale of Energy Efficiency, Wealth and Economic Growth

Our economic system currently is still very much based on economic growth measured mainly by one single indicator: the growth of the gross domestic product. The critique of the singularity of taking the growth of GDP as the indicator of welfare dates back to the beginning of the last century (van der Bergh, 2007).

The reasons for criticism may have altered with time but has once again come to the forefront in recent years. Following the publication "The Limits to Growth" of the report to the Club of Rome in the year 1972, doubts about the ecological limits to an ever-expanding economy became increasingly apparent. Scientists, the civil society as well as some politicians started to re-think the idea of growth. The slogan of de-coupling economic growth and resource consumption started to develop, although economic growth rates continued to increase with an even higher speed each year. Some argue that our societies have reached already de-coupling as the rates of recourse consumption are increasing at a slower pace than economic growth, pointing at increasing energy efficiency and reduced rates of energy intensity (Ramanathan, 2006).
However, in political debates there is deliberate confusion about absolute and relative decoupling, depending on which argument is at stake. Absolute decoupling has partly occurred for air pollution such as for SOx emissions in the OECD countries (OECD, 2001).
In terms of resource and energy consumption, only relative decoupling if at all has been achieved so far (Geller, 2005).

There is no doubt that energy and resource efficiency are at the core of an economic development that has committed itself to the concept of sustainable development. Given the fact that in the long-run absolute decoupling can only be achieved by a total reduction, theorists started to openly discuss concepts of de-growth in recent years, although this is seen as almost heretical by an overwhelming part of traditional economists and politicians (Giljum, 2009).

However, resource efficiency is still widely understood as economic growth with a lower input of resources. In order to overcome the problems associated with GDP as the single yardstick to measure wealth, a shift in the focus towards measuring the intermediate economic activities rather than the goods that those intermediate activities provide has to be achieved in the long run (Barrett et al., 2008).

In order to bring a different perspective into the political discussion, the term "service level" can be derived from the physical thermodynamic indicator. Any technological change towards energy efficiency reduces the input of energy without decreasing the service level, meaning that with less energy input the welfare output remains the same. However, behavioural change may either imply a switch towards a service level with lower energy intensity, or reducing the service level as such. The latter could even mean that some services are no longer used. This could be seen as a reduction in welfare from a traditional economic point of view. Good examples for how energy efficiency could actually improve the standard of living are widespread. The work that has been undertaken by Lovins and Weizäcker provide examples of factor four or factor ten technologies, where the service level could be increased twofold with half the resources needed. However, every technological change triggers behavioural changes as well. Furthermore, Barrett et al. show that more efficient technologies would only lead to an overall reduction of energy consumption under the condition that price mechanisms constrain the direction and growth rate of the economical development (Barrett et al., 2008).

Consequently, there are two main diverging interpretations of energy efficiency.
One commonly found in economic analysis defines energy efficiency as a method to support energy use with less primary energy and usually refers to the microeconomic level.
A second interpretation addresses the question of how to support growth in energy use with an absolute reduction in primary energy consumption. This definition refers to a macroeconomic model.
If energy efficiency remains to be seen as reducing the input of energy per unit of output, the total effects are quickly outweighed as *"we appear to have an innate ability to thin up new ways of using energy, which almost always outstrip efficiency improvements"* (Barrett et al., 2008; p. 4593).

This effect is commonly known as the rebound effect, and describes the relation between efficiency improvements and the demand for resources: *"Efficiency improvements also affect*

the demand for recourses or energy, and often an increase in efficiency by 1% will cause a reduction in resources use that is far below 1%, or sometime, it can even cause an increase in resource use" (Binswanger, 2000; p. 119).

This direct rebound effect that has initially been investigated by Khazzoom is based upon a single service model and is sufficiently documented and analysed in the scientific community. However, there is no general agreement on the real impact of the rebound effect if it is analysed in a multi-services model. The strength, direction and impact of the rebound effect strongly depend on the substitutability between the services and the direction of the income effect. Both direct and indirect rebound effects differ in strength and it would be necessary to analyse every sector and application in detail to get exact figures. However, as within the economic sphere, the adaptation mechanisms are endlessly complex, and there can only be estimates about the final macroeconomic weight of rebound effects. These general equilibrium effects are likely to level out sectoral efficiency effects and finally increase the total energy demand (Herring, 2006).
The studies of Barker et al., however, show that energy efficiency improvements for both consumers and producers had an overall reduction in energy demand in the UK. In their analysis, the macroeconomic rebound effect only accounted for 26%, thus supporting the idea of policy incentives aiming at micro level efficiency (Barker et al., 2007). There is nevertheless uncertainty if the result would have as well been only at 26% if the system boundaries would have been drawn larger than the only UK, thus accounting for industrial migration as well.

Still, the implications of the rebound effect for the European Union in particular cannot be underestimated. Efficiency measures save time and results in a strong time-related rebound effect especially in high income countries with comparatively low energy prices.[1] "*High wages, which represent the opportunity cost of time, in combination with low energy-prices encourage the increasing use of time-saving but energy intensive devices leading to an overall increase in energy use as people constantly try to "save" time"* (Binswanger, 2000; p. 121).

[1]Energy prices are currently considered by the public as too high because they are compared to historical figures. This paper however considers them as being "too" low as they are firstly subsidised and secondly do not account for secondary negative environmental costs.

Summary:

It has been shown that there is still uncertainty about the actual efficacy of addressing energy efficiency in a micro scale way and that technological change towards energy efficiency is therefore probably less influential on the total reduction of consumption of primal energy than on behavioural change. There are still doubts about the scope of potential rebound effects that have been largely ignored by policy and decision makers in the European Union, either out of ignorance or lack of political will to address the real controversial topics such as establishing correct price mechanisms. The reality shows that rather than addressing energy efficiency, energy sufficiency/conservation has to be placed on top of the political agenda, thus ultimately leading to limit energy consumption. A fruitful political discussion about energy cannot be undertaken without seriously discussing strategies about de-growth.

It will be shown in this paper that the European Union has finally addressed behavioural change and consumer choice. The European Union and the constituent Member States finally account for the historical imbalance of policies, which aimed mainly at technological change to the detriment of behavioural change. Social and political pressure still renders behavioural change far more difficult to achieve, but it has been finally understood that the aims that have been set by the European Community could only be achieved by facing the challenge of addressing both sides: technology and behaviour.

It is crucial to remember the high complexity of the energy system and containing various different actors and stakeholders such as consumers, distributors, transmitters, producers and developers of technology. All these actors are interlinked in the same system, though following different objectives and motivations.

One of the main challenges for the policies of the EU towards the promotion of RES-E and energy efficiency will be whether it will achieve correct and legitimate price regulation for energy, and to which extent external costs will be internalised in the production costs.

As the motivation behind the recent Energy and Climate Change Package addresses the climate change issue, a reduction of the total primary energy consumption only makes sense if the reduced energy consumption is supplied by non-carbon emitting technologies.

1.4 Europe's energy Position - Consumption vs. Supply

This section will examine how much energy is produced and consumed in the European Union, thus setting the frame for a policy analysis of the Energy and Climate Change Package

The Gross Inland Consumption did not significantly increased in the period 1990 - 2006. Figure 1 below shows the Gross Inland Consumption as well as Final energy Consumption, which excludes the energy that is lost in the conversion process. It will be nevertheless shown in Figure 5 that this does not hold true for electricity consumption.

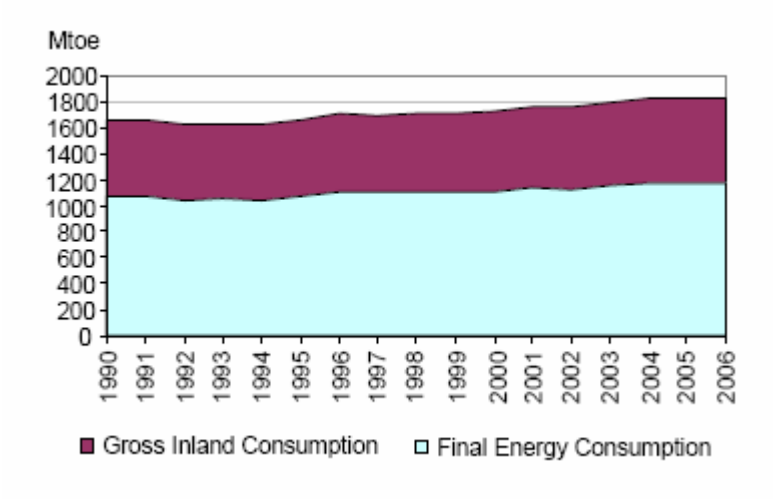

Figure 1: Gross Inland Consumption and Final Energy Consumption in Mtoe for EU – 27 (Source: SEC (2008) 2871 based upon sources from Eurostat)

Given the fact that there has been a continuous growth in the EU-27's economy, one could almost believe that a process of absolute decoupling economic development and energy consumption is about to take place.

The main contributor to this relative success has been the industry. Throughout the 1990s, the process of transition from planned to market economies was ongoing, and many industries were simply shut down or had to comply with higher efficiency standards. In Western Europe, there has also been a shift away from an economy that was based on industry towards a more service-oriented society and industries have been migrated either to the new Member States or even further eastwards to China and India. Throughout the analysis of the Second Strategic Energy review, the terms energy intensity and energy efficiency are used almost synonymously. In the understanding of the review, the only difference is that energy efficiency relates to individual processes and energy intensity to the economy as a whole (SEC (2008) 2871).

Figure 2 shows the final energy intensity of the European Economy measured in tons of oil equivalent per million euros.

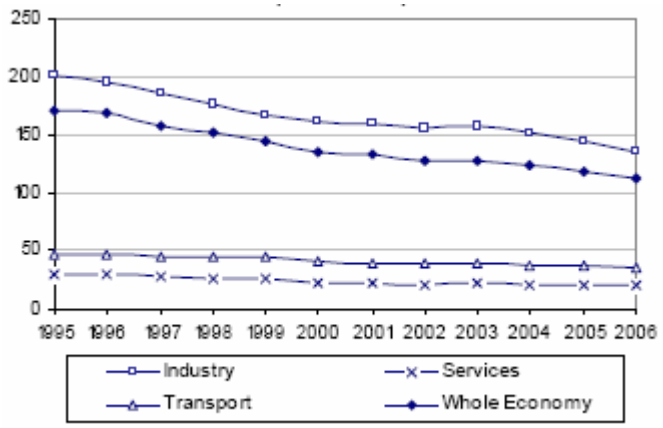

Figure 2: Final Energy intensity in M toe/ Euro for the EU-27 (Source: SEC (2008) 2871 based upon sources from Eurostat)

One of the main drivers for the common European energy policy is the security of supply. When only taking into account the constant final energy consumption and increasing rates of energy intensity at low rates of macroeconomic rebound effect, the problem of energy dependency could eventually be solved. However, as the domestic production has been in constant decline since the 1990s, the import dependency is steadily increasing, from nowadays around 54% to an estimated 70% in the year 2020. Nuclear Energy is still the biggest single domestic contributor to Europe's energy production. In the year 2006, renewables already accounted for 14% of total domestic production. The latest figures from the year 2007 have shown an increase of almost 28% percent from 987.000 toe to 1,263.000 toe (Eurostat, 2009).

Figure 3 shows the EU-27's domestic production divided by energy sources and measured in million tons of oil equivalents.

Figure 4 shows the EU-27's import dependency measured as ratio between imports and domestic production.

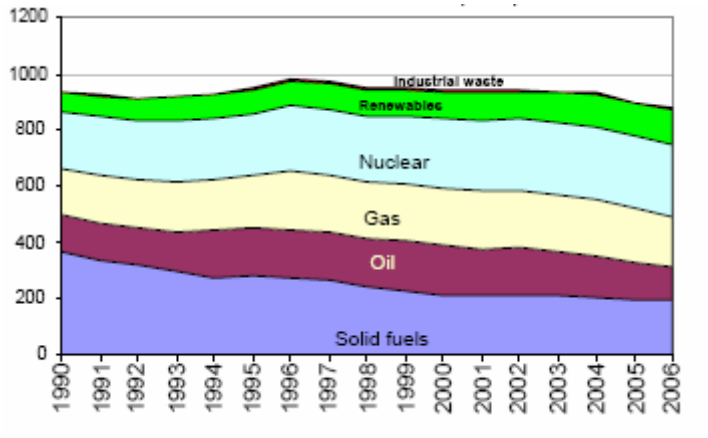

Figure 3: Domestic Energy Production in the EU-27 in Mtoe (Source: SEC (2008) 2871 based upon sources from Eurostat)

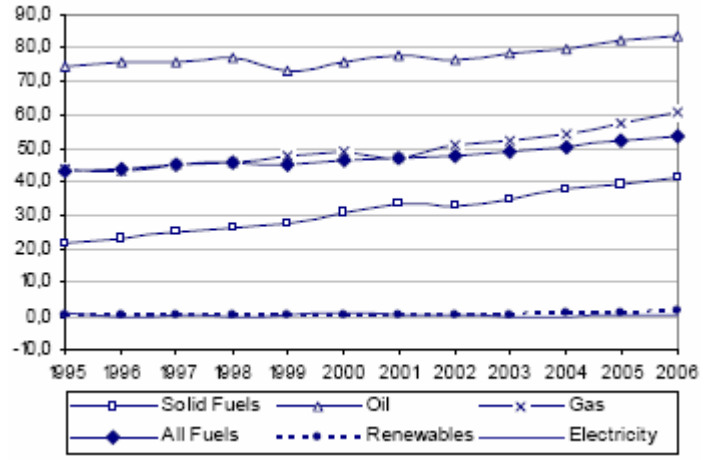

Figure 4: Final Energy Intensity in percent Domestic Production/ Import (Source: SEC (2008) 2871 based upon sources from Eurostat)

Electricity as such is still hardly imported. As a result of the European Policy towards biofuels, there are increased imports in this sector that have resulted in a slight import dependency.

Summary

The purpose of the above graphs was to emphasis on the necessity of urgent action. It has been shown that decreasing rates of energy intensity and increasing growth rates of renewable energy cannot buffer the decline in domestic production.

1.4.1 The European Electricity Generation

Contrary to the near stagnation in the overall consumption of final energy, electricity consumption is constantly rising. Only in the period 1996 – 2006 did the total gross electricity production rise from 2,829.750 GWh to 3,361.694 GWh. This is an increase of almost 18% within 10 years. Figure 5 shows the development of different energy sources for electricity generation. Coal and oil were continuously declining, while the importance particularly of gas rose. Nuclear energy is still the most important source for electricity and renewable, and accounted for 14% in the year 2006. The latest estimate by the Commissions is that the share of RES-E will only just fall short of the targets, reaching 19% to 20% by the year 2010 (RAPID, 2007).

