MEMO/11/914

Brussels, 15 December 2011

The Commission's Energy Roadmap 2050

Why is there a need for the Roadmap 2050?

The EU has set itself the goal to reduce greenhouse gas emissions to 80%-95% below 1990 levels by 2050. The Roadmap explores how this goal can be achieved while at the same time improving the competitiveness and the security of supply.

Rather than presenting one strategic option, it describes seven different scenarios. Every scenario is based on a different energy mix, combing varying shares of renewables and the importance given to energy efficiency and new technologies such as CCS. By describing these scenarios and also their impact on costs and prices, it should help Member States to make the necessary policy choices.

Each country is responsible for its own energy choices. But they must be integrated in the overall context and take into account the potential consequences on its neighbours.

Why is there a need to start now a discussion about 2050?

Member States have to start now to debate how their energy mix will look like in 2050 and create a stable business investment for private investors. If the political choices are not made, there is uncertainty and much needed investments will be delayed. In the energy sector, investments are made for a period between 20 and 60 years.

What are the key outcomes?

Irrespective of the particular energy mix chosen, there are a number of common elements in all decarbonisation scenarios:

1) The demand for renewable energy will grow
2) Energy savings will be crucial
3) The role for electricity will increase
4) Capital investments will increase
5) The fossil fuel bill will decrease.

What is a scenario and which ones have been chosen for the analysis?

A scenario is a **tool to assess the effects of policy options**, created by changing many variables simultaneously and presenting the outcome foreseen.

The Commission, after extensive discussions with stakeholders, has identified **four main decarbonisation routes for the energy sector** – energy efficiency impacting mostly on the demand side and on the supply side renewable, nuclear and CCS. **The scenarios proposed explore different combinations of this four decarbonisation paths interacting**:

- **two current trend scenarios:** the reference scenario and an updated version including current policy initiatives. This latter scenario serves as the basis of all decarbonisation scenarios;
- **a high energy efficiency**, where there is a commitment to very high energy savings, leading to a 41% decrease in energy demand by 2050 compared to the 2005-2006 peaks;
- **diversified supply technologies**, in which all energy sources compete on a market basis with no specific support measures;
- **high renewable energy sources (RES),** with strong support measures for RES resulting in a RES share amounting to 75% in gross final energy consumption, and to 97% in electricity consumption;
- **a delayed Carbon Capture and Storage (CCS)** with the share of nuclear energy in primary energy consumption amounting to 18%;
- **and a low nuclear** with higher shares of CCS, around 32% in power generation.

What role has gas in the transition?

Gas will be critical for the transformation of the energy system. Substitution of coal (and oil) with gas in the short to medium term could help to reduce emissions with existing technologies until at least 2030 or 2035. Gas will stay high in sectors such as the power sector over a longer period. In the Diversified Supply Technologies scenario for example, gas-fired power generation accounts for roughly 800 TWh in 2050, slightly higher than current levels.

What role has nuclear in the Roadmap 2050?

The EU Commission and the Roadmap 2050 **is neutral on the question whether or not Member States should use nuclear power.** It does **not give a recommendation or a forecast on the future development of nuclear energy in Europe.**

One scenario assumes that nuclear policy is almost zero (This is based on the assumption that only those nuclear power plants which are currently under construction are used in 2050, while existing ones will have come to the end of their life time and will not be replaced). Under this scenario, nuclear makes amounts to less than 3 percent of primary energy consumption (currently it is 14%).

Another **scenario** looks at the effect a delayed implementation of CCS has on the energy mix. This technology allows capturing and storing CO2 emissions from gas and coal power stations. If this technology will not be fully exploited in the Member States, it is assumed that nuclear power will play a bigger role. This would result in almost the same **share of energy consumption in 2050 as in 2005 (18 % versus 14%). Depending on Member States' decisions, the share of nuclear could of course be higher.**

What role has energy efficiency and renewable energy?

Renewables move centre stage. The share of renewable energy (RES) rises **substantially in all decarbonisation scenarios, achieving at least 55% in gross final energy consumption in 2050** up 45 percentage points from today's level at around 10%. The share of Renewables in electricity consumption reaches 64,8 % in a High **Energy Efficiency scenario and even 97% in a** High Renewables Scenario.

The Energy Roadmap 2050 is also ambitious when it comes to energy efficiency: It shows that we need to reduce energy consumption by 2050 by a minimum of 32 percent to maximum of 41 percent compared to the peak in 2005/2006, according to the different scenarios.

Investments cost a lot of money. Is it not cheaper if we forget about decarbonisation?

The analysis shows that **costs will rise anyway and will be roughly at the same level as if we were not to do anything.** If we continue current policies, the total **energy system cost** - **including fuel, electricity and capital costs, investment in equipment, energy efficient products -** could represent 14.6% percent of European GDP in 2050 (compared to 10,5% in 2005).

If we **continue with current policies, we may not have to invest as heavily** in **infrastructure** as in the decarbonisation scenarios (high efficiency, high renewable, delayed CCS, low nuclear and diversified supply technologies), but we the face higher fossil fuel costs as gas and petrol prices are estimated to rise due to an increase in world wide demand. By contrast, in the case of the decarbonisation scenarios higher upfront investment is needed but less fossil fuel.

What contribution will be provided by the EU single market?

