SNETP
Sustainable Nuclear Energy Technology Platform

Nr. 5

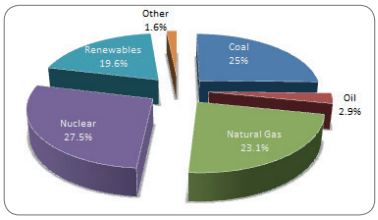
Sustainable development is usually defined as "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs" . For energy production to be sustainable, it must be available for the future generations at reasonable financial costs with minimized health and environmental impact. Nuclear energy contributes significantly to a sustainable energy mix already, by providing affordable electricity, emitting hardly any greenhouse gases during the fuel cycle, using a plentiful resource while releasing a very low amount of waste products to the environment. Above that, the health impacts to society at large are virtually non-existent. Nuclear energy can do even more in case advanced materials, systems and fuel cycles are developed, which SNETP and its members support by targeted and appropriate nuclear fission R&D.

Nuclear Energy Factsheets

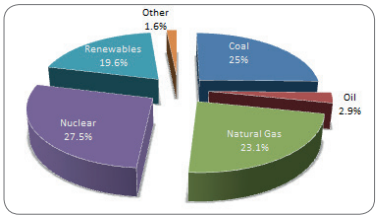
Nuclear fission and sustainability

• Energy demand and sources

With a growing world population, large share of which will claim their right for an improved standard of living, the anticipated demand for secure, affordable and clean energy will increase dramatically this century.



Gross Electricity Generation EU-27[1]



Final Energy Generation EU-27[1]

The predicted increases in world population and per-capita energy demand in the next few decades are expected to cause a substantial rise in world energy consumption. Only if energy needs are met reliably, society can sustain its current economic development. Nuclear energy currently provides already large scale continuous, reliable and affordable electricity as base load to the electricity grid, for which the need will increase. As the share of renewable sources increases, this will introduce more variation in electricity supply and therefore the nuclear capacity will be required to be more flexible.

Europe has to face three energy challenges: security of energy supply, limitation of greenhouse gas emissions and competitiveness of energy-reliant economies, while keeping the global temperature increase below 2°C and thus avoiding dangerous impact on climate. The European Council committed in March 2007 to very ambitious goals putting Europe at the forefront of the fight against climate change.

The *20-20-20* objectives for 2020 are:

- 20% reduction in GHG emissions compared to 1990
- 20% energy savings
- 20% share of renewable energies in the total energy mix

The EU is currently on track to meet two of those targets, but will not meet its energy efficiency target unless further efforts are made . The European Council has also given a long-term commitment to the decarbonisation path with a target for the EU and other industrialised countries of an 80 to 95% cut in emissions by 2050 compared to 1990 levels.

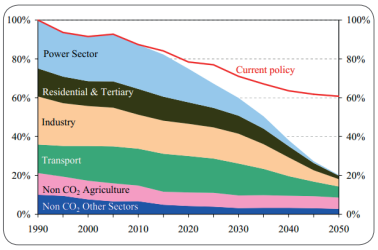


Figure 3: EU GHG emissions towards an 80% domestic reduction (100% = 1990)

To achieve both the medium term goals (2020) and the long term vision (2050), Europe launched in 2007 the "Strategic Energy Technology (SET) Plan" which identifies a list of competitive low carbon energy technologiesto be developed and deployed in Europe .

The SET plan identifies nuclear fission as one of the key low carbon energy technologies which Europe must develop and deploy. For the 2020 objectives, the intention is to "maintain the competitiveness in fission technologies together with long term waste management solutions". This can be translated as maintaining at least the current level of nuclear energy in Europe's electricity mix (around 28%) through long term operation of existing plants and an ambitious programme of new build.

For the vision of 2050, the SET Plan recommends us to act now to "complete the preparation for the demonstration of a new generation of fission reactors with increased sustainability".