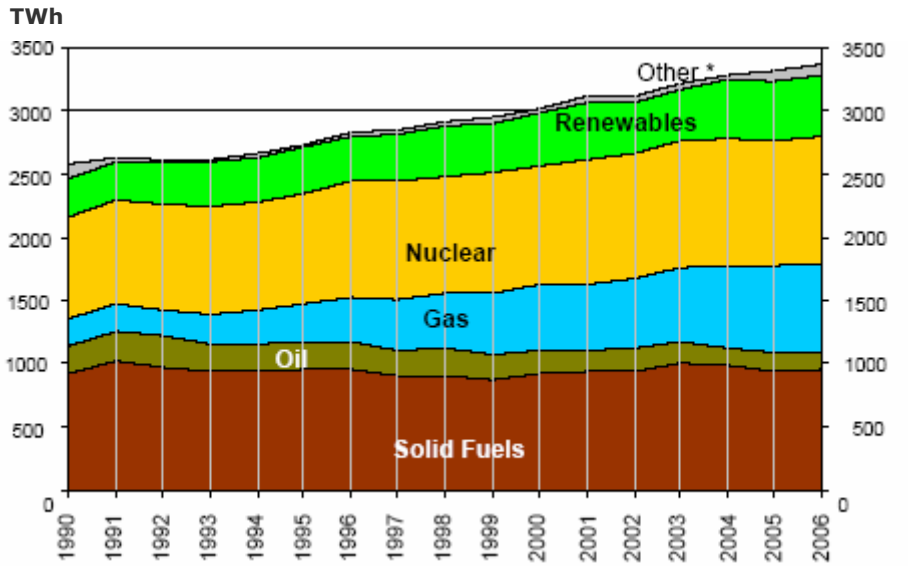

Figure 5: Gross Electricity Generation in the EU-27 measured in TWh (Source: SEC (2008) 2871 based upon sources from Eurostat, May 2008)

With the conversion of renewable energy to electricity, there will be an increasing share of wind to the relative detriment of hydro power. This becomes apparent in examining the age structure of the utilities, the fact that the hydroelectric potential is already widely employed in Europe, and by looking at the growth rates. Installed wind power grew by over 200% in the period 1996 to 2007. Hydropower actually declined from 346190 GWh in 1996 to 343768 GWh in 2007 (Eurostat, 2009).

1.4.2 Contribution of Energy Efficiency

In order to better perceive the full potential of energy efficiency in the bigger picture of the European energy mix, the concept of "negajoules" will be briefly introduced. A. Lovins first coined the term negawatt, a fictitious unit "measuring" the energy that is not used due to increased energy efficiency. In Figure 6, the energy savings for the EU-25 are calculated on average energy intensity in the year 1971. However, although this concept does not fully hold true because it does not consider feedback mechanisms between energy efficiency and economic growth and macroeconomic rebound effects, it still serves well to illustrate the potential of demand side measures.

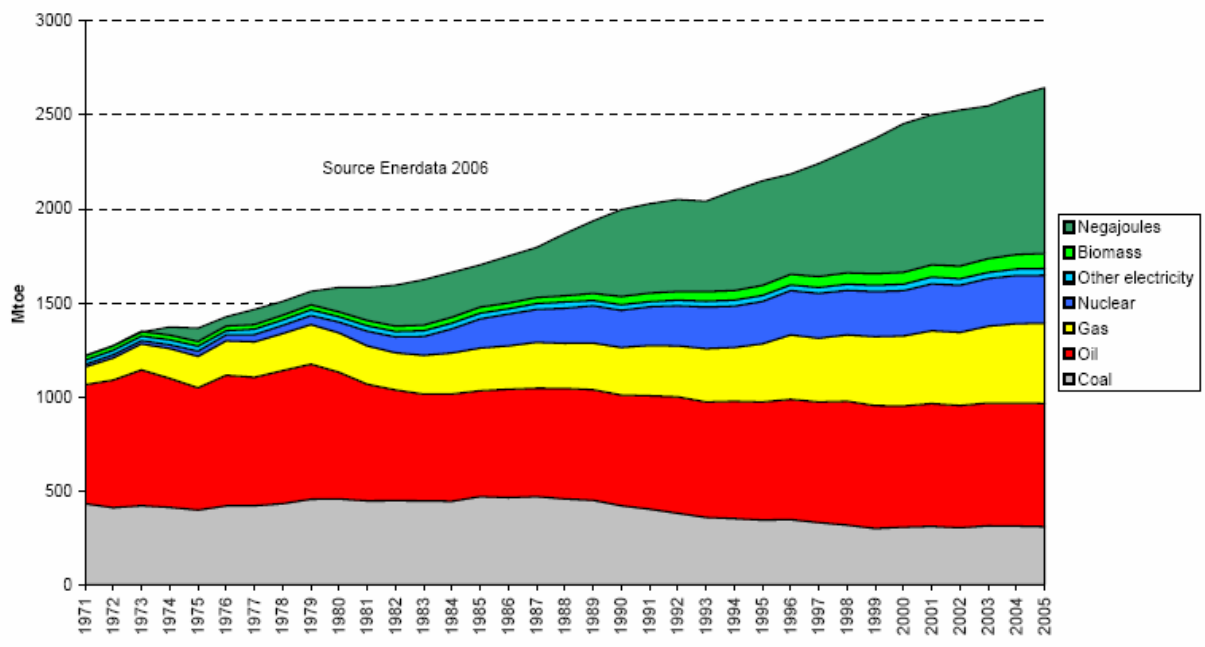

Figure 6 Primary Energy Consumption for EU-25 divided by sources, including "negajoules" (Source: Eufores, 2008; Enerdata, based on data from Eurostat, 2006)

Under this perspective, energy efficiency is the biggest single source of energy and provides a reason for the relative moderate increase of overall energy consumption. As it has been pointed out in section 1.3, the issue is more complex than it is mapped here. However, it serves as a comprehensive illustration how energy efficiency can be perceived.

1.4.3 Projections

The Second Strategic Energy Review undertook an estimate on the future impact of the Energy and Climate Change Package,based upon the PRIMES model. The PRIMES model principally differs between a baselines scenario that assumes a "business as usual" policy and a New Policy Scenario where full implementation of all envisaged measures is considered.

With regard to energy efficiency, the model assumes full implementation of all measures that are foreseen in the Action Plan for Energy Efficiency. The main driver for the development of energy efficiency in the New Policy Scenario is the oil price. In Figure 7, a projection of gross inland consumption measured in Mtoe is compared to the New Policy scenario and the baseline scenario. In this comparison, the GDP is assumed to be equal in both scenarios thus energy efficiency equals actual energy savings.[2]

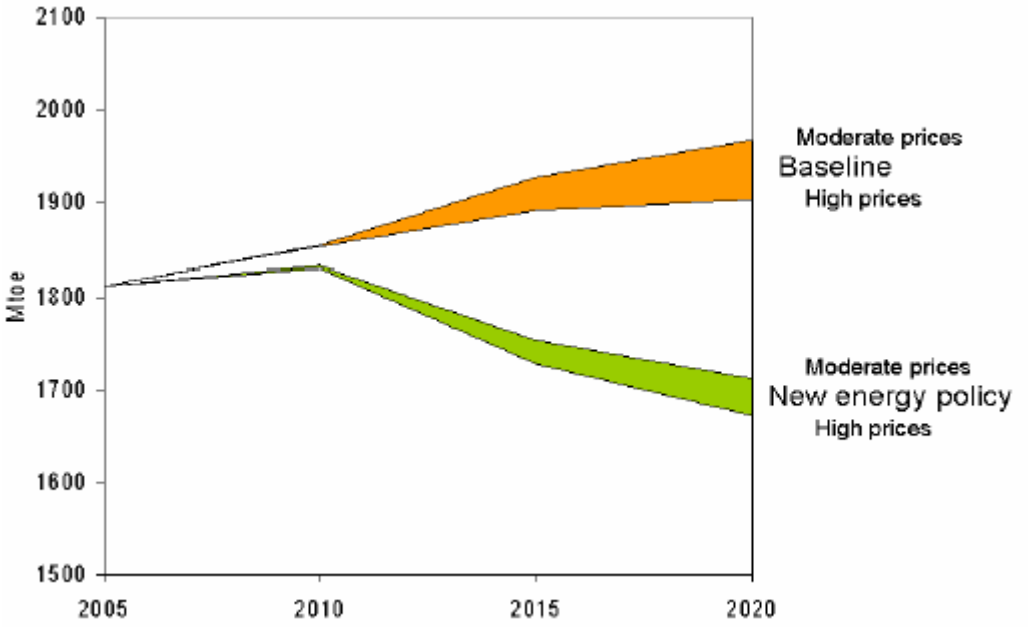

Figure 7: Projection of future Gross Inland Consumption in Mtoe for EU-27 (Source: SEC (2008) 2871 based upon sources from PRIMES)

Even under the baseline scenario, energy intensity could decline by as much as 27% due simply to increasing oil prices and an ongoing shift towards a more service-oriented economy. Figure 8 shows that if all measures are implemented, energy efficiency could increase up to 36%, thus resulting in an extra decline of energy intensity by up to 13%.

[2] The Second Strategic Energy Review measures the impact of demand-side measurements by the evolution of energy intensity, which refers to the quantity of energy necessary to produce one unit of GDP (SEC(2008) 2871, p.13)

The savings potential has been estimated at an initial value of 50 billion Euros that will increase to 100 billion Euros in the year 2020. If the oil price is set at 70 US-Dollar per barrel, saving could rise up to 150 billion each year (SEC (2006) 1174).

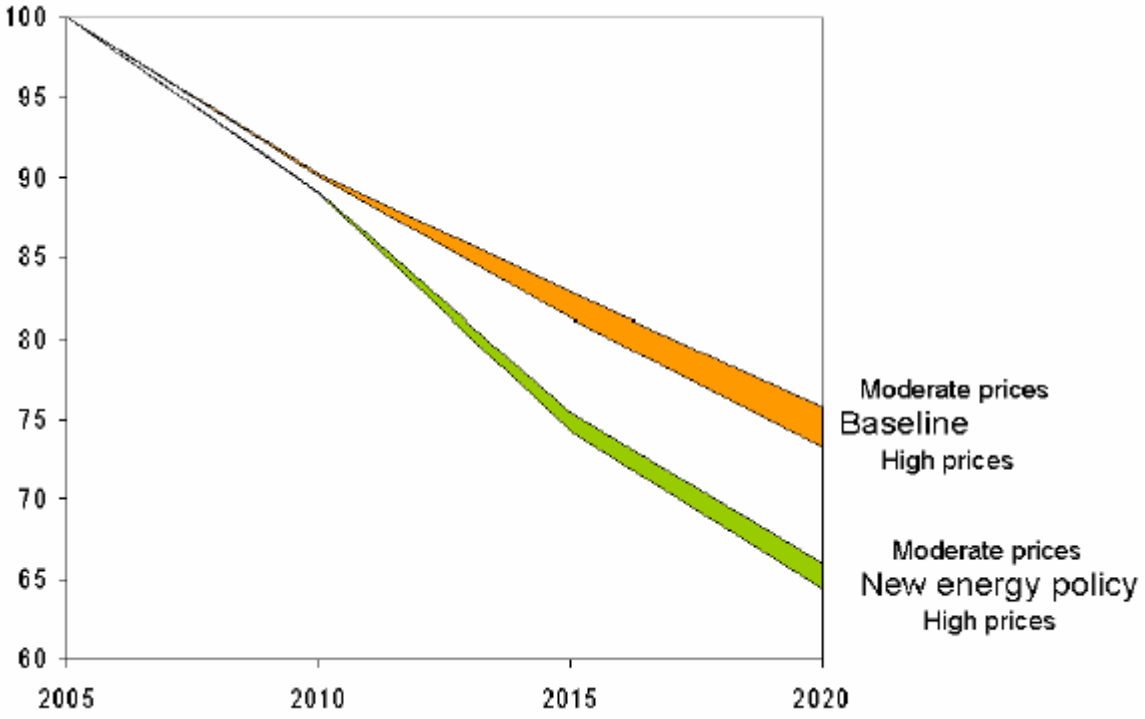

Figure 8 Energy intensity measured as energy input per unit of GDP - Year 2005 equals 100 (Source: SEC (2008) 2871 based upon sources from PRIMES)

With regard to the development of renewable sources of energy, price signals are perceived to play a lesser role than policy measures. Under the baseline scenario, renewables would develop from the current value of 9.5%, to 13% percent of the final energy demand until the year 2020. As shown in Figure 9, even when the oil price rise and renewables are fully supported with current legal instruments, they would not account for more than 15% by 2020. The assumptions for renewables are particularly optimistic, as only if all measures under the Energy and Climate Change Package are immediately implemented would the share exactly reach the goal of 20%.

High prices under the New Policy scenario would hardly have any effect.

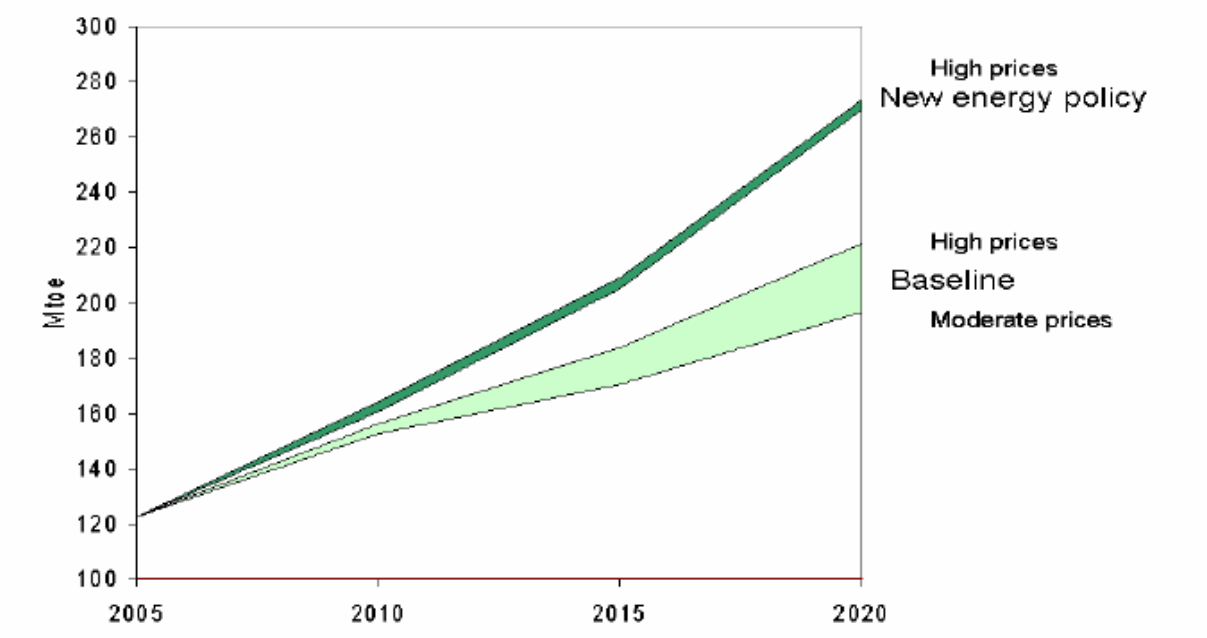

Figure 9: Projected renewable consumption measured in Mtoe for the EU-27 (Source: SEC (2008) 2871 based upon sources from PRIMES)

Summary:

The main drivers for energy efficiency measures and the deployment of RES-E are policy measures and the oil price.

