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# Energy Transition by 2050: A Multifaceted Challenge for Europe

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This paper serves as a background for the International High Level Energy Conference organised by Egmont - Royal Institute for International Relations - and the Development Group in Brussels on 10th May 2012

## Introduction

Building on the preparatory expert seminar held on 28th March 2012, Egmont - Royal Institute for International Relations and the Development Group are organising an International High Level Energy Conference in Brussels on 10th May 2012. The Egmont Institute and the Development Group aim at staging a vivid debate and bringing together the views of the industry and other energy stakeholders with those of EU decision-makers.

The objective of this **comprehensive project** is to analyse the issues posed by the multifaceted challenge of the energy transition of Europe by 2050, taking place within the framework of the transition towards a competitive low-carbon economy by 2050.

The EU transition to a low-carbon society may be described as the "**third industrial revolution**", requiring a massive transformation of the energy sector from production, transport and distribution to use and storage.

This energy transition raises **major questions** to be addressed, such as inter alia: What are the core energy resources of the future European energy mix? How to encourage energy efficiency measures? What are the required clean energy technologies and can the EU compete worldwide in developing and deploying them? How to modernise, adapt, expand and further integrate the energy infrastructures in Europe? How to finance the energy transition? What are both the responsibility and the contribution from the public and private sectors? What levels of governance are required (local, national, regional, EU and/or international)?

This **policy brief** aims at summing up the main findings and issues raised at the expert seminar held on 28th March 2012, and at offering a background analysis of the key issues to be addressed at the International High Level Energy Conference of 10th May 2012.

## 1. EU Energy Roadmap 2050

The EU is committed to reducing its $CO_2$ emissions by 80-95 % below 1990 levels by 2050. In this context, the Commission released on 8th March 2011 "a Roadmap for moving to a competitive low-carbon economy in 2050". The Roadmap envisages that the power sector alone must support a reduction of 93-99 % i.e. become almost carbon-neutral. In its subsequent **Energy Roadmap 2050**, released on 15th December 2011, the European Commission explores the challenges posed by the energy transition *per se* and develops a framework for a European long-term strategy for sustainable, competitive and secure energy.

The Commission has outlined **seven different potential scenarios**, illustrating possible evolutions of the energy system in Europe by 2050. These scenarios are split into 2 current trend scenarios, which are not ambitious enough to achieve the EU's 2050 decarbonisation goal, and 5 other possible decarbonisation scenarios.

Among the **current trend scenarios**, the first reference scenario includes current trends in accordance with policies adopted by March 2010 and long-term projections on economic development, while the second current policy initiatives scenario takes into account the recent measures adopted, especially after the Fukushima events.

While the current trend scenarios are insufficient, the **five other scenarios** show that decarbonisation is possible. They each represent a main route to achieve the energy transition, focusing respectively on high energy efficiency (1), high renewable energy sources (2), diversified supply technologies where all energy sources can compete on the market, including both nuclear and Carbon Capture and Storage (CCS), and decarbonisation is led by carbon pricing (3), diversified supply technologies but assuming CCS is delayed, resulting in higher shares for nuclear energy (4), and diversified supply technologies with no new nuclear, leading to a higher penetration of CCS (5).

The **major tendency** emerging from the EU Energy Roadmap is that a large share of energy production would become renewable, fossil fuels (mainly natural gas) playing a complementary and transitional role towards an exclusively low-carbon energy production, and nuclear energy facing a potential decline. Energy efficiency is set to play a major role in all cases. The development of shale gas and emerging technologies such as CCS could also significantly change the transition pathway.

**Key issues to be addressed**

- What are the most pertinent scenarios?
- What are the consequences of these scenarios?
- To what extent can these scenarios be combined? What trade-offs are possible between them?
- How to link these decarbonisation scenarios to both the current and prospective European energy policy framework?

## 2. European energy mix

The central issue underpinning the transformation of the energy system is the choice of energy sources within the EU i.e. the **energy mix**. The transition towards a sustainable energy system will inevitably require the diversification of the European energy mix and the stimulation for clean, sustainable and decarbonised energy sources.