More than ever should the full scale of the internal market be used. Electricity and gas markets are **increasingly connected**, allowing to trade energy easily across borders. This helps to ensure that electricity is produced where it is most economical.

A new challenge is the **need for flexible resources** in the power system as there are more variable renewables in the system. Access to flexible supplies of all types (e.g. demand management, storage and flexible back-up power plants) can be best delivered in a well-connected and well-functioning internal energy market. It helps to use resources efficiently across Europe. For example, with sufficient interconnection capacity and a smarter grid, managing the variations of wind and solar power in some local areas can be provided also from other sources (e.g. renewables, storage or back-up power plants) elsewhere in Europe.

Energy policy developments need to take full account of how each national electricity system is affected by decisions in neighbouring countries. Now more than ever, coordination is required. **Working together will keep cost down** and ensure security of supply.

Which other EU policies are expected to play a pivotal role?

First, **new and flexible infrastructure development is a "no regrets" option** and could accommodate various pathways of different Member States. An overall increase of interconnection capacity by 40% up to 2020 will be needed, with further integration after this point.

Second, much depends on the **acceleration of technological development**. New technologies bring new options in the future. Technological progress can yield significant cost reductions and economic benefits.

Third, the **social dimension** of the energy roadmap is important. The transition will affect employment and jobs, requiring education and training and a more vigorous social dialogue. For example, we need to ensure that we have enough engineers.

Is it true that investments are cheaper if we make them now and at European level?

Yes. If investments are postponed, they will cost more and create greater disruption in the longer term. For **every US Dollar of investment not made in the power sector before 2020, an additional US 4,3 would need to be spent after 2020 to** compensate for increased emission, the IAE says in is 2011 World Energy Outlook.

For Europe, the Commission already analysed in its "Roadmap to a competitive low-carbon economy" (March 8, 2011) the following absolute figures: Investment **expenditure increases by around Euro 100 bn per annum for the 20 year period from 2030 – 2050, without comparably decreasing the investment before 2030.**

The Commission has not undertaken a counter-factual modelling comparing a Member State by Member State approach with **an EU approach**. Some stakeholders[1] show however that the cost-efficient deployment of renewables across Europe can reduce cumulative costs by more than a fifth by 2030 compared to a Member State by Member State approach.

Why are electricity prices rising? Are they rising only for renewables?

Electricity prices **will rise in the next decades in any case,** regardless if we **continue with our actual energy policy or go for decarbonisation**.

- If we stick to our **current energy mix**, we will face higher electricity prices due to **increases in fossil fuel prices (gas, coal and oil)**. This is because world wide demand is increasing, especially in Asian countries such as China.
- If we opt **instead for any decarbonisation scenarios** (high efficiency, high renewable, delayed CCS, low nuclear and diversified supply technologies), **electricity prices rise because we have to invest heavily in new infrastructure** and technologies.

[1] Power Perspectives 2030", European Climate Foundation, 7 November 2011.

Why are electricity prices raising until 2030? And then decreasing or stabilizing?

They rise until 2030 because capital, grid and fuel costs rise and auctioning payments will increase. Until that year, the increase of electricity prices **is roughly the same in all scenarios, regardless whether we stick to our current energy mix or go for decarbonisation**, e.g. high renewable share.

After 2030, **electricity prices stabilize or decrease** under the decarbonisation scenarios. This is because less operational costs are needed for electricity production which in turn has a positive impact of prices. These operational costs include ETS allowances and fossil fuels.

In the **case of renewables, the modelled investment needs beyond 2030** are higher than in the case of the others scenarios. This is due to this scenario being a somewhat extreme "near 100% renewable power" scenario which comprises assumptions about very increased storage needs, extension of the grid and back up facilities such as gas power stations. Most of these investments will come after 2030 due to the sharp increase of renewables in the same period of time. **This means also higher electricity prices for this particular scenario, but substantial RES penetration in itself does not necessarily mean high electricity prices. Some of these costs are attributable to conventional power plants built prior to 2030 which are assumed to need to recover their investment costs fully despite not running at close to full capacity due to the subsequent renewables growth.**

What would be the benefits of these changes?

The energy system transformation will drive growth and employment in a wide range of sectors, from construction, renewable energy, power generation and transmission, energy efficient appliances and vehicles, and has the side-benefit of a reduced external fuel bill. Additionally, the transformation will make Europe less dependent on external energy supplies. It is **up to Europe to ensure a strong industrial base ready to take advantage of these opportunities**.

How does the Roadmap assess the trade-off between climate change policies and competitiveness?

Investments in energy efficiency and new technologies pay off in the long run, reduce the fuel bill and place Europe at the forefront of innovation. Industry must focus on these medium to long-term opportunities and not on short-term costs. Of course, there **can be tradeoffs as well as synergies between sustainability and competitiveness**. Hence the importance of the emissions trading Directive's existing measures to avoid carbon leakage.

What are the costs of EU unilateral action, e.g. no climate deal?

The European Union is working continuously to convince partners to move towards greater decarbonisation worldwide in a common effort. A more comprehensive analysis of different global paths to decarbonisation was presented in the Low Carbon Economy Roadmap 2050 exploring impacts of three global climate situations: a) business as usual; b) global climate action and c) fragmented action.