Whereas for both energy efficiency and RES-E policy measures are estimated to have a relatively big effect, the effect of high oil prices differs. A reduction of energy intensity is a direct result of high oil prices and even under the baseline scenario, the saving potential is considerable. On the other hand, investments in RES-E have almost no price elasticity. Policy measures have to be fully implemented to get the desired 20% share.

It will be shown in the following section that there is a considerable discrepancy between the findings of the Second Strategic Energy Review and the underlying scientific model of this paper with regard to the role of price signals on the deployment of RES-E.

Chapter 2 - Setting Policy Benchmarks

2.1 Barriers

There is a wide range of policies available to promote both renewable energies and energy efficiency. Reasons for why policy has to take urgent action have been delivered in the above sections. This section will look at the necessity of comprehensiveness in promotion policies and will particularly highlight four policies that refer to a recent publication of Benjamin Sovacool. He has filtered the most relevant policy options in an intensive series of international interviews with key stakeholders.

This section will establish a set of policy benchmarks upon which the recent EU legislation will be examined. According to the work of Sovacool, the four most pressing policy measures are: eliminating subsidies for conventional and mature electricity technologies, pricing electricity accurately, passing a feed in tariff, and implementing a systems benefit fund to raise public awareness, protect lower income households, and administer demand side measurement programmes (Sovacool, 2009).

Although the interviews were undertaken worldwide and mainly in the United States Sovacool's findings refer to four main categories of barriers that are very valid for the European Union as well: 1. Financial and market impediments, 2. political and regulatory obstacles, 3. cultural and behavioural barriers and 4.aesthetic and environmental challenges.

These barriers can of course be fragmentised and analysed separately. As this thesis's intent is mainly to account for the systemic complexity of the European Energy Policies, rather than to examine a single policy, the frame of analysis is kept broad deliberately. Consequently these barriers seem to suit best for the purpose of setting an analytical frame for the European Energy Policy. Still, the barriers are found in every industrialised country and are encountered on the level of states, regions and local communities.

2.1.1 Financial barriers

Energy investments are generally linked to high capital costs.
Particularly improper discount rates and too high rates of return impede new investments. John Geesman, a former Californian energy commissioner and author in renewable energy policies, argues that conventional accounting of discount rates are a proper tool to evaluate private investment but that it serves as an improper tool when it comes to consider interests of future generations. He argues that conventional computer models to account discount rates and rates of return are not working when it comes to support broader swathes of the society as such. In order to effectively encourage a "green revolution" it is necessary to transform the pure costs of capital into a social discount rate (Geesman, 2009).

Another issue that has already become something like the descriptive constant of the renewable energies and energy efficiency discussion is the principal agent problem. The problem of split incentives becomes a particular problem for energy efficiency investment. It is a major problem particularly in cities in Europe, where renting flats is predominant and where either landlords make energy decisions for their tenants or builders for the homeowners. Related to this problem of split incentives is that fiscal or administrative regulations do not encourage or even discourage energy efficiency measurers (Nilsson, 2007).

With regard to market structures and market power, energy enterprises are particularly in Europe structured as huge corporations that have broadened their market influence far beyond their initial core business. Rather than to invest in innovative forms of energy supply they were expanding in more profitable businesses such as for example financial services. Market power is often used to act as predators on evolving energy markets and big utilities and suppliers are using their power to establish factual barriers such as misusing intellectual property rights and the blocking of patents or suppression (Domanico, 2007).

2.1.2 Political and regulatory obstacles

The mindsets of state agencies that are in charge of promoting energy efficiency and RES-E are predominately characterised by top-down approaches. This is reasonable in for large scale RES-E utilities such as off shore wind parks but does not necessarily serve well for dispersed generation of RES-E and for energy efficiency. Funding research and development for electricity from renewable energy sources and energy efficiency does not correspond with the

expectative burden policy makers loaded on RES-E and energy efficiency. Where public funding has partly declined, the private sector did not always jump in with adequate commitment. On Member States' level there are sometimes variable and inconsistent incentive schemes in place. As the example of the development for RES-E in Austria shows, investments have been held back extensively, due to expiry of an existing feed in tariff scheme (Scheer, 2009).

2.1.3 Cultural and behavioural barriers

This is apparently the field with the highest uncertainty and potential to establish a long term supportive policy but the potential is vast. This can be seen from examples in the housing sector where technologies for new build passive house standard buildings are readily available and implemented. Nevertheless, due to traditional customs of heating and cooling many benefits are not harvested and in the end the energy balance does not hold what has been promised beforehand. There is still a common notion that using renewable energies instead of conventional sources would either result in a reduction of wealth or security of supply. People generally weigh comfort, freedom and control higher than then energy conservation and use of renewables. This preference order is however only based partly upon evidence. In general people's perception of wealth very much relates to how much consumption they can effort. Modern consumption patterns are again based upon energy abundance and short life cycles. In order to achieve sustainable consumption it will however not only be necessary to change pattern of consumptions towards products with less energy intensity but as well to reduce the level of consumption (Alfredsson 2002).

2.1.4 Aesthetical and environmental challenges

Although commonly considered as green energies, renewable energies have a considerable environmental impact. Resistance against large hydro power has in many countries in Europe been the initiator for the foundation of Green Parties. Innovative materials for energy efficiency improvements in the building sector are often of high chemical complexity with high amounts of grey energy and may have negative balance if the whole life cycle is assessed. There are even cases where the grey energy for construction and recycling of energy efficient appliances outweighs the saved energy during operation.

From an environmental economist's point of view, the challenge of how to internalise external environmental cost is crucial for both RES-E and energy efficiency. Generally the real environmental costs for conventional energy are not sufficiently reflected in the market price of the final energy. The consumers can therefore not rationally decide which energy sources to purchase. A rational comparison based on prices that reflect the actual costs of energy can only take place if the "true" external environmental costs are reflected.

There is a strong symbolist connotation linked to renewable energy. This has both potentially positive and negative implications. A "green image" is not always considered positive and there is a potential for conflict of images depending on the social class or political opinion someone is adhered to. Apart from implications from the subtext of renewable technologies there are real impacts mainly in the landscape (Sovacool, 2009).
Particularly wind project and large scale photovoltaic power farms do face opposition from landscape protectionist groups. People often fear degrading of the landscape and potentially harmful impacts on soil, water, air quality and on biodiversity both during construction and operation.

2.2 Policy responses

In the underlying study from Sovacool, crucial stakeholders such as consumer interest groups, energy agencies, energy systems manufacturers and research institutes were given the chance to elaborate the most pressing policies in response to the above listed barriers. The work of Sovacool has identified four policy measures that were considered by the majority as the best ways to promote both RES-E and energy efficiency:

1. Remove subsidies for conventional energy
2. Price electricity more accurately
3. Enact a harmonised feed-in tariff
4. Educate the public, protect the poor and fund demand side measurement

2.2.1 Remove subsidies for conventional energy

The biggest concern among the key stakeholders was that the policy support for renewable power has been inconsistent and unfairly distributed for a log time. Addressing the issue of unfairness, the easiest policy is to first stop subsidies for conventional energy supply.

Conventional in this context not so much reflects the source of energy that is used but rather relates to the maturity of the technology. Consequently here is no difference made between large scale hydropower and power generation from fossil fuels. The range of subsidies that currently exists is huge and broadly distributed over different sectors of energy production and conversion. Subsidies are not necessarily monetary governmental transfers. They can be given either directly in the form of financial transfers and public funding and preferential tax treatment. Specific expenditures for R&D and giving preferential access to public land are more indirect subsidies. Nuclear power is throughout Europe supported by the assumption of risk by the state, thus making this type of electricity comparatively cheaper.

Within the European Union there is so far no common agreement what exactly counts as energy subsidies. The European Environment Agency (EEA) undertook a study in the year 2008 based on figures from the EU-15 from the year 2001 to examine the pressures on the environment resulting from energy subsidies. The EEA has allocated the subsidies for the primary inputs rather than on end energy which allows for the highest transparency. The study separates between on-budget and off – budget subsidies (EEA, 2008).

On-budget subsidies occur as government expenditure in the budget and are commonly direct payments in form of cash payments to utilities, industries or consumers. Apart from cash transfers governmental subsidies can be low interest rates or low rate loans that are either given directly by governmental agencies or by banks that have state interest subsidies.

Off-budget subsidies are all those transfers that do not appear on the government expenditure balance sheet. Transfers could nevertheless be given in the form of tax exemptions, credits, deferrals or rebates. Apart from monetary subsidies governmental support can be as well due to regulations that are tailored towards conventional energy structures, such as preferential planning consent and access to natural resources. It strongly depends on the national structure and the tradition of each Member State whether on-budget or off-budget subsidies prevail, but

in general there is a trend towards off-budget subsidies. This is due to the process of privatisation and liberalisation throughout the European Union

The study has unfortunately been undertaken only once and based upon data from 2001. The findings nevertheless support many arguments for the removal of subsidies for conventional energies. In the year 2001 the total subsidies accounted for 29 billion Euros in the EU – 15. This figure includes subsidies given to renewable energies as well. Total governmental expenditure to renewables accounted for 5.5 billion Euros. Solid fuels - mainly coal - have received the largest share of subsidies with 13 billion Euros that were split almost evenly between on – and off- budget subsidies, follow by 8.7 billion Euros that were given to oil and gas although the EEA estimates that 97% of these subsidies given here were off-budget. Nuclear power is the smallest fraction with 900 million Euros subsidies.
Figure 10 shows the subsidies given to each of the four sectors as percentage of total subsidies.

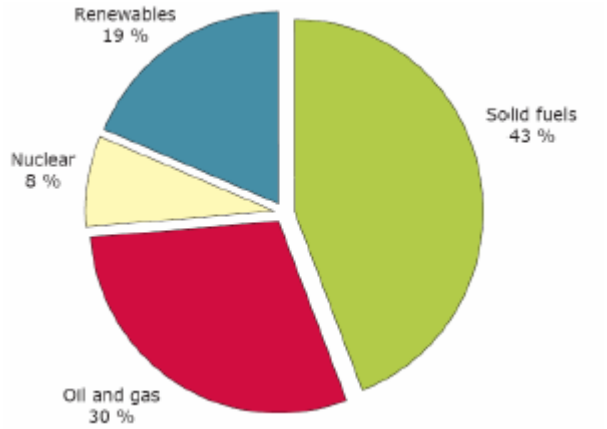

Figure 10: Estimation on the distribution of energy subsidies in the EU-15 in the year 2001 (Source: EEA, 2008)

Throughout the European Union over 70% of all subsidies are given to fossil fuels. Although some countries have stopped the subsidies for coal almost entirely, Germany, Spain and the UK are still heavily subsidising coal extraction and conversion. Concerning the funding of renewables, the support has constantly increased in the last years but is still far from reaching the share of fossil fuels. Expenditure in R&D for renewables has increased as well and private investment particularly in the commercialisation phase has played a significant role, although not included in the study undertaken by the EEA.

What remains remarkable is that the support for R&D dedicated to energy efficiency and conservation has actually declined by 19% in the period from 1995 to 2005 only accounting for 8% in total expenditure for energy research and development in the year 2005.[3]

Subsidies for conventional energy production do of course hinder the deployment of renewable energy and are at the same time counterproductive to the development of energy efficiency as they do not allow the development of accurate price mechanisms and including environmental externalities. A fast removal or at least substantial reduction of governmental subsidies would be the first logic consequence. Removing subsidies would result in the building of correct market prices, increase the competition among mature electricity providers and would allow for spending the money on subsidies for renewables or energy efficiency. This price correction could however only be a first step to account for the real costs of investments. In a second step internalising the external environmental and societal costs would be necessary with regard to long term sustainability.

The historical support for cheap electricity has resulted in a creation of structures that enhance consumption levels that are beyond the true needs. Those structures have clearly enhanced over consumption. Getting the prices right would increase the prices of electricity which is the best and most effective way of increasing energy efficiency in the first stage. Subsidies for conventional electricity discourage consumers to actively search for alternatives both in reducing electricity demand as well as looking for small scale and regional supply of RES-E. When subsidies are given to specific sorts of technology, the process of commercialisation and development of potentially more efficient and less environmental damaging new technologies might be undermined. Throughout Europe particularly large scale and centralised energy provision schemes have been heavily subsidised. There are reasonable arguments that in order to overcome the historical imbalance, counteraction in the form of subsidies dedicated to re-create local structures providing renewable energy has to be taken. (Community Guidelines on State Aid for Environmental Protection)

Money that is not spend on subsidies can be spend either directly on supporting schemes for renewables such as feed in tariffs and R&D or indirectly for education and social security measures buffering increased energy prices.

[3] These figures do not include funding from Member States. Austria, Finland, Ireland, Sweden and Portugal spend for example over 25% of their expenditure in energy R&D on efficiency and conservation.

A removal of subsidies for conventional energy would as well increase the competition between existing energy providers. Some energy providers in the European Union are still operating in an oligopoly or monopoly. This alone accounts for price distortions. Increase competition usually results in falling prices which at the end would again balance to a certain extent the estimated price increase occurred due both the reduction of consumer and producer subsidies.

2.2.2 Pricing electricity more accurately

There are roughly four distortion mechanisms linked to the building of electricity prices: Price caps, block- rate pricing, not appropriately mapped time and externalities.

Price caps take into account the overall inflation rate of the economy and the relative efficiency gains of the operator compared to the average enterprise. The electricity provider can adjust its prices accordingly, including the inflation for its input goods as well. This mechanism has a tendency to buffer price volatilities and keeps the price in general artificially low. The consumer has therefore a low incentive to adapt the consumption pattern according to the supply of electricity.[4] The actual supply of electricity would of course be reflected more accurately in the prices if price caps are withdrawn.

Declining bloc rates offer large energy consumers reduced prices per electricity unit with increasing demand. The result is again a relative incentive to consume more. There are artificially introduced decreasing marginal costs although both the environmental and societal costs have in reality properties of marginally increasing costs properties. Equity is neglected as small consumers, although valuing energy at least as valuable as large consumers have to pay relatively more. It would be eventually advisable to introduce inverse bloc rates. This would better reflect the reality of increasing marginal environmental and societal costs.

A timelier pricing of electricity would provide for a better indication of daily or seasonal scarcity. Decentralised local structures might be more suitable for an exposure to increased volatility as they can better address demand side management. Given the fact that too high price volatilities in large scale structures would not result in energy savings either it would at

[4] Customer adaptation would be easier in small scale decentralised systems and is rather unlikely to actually take place in large systems

least make sense to better elaborate a pricing system that differs between peak and off-peak consumption.

Getting electricity prices truly right would as well mean that all external environmental and societal costs are internalised. This is a well known but ill solved problem for any economic activity and environmental economists are still looking for a satisfactory solution to this. Depending on whose interests are on stake, the definition and scope what is considered to be the true external costs might vary quite significantly. Protectionist groups have of course a different interest than the industry and serious economists would acknowledge the fact that external costs are always based more on political consensus rather than on objective scientific facts. Nevertheless, there is almost consensus that external costs are far from being sufficiently internalised and that further internalisation has to take place. No matter to which extent, this would necessarily result in higher energy prices, thus again creating an incentive for the consumers to take energy efficiency more serious and to reduce wasteful use of energy.
There is reasonable concern that the above measures would result in social problems and in order to guarantee access to energy which is a pre-requisite for human development countermeasures have to be taken. This will be discussed in section 2.2.4.