**Renewable energy** would therefore continue to be increasingly phased in ahead of 2050. However, while the EU and its member states

have renewable energy targets in their policy, it remains unclear whether there are sufficient policy incentives for additional large-scale renewable investments. Since the renewable energy market remains predominantly policy-driven, the lack of confidence in the delivery of European and national renewable energy targets could hamper the growth of the sector in the future.

The accident in Fukushima has re-launched the public debate about the acceptance of **nuclear energy**, questioning its future use in several countries across the EU. Some have already decided upon a progressive phasing out of nuclear energy, while others continue to believe that it is a secure, reliable and affordable source of low-carbon electricity generation. Given the major role of nuclear in the production of low-carbon energy in the EU today, any reduction of its share in the energy mix will make it necessary to consider alternative scenarios. In parallel, the EU nuclear safety and security framework will need to be reinforced to encourage those willing to keep the nuclear option.

As an economically attractive option for investors, an ideal backup source for variable renewable energy and the least-polluting fossil fuel, **natural gas** should play an essential role in the transition towards a low-carbon economy. It should therefore display an important growth rate until at least 2030-40, especially for Member States that withdrew from nuclear energy. As a result, the EU gas import dependency would increase in the short and medium term. The potential development of shale gas and other unconventional gas sources within the EU could ease this foreign dependency. However, their development remains controversial due to geological constraints, high extraction costs, and uncertainty regarding the environmental impact of production. When other low-carbon energy sources and technologies will be ready for deployment, the role of gas in the long run might be progressively limited to a backup source for intermittent renewable energy sources.

Regarding the **other fossil fuels**, oil will remain in the energy mix in 2050 and represent a major source for transport at least until 2030. As for coal, it offers advantages in terms of energy security and competitiveness. However, as the most polluting energy source, its share in the EU energy mix might progressively decrease except in case of development of the low-carbon CCS technology from around 2030.

**Key issues to be addressed**

- What optimal energy mix is required?
- What are the core elements of an EU strategy for low carbon energy resources?
- What will be the main criteria for selecting energy resources?
- How to find the right balance for each energy resource between the three objectives of sustainability, competitive-ness and security of supply?
- What is the future for fossil fuel resources?
- Will oil and coal remain indispensable?
- Is natural gas a major source for the energy transition or is its role limited to back-up supply?

## 3. R&D and technological innovation

The energy transition will much depend on research in **new clean technologies** and the pace of their technological development and deployment on the mass market. The research, development and deployment of new clean technologies can offer huge opportunities for the EU in terms of environment, competitiveness, job creation and economic growth. However, all large

economies like China, Japan and the US are embracing the race to compete in this field, potentially impacting on the global competitiveness of European industry.

Furthermore, this "green gold rush" takes place at a time of **unprecedented uncertainty**. This continuing uncertainty over the development and deployment of technologies further complicates the choice of optimal energy sources. The share of gas, coal, oil, renewable and nuclear in the European energy mix by 2050 could therefore largely change in function of the research, development and deployment of technologies for each of these sources of energy.

**Carbon Capture and Storage** (CCS) is a particularly good example of technology that could influence the future European energy mix if it is developed and deployed on a large scale. This low-carbon technology could make coal and gas attractive options in the long-term, both in terms of availability and sustainability. However, the future of this technology depends on public acceptance and carbon prices. If, beyond subsidised demonstration projects, CCS proves to be cost-competitive and legally well-framed, rapid deployment will be necessary from 2030 on.

**Key issues to be addressed**

- How the cooperation between member states in the field of R&D can be encouraged?
- What are the core elements of an EU strategy to develop low carbon energy technologies?
- What will be the main criteria for selecting technologies?

## 4. Energy efficiency

**Energy efficient measures** are crucial in all the transition scenarios towards a low carbon economy, allowing the EU to achieve decarbonisation in a faster and cost-efficient way. As often mentioned, the most environment friendly energy unit is the one which is not spent. The EU and its member states will need to further act on their energy consumption and make progress on energy efficiency, for instance through a greater use of standards and norms for buildings, transport vehicles, products and appliances.

The EU energy efficiency pledge to cut energy consumption by 20% by 2020 relative to 1990 levels is not legally binding. **Binding targets** have provoked strong opposition among member states. There is so far a huge gap between high expectations for more energy efficiency and current achievements. Unless the EU more than doubles its energy savings efforts, the 20% energy savings by 2020 won't be achieved.