• Role of nuclear in the energy mix in Europe

The Communication from the European Commission in December 2011 entitled "Energy Roadmap 2050" , recognises the importance of nuclear energy's contribution in Europe today. With approx. 122 GWe in operation in Europe, that equates to 30% of electricity generation (produced by more than 131 reactors located in 14 countries in the EU-27 ,), nuclear fission represents the largest low-carbon energy source in Europe (2/3 of the decarbonised electricity).

Thus, nuclear energy is the most important low carbon technology in Europe's energy mix. It is estimated (see the

platform's Vision Report) that compared to a representative mix of alternative base-load capacity (essentially gas and coal), Europe's nuclear power plants represent a saving of almost 900 million tonnes of CO_2 per year, i.e. approximately the level of emissions from the whole transport sector.

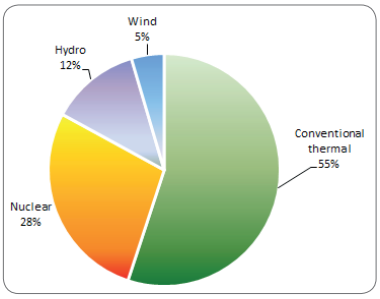


Figure 4 Electricity generation shares in EU-27 in 2011 [Source: Eurostat / Electricity production and supply statistics]

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Nuclear energy generates around one-third of EU electricity and two-thirds of its carbon free electricity.

Access to secure and affordable energy is vital if society is to meet these needs. Because of its polyvalence, access to electricity is particularly important.

To be sustainable, energy production must avoid endangering the well-being of future generations, not only by reducing the use of natural resources but also by minimising detrimental effects on public health and the environment, including the production of ultimate waste. In particular, electricity production must achieve high levels of safety and limit harmful emissions over the full lifecycle of the plant (cradle to grave).

Nuclear energy is the most cost competitive carbon free form of electricity generation. The share of new power generation and investment shows how renewables are often capital-intensive, representing 60% of investment for 30% of additional generation.

Furthermore the European nuclear industry is a big job creator in the low carbon energy mix. Based on the scenario "Delayed CCS" of the EU Energy Roadmap 2050 (where nuclear contributes nearly 20% in 2050) the nuclear industry will create 347,000 additional jobs in Europe coming from Lifetime extension, new build, decommissioning and geological disposal programmes, over and above the jobs created by the regular operation (900,000 jobs). The corresponding total «valued added» for the European economy can be estimated to 70 billion euros per year.

Security of supply is a key factor in the role of nuclear energy. With the current efficiency of uranium in nuclear power plants and at the projected 2012 rate of consumption, the natural resources may last approximately 100 years , depending on the nuclear power growth rate in the coming decades. The security of supply will be assured for thousands of years if fast neutron reactors are deployed.

• Nuclear proliferation

key factor in

• Nuclear proliferation

Proliferation risk of nuclear weapons and the associated public concerns induce constraints on nuclear power deployment throughout the world . While it would be wrong to believe that quick-fixes exist for the problem of proliferation, the Non-Proliferation Treaty (NPT) and the comprehensive safeguards regime implemented worldwide under the IAEA umbrella have generally proven to be effective in detecting and deterring diversion of nuclear material or technology for non-peaceful applications. Constant vigilance backed up by strong international action against suspect states is needed though to ensure the effectiveness of these actions.

The GEN III reactors under deployment together with the development of a new (4th) generation of reactors offer opportunities for enhancing proliferation resistance and facilitating the safeguards control. Past experience and ongoing R&D provide confidence that proliferation risks can be mitigated and reduced to a level acceptable by the society in the context of a stringent and powerful international safeguards regime.

Nuclear non-proliferation is a political challenge, for which technical measures have been implemented to physically restrict unwanted developments. However, high level political intervention and preferably the agreement of the UN Security Council is ultimately required in order for them to be effective.

REFERENCES

[1] EUROBAROMETER

[2] Society and Nuclear Energy: Towards a Better Understanding, © OECD 2002