2.2.3 Enact a harmonised Feed in tariff

Aiming for the quickest deployment of renewable energy, feed in tariffs are a very good promotion. Examples from Germany, Spain and Denmark show well that feed in tariffs are a very effective promotion scheme. It is very much recognised that this form of promotion scheme gives the most stable and consistent climate for manufacturers, investors and producers.

Nevertheless, it is not necessarily the most cost-efficient way to support renewable energies. However, the reverse does not hold true either. Market based mechanisms are not neccessarly more efficient. There is so far no final conclusion within the scientific community which promotion scheme performs best in terms of equity, efficiency and effectiveness. (Jacobsson et al., 2009)
Sovacool has analysed in his study that most stakeholders are in favour of a harmonised feed in tariff, in order to increase the share of renewables. However this does not necessarily

reflect the overall political consensus and might biased by individual interests of the stakeholders.

It will be shown in section 3.2.2, in a critical review on the impacts on RES-E, that competing support schemes with options of cooperation might have in the mid run an advantage over a too early established harmonised feed in tariff system. A system of co-existence has the potential to both effectively and efficiently promote the deployment of renewable energies better than a harmonised but exclusive promotion scheme. (Fouquet and Johansson 2008)

Consequently, with regard to the realities of the European Union a harmonised EU-wide feed-in tariff can not be established as a policy benchmark. It serves very well as a policy benchmark on the national level but would not reflect the complexity and diversity of the European Union. Thus the analysis within this thesis will examine the state of existing harmonisation and critically reviews to which extent the goals that form the basis of current support schemes are considered.

2.2.4 Educate the public, protect the poor and fund demand side measurements

Education that addresses the aesthetical and environmental issues related to renewable energy is an intangible asset that has to be build up over a long period of time. In order to guarantee for objective information this task can not be left to the companies itself. As apart from companies or protectionist groups no one has an incentive in investing in education on environmental and aesthetical impacts of renewable energies, thus underinvestment in targeted objective educational programs would be the outcome.

Education on energy efficiency is not in anyone's direct interest either. This is particularly challenging as education is the single most effective way to increase energy efficiency. Only educated users are able to fully benefit from increased energy efficiency resulting from technological innovation and to keep direct rebound effects small. This however has to go hand in hand with a process of standardisation and the creation of indices implying the creation of structures for rating and labelling and the training of monitors, applicants and industrial, commercial and residential customers.

One main policy should be to get the prices in electricity right. In order to avoid environmental classism, concessions have to be made to the more vulnerable. As poorer households usually have to spend a higher fraction of their income on energy, a fund has to guarantee that they receive support such as percentage reduction on energy bills, loans and rebates. In any case this is politically a very sensitive issue and should be based on nationally existing support schemes thoroughly avoiding the creation of new solicitants. One possible approach could be to give loans to builders and homeowners to invest in energy efficiency measures and to increase the energy standards for existing publicly owned social housing. A bonus could only be given to those builders or architects that can provide highest energy standards. Introducing standards and labels can only have an impact if architects, builders and workers are able to technically comply with them. Although the reputation of efficient building and housing is comparatively high in Europe, there is not enough incentive to privately finance training. Training and technical assistance has to be therefore offered accordingly and partly supported by the state.

Summary

All the above preferred measures imply that they are executed comprehensively. Some measure would not unfold the full impact if the other measures are not taken similarly serious. Nevertheless there is a potential for both negative and positive feedback mechanisms.

If for example the subsidies for coal are reduced without at the same time promoting energy efficiency, the domestic coal will simply be replaced by comparatively cheap coal from abroad. Only if utilities are as well supported to invest in renewable structures at the same time, phasing out coal subsidies achieve the desired impact. When electricity prices rise due to the reduction of distortions and there is not enough information for the households on actual consumption and peak prices, customers would not get a fair chance to adapt their consumption pattern and level. The impact would be particularly hard to poorer household who are firstly more dependent on energy and secondly have usually less free resources to get the education and information that would be necessary to wisely adapt to increasing energy prices.

There are as well doubts that price increases would even in the long run result in a significant reduction of energy demand. Even though there is a correlation between price and demand the energy demand is not as flexible as one might wish (Sovacool, 2009).

The structure of the European Union would in principle provide for the best platform to execute these measures comprehensively. Still, this very much depends on the willingness of the Member States to interpret the subsidiarity principle in a constructive way.

Chapter 3 - Current Legal Framework and Policies: The Energy and Climate Change Package – the pathway to 2020

The main driver for the latest agreement on the Energy and Climate Change Package was the concern about whether Europe can sustain its wealth.
The biggest threats to this are seen in the security of energy supply including concerns about rising oil and gas prices and the threats of a changing climate. There is now a common understanding that in order to limit the worst effects of global warming, immediate action has to be taken to limit the temperature rise on an increase of 2° Celsius average. The EU has agreed to cut its CO2 emissions, increase energy efficiency and boost renewable energy. For each of these three goals binding targets were set to be reached by 2020.

In order to bring the overall EU-wide goals into the Member States' political reality the Commission based its political architecture upon five principles that were set by the Council (COM (2008) 30 final, p.4)

1. The targets must be met and appropriate monitoring and compliance mechanisms have to be established.
2. The proposal must take the Member States' different starting points into account to guarantee fairness.
3. The costs of the proposal must not negatively affect the EU's global competitiveness, employment and social cohesion.
4. The final target must be to reduce the global GHG emissions by 50% until 2050.
5. The EU must act as a motor to reach an international agreement on GHG emissions.

The first EU wide substantial discussion addressing all aspects of an integrated energy policy started with the launch of the Commission Green Paper "A European strategy for sustainable, competitive and secure energy" from March 2006 (COM(2006) 105). The ideas that were presented in this Green Paper found their way into the so called Energy and Climate Change Package which has been approved by the Council in April 2009 after the Parliament has adopted the package with amendments and changes in December 2008 (European Parliament, 2008). Although this was perceived as a pioneering policy by the general public, green lobbying groups were partly disappointed with the decision of the parliament arguing that the

package was not far reaching enough particularly in terms of commitments towards the fight against global warming (Euractiv, 2008).

The political basis for the establishment of legislation addressing both energy and climate has been set earlier by an agreement on a two year action plan on energy in May 2007. This action plan stressed the need for a common European action and the agreement that climate change and energy issues have to be addressed hand in hand (European Council, 2007). It has been clear from the beginning the Energy and Climate Change Package has to go through a co-decision process as it will touched areas such as environment, the internal market and consumer protection. Compared to other legal instruments that are as well subject to the co-decision process, an agreement on the final text has been reached quickly. The legislative work as such did not take longer than eleven month. The speedy coming into force was of particular importance with regard to the upcoming climate conference in Copenhagen and the necessity to find a common EU standpoint beforehand (Kérébel, 2008). The concerns both by the Council and the Parliament that an agreement could eventually not be reached before the elections to the European Parliament taking place in June 2009 provided further acceleration.

Apart from the "20-20-20 by 2020" goals that were broadly communicated in the media and that are the area of focus of this thesis there has been agreement on other issues as well that should only be briefly mentioned in the following: Completing the internal market for electricity and gas, promoting "clean coal" and carbon capture and storage as means to reach a low CO2 fossil fuel future, development of a common external energy policy and a focus on R&D by a European Strategic Energy Technology plan. With regard to the different standpoints of the Member State towards nuclear energy it has been decided to leave the decision up to each individual Member State to which extent nuclear energy can contribute to reach the aims of reducing CO2 emissions (Euractiv, 2007).

The goals that are behind the buzzword 20-20-20 targets are explained in brief: a reduction of CO2 emissions by 20%, an increase in the share of renewable energy by 20% and a decrease in the overall energy consumption by 20% until the year 2020. The fact that these goals were easy to communicate protected them of being watered down.

The targets are the outcome of long lasting discussions and negotiations that have recently been influenced by the global economic downturn. Particularly representatives of the industry

feared in times of decreasing demand, a further decline of their businesses that have already been trembled by the economic crisis. Politicians turned in at the last instance, threatened by the perspective of politically unpopular migration and closure of the European industrial production, summarised under the term “carbon leakage”.

With regard to the upcoming negotiations in Copenhagen in December 2009, where new commitments on green house gas emission reductions will be negotiated in order to replace the Kyoto protocol, the EU agreed already on an emission reduction of at least 20% until 2020. This target would be lifted up to a reduction of 30% if other major emitters both from developed - particularly the US- as well as from the big developing countries like Brazil, China, India and Russia would agree on significant reduction targets as well. Nevertheless the EU will not commit to this automatically but a new and separate legislative co-decision process will be eventually opened. This has to be seen as an attempt by the European Union to make a real offer to the US and to Japan to reach an overall reduction of 30% in the developed countries.

The European Trading Scheme (ETS) for Green House Gas Emissions that has been launched in the year 2005 will be enhanced. To combat global warming, other states will eventually join either the existing European Trading Scheme or set up similar systems. There are changes envisaged to address the problem of how to define the level and mode of allocation of emission permits. Whereas the permits are currently allocated on the national level, in future they will be distributed EU-wide under a common cap. The initial plan to fully auction the permits and not to allocate them for free, based on historical emission levels, was declined after protest from Germany, Italy and Poland whose governments faced severe opposition by their national industrial lobbies. The industry argued that they would be forced to shift the production to countries with less stringent emissions targets in order to stay competitive. As a result to this pressure, those industries with a high risk of “carbon leakage” will be exempted. Until 2010 it has to be decided which industrial sectors will qualify for exemptions. In order to comply with the principle of cutting emissions first in those sectors with the highest cost-effectiveness ratio, flexible mechanisms like the Joint Implementation (JI) and the Clean Development Mechanism (CDM) will be increasingly enhanced. The legislation included new lower binding targets for CO2 emissions for cars and new regulation for Carbon Capture and Sequestration (CCS) (Kérébel, 2008).

The core of the legislation is nevertheless energy. The content of the Energy and Climate Change Package will be first analysed in detail, followed by a critical review on the impact of the policies. The policies that have been identified in the upper section will serve as benchmarks upon which flaws in the respective directives on energy efficiency and RES-E are identified. As the Energy and Climate Change Package is build upon preceding provisions that overlap with the current proposal, the preceding legislation is included in the analysis as well. This allows for more comprehensiveness and understanding of the historical and institutional context.

3.1 Electricity Produced from Renewable Sources of Energy - RES-E

3.1.1 A first milestone: the development of the 2001 Renewable Directive

The directive on the promotion of RES-E in the internal electricity market (Directive 2001/77/EC) entered into force in the year 2001. For the first time in history the European Energy Policy established a common legal community framework setting targets for the share of RES-E.

The Directive 2001/77/EC is the result of a long lasting process of negotiation which is even for the European Union remarkable. The directive is the final outcome of a Green Paper from the year 1996 that has first developed into a White Paper "Energy for the future: renewable sources of energy" in the year 1997. Nevertheless as the content of the White Paper touched several issues those were subject to the co-decision process laid down in the Article 251 of the EC treaty, several amendments both from the European Council and the European Parliament delayed the ratification. A conciliation process which would have prolonged the process even further could however finally be inhibited. The long time spam from draft to implementation is not only due to the institutional complexity of the European legislative system but as well due to real substantial disputes mainly over the definition of the term "renewable energy". The distribution of the national targets and the design of a harmonized supporting scheme have been other major hurdles (Rowlands, 2005).

The discussion concerning the term renewable energy mainly pertained to the use of large scale hydropower and biomass. The main concerns towards the production of electricity coming from large scale hydropower centred on three issues: Firstly, the question whether

governmental support is necessary as large hydro power is a profitable business already. Secondly, doubts about the social and environmental impact and finally due to concern about immense costs if treated like other renewable sources like solar or wind energy. Supporters of including large scale hydropower into RES-E regulation mainly argued alongside the necessity to cut CO2 emissions and feared that both the national renewable targets as well as the obligations stemming from the Kyoto protocol would never be achieved without including large scale hydropower into the support scheme. In the end it has been agreed that large hydropower (above 10 MW) is a renewable source but the debate was at least on the European level postponed as it was left upon each Member State whether they included large hydropower into their national supporting scheme (Rowlands, 2005).

The controversy around the definition of biomass was complex and centred on the dispute what kind of waste should be included into the Biomass fraction. It was disputed whether municipal waste or even industrial waste could be counted as biomass as well, a term that was initially shaped by biodegradables stemming from agriculture and forestry. Apart from environmental concerns, the main concerns were potential drawbacks on the support of the core biomass digestible fractions. The fear was that by adding bigger fractions of almost profitable and cheaper biomass the more environmentally friendly fraction would be crowded out. In the end a broader definition was accepted including electricity coming from industrial waste in any conceivable form mainly pointing at the cost effectiveness to reach the national targets (Rowlands, 2005).

In the underlying initial position of the first Green Paper from the year 1996 the targets for the share of renewable energy in the total energy mix were set at 15% by 2012. This aim has been lowered by pressure of the Council and the Commissions to 12% as in the meantime energy consumption has risen quicker than expected. This meant a respective share of 22.1% RES-E. Each Member State set a national goal contributing to the overall community goal upon which they could be monitored. Although both the Commission and the Parliament both opted for binding targets the Council strongly opposed any legal obligation, with the result that the aims finally stayed indicative (Rowlands, 2005).
The initial target of 22.1% has bee lowered with the accession of the new Member States. In order to monitor this target a harmonized reporting system as been established as well. This Directive however did not succeed to establish a harmonized supporting scheme for RES-E (M. Roggenkamp 2007, p. 379).

The directive is nevertheless considered to be a relative success. The latest estimate by the Commissions is that the share of RES-E will just fall short of the targets, reaching 19% to 20% by the year 2010 (RAPID, 2007).

Another point of dispute was the question whether and to which extent a community wide harmonized support scheme for RES-E should be established. At that time being there have been already three main types of support schemes implemented: Feed–in tariffs, quota systems and tradeable certificates, although the first two were predominantly deployed. The Commission was initially strongly in favour of tradeable renewable certificates which were perceived as being the most market friendly measures and in line with the common policy pattern of the European Union at that time. Following the rationale of the internal market, a process of harmonization would be a logical consequence. As a result of the differing experiences the Member States had with different supporting schemes and due to doubts from parts of the scientific community (e.g. Toke 2008), the Commission redeemed its unambiguous position. It has been resolved to postpone the decision until further evidence about which supporting scheme performs to promote renewable energy in the fastest and cheapest way could be obtained (COM (2005)627).

Since the beginning the European Parliament has been in favour of a feed-in tariff which had proved to be the most effective, though not necessarily most economic way of increasing RES-E as the developments in Spain, Germany and Denmark had already shown (SEC (2008)57).

The Council urged that as far as there was still uncertainty about the best support scheme, harmonisation would be premature but it has been agreed to evaluate the supporting schemes at a later state before harmonisation should start (Rowlands, 2005).

