

## **Electricity and security of supply**

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Electricity is an energy vector which is more and more used because of its convenience. As a consequence, the electricity demand increases faster than the total primary demand. One of the drawbacks of electricity is that it is not possible to store it in big quantities. The only way to do that on large scale is for the moment to pump water in the reservoir of a hydroelectric plant. Another way, much less used, is to store compressed air in underground cavities. Therefore, as far as electricity is concerned, the demand should be, at each time, equal to the production. This means that there is clearly a problem with high power intermittent energy sources, like wind energy, since when the consumer wants electricity there is not necessary wind to produce it and vice versa.

Apart from a regular increase of electricity consumption as expected in a scenario “business as usual”, new uses of electricity can appear. Indeed, if one wants to decrease our CO<sub>2</sub> greenhouse gas emissions and to decrease our dependence with respect to oil, we need to use energy differently. We should, in particular, produce more heat or cold using alternatives technologies. Heat pumps are one of them. It allows producing 3-4 kWh of heat or cold from air, water or ground but needs 1 kWh of electricity to do that. A large development of heat pumps would require additional electricity means of production. As regards transport, one can think that, in the medium term, plug in hybrid vehicles will develop. This would also require additional electricity. Second generation biofuels, in which external energy is used in the process and extra hydrogen, produced by electrolysis, is added for the Fischer-Tropsch synthesis, would also require more electricity. However, in the end, less CO<sub>2</sub> will be emitted and our dependence upon oil will decrease.

At the world level and in terms of energy content, transport ( $\approx 2$  Gtoe) represents roughly two times the energy contained in electricity ( $\approx 1$  Gtoe), and heat (or cold) three times ( $\approx 3$  Gtoe). It is important that transports, which rely almost entirely on oil, and heat, which uses often fossil fuels, use more renewable energies and electricity. In this later case it is also necessary that electricity can be produced with a minimum of CO<sub>2</sub> emissions. In order that these new uses of electricity develop while minimizing CO<sub>2</sub> emissions, it is necessary that electricity is produced in the cleanest way as far as greenhouse gases are concerned. This favours renewable and nuclear energies.

Taking into account the importance of the electricity and the strategic position of this energy vector in our civilization, it is necessary to ensure its availability at all times in sufficient quantities and at affordable prices. This is the security aspect which should be completed by the constraint that electricity should be produced avoiding as much as possible CO<sub>2</sub> emission in the atmosphere. This also implies to ensure the supply of primary energies to produce electricity and the possibility to distribute it all over Europe.

With respect to oil, Europe has a high import dependency and a large dependence on the Middle East. With respect to gas it strongly depends upon Russia. Mechanisms have been

settled up with the IEA (international energy agency) in order to prevent short-term disruptions of fossil fuels, but a long term approach would also be needed. Several hundred of billions investments are needed in Russia, Middle East and Africa in order to exploit fossil fuel resources. Investments in Europe are also needed to increase the infrastructure in transportation, storage and distribution. We shall feel this lack of investments probably before we feel the decrease of oil production. Russia has a central position as far as oil and gas are concerned. New resource exploration and concession of new resources as well as the construction and maintenance of pipe-lines are of basic concern for Europe.

Europe is based on a “market approach” in which it is assumed that the market allows that energy is available. It is also important to favour exchange of electricity between European countries. The existing grid is still limiting possible exchanges. It is necessary to reinforced it and develop new connections. This goes in the path of a better solidarity between countries and increases the security of supply. Problems connected to the liberalization market may give rise to new problems, as it has been recently illustrated by the California crisis. Because it cannot be stored easily, electricity is not an ordinary good. A complete liberalization might weaken the security of supply. In particular which company will provide electricity at certain hours when the demand is small and the price very low?

One way is to decrease the electricity demand for the same service. The best energy is the one that is not used. Energy efficiency enhancement is an important issue which requires intervention from governments. Since Europe grant importance to reducing greenhouse gas emission, government intervention will also be required in this area.

Renewable energies are an important issue in the European Union. The quantity of electricity produced by renewable sources increases but some of them, like wind, are intermittent. There is for the moment no efficient mean to store large quantities of electricity when there is wind but no associated demand. Since the renewable energy production is dominated by hydroelectricity, the warming up that we seems to observe now, may lead to a decrease of the hydroelectricity production. Some hints in this direction have already been observed in several countries. Within the next decades, renewable energies will probably not give enough electricity to ensure a large scale domestic production. Local or domestic production will also need some time before a large quantity of electricity is produced. Furthermore, in dense population's areas, this is not necessary the cleaner and more efficient way to produce electricity and the total installed power will be larger than using centralized plants.

The advantage of nuclear energy is to secure electricity supply in the short and long term because it is easy to store uranium for several decades and then prepare nuclear fuel. In addition, electricity production is done without emitting greenhouse gases. Some European countries are in favour of phasing out nuclear reactors while other are keeping open the nuclear option. It is not possible, for the moment, to replace quantitatively nuclear energy by renewable sources. On the other hand replacing nuclear reactors by fossil fuels plants would increase our dependence upon fossil fuels, have a large impact

on pollution, and increase a lot our CO2 emissions. Nuclear energy seems therefore to be inevitable in the European energy mix.

In conclusion, electricity demand increases more than the primary energy demand. New uses like heat pumps, plug in hybrid vehicles or the development of second generation biofuels will increase the demand and require more production means. Europe is becoming more and more dependent upon outer countries as far as fossil fuels are concerned. This dependence cannot only be solved by a market approach since political issues are also concerned. Therefore it is important that Europe enhance a diversification of supply sources and reduce its dependence on a specific country or region. Energy savings, sobriety, energy efficiency should be the priority to maintain our electricity consumption to a reasonable level and even decrease it while keeping a similar quality of our way of life. Renewable energies as well as nuclear energy are essential if Europe wants to increase its security of supply and the number of jobs.