European Energy Policy and Global Reduction of CO_2 emissions:
Towards an effective sustainable electricity production in Europe

The Position of the Energy Group of the EPS

The forthcoming United Nations Climate Change Conference (Paris, December 2015) will be held with the objective of achieving a binding and global agreement on climate-related policy from all nations of the world. This conference, seeking to protect the climate, will be a great opportunity to find solutions in the human quest for sustainable energy as a global endeavour. The Energy Group of the European Physical Society (EPS) welcomes the energy policy of the European Union (EU) to promote renewable energies for electricity generation, together with energy efficiency measures. This policy needs to be implemented by taking into account the necessary investments and the impact on the economical position of the EU in the world. Since the direct impact of any EU energy policy on world CO_2 emissions is rather limited, the best strategy is to take the lead in mitigating climate change and in developing an energy policy that offers an attractive and economically viable model with reduced CO_2 emissions and lower energy dependence.

The Energy Group of the EPS has the following observations on the **presently planned energy transformation in Europe:**

(i) Europe alone cannot curb the increase in global CO_2 emissions. Global action is required.
The specific emissions due to power generation in Europe (352 gCO_2/kWh in 2011 [1]) are already only half as large as those in e.g. China and the EU contribution to the global CO_2 emissions is currently only about 11%. So, the recently proposed implementation [2] of the 2050 Energy Roadmap [3], aiming, *inter alia*, at a reduction by 40 to 50% in the total CO_2 emissions of the EU by 2030, would correspond to an estimated saving of a mere 4 to 5% in global CO_2 emissions [4], even after decades of enormous investments. The impact of reductions in CO_2 emissions in the EU will therefore remain marginal and will be massively overcompensated by rising emissions elsewhere, unless other nations contribute their share in reducing CO_2 emissions.

(ii) An efficient expansion of renewable energy sources requires solutions for intermittency and storage.
The substantial CO_2 reductions recommended in the 2050 Energy Roadmap for the electrical power sector (as compared to 1990: a reduction of 57-63% by 2030 and 93-99% by 2050) implies a vast transformation of the existing power supply system in the EU (in which about 50% of the electricity production currently comes from fossil fuels) into either renewable or nuclear power or some combination. Already at the present level of penetration of renewables (~23% of the electricity production), solutions are urgently needed to tackle adequately the problem of intermittency. This will demand a combination of high capacity non-intermittent (e.g. nuclear, oil and coal fired) and flexible backup plants (e.g. gas, hydropower), large electrical energy storage capacities and substantial expansion of electricity distribution grids, including smart grids. Furthermore, the integration of this variable electricity supply is expected to become even more difficult as its percentage rises to above 30-40%. The expected change in the energy system is a colossal challenge (see e.g. [5]) and is expected to raise major technological and political issues requiring long-term perspectives and sustained investment in research and development.

(iii) The EU energy policy ought to be framed to strengthen Europe's economic position in the world.
The level of subsidies for carbon-free energy sources ought to be set to assist in promoting the necessary research and to provide a competitive environment for developments in new energy technologies. Excessive subsidies are currently causing high electricity prices that are far beyond those in other regions of the world, contributing to the on-going relocation of industry from Europe into other regions of the world with less expensive energy. There is growing concern over the accelerating relocation from electricity intensive industries in the EU into countries with lower environmental standards [6], leading not only to increased European unemployment but also to increases in global greenhouse gas emissions.

(iv) Europe can lead the global effort in CO_2 reductions by proposing and demonstrating an attractive and economically viable model.
In Europe we are facing a global challenge that requires a multi-decade approach, going beyond the present "European Energy Transition Model". This will require a coherent and sustained energy policy that strengthens the mutually beneficial relationship between education, research and innovation.

The Energy Group of the EPS therefore recommends the following:

(1) A review of current electrical energy subsidies in the EU.
A review of current electrical energy regulations in Europe (subsidies, feed-in tariffs, etc.) is urgently needed and should focus on supporting the internal energy market in providing clean energy at competitive prices. This implies in particular enhanced efforts in research and innovation for sustainable energy technologies.

(2) The inclusion of external costs when pricing electricity from all supply options.
The cost of various electricity production options should be correctly quantified by taking into account external costs, including an adequate carbon price, costs linked to societal and health risks and the additional costs inherent in the use of large amounts of intermittent power generation. This last point will become very important when implementing the 2050 Energy Roadmap, as it will be essential to have parallel development programmes for energy storage technologies (batteries, power-to-gas, etc.), back up power solutions, upgrades of distribution grids including smart grid technologies and energy efficiency measures (heating, cooling, light, …).

(3) An increase in R&D funding for sustainable technologies with a focus on developing an effective and economically viable low carbon electricity system.
R&D in improved technologies for the electricity sector together with Carbon Capture and Storage is a key to achieving a sustainable electricity future. The return on this investment will be a competitive advantage in the rapidly growing world market for sustainable technologies.

(4) Consideration of all non-fossil electricity options when discussing the EU energy future.
The present focus on the deployment of intermittent renewables should be complemented by developing and implementing other low carbon options, which are able to provide base load and dispatchable power to the grid (such as second generation biomass, geothermal, nuclear fission at present and fusion in the longer term). The objective should be to provide a balanced energy mix, which is economically optimized and ensures security and diversity of supply. Although the present policies on nuclear fission differ in individual EU countries, this option and the related know-how, remains globally important. An adequate level of research and technological competence must be maintained to keep open the option of building next generation fission reactors, in addition to fusion technology at a later stage.

(5) Negotiation of a global agreement for a reduction in worldwide CO_2 emissions.
The implementation of a globally relevant and economically viable future energy policy, agreed upon by all European nations, will strengthen the position of Europe as a leading party in on-going international negotiations towards a worldwide agreement on reducing global CO_2 emissions, together with other major greenhouse gases. Global emission reductions can only be achieved if all nations in the world assume their responsibility for mitigating greenhouse gas emissions.

(6) A revisit of the 2050 Energy Roadmap.
What is needed is a Roadmap that not only sets targets with defined dates in terms of amounts of installed electrical power, energy production and demand and emission reductions, but also takes into account technology development times, safety and socio-economic aspects of various energy technologies. As low carbon options become more competitive, the choice of the technology mix should increasingly be left to the market, taking into account national and regional differences.

(7) Fostering scientifically and factually based educational programmes for students and the general public on energy use and energy technologies.

The EPS calls for discussions on the EU Energy Policy and on these recommendations in all relevant contexts. The EPS also encourages strengthening the voice of scientific and technical knowledge in the field of energy, with the aim of assisting in the definition of a farsighted and effective energy policy.

References:

[1] CO_2 Emissions from fuel combustion, Highlights, IEA Statistics, 2013 Edition
[2]"A policy framework for climate and energy in the period 2020 to 2030", COM(2014) 015, EC Brussels, 22 Jan 2014
[3] "Energy Roadmap 2050", COM(2011) 885, EC Brussels, 15 Dec 2011
[4] EDGAR, Emission Database for Global Atmospheric Research (http://edgar.jrc.ec.europa.eu)
[5] F.Wagner, "Considerations for an EU-wide use of renewable energies for electricity generation", Eur. Phys. J. Plus (2014) 129: 219
[6]"Resolution and Report on renewable energies and economic competitiveness", EEA Consultative Committee, Ref. 1130862, Oslo, 8 May 2014; "Impact of energy and feedstock costs on the competitiveness of the chemical industry in the ARA-cluster", Essenscia, Brussels, 8 May 2014;"Development and integration of renewable energy: lessons learned from Germany", Finadvice, Aldiswil, June 2014.