This has been done twice in the meantime with Commission Staff Working Document "The support of electricity from renewable energy sources" SEC (2008)57 from the year 2007 and COM (2005) 627 from the year 2005 which could still not single out the best promotion scheme either, although Member States have made significant further experience in the meantime. There have been serious doubts, particularly from those experts who were in favour of tradable certificates that due to the Commissions' drawback the overall target of increasing the share of RES-E would not accomplished and that the national targets would possibly not be met solely by domestic production without any trading. (Verhaegen et al., 2007)

The Renewables Directive takes also into account the challenges of more RES-E for the transmission and distribution systems. It points out that the Member States have to take necessary measures to ensure that both transmission and distribution guarantee the transmission and distribution of RES-E. The national regulatory authorities are obliged to monitor and control the terms and conditions for producers of RES-E newly entering the market and to fully account the cost for providers of renewable energy sources, cogeneration and distributed generation.

For the first time in history this Directive provides a legal basis upon which a consumer may request a Guarantee of Origin of the purchased electricity (Directive 2001/77/EC). These GOS were initially meant to serve as a way to count the national targets for RES-E but it turned out that they were mainly used for the identification of green power products and for disclosures. GOS allow the consumer to decide which type of electricity to purchase (conventional vs. renewable) and to further differ between different sources of electricity (wind vs. hydro). This is important as green electricity is not considered equally sustainable. Consumers of green electricity might prefer electricity from industrial waste to electricity from biomass. Electricity suppliers have an obligation of disclosure about the share of each energy source on the total energy mix they provide (Verhaegen et al., 2007).

GOS could as well serve as starting point for an European-wide trading system. It has been in the interest of the Commission to establish such a system at an early stage in order to facilitate a transition towards a system of tradeable certificates. After the Member States gained experience in issuing and monitoring GOS a process of harmonisation should be started. (COM (2008)19 final)

Certain agreements that have been reached were crucial for the design of the current Energy and Climate Change Package. Namely that quantified national targets for consumption of electricity from renewable sources of energy have been set. Having agreed on a common methodology alleviated the process of setting national binding targets in the current negotiation, which is seen as crucial for the provision of certainty for investors (COM (2008)19 final). It has been accepted that different national supporting schemes can exist alongside and that a harmonised support scheme is still to be aimed for once further evidence is available after more monitoring. It has been as well agreed on simpler national administration procedures for the authorisation of new RES-E projects and that electricity

produced from renewables receives a guaranteed access to transmission and distribution systems (Jäger-Waldau, 2007). The majority of these achievements have been absorbed in the new Energy and Climate Change Package.

3.1.2 Conceptual critique

Verhaegen et al. were analysing a methodological confusion concerning the targets for RES-E that occurred during the legislative process of the Directive 2001/77/EC.
Firstly, confusion arose whether the national targets were proportional or absolute.
Secondly, it was not clear whether the targets address consumption or production of RES-E.

There are stronger implications linked to a confusion of proportional and absolute targets. In principle, Member States can address both the nominator and the denominator when addressing a percentage figure. This has potentially huge implications on the role of energy efficiency in reaching the national indicative targets. Only by lowering the overall consumption of electricity and keeping the share of RES-E constant an increase in the share could be achieved. The same reasoning holds true for the contrary. In the case of higher overall electricity consumption the share of renewables would decline if measures are not taken to increase RES-E. As there is a significant amount of electricity traded within Europe, imports and exports can account for huge differences in the consumption of electricity on the national level (Verhaegen et al., 2007).

Verhaegen et al. show that although a percentage of 21% RES-E is given as a proportional aim, there is still an absolute component in the target. The European Communities were using a consumption scenario that has been derived from an energy model, projecting the total gross electricity production at 3.058 TWh in the year 2010. This assumption served as the denominator from which 675 TWh from RES-E is calculated with the consequence of an overall aim of 21%. In the final version of the directive there has been ambiguity left on whether these 675 TWh relate to production or to consumption.
Nevertheless any figures expressed in TWh for targets of the Member States remain indicative targets and albeit there is theoretical uncertainty on whether the text of the directive actually meant production or consumption aims, in reality the Member States construe the text as production targets. There is strong evidence that this has not been the initial intention of the text but the political reality has adopted it that way (Verhaegen et al., 2007).

3.2 RES-E in the Energy and Climate Change Package

In the following section the content of the Energy and Climate Change Package will be analysed with regard to the regulations on RES-E.

The regulations are inscribed in the working document SEC (2008) 57 on the support of electricity from renewable energy source accompanying the Directive COM (2008) 19 final on the promotion of the use of energy from renewable sources.

With the new Energy and Climate Change Package each Member State has an obligation to assign to national proportional targets for renewables. These targets are legally binding and depend on the historical share of renewables and on the GDP. The GDP is again related to the population thus resulting in the calculation of the final share of the targets for renewables. This way it is accounted for the differences among Member States' starting points, the renewable energy potentials and the existing energy mix (COM(2008)19).

The share of total renewables is measured as share of final gross energy consumption. Nevertheless every Member State has to commit to an increase of its share of renewables by 5.5% measured upon 2005 levels, which is considered as the latest year for which reliable data on shares for renewables are available. (Art.3 and Art. 5, COM(2008)19final)[5]

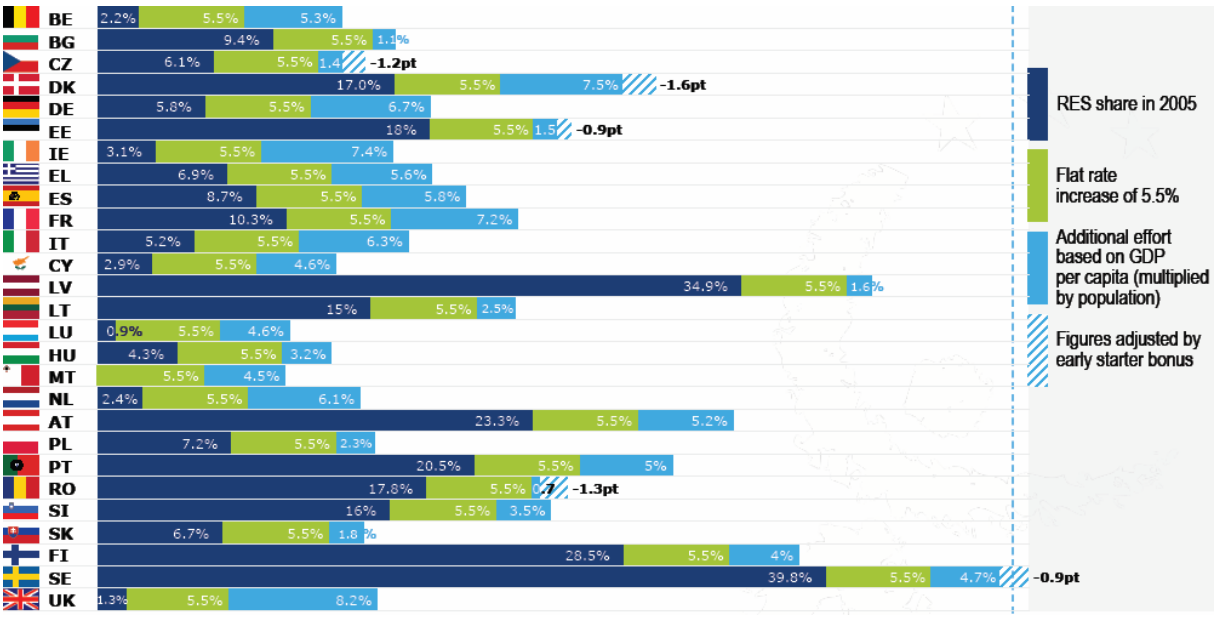

Figure 11: Targets for Renewables for the EU-27 until 2020 (Source: Veum, 2008)

As a result of the still unresolved issue of a common European harmonized supporting scheme, the legislation foresees flexibility in the national supporting schemes thus offering the possibility of co-operation and co-ordination among Member States. The objective of the

European Commission to introduce a harmonized supporting scheme for RES-E based on tradeable certificates into the new Energy and Climate Change Package has failed again.

The first general revision and evaluation of the co-existing support schemes has been undertaken 2005 by the Commission in the report on the application and coexistence of the different support mechanisms for electricity from renewable energy sources COM(2005)627. The report concluded that there is still not enough evidence about efficiency and effectiveness to finally decide which scheme to thrive for. Against the background of a still not fully liberalised electricity markers both quota systems and feed-in tariffs were considered to be still in a phase if transition. *"Whilst harmonisation of support schemes was considered a long term objective, persisting barriers to the development of renewable electricity and the low level of competition in the electricity market implied that such harmonisation would be premature"* (SEC(2008) 57, p.3).

Nevertheless the Commission was still in favour of an European–wide trading scheme.
In order to push forward the idea of a full scale trading scheme the Commission initially proposed an option for voluntary trade with the GOS. This has been seen by the majority of the member countries and renewable energy industry lobby groups – mainly those who had opted for feed-in tariffs and who feared negative impacts on the promotion of their specific renewable technologies – as a threat to their existing support schemes and a backdoor for introducing an EU- wide trading scheme for green certificates. The Commission had therefore to partly withdraw and water down the initial proposal. (Toke, 2008)

Member States are thus still free to adhere to their national support scheme. However, as there is a common agreement that an EU-wide harmonised supporting scheme is still an aim to thrive for, certain commitments have been made resulting in a set of five cooperation mechanisms usually referred to as "flexibility mechanisms" (Kérébel, 2008).
(Art. 6-9 COM(2008)19final):

1. Statistical transfers between Member States
2. joint projects between Member States relating to the production of energy from renewable electricity, heating or cooling;
3. joint projects between Member States and third countries regarding the generation of electricity from renewable sources;

4. joint support schemes in which two or more Member States join or partly coordinate their national support schemes;
5. GOS of electricity, heating and cooling from renewable energy sources (but limited to a transparency purpose to increase the visibility of the renewable energy production).

3.2.1 Content Analysis

3.2.1.1 Flexibility mechanisms[6]

In principle the introduction of the flexibility mechanisms have been favoured and pushed forward by those Member States that feared they would either not have enough national potential for RES-E or the cost of exploitation to meet the agreed target would be disproportional. As an introduction to the mindset that is behind the flexibility mechanisms one might think of the Joint Implementation mechanism laid down in the UNFCCC. Member States will have the possibility to commit to investments into RES-E projects in other states. These states could either be members of the EU or part of the Energy Community of South-East Europe, including apart from the EU as such, Albania, Bosnia & Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Montenegro, Serbia and the United Nations Interim Administration Mission in Kosovo (Energy Community, 2009). The extra energy that will be generated by new investments in another country will be counted to the reduction targets of the investing country. With regard to states that are neither member countries of the EU nor of the Energy Community of South East Europe, electricity from RES-E investments has to be physically imported into the European grid in order to be counted to the targets of the investor(COM(2008)19 final).

3.2.1.2 Compliance

In contrast to the targets that were set under the Directive 2001/77/EC the targets that are set in the new Renewable Directive are binding. In order to guarantee the fulfilment of the targets by the Member States a compliance mechanism had to be developed. The Parliament through the Committee on Industry, Research and Energy has been in favour of a strong compliance

[6] So far there is no concrete segregation between the mechanisms to be found in the scientific community. There is as well still uncertainty on whether these mechanisms are an inclusive list but it seems that the EU- institutions will refer to the list of these five as flexibility mechanisms.

regime including fiscal penalties and a strict monitoring scheme. However any initial attempt from the Commission to establish a strong compliance mechanism failed.

In case of non-compliance with either the final or the intermediary targets, the new legislation foresees only tightened and harmonised reporting schemes. Every Member State is now obliged to submit a standardized Renewable Action Plan by the year 2010. In case any derogation from the interim targets becomes apparent, the Member States have to revise their Action Plan (COM (2008)19 final, Art. 4).

Any infringement resulting from an inappropriate Action plan of the Member State triggers a statement by the Commission, who can then ask the Member State to correct the Action Plan accordingly. As the burden of proof lies with the Commission, the intermediary targets have been set as compulsory benchmarks to provide a basis for triggering action. Nonetheless as there are no fiscal penalties linked to this, it is a relatively weak measure.

3.2.1.3 Access to the grid

Apart from the support mechanisms that mainly aim at helping RES-E in the penetration of markets dominated by large scale providers of conventionally produced energy, there are non-economic barriers that have to be removed in order to achieve the envisaged targets. It has been broadly criticised by interest groups and suppliers of renewable energies, both gas and electricity, that there has been restricted access to pipelines and the electrical grid. Although not mentioned specifically in which way each Member State should address this issue the directive aims for an EU-wide priority access for Biogas and RES-E (COM (2008)19 final, Art. 14).

Many Member States have already individually developed wide-ranging guarantees for renewable electricity suppliers for the access to the transmission and distribution grids (Adam, 2009).[7] Nevertheless there are new obligations for the transmission system operator (TSO) and the distribution system operator (DSO) to provide transparent information about the costs of connecting renewable electricity to the grid. This has to be seen against the background that the Member States may impose the cost of connecting RES-E to the grid on the TSO and the DSO. It is within the Member States' responsibility at least to provide a guarantee of access to the grid. Depending on the vulnerability of the grid in terms of reliability and safety, the Member States can opt for a "priority clause" for RES-E. This means they have not only

[7] Germany, Denmark and Spain fore example

to guarantee the access of RES-E but they have as well to give priority to RES-E to the detriment of conventional energy. To which extent regulators will have influence on the decision on whether to opt for guaranteed or priority access depends on the legislation of the Member States.

A consequence of the transparency requirements of access costs is that energy regulators will face increased responsibility as they will have to monitor and control the provision of complete and transparent delivery of data concerning the cost of connecting RES-E in order to ensure non-discrimination.

3.2.1.4 Review Clause

As has been shown in the upper sections certain that initial aims were watered down during the process of coming into force of the Energy and Climate Change Package. This has happened mainly due to the pressure of the Council. Particularly Italy has exerted pressure within the Council to introduce a review clause. Consequently, by the year 2014 the whole directive will be reviewed (Euractiv, 2008b). The review will evaluate the actual greenhouse gas emission reduction coming from the increased use of biofuels as there is still some uncertainty to the actual balance and how to account for secondary effects. (Harrison, 2008) The review will as well focus on the availability of electrical and hydrogen cars. It has been agreed that any technological innovation that results in cost cuts might be included particularly into the targets for biofuels in the transport sector.

It has as well been agreed that in case the review identifies shortcomings, both the national sovereignty to choose the support scheme for renewables and the aim of increasing the share of renewables to 20% will no be touched.

3.2.2 Critical review of impacts on RES-E

The purpose of the following section is to analyse whether the measures that are envisaged in the Energy and Climate Change Package are in line with those policy benchmarks that have been established in section 2.2:

1. Remove subsidies for conventional energy
2. Price electricity more accurately
3. Enact a harmonised feed-in tariff
4. Educate the public, protect the poor and fund demand side measurement

The Directive on the promotion of the use of energy from renewable sources COM (2008)19 final identifies 57 stipulations in order to implement the policies regulating RES-E deployment. Those stipulations were incorporated into 25 Articles. In the following those stipulations and Articles that refer to the four policy benchmarks are analysed with regard their relevance in the respective promoted policies.