**Key issues to be addressed**

- How to fill the gap between high expectations and current achievements regarding energy efficiency?
- Are binding targets for energy efficiency the right solution?

## 5. Energy infrastructures and market developments

A cornerstone of a modern and sustainable European energy system is a smoothly functioning and smart grid network. They are not only indispensable for ensuring reliable energy supplies and saving energy, but also for the development of a competitive internal energy market.

**New energy infrastructures**, strategic interconnections and storage facilities are further needed both within and outside the EU in order to ensure the security and diversification of supply. Interoperability with the energy networks of neighbouring regions (in the Balkans, Caucasus, Mediterranean, Black Sea and Caspian Sea basins, and in the Middle East and Gulf regions) capable of supplying Europe with both traditional and renewable sources is therefore essential.

The construction of an efficient Europe-wide network of infrastructure also becomes indispensable in order **to connect a growing share of intermittent renewable** energy sources to the electricity network. The decentralised renewable energy systems will increasingly have to interact with centralised large-scale systems (e.g. gas and nuclear power plants), requiring the modernisation, expansion and integration of current distribution grids.

In order to save energy and better manage the variable generation from many sources on the network, **smart grids** are also needed. By using IT technologies, supply and demand between producers and consumers can be optimised, leading to energy savings, secured networks and reduced costs. The deployment of smart meters should also allow consumers to control their precise power consumption, allowing them to reduce their bills and save energy.

Altogether, these huge changes in the energy system will require **new market designs** and ways of cooperation in order to develop a fully integrated energy market. Such a market should allow consumers to have access to better services, greater choices due to the diversification of supply, and more competitive prices.

So far, the EU approach regarding the need of smart cross-border energy infrastructures has mainly focused on building interconnections rather than an integrated **European super grid**. The objective to make a pan-European grid infrastructure requires a Europe-wide regulatory framework. However, the existence of diverse regulatory approaches among member States makes it very difficult to realise.

**Key issues to be addressed**

- Should the EU limit itself to building interconnections or also develop a Pan-European (super) grid infrastructure?
- Is the current regulatory framework adapted to the future design of a pan-European grid infrastructure?
- How to rethink/reinvent market designs and structures within the EU?
- How to introduce more capacity and flexibility in the market?

## 6. Financing the transition

Both the development of clean technologies and energy infrastructures will require further **massive investments**. Market forces and public policies will be necessary in order to cope with these vast investments. New models of financing combining public and private funds, alongside existing tools, might also be needed. Furthermore, the next EU Multiannual Financial Framework will be a good way of measuring the political commitment of the EU to invest in the research, demonstration and deployment of low carbon technologies as well as in the required infrastructures.

The bulk of the investments required for the transformation of the energy system will come from the **private sector**, particularly through a market-based approach. The role of

the EU Emissions Trading Scheme (ETS) should therefore be particularly important in setting an adequate carbon market price. At this time, the EU ETS is unable to play this role. Decarbonisation efforts are therefore currently mostly relying on various public support schemes rather than on market developments. This trend should continue in the short and middle term. Public subsidies will be particularly important to encourage the development and deployment of new green technologies and correct market failures. However, as technologies mature, costs should be reduced and public support should decrease.

It is important to highlight that the longer we wait to make the necessary investments, the more the cost of the shift towards a low-carbon economy will increase. Yet, uncertainty in the development of the energy market currently impedes the necessary investments and increases the capital expenditure. **Concrete milestones** such as mid-term targets are thus necessary to create more stable investment conditions.

**Key issues to be addressed**

- Where will the money required for massive investments in infrastructures and technologies come from (private, public, carbon market)?
- What is the impact of each scenario from the Energy Roadmap in terms of investments?
- What is the role of public support in the short, medium and long term?
- To what extent should low-carbon energy technologies be subsidised, and how long before they can be cost competitive?
- Is the wide heterogeneity of member states' support schemes compatible with the aim to create an EU energy internal market?
- Is carbon pricing the main driver for the deployment of low-carbon technologies or one amongst many others?
- What future for the EU ETS?
- What are the concrete responsibilities and contributions from the industry in terms of investments?
- Where do the main factors of uncertainty to invest in the energy sector come from? How to address these factors?
- From where the predictability to realise the required investments can/should come (EU energy framework, national policies, regulators, etc.)?