Within the Directive COM (2008)19 final on the promotion of the use of energy from renewable sources, the majority of the stipulations deal with setting standards for biofuels. Only 5 refer to educational measures and training. There are further 3 stipulations that relate to the GOS and will therefore be discussed in the section on the harmonised feed-in tariff. None of the stipulations that serve as general legal guidelines for the actual Articles address the issue of subsidies for conventional energy or the issue of pricing electricity more accurately.

Nevertheless in another communication from the Commission, the Guidelines on State Aid for Environmental Protection, the issue of environmentally harmful price distortions is addressed and are added to the analysis consequently.

3.2.2.1 Price electricity more accurately[8]

The problem that negative environmental externalities are not properly internalised is addressed by the Community Guidelines on State Aid for Environmental Protection: *"The primary objective of State aid control in the field of environmental protection is to ensure that Sates aid measures will result in a higher level of environmental protection than would occur without the aid and to ensure that the positive effects of the aid outweigh its negative effects in*

[8] Section "Remove subsidies for conventional energies" does not exist due to the total lack of policies in this area

terms of distortions of competitions, taking into account of the polluter pays principle (..)". "Full implementation of the PPP would thus lead to correction of market failure".
Apparently the Community is aware of the negative distortions of subsidised conventional energy. However it concludes not to address the cause but rather the effect of the problem. Instead of removing subsidies, the reason for price distortion of artificially cheap conventional energy, it tries to correct the market failure by further state intervention.

3.2.2.2 Enact a harmonised feed-in tariff

In line with the suggestions of the findings from Sovacool, concerning the best support schemes, the assessment report that followed the Directive 2001/77/EC concluded that *"Comparing the two main types of support schemes, namely quota obligations and feed-in tariffs, historic observations from EU Member States suggest that feed-in tariffs achieve greater renewable energy penetration, and do so for lower costs to the consumer"* (SEC(200)57, p.8). The report analysed the support schemes both in terms of effectiveness as well as in terms of efficiency. It has been shown that *"the effectiveness of policies promoting wind energy, biogas and photovoltaics technologies has been highest in countries using feed-in tariffs as their main support scheme*(SEC(200)57, p.8).

Efficiency is measured by comparing the total amount received for renewable energy to the generation cost. An efficient measure is one where the total amount received for renewable energy is close to the generation cost. Efficiency therefore not so much depends on the type of promotion scheme but rather on the actual design. Thus there is a clear statement in terms of effectiveness but it could not be proven that either measure is more efficient, thus providing a reason for co-existence.

There are three more reasons why the Commission has actual decided to accept the co-existence of support schemes.
Firstly, both schemes can be designed in a way that they do not violate the rules of the internal market for electricity, the free movement of goods and state aid rules.
Secondly, a premature harmonised support scheme would not allow for appropriate differentiation between different costs for different technologies in different countries.
Thirdly, there are secondary regional developmental effects included in the national promotion schemes that would become obsolete in case of full harmonisation.

Apparently the Commission has decided that it is too early to enact a harmonised feed-in tariff. The main reasons for that are listed above. An analysis if the European Union meets this policy benchmark could therefore end here. However there are good reasons that support that "enacting a harmonised feed-in tariff" is a crucial policy on the national level. That this does not necessarily hold true for the European Union has been showed above, but it is still worth to consider the initial purpose of the policy and to scrutinise to which extend the essence of the policy has been considered in the underlying legislation.

Those flexibility mechanisms that have been described above and that can be seen as the preliminary phase to a finally harmonised support scheme will be analysed with regard to the potential impact on the future development of RES-E.

As the initial reference rendered obsolete in the context of the European Union a new set of references has to be established upon which the future impact of the flexibility mechanisms might be measured. Filtering the goals rather than looking at the design of a support scheme provides a threefold reference base. The potential impact can be analysed if three very basic questions are asked: does the policy serve to reduce the risk to the investors in renewable energy, does it minimise the costs for the consumers and does it ensure cost effectiveness.

It will be argued in brief in the section below that apart from reducing the risks for investors these very basic policy goals have not been achieved and there is doubt that the measures will have the necessary impact.

But first to start with the potential reduction of the investors risk.
As the different national supporting schemes have been in place already for quite a while, investors have already learned how to adapt and to design their investments accordingly. With this regard the commitment to keep the national supporting schemes in place has to be seen positive. The most obvious reason is that there are no new learning costs evolving. Both interest groups and investors were most concerned about quick and unforeseeable changes in policies. Any form of a stop-and-go policy increases the risk of an investment. On the other hand changing circumstances might give space for newcomers and niches might open that have been closed by established enterprises. As the Austrian example shows, a continuation of existing policies is not necessarily an aim to thrive for. (Scheer, 2009)

Within the political process that has led to the flexibility mechanisms, policy makers had to balance between the overall aim of a harmonised support scheme and the consuetude of existing support schemes. This balancing attempt had to carefully avoid any interference with instruments that are already functioning on a national level, but nevertheless to address the issue of increasing both the efficiency and effectiveness coming along with increased co-operation. The biggest concern of opponents of feed in tariffs has always been the potentially poor cost-effectiveness relation. If taking a look at the flexibility mechanism there is no hint that this issue has been directly addressed. The idea of giving freedom to Member States to coordinate their support schemes has a much bigger potential impact on a quota system with tradable certificates. The higher the amount of trading partners is the closer one comes to a potential efficient optimal solution. The same reasoning holds true for the possible extension of "green investment credits" coming from investments in renewable energy in third party countries. Countries, where the potential of renewable energies has still not been developed, can offer much better cost-effectiveness ratios as countries where the potential has been widely exploited already. Both the idea to enhance the statistical transfers between Member States and to increase the transparency related to GOS are steps towards an increased standardisation. This process is the prerequisite to tackle the problem of distortions of cross-boarder trade. (Ragwitz, et al.2009)

However the process of harmonisation proceeds, in terms of efficiency of support schemes an incomplete harmonisation must not serve as an excuse for national inefficiency. Studies have shown that two thirds of the potential efficiency measures can be addressed on the national level.

It has to be differentiated between what has been the intent of the directive on renewable energy and what has been intended with other policy instruments. A major prerequisite for the development of a harmonised support scheme is the finalisation of the internal market. Only if unbundling has been completed, the process can take off. Given that providers of renewable energy technologies may take advantage of the in-efficiency of support schemes and given that large energy providers are still reluctant to commit to unbundling it seems that lobbyism has been successful.

In order to evaluate where the European Union stands in the process of harmonisation one can classify three steps (Ragwitz, 2008):

1. A central co-ordination with harmonised binding framework conditions and minimum design criteria which are independent of the type of support.
2. Convergence, where the Member States agree on an EU-wide support system but can have their own national designs
3. Full harmonisation, where there is one support system with the same design in all Member States.

According to this sequence the whole harmonisation process got stuck in the first step, although it has to be said that the harmonised binding framework only holds true for the standardisation of GOS and the statistical exchange procedures. As the substantial core, the central – coordination is still absent and will, if at all, lie in regional blocs, doubts are appropriate whether the process of harmonisation has even reached the first step.

3.2.2.3 Educate the public, protect the poor and fund demand side measurement

The main focus of the measures is addressing issues of technical standardisation and certification. Mainly they build upon already existing directives that lack enforcement. Article 13 particularly regulates information and training. *"Member States shall develop certification schemes for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems and heat pumps. (...) Each Member State shall recognise certification awarded by other Member States in accordance with these criteria"* (Article 13 (3) COM(2008)final 19).

With regard to demand side measures there is no extra funding planned in the directive but it points out the responsibility of the Member States to *"ensure that information on the net benefits, cost and energy efficiency of equipment and systems for the use of heating, cooling and electricity from renewable sources is made available either by the supplier of the equipment or system or by national competent authorities"* (Article 13 (2) COM(2008)final 19).

There are no particular measures foreseen to protect the poor, except a general provision that energy should remain affordable for everyone.

3.2.2.4 Access to the grid

Although not established as a policy benchmark, the access to the grid issue has to be treated as well as it relates to the policy of pricing electricity accurately.

In order to get transparent prices, the national energy regulator's authority might not be strong enough to guarantee objective control of transparency. The best way to achieve objective transparency on the costs of access to the grid would be if unbundling would be pursued more seriously. Supporting the access of decentralised renewable sources is still in the national responsibility but there is concern that if trade is increased within the Member States, the necessity to develop more decentralised production structures remains limited.

If the full national potential shall be developed and tapped, every country should introduce priority access to RES-E. The Member States' reluctance to solve the issue of unbundling favours the market power of large scale electricity providers. This is mainly a result of direct lobbying from the major electricity companies and pressure from the Council. If the future strategy of the European Union should be based on strengthening the decentralised production of RES-E, this has to be seen as a clear drawback. The impact both on development and deployment of regionally produced RES-E on the overall targets will be smaller.
This triggers two other effects:
Firstly, it is understood that decentralised production systems are particularly effective in creating jobs.
Secondly, if physical trade of electricity is continued to be constrained by a lack of unbundling, the costs for consumers will not decrease.

3.2.2.5 Summary

The two most pressing policy issues are not directly touched in the Energy and Climate Package. Subsidies for conventional energies are not mentioned once and pricing electricity is only treated indirectly.

In the relevant relating document "Guidelines on state aid for the environment" the problem of price distortions is considered to be important. However, rather than tackling distortions due to existing subsidies for conventional energy directly, guidelines for state aid to green energy are aiming to avoid new distortions.

It has been shown that the policy benchmark "Enact a harmonised feed in tariff" does not hold for a complex Union of nation states and had therefore to be adapted. There are good reasons against a premature harmonisation but it has been shown that the process did not take off yet.

The responsibility of Member States to support education and to provide information is clearly underlined in the Energy and Climate Change Package, however real demand-side management measures are missing. Apart from generally acknowledging the potential impact of energy insecurity on social cohesion there are no policies at all to protect the poor.

3.2 Energy Efficiency in the Energy and Climate Change Package

3.2.1 Content Analysis

The "Action Plan for Energy Efficiency: Realising the Potential" COM (2006) 545 final summarises the content of the fractionised regulations and directives on energy efficiency and is the central document addressing energy efficiency in the Energy and Climate Change Package. The Action Plan has evolved from the Green Paper on Energy Efficiency.

In line with the three pillar strategy of the European Community on energy issues that has characterised the developments of the last decade in this regard, The Green Paper on Energy Efficiency aims at addressing all three goals at once: competitiveness, security of supply and sustainability including the fight against global warming. It is perceived by the European Commission that focussing on energy efficiency would allow for the most cost effective and quickest way to reach those goals. Energy efficiency would at the same time help to promote renewable energy production. The consultation process that followed the Green Paper did not change the core strategy of the Commission but became more detailed on the actual expectations and figures. The Commission was starting to finalise the Action Plan on Energy Efficiency consequently (Euractiv, 2008c). The Action Plan foresees a development that brings the European Union in the position of a world leader in energy efficiency. The EU should provide its citizen with "*the most energy efficient buildings, appliances, processes, cars and energy system*" in the world (COM (2006)545 final).

Already in the year 2007, when the proposal on an integrated Energy and Climate Change Package has been put forward by the Commission, it has been expected that mere energy

efficiency measures could save about 100 billion Euro and 780 tonnes of CO2 each year once the target of saving 20% of total primary energy consumption by 2020. However, as this 20% reduction of total energy consumption is based upon projected business as usual consumption scenarios, the actual reduction from a year 2008 perspective would only be 13%. (COM (2006) 545)

Energy efficiency is understood in two ways in the Green Paper and has not changed in the process of the adaptation.
On the one hand higher energy efficiency means a decrease of energy intensity measured in Million tons of Oil equivalent (Mtoe) per economic output (GDP). This can on the one hand be achieved by increasing the efficiency of energy end-use in transportation, domestic or industrial consumption. On the other hand the efficiency of electricity generation as such can be made more efficient (RAPID, 2007b).
It is considered that not only the technology but as well the rational use of this technology plays a crucial role: "*Energy efficiency is about informed choice by individuals, not just by legislation."* (COM (2006)545 final)
The consumer stands in the centre of any strategy addressing energy end-use: To change consumer's behaviour towards the purchase of energy efficient technology and at the same time encouraging the producer to further develop more efficient technologies.

The Action plan expects the highest savings potential for households and commercial buildings as highest with an estimated 30% of savings compared to current energy use. The manufacturing industry is estimated to have a savings potential in end use of 26%.
Nevertheless the Action Plan singles out the transport sector as the most crucial one. The transport sector accounts for the highest energy consumption with 405 Mtoe in the year 2005. As transportation in the European Union still almost entirely depends on fossil fuels[9], increasing the efficiency is especially important.

In general the proposed strategy of the Commission is based upon three pillars.
It firstly addresses issues that could be broadly summarised as problems of innovation. There are highly efficient technologies already available for a broad band of sectors that have had problems of market penetration and dissemination. The approach to this is to enhance the comparability by standardisation and setting benchmarks. The Plan therefore highlights the

[9] Accounting for a share of 20% in total primary energy consumption in Europe

importance of establishing energy performance requirements for energy-using products, buildings and energy services. There is already a broad set of directives in force that have only poorly been legislated on the Member States level.[10]
The problem is hence not so much the inexistence of a legal framework but the willingness of the Member States to implement existing law.
The strategy tackles as well the issue of improving energy transformation. In the year 2005 transformation losses accounted for 33% of all primary energy consumption. The main hope with regard to transformation losses lies in the future of the European Trading Scheme (ETS). At the time of the coming into force of the Action Plan, it was assumed that the additional price resulting from increased prices for GHG certificates would create sufficient momentum to curb waste of energy in the generation and transmission. The Action Plan sets up measures to establish good regulatory practices to reduce transmission and distribution losses in co-operation with the Council of European Energy Regulators and the European Regulator's Group for Electricity and Gas. (COM (2006) 545 final, Annex I)

Secondly, the Action Plan considers the need to get the prices for energy right and to allow the market to send correct price signals in order to improve energy efficiency. A the same time it allows for the set up of a financing tool as long as they are in line with the existing State Aid rules. Similar to what has been analysed above with regard to the promotion of RES-E this however does not tackle existing subsidies for conventional energies but relates to specific state aid given to new energy efficiency policies. In principle the Action Plan accounts here for the barriers and policy benchmarks that have been identified in the above section. It considers as well the need of raising awareness in order to make markets work. Without having the educational basis to take rational decisions, increased prices would not have the needed allocative function.

It thirdly puts emphasis on the role of technological progress and argues that information and communication technologies are those areas with the best opportunities for overall energy efficiency.

Based upon these three pillars, the Action Plan proposes 10 areas with highest priority.
They are expected to have the highest and quickest effect.

[10] Eco.Design Directivem Energy Star Regulation, Labelling Directive, Directive on Energy End Us Efficiency and Energy Services and the Energy Performance of Buildings Directive

Innovation and market penetration

1. Appliance and equipment labelling and minimum energy performance standards
2. Building performance requirements and very low energy buildings (“passive houses”)
3. Making power generation and distribution more efficient
4. Achieving fuel efficiency of cars

Appropriate Price Signals

5. Facilitating appropriate financing of energy efficiency investments for small and medium enterprises and Energy Service Companies
6. Spurring energy efficiency in the new Member States
7. A coherent use of taxation
8. Raising energy efficiency awareness

Technological Progress and ICT

9. Energy efficiency in built-up areas
10. Foster energy efficiency worldwide

3.2.2 Critical review on impact on Energy Efficiency

The purpose of the following section is to analyse whether the measures that are envisaged in the Action Plan on Energy Efficiency are in line with those policy measures that have been established in section 2.2 as crucial benchmarks.

1. Remove subsidies for conventional energy
2. Price electricity more accurately
3. Enact a harmonised feed-in tariff
4. Educate the public, protect the poor and fund demand side measurement

The Action Plan for Energy Efficiency identifies 57 concrete measures in order to implement the policies related to the 10 high priority areas. In the following those measures that refer to the four policies are analysed with regard to their relevance and potential impact in the respective promoted policies.

Apparently there are no policies in the Action Plan for Energy Efficiency that aim for a harmonised feed in tariff so this policy will not be treated in this section at all.
In analysing the second policy – price electricity more accurately - not only electricity will be taken into account but efforts to price energy in general more accurately.

From the 57 proposed measures 24 of them have to be classified as measures on education or funding demand side measurements. 22 measures could not be classified within the framework of the policy benchmarks. 9 measures could be identified as helping to correct the mismatch for conventional subsidies and 2 measures are identified as addressing pricing energy more accurately.
The classification does not account for eventual secondary feedback mechanisms but has tried to identify those measures that could be directly or indirectly associated with the aim of the policy benchmarks.

3.2.2.1 Remove subsidies for conventional energy

Removing subsidies for conventional is considered to have a bigger impact on the deployment of RES-E but there are several potential positive implications for energy efficiency as well. Subsidies are a major obstacle for the development of appropriate price signals and to finally contribute in overcoming structures that enhance over consumption.

Usually subsidies hinder the development, deployment and application of more efficient technology in the form of off-budget subsidies. Conventional spatial planning structures are the biggest challenge. They exist as factual barriers to a less energy intense mode of living in many countries and are tailored towards the provision of cheap energy.
Poorly funded R&D is another big challenge. As the study from the EEA on subsidies for the energy sector has shown there has been an actual decline in funding for research and development for energy efficiency in the period between 1995 and 2005 (EEA, 2008).

Within the building and housing sector many direct subsidies are still given to specific sorts of technology thus hindering the process of commercialisation of new efficient building technologies.

Given the relative importance of this first policy, the outcome of the analysis of the 9 measures that could be classified in the group of removing subsidies is disillusioning. Out of the nine measures only one directly addresses the problem.
However the envisaged measure is neither very precise nor binding: "*prepare a Green Paper on indirect taxation (2007) and, subsequently review the Energy Tax Directive to incorporate*

better energy efficiency and environmental considerations (2008)" (COM (2006) 545 final, Annex I, p. 24)[11].

All other eight measures are mainly helping to rise funding for energy efficiency investments, thus not directly reducing subsidies for conventional energies but decreasing the relative gap. As many measures are meant to be implemented in the period between 2007 - 2012 there are unfortunately no quantitative studies yet available on how much money has been dedicated to energy efficiency on a European level as a result of these recent policies.
Apart from stressing the implementation of existing directives such as the Energy Performance of Buildings Directive (2002/91/EC) into national law that would promote the disbursement of national funds, the measures particularly highlight the role of the European Bank of Reconstruction and Development, the European Investment Bank and the Structural and Cohesion Fund. (COM (2006) 545 final, Annex I, p. 23)
Member States should *"consider costs and benefits of tax credits as incentives for enterprises to produce more and better energy –efficient appliances and equipment and for consumers, to promote the purchase of such appliance and equipment."* (COM (2006) 545 final, Annex I, p. 24)

3.2.2.2 Price Energy more accurately

Similar to removing subsidies, internalising external costs will finally price energy more accurately thus helping to overcome consumption patterns that are beyond true needs. Measures that help to provide the consumer with a more accurate overview on his actual energy consumption will develop a more rational behaviour towards energy consumption. There are two measures that could be classified at aiming to get the prices right, yet only one indirectly addresses the issue of external costs.

The first measure, *"promote legislation to include the aviation sector in the EU Emissions Trading Scheme (end of 2006)"* (COM (2006) 545 final, Annex I, p. 23) expects that the prices for certificates consider the external costs of global warming. This is at least an attempt in the direction of pricing aviation fuel accurately, although it would be probably more efficient to curb subsidies for airlines instead.

[11] At the time of finalising this paper a Green Paper on indirect taxation has not been published

The second measure, aims at reducing "tank tourism" by narrowing excessive differences in tax levels between Member States. (COM (2006) 545 final, Annex I, p. 24) Even if this measure would be taken seriously there are reasonable doubts about the effective impact.

3.2.2.3 Enact a Harmonised Feed in Tariff

Enacting a harmonised feed in tariff would only have secondary feedback effects on energy efficiency. Nevertheless the Action Plan considers the positive effects on energy efficiency of changes in the structure of electricity production, transmission and distribution: *"propose a new regulatory framework for the promotion of grid access and connection of decentralised generation (2007)"*. (COM (2006) 545 final, Annex I, p. 22)

3.2.2.4 Educate the public, protect the poor and fund demand side measurements

This last policy field accounts for the overwhelming priority of the Action Plan.
However none of the measures takes into account the protection of the poor. The reasons for this could be at least threefold.
Firstly, it can be either seen as a result of the principle neglect of the first two measures that would actually result in higher energy prices.
Secondly, other policies outside the Energy and Climate Package are taking the social implications into account.
Thirdly, the implications are not considered to be important enough to be addressed in an Action Plan aiming at energy efficiency.

The efforts on education have been considerably taken serious, which is a positive sign given the fact that changing consumer's behaviour is the single most effective way to save energy.
The measures are mainly aiming at implementing and amending existing directives on labelling, certifying and standardisation processes: Implementation of ECO-Design Directive (2005/32/EC), Labelling Framework Directive (92/75/EC), Energy Star Agreement, Energy End-Use and Energy Services Directive, the Construction Products Directive (89/106/EEC), the Car Fuel Efficiency Labelling Directive (1999/94/EC) and the EMAS certification directive.

The Action Plan addresses as well the issue of supporting training and technical assistance by proposing *" a vocational educational initiative on energy efficiency"* (COM (2006) 545 final, Annex I, p. 24) This is one of many measures attempting to change energy behaviour directly.

Another focus is to strengthen the cross European cooperation in energy efficiency among mayors, to create new networks in the Sustainable Energy Europe Campaign and to foster the role of the European Institutions as role models in energy efficiency. Community programmes will as well address schools by providing teaching guidelines and recommendations to include energy and climate change issues into educational curricula.

The transport sector will face minimum efficiency requirements and standards for air conditioning and tyres but the Action Plan aims as well at strengthening the EU-wide real-time traffic and travel information systems and traffic management.

There is only one measure that directly addresses demand side measurements. The Action Plan *"seeks to identify and remove legal barriers in Member States to use ESCOs, and contracting instruments for energy services (2007-2009).* (COM (2006) 545 final, Annex I, p. 23) Energy Service Companies (ESCOs) provide energy services such as, energy analysis and audits, energy management, project design and implementation, maintenance and operation, monitoring and evaluation of savings and the provision of services like space heating/cooling and lighting.

An ESCO develops, implements and finances (or arranges financing for) an energy efficiency project or a renewable energy project, and uses the stream of income from the cost savings, or the renewable energy produced, to repay the costs of the project, including the costs of the investment (REEEP, 2009).

Energy Service Companies will therefore play a crucial role in commercially providing demand side management.

3.2.2.5 Summary

Apart from what has been analysed above in a more hermeneutical manner, there are several structural and conceptual flaws within the legislation of the Action Plan.

The first and most apparent conceptual flaw in the Action Plan is that the targets remain indicative and are not treated with the same ambition as the targets for Green House Gases and renewables although both aims could be reached at the same time with considerably less effort if energy efficiency is addressed.

The impact assessment on the Energy Action Plan states *"that not one single policy, be it a regulatory, a voluntary approach, or an approach geared towards raising awareness, would be sufficient to reach the potential. The EU can now confidently move from problem and barrier identification to a vigorous pursuit of the solution: a balanced mix of policy options as formulated in the Action Plan"* (SEC (2006) 1174). This statement is very true, though apparently held very general. However given the problem of not addressing the problem of subsidies for conventional energies and getting the prices for electricity right out of political interests, the Action Plan will not have the desired impact. Even if all policy and decision makers would fully engage within the frame of the Action Plan, a real step change in efficiency policy will not happen.

What remains paradox is that the problem definition from the European Commission in the Green Paper on Energy Efficiency was similar to the study of Sovacool. If the identified problems would have been addressed with similar political openness a structural change would be launched.

"Lack of internalisation of external costs in current tariff and taxation structures further aggravated by the adverse effects of not fully competitive markets, leads to a situation where a strong incentive to use less energy or electricity is missing" (SEC (2006) 1174).

In the impact assessment price caps are mentioned as a particularly adverse example. The impact assessment further highlights the supremacy of demand side management to attenuate price volatilities rather than to focus on supply side measures.

It moreover singles out income and rebound effects as serious potential to level out policy measures.

Finally, the dangers of diverging interests "*some peoples' short term gains may become other peoples' long term losses"* and split incentives are as well considered. Although those

problems have been identified, they did not find their way onto the political agenda. The process of consultation of stakeholders that followed the Green Paper on Energy Efficiency and which eventually formulated the Action Plan has however identified areas of focus without the potential of a real structural step change.

The focus subjects were ranked in the following way:

1. Information and raising awareness
2. Better financing for energy efficiency
3. Implementation of EU acquis
4. Transport
5. Energy transformation
6. EU energy efficiency actions in international context

They are concerning their intent and ranking apparently not in line with the policy benchmarks that have been established above and do not go into the core of the energy problem. A necessary step change in Energy Policy would require a different policy agenda. Reducing subsidies, internalising externalities to get prices right and protecting the poor with new funding schemes tailored towards energy go straight to the core of historically grown political structures. Policy and decision makers who are willing to push forward such an agenda have to truly commit and will apparently face very strong opposition of interest groups.

3.2.3 A first result: the 2008 review of the Energy Efficiency Directive 2006/32/EC

In order to account for the need to take action not only on the European level but as well on the national, regional and local level the directive 2006/32/EC sets up National Energy Efficiency Action Plans. They have been revised for the first time in the year 2008.

The importance of Energy efficiency has been first comprehensively regulated in the Directive 2006/32/EC – the so called Energy Services Directive. The issues that are addressed in the directive are as well incorporated in the latest Energy and Climate Change Package. The role of efficiency as contributor to security of supply, competitiveness and sustainable development stands again at the heart of this directive. On paper it refers to many policies that are alike those policy benchmarks that have been set up above (2.2), including the aim of

pricing energy accurate, the necessity of education and rebates for energy efficiency investments.

The directive establishes national targets, although they remain indicative. "*The Directive requires Member States to adopt a 9% indicative energy and-use savings target in 2016 and to put in place institutional and legal frameworks and measures need to remove barriers to efficient energy end-use."* (SEC (2008) 57)

However the Member States are obliged to deliver National Energy Efficiency Action Plans (NEEAP) to the Commission on how the Member States intend to achieve their adopted energy savings target. Apart from providing means for the Commission to monitor the progress of the Member States, the NEEAPs are meant to enhance the exchange of best practices and to develop synergies among the national strategies. (SEC (2008) 57)

After a first review of the National Action Plans by the European Commission huge differences between the Member States became apparent.[12] While some were seriously looking for new innovative approaches, the majority relied on business as usual strategies (RAPID, 2008). The biggest concern was that although there have been throughout the sectors reductions in the energy intensity due to increasing energy efficiency, the overall energy consumption kept on rising between the years 2006 and 2008.

Given the high expectations that have been stoked in the communications by the European Commission the result of the example for the most successful strategy that has been singled out by the Commission is disappointing: The provision of *"examples of good practice with particular emphasis on the exemplary role of the public sector and the provision of information…"* (COM (2008) 19 final; p.4)

There is no need for a detailed comparison to the above policy benchmarks to understand that this can not be seen as a very promising assessment.

Given the need for huge structural changes, the provision of good practices and information can not bee seen as a sufficiently committed strategy. Apart from the principal shortcomings to approach the complexity of energy structures with a single policy, only a few Member States have taken the exemplary role of the public sector seriously and have provide detailed information on how they will actually comply within their National Action Plans. With regard

[12] At the time of the first assessment of the NEEAPs only a few Member States have submitted their plans in time and from the received report the majority delivered them delayed. Infringement procedures for not delivering the NEEAPs timely were triggered against 17 Member States.

to the provision of detailed information on how to implement the national strategies concerning the exemplary role of the public sector, the Commissions positively mentions Ireland, Germany, Denmark, Malta, UK, Finland, Austria, Spain and Poland (SEC (2008) 57).

The other focus on how to promote energy efficiency within the European Union foresees the large scale dissemination of information and to raise awareness at all levels of stakeholders. Providing information nevertheless can only unfold its full impact if it is coupled with clear price signals, thus encouraging at the end real energy savings. In many countries consumers do not have an appropriate overview on their actual consumption patterns. Information campaigns should therefore not only provide information as such but should address the issue more holistically by providing clear feedback on actual consumption. Many Member State have already put a lot of effort in providing information on energy savings and best practice in a top down approach but so far only the UK and Estonia have committed to structural changes enhancing feedback for the consumers on actual consumption such as smart metering.

When it comes to the challenge of structural changes in the Member States there is a underlying conflict between establishing the correct price signal and the promotion of fiscal and financial incentives helping to reduce transaction costs and risk associated with switching to new technologies. A main benchmark is whether funds have been established that aim at overcoming distorting historical structures that have been carried forth and to protect the poor from increased energy prices. The result of the First Assessment of the NEEAP does not indicate that any Member State have really committed to fundamentally change existing funding structures.
However, Germany, Austria, Estonia, the Netherlands and Italy have set up funding schemes that particularly address energy efficiency investments in the housing sector where the potential for savings is generally considered to be highest. Finland, the Netherlands, Denmark, Spain, Poland, UK and Ireland rely mainly on voluntary agreements between the government and public and private actors.
In almost all countries that have delivered their NEEAP timely some sorts of obligations exist. Obligations are occasionally coupled with market based mechanism like white certificates as they exist in Italy. These obligations are however only binding for few energy suppliers and market mechanisms, if in place at all, do not include large scale energy costumers.

What remains remarkable is that some Member States have communicated their commitment to enhance commercial energy services and to create a market for energy efficiency. This is so far only established on paper and no country has actually managed to establish a system of performance contracting that is the basis for the establishment of commercial energy services and of an energy efficiency market. [13]

Transport and spatial planning is another big potential for energy efficiency and has unfortunately hardly been included in the NEEAPs. Only Austria and Ireland have committed to touch the sensitive issue of restructuring the spatial planning.