## 7. Governance of the energy policy

The **EU energy policy** has intensely developed over the last years, with the adoption of an impressive set of regulations, directives and strategies. This has profoundly impacted the energy landscape in Europe. Lastly, the European Council of February 2011 has set the deadline for completing the European energy internal market by 2014. All this process has lead to greater political, economic and technological interdependence between member states.

At the same time, the energy policy is a **shared competence** between the EU and its member states. Energy policy remains a highly sensitive issue of national interest. European countries can make unilateral sovereign choices in the field of energy. However, this comes at a price as it often increases the risk of divergence and can even create tensions and conflicts. A lack of cooperation could thus have far-reaching detrimental consequences. Member states' priorities and heterogeneity (different energy mix, policies and strategies) remain difficult to **reconcile in a common framework**. It is therefore crucial that the EU energy

Roadmap takes into account national strategies. A major challenge for the energy transition will be to conciliate a European energy strategy with different national energy policies, mixes and market structures in each Member State.

The EU energy policy framework is also widely **influenced by international developments**. If the EU adopts too-stringent climate and energy policies relative to the rest of the world, adverse consequences on EU competitiveness could follow, leading to a risk of carbon leakage.

The stable investment environment required for the shift towards a low-carbon economy is currently not in place. The lack of certainty for investors is in part linked to external factors such as the absence of a global climate agreement, the global economic situation and the decisions to be taken by external actors.

In order to create more **certainty for investors**, the EU will need to take major and difficult decisions in the short and medium term, such as the adoption of mid-term targets. However, an agreement on binding targets will hardly come quickly, given the serious opposition from some member states and the slowness of the international climate negotiations.

Last but not least, the issue of **public acceptance** is another essential element of governance. As the EU energy transition will affect the society at all levels, involving the civil society is essential for the legitimacy of policy decisions. Citizens should be systematically involved in the debate on energy related issues at the regional, national and European levels through a structured dialogue between the policy-makers, the different stakeholders and the civil society.

The EU Energy roadmap is a step towards the **Europeanisation of energy policy**. It creates a new narrative, which is here to stay. A major challenge in terms of governance will be to better coordinate the EU approach with the global, regional, national and local levels. However, although there is a growing consensus amongst all stakeholders on the main objectives of the EU energy policy and the ultimate decarbonisation goal of the entire economy, there is still a lack of consensus on how to achieve it.

**Key issues to be addressed**

- What are the next steps after this energy roadmap (intermediate 2030 and 2040 targets)?
- What are the benefits of a European approach on the energy transition, and what would be the costs of the absence of such an approach?
- How to make both processes of Europeanisation of energy system and specialisation of national energy policies and mixes complementary?
- How to further improve coordination, cooperation and integration at EU level?
- What could be the new drivers for Member States to cooperate at the EU level?
- How to make all stakeholders better interact i.e. EU institutions, national governments, private sector and civil society?
- How to reconcile and combine the various levels of governance (global, EU, regional, national, local)?

## Conclusion

In light of the prevailing trends, the question for the European Union is how the forthcoming developments can deal with the numerous and profound widespread energy issues to come. The future of the energy policy has become a central long-term geopolitical, economic, environmental and social concern for Europe. The major decisions to be taken in the coming years in order to achieve the EU's decarbonisation objective will engage member states, the industry and citizens over decades and will drastically change the energy picture of Europe.

However, this debate takes place at a time of "unprecedented uncertainty", which makes the decisions to be taken even more difficult. Looking forwards to 2050, the pace of change remains all but certain due to the wide range of possible technology and policy scenarios, as well as major factors of uncertainty, which will impact on the future European energy landscape. These include:

- the economic downturn and the conditions and timing for recovery due to the strong correlations between economic activity, energy supply and demand, and energy investment;
- the outcome of current international negotiations regarding climate change;
- the decisions to be taken by external actors such as energy suppliers, transit and major consumer countries, as well as international organizations such as OPEC.

Against this background, the International High Level Energy Conference on 10th May 2012 will address the EU strategy and policy measures for the decarbonisation of the energy sector by 2050.

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