To summarise, the assessment of the NEEAP does not provide for a lot of optimism, but one has to bear in mind that some countries were not included in the assessment. It would by far go beyond the scope of this thesis to go into even only a superficial analysis of the strategies of the missing countries but it would presumably change the overall assessment for the bad rather than for the good. However, as the NEEAP should mainly take into account new and additional measures, some countries have already undertaken important measures in the past. To take out the example of spatial planning, a country like Austria has probably taken this issue more seriously as it has failed to tackle the problem already at an earlier stage. The Commission concludes as well that there is a huge gap between the political commitment and the resources that are dedicated the actually take measures.

In spite of the outcome of the assessment, the Commission refrained to suggest a strategy delivering a path for structural changes. Given the legislative structure of the European Union and particularly the subsidiarity principle, the Commission has only limited responsibility for the issues with real importance in energy efficiency. The Commission, somehow dampened by the willingness of the Member States of mainly voluntary action, can only act in the role of coordinating action. Thus, the Commission is again on the spot for not taking enough action although this is mainly the result of the structural constraints not to interfere too much into national sovereignty. The suggestions from the Commission that were drawn after the assessment of the NEEAPs very much reflect this dilemma. The main policy suggestions were to enhance cooperation between the Member State in order to facilitate the implementation of energy efficiency and to increase the involvement of stakeholders.

[13] (Italy, Spain, Ireland, Austria, Poland and Germany)

In order to facilitate an actual impact of the NEEAPs, it makes first of all sense to support the Member States in complying with the existing legislation. It seems important that the targets for energy efficiency are further clarified and monitored by an independent energy conservation agency. It seems that there is a need for an enhanced dialogue both on the national level and the European level. The rationale that a lack of communication hinders the dissemination of good practices holds true as well on the national level where regular dialogues between the various stakeholders on the local, regional and national level have to be established.
Concerning the funding of energy efficiency, further funding is only partly necessary. The money that is available in national budgets and in EU funds like the cohesion fund and the structural fund can be linked to an obligation to invest either directly into energy conservation programmes or may be dedicated only to those project that fulfil certain efficiency standards.

Conclusion

Given the progressively widening gap between increasing consumption and domestic production of energy the necessity of urgent action in energy efficiency is apparent. Even under the assumption of overall low macroeconomic rebound effects, decreasing rates of energy intensity can not buffer the decline in the domestic production. The European Union both increases its import dependence and exacerbates the risk of falling short of the ambitious targets that have been set in the Energy and Climate Change Package.

The European Union has witnessed only a moderate increase in the overall consumption of final energy. However electricity consumption is increasing continually, accounting for an 18% rise within only 10 years thus putting RES-E at the forefront of an integrated energy and climate strategy. It could not be proven that there is a conceptual neglect of addressing energy efficiency within the current legislative framework, yet both the direction as well as the potential momentum of the efficiency policies is questionable.

There is a short term and a long term reason why a serious integrated energy and climate change policy has to commit itself with much higher impetus to energy efficiency. As there is evidence that the targets for renewables were set proportionally there is sufficient support for the idea to reduce demand rather than increase supply of RES-E to reach the renewables target more efficiently. The implementation of all policies could earn annual savings of 100 billion

Euros in the year 2020 that could rise to 150 billion each year if the oil price is set at 70 US-Dollar per barrel. In a simplistic model the savings potential both concerning money and energy is enormous. Energy efficiency could be seen as the biggest single source of energy within the European energy system. However matters are more complex and it has been illustrated that simplistic assumptions about energy efficiency have led to wrong political conclusions that are partly reflected in the Energy and Climate Change Package.

There is evidence that addressing energy efficiency in a micro level does not provide for a long term sustainable energy strategy. Potential rebound effects are largely ignored by policy and decision makers in the Member States and the European Commission, this is presumably more out of a lack of political commitment than of lack of knowledge. Energy conservation on a macro level has to be placed on top of the political agenda which can not occur without seriously discussing strategies about de-growing.

The European Union however considers that technological change has less impact on the total reduction of primal energy consumption than behavioural change thus finally addresses behavioural change and consumer choice. This is only partly accounting for the historical imbalance technology focused policies that were to the detriment of behavioural change.

The findings of the forecasting model that influenced the design of the European Energy Policy indicate almost no price elasticity for investments in RES-E. However it has been shown that in order to tackle a real structural step change, price signals are the single most important cause both for energy efficiency and RES-E investment. In the long run the main challenge for the EU towards the promotion of RES-E and energy efficiency will be whether the prices properly account for external environmental costs. The two most pressing policies are not sufficiently touched by the Energy and Climate Change Package: removing subsidies for conventional energies and pricing electricity accurately.

Although the problems of price distortions from existing subsidies have been identified, they did not find their way onto the political agenda. Rather than tackling price distortions due to existing subsidies for conventional energy directly new support schemes for RES-E will be introduced. As price increases would eventually result in a significant reduction of energy demand other policies on education and social fairness have to be addressed comprehensively.

Without the necessary educational frame and information the provision of a clear feedback on actual consumption will not lead to a change in behaviour

It has been shown that the policy benchmark “Enact a harmonised feed in tariff” does not hold for a complex union of Nation States and had therefore to be adapted. There are good reasons against a premature harmonisation but it has been shown that the process of harmonisation has anyway not yet taken off.

A necessary step change in Energy Policy would require a different policy agenda. Reducing subsidies, internalising externalities to get prices right and protecting the poor with new funding schemes tailored towards energy go straight to the core of historically grown political structures. Policy and decision makers who are willing to push forward such an agenda have to truly commit against strong opposition of interest groups.

Given the legislative structure of the European Union and particularly the subsidiarity principle, the Commission has only limited responsibility for the issues with real importance in energy efficiency. The Commission can only act in the role of coordinating action and very much depends on willingness of the Member States to interpret the subsidiarity principle in a constructive way.

Bibliography

Primary Sources

COM (97) 599 final: *White Paper: Energy for the future - renewable sources of energy*

COM (2005) 627: *The support of electricity from renewable energy sources*

COM (2006) 105: *Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy*

COM (2006) 545: *Action Plan for Energy Efficiency: Realising the Potential.*

COM (2006) 11 final: *on a first assessment of National Energy Efficiency Action Plans as required by Directive 2006/32/EC on energy end-use efficiency and energy services.*

COM (2008) 19 final: *on the promotion of the use of energy from renewable sources.*

COM (2008) 30 final: *20 20 by 2020 Europe's climate change opportunity.*

Directive 2001/77/EC: *on the promotion of electricity produced from renewable energy sources in the internal electricity market*

Directive 2006/32/EC: *on energy and-use and energy services and repealing Council Directive 93/76/EEC*

(SEC (2006) 1174): *Commission Staff Working Document, accompanying document to the Communication from the Commission Action Plan for Energy Efficiency: Realising the Potential, Impact Assessment*

(SEC (2008) 2871): *Commission Staff Working Document, Second Strategic Energy Review: An European Security and Solidarity Action Plan.*

(SEC (2008) 57): *Commission Staff Working Document, accompanying document to the Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources.*

Community Guidelines on State Aid for Environmental Protection: http://ec.europa.eu/competition/state_aid/reform/environmental_guidelines_en.pdf (accessed on: 10-06-2009).

Secondary Sources

Adam, 2009: *Britain tries to block green energy laws.* http://www.guardian.co.uk/environment/2008/jul/24/renewableenergy.greenpolitics (accessed on: 12-6-2009)

Alfredsson E.C., (2002): *"Green" Consumption – no solution for climate change.* Energy 29, 513-524.

Barker T., Ekins E., Foxon T., (2007): *The macro-economic rebound effect and the UK economy.* Energy Policy 35, 4935-4946.

Barrett M., Lowe R., Oreszczyn T., Steadman P., (2008): *How to support growth with less energy.* Energy Policy 36, 4592-4599.

Binswanger M., (2000): *Technological progress and sustainable development: what about the rebound effect?* Ecological Economics 36, 119-132.

Blok K., (2006): *Renewable energy policies in the European Union.* Energy Policy 34, 251-255.

de Alegría Mancisidor I.M., de Basurto Uraga P.D. Alegría Mancisidor I.M., Arbulo López P.R., (2009): *European Union's renewable energy sources and energy efficiency policy review: The Spanish perspective.* Renewable and Sustainable Energy Reviews 12, 100-114.

Domanico F., (2007): *Concentration in the European electricity industry: The internal market as solution?* Energy Policy 35, 5064-5076.

EEA, 2008: *Are environmental costs better incorporated into the pricing system?* http://themes.eea.europa.eu/Sectors_and_activities/energy/indicators/EN34%2C2008.11 (accessed on 2-6-2009)

Eufores, 2008: *Action, not talk.* http://www.eufores.org/fileadmin/eufores/documents/Energy_Efficiency_Watch_Background_Paper.pdf (assessed 5-6-2009)

Energy Community, 2009: *No Title.* http://www.energy-community.org/portal/page/portal/ENC_HOME (accessed on: 26-5-2009)

Euractiv, 2007: *Energy and climate change: Towards an integrated EU policy.* http://www.euractiv.com/en/energy/energy-climate-change-integrated-eu-policy/article-160957 (accessed on 24-5-2009)

Euractiv, 2008: *Mixed reactions as Parliament approves EU climate deal.* http://www.euractiv.com/en/climate-change/mixed-reactions-parliament-approves-eu-climate-deal/article-178163 (accessed on: 24-5-2009)

Euractiv, 2008b: *Italy defies EU summit deal on climate change*. http://www.euractiv.com/en/climate-change/italy-defies-eu-summit-deal-climate-change/article-177876?Ref=RSS (accessed on: 26 -5- 2009)

Euractiv, 2008c: *Energy efficiency: the EU's action plan.* http://www.euractiv.com/en/energy-efficiency/energy-efficiency-eu-action-plan/article-143199 (accessed on: 7-6-2009)

European Council, 2007: *Presidency Conclusions – Brussels, 8/9 March 2007.* http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/93135.pdf (accessed on: 24-5-2009)

European Parliament, 2008: *Briefing - 15-18 December 2008 - Strasbourg plenary session.* http://www.europarl.europa.eu/news/expert/briefing_page/43934-350-12-51-20081208BRI43933-15-12-2008-2008/default_p001c002_en.htm (accessed on: 24-5-2009)

Eurostat, 2009: *Renewable energy primary production: biomass, hydro, geothermal, wind and solar energy - (1 000 toe.)* http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=ten00082&plugin=1 (accessed on: 9-6-2009)

Fouquet D., Johansson T.B., (2008): *European renewable energy policy at crossroads – Focus on electricity support mechanisms.* Energy Policy 36, 4079-4092.

Geesman J., 2009: *Discount Rates: The Divine Right of Economists.* http://greenenergywar.com/2008/08/13/discount-rates-the-divine-right-of-economists/ (accessed on: 1- 6 – 2009)

Geller H., Harrington P., Rosenfeld A.H., Tanishima S., Unander F., (2005): *Policies for increasing energy efficiency: Thirty years of experience in OECD countries.* Energy Policy 34, 556-573.

Giljum S., 2009: *Resource use and ecological limits to growth: implications for de-growth.* http://www.clubofrome.at/2009/degrowth/files/giljum.pdf (accessed on: 8-6-2009

Harrison P., 2008: *EU ends biofuel battle to get green energy deal.* http://uk.reuters.com/article/environmentNews/idUKTRE4B30CL20081204 (accessed on: 5-6-2009)

Jacobsson S., Bergek A., Finon D., Lauber V., Mitchell C., Toke D., Verbruggen A., (2009): *EU renewable support policy: Faith or facts?* Energy Policy 37, 2143-2146.

Jäger-Waldau A.,(2007): *Photovoltaics and renewable energies in Europe.* Renewable and Sustainable Energy Reviews 11, 1414-1437.

Kérébel, 2008: *The Results of Negotiations on the "Climate and Energy Package".* http://www.ifri.org/frontDispatcher/ifri/publications/actuelles_de_l_ifri_1197584475485/publi_P_actuelles_ck_package_eng_1234954562592 (accessed on: 25-5-2009)

Herring H., (2006): *Energy efficiency – a critical review.* Energy 31, 10-20.

Nilsson M., (2007): *Red Light for Green Paper: The EU policy on energy efficiency.* Energy Policy 35, 540-547.

OECD, 2001: *Indicators to measure decoupling of environmental pressure from economic growth.* http://www.oecd.org/dataoecd/0/52/1933638.pdf (accessed on: 29-5-2009)

Patterson M.G., (1996): *What is energy efficiency?* Energy Policy 24, 377-390 .

Ragwitz M., del Rio Gonzalez P., Resch G., (2009): *Assessing the advantages and drawbacks of government trading of guarantees of origin for renewable electricity in Europe.* Energy Policy 37, 300-307.

Ramanathan R., (2006): *A multi factor efficiency perspective to the relationships among world GDP, energy consumption and carbon dioxide emissions.* Technological Forecasting and Social Change 73, 483-494

RAPID, 2007: *EU almost on track in reaching its 2010 renewable electricity target.* http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/07/12&format=HTML&aged=0&language=EN&guiLanguage=en (accessed on: 2009-06-11)

RAPID, 2008: *Memo on the first assessment of National Energy Efficiency Action Plans (NEEAP).* http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/08/32&format=HTML&aged=0&language=EN&guiLanguage=en (accessed on: 4-6-2009)

REEEP, 2009: *ESCO Model.* http://www.reeep.org/130/esco-model.htm (accessed on: 8/6 2009)

Roggenkamp M.M., Redgwell C., del Guayo I., Ronne A., (2007): *Energy Law in Europe*. 2nd ed., Oxford University Press, Oxford.

Rowlands I. H., (2005): *The European directive on renewable electricity: conflicts and compromises.* Energy Policy 33, 965-974.

Serrallés R.J., (2006): *Electric energy restructuring in the European Union: Integration, subsidiarity and the challenge of harmonisation.* Energy Policy 34, 2542-2551

Sovacool B., (2009): *The importance of comprehensiveness in renewable electricity and energy-efficiency policy.* Energy Policy 27, 1529-1541

Toke D., (2008): *The EU Renewables Directive – What is the fuss about trading?* Energy Policy 36, 3001-3008.

van der Bergh J.C.M., 2007: *Abolishing GDP*. http://www.tinbergen.nl/discussionpapers/07019.pdf (accessed on: 3-6-2009)

Verhaegen V., Meeus L., Delvaux B., Belmans R., (2007): *Electricity produced from renewable energy sources - what target are we aiming for?* Energy Policy 35, 5576-5584.

Veum K., 2008: *The proposed Renewable Energy Directive.* http://www.futures-e.org/WS%20London/Proposed%20RES%20directive%20(Veum,%20DG%20TREN%20-%20London%2025-04-2008).pdf (accessed on: 25-5-2009)

Scheer H., 2006: *Stellungnahme zur österreichischen Ökostrom-Novelle.* http://www.oekonews.at/index.php?mdoc_id=1015176 (accessed on: 3-6-2009)

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