POSITION PAPER

ANNEX:

KEY ROLE OF EUROPEAN ENGINEERS (FEANI) IN THE DEVELOPMENT OF A EUROPEAN ENERGY POLICY

MAY 2010
EXECUTIVE BOARD
FEANI

Key role of European engineers (FEANI) in the development of a European Energy Policy

1 EC goals for a European Energy Policy

European Energy Policy in accordance with the criteria established by the EC must achieve the following goals

- Ensure a secure energy supply
- Be sustainable and reduce greenhouse gas emissions by:
  - Energy efficiency
  - Renewable energy
- Develop energy technologies
- Consider the future of nuclear energy

2 Ensure a secure energy supply:

A priority goal of the European Energy Policy is to minimize the EU's vulnerability concerning imports, shortfalls in supply, possible energy crises and uncertainty with respect to future supply. Europe is becoming increasingly dependent on imported hydrocarbons and with "business as usual" the EU's energy import dependence will jump from 50% of total EU energy consumption today to 65% in 2030. Reliance on imports of gas is expected to increase from 57% to 84% by 2030, and of oil from 82% to 93%.

3 Be sustainable and reduce greenhouse gas emissions:

Energy accounts for 80% of all greenhouse gas emissions in the EU. It is at the root of climate change and most air pollution. The EU is committed to addressing this - by reducing EU and worldwide greenhouse gas emissions to a level that would limit the global temperature increase to 2°C compared to pre-industrial levels.

However, current energy and transport policies will mean that EU CO2 emissions would increase by around 5% by 2030 and global emissions would rise by 55%. The present energy policies within the EU are not sustainable.

Most of the trends in energy are included in The "Climate Package" approved by the European Parliament and the Council, and published in the Official Journal on 5 June 2009. The aim of the measures in the package is to reduce greenhouse gas emissions 21 % over the period 2005- 2020

The “Climate Package” outcomes are closely related to the energy criteria established in regulations:

- Reduction of emissions of CO2, which affects energy production in plants with solid and liquid fuels
- Reduction of emissions of CO2 in transport (cars, aviation, inland waterway vessels)
- Promotion of the use of energy from renewable sources
- Use of biofuels
- Geological storage of CO2

The above are covered by regulations described in Directive 2009/28/EC,

- Control of European energy consumption
- Increased use of energy from renewable sources,
- Energy savings and increased energy efficiency

3.1 Energy efficiency:
Reducing its energy consumption by 20% by 2020 is the objective the EU has set itself in its Action Plan for Energy Efficiency (2007-2012).

With regard to energy, the policy makers, the European and national administrations, the decision makers at different level in the economic activities, and the technicians (most of them engineers) have, in Europe, as their first responsibility the saving of energy and, secondly, improving the energy efficiency of industrial (in the broadest sense) processes.

To improve energy efficiency in industrial processes as well as in diffuse sectors the following must be taking into account. The implementation of the best available techniques (BATs), including the use of the most suitable available fuels, within an economically viable framework which takes into account the continuing competitiveness of industry.

Some measures which must be taken are:

• Implementation of energy audits as a procedure for identifying the sources of savings of energy.

• Development of legislation to encourage savings of energy, establishing requirements in the standards and procedures to ensure low consumption.

• Development of cogeneration, especially in residential and tertiary sectors which still have a high potential to make savings.

• Improvement of industrial processes and socioeconomic activities (transport, urban development, housing, etc.) to reduce energy consumption and production of greenhouse gases

• Implementation for each industrial sector of the corresponding BREF (Best Reference available techniques) developed by the EC and the stakeholders of the relevant sectors

3.2 Renewable energy:
In its Renewable Energies Roadmap the EU has set itself the objective of increasing the proportion of renewable energies in its energy mix by 20% by 2020. This objective requires progress to be made in the three main sectors where renewable energies are used: electricity (increasing the production of electricity from renewable sources and allowing the sustainable production of electricity from fossil fuels, principally through the implementation of CO2 capture and storage systems), biofuels (which should represent 10% of vehicle fuels by 2020), and finally heating and cooling of buildings.

In relation to the required increase in renewable energies to achieve the goals set by the EC, some priority measures are listed below.

• R&D in the technology of renewable sources like hydropower, wind power, solar power, biomass power, geothermal power, etc.

• R&D in diversification and the contribution mix of renewable energy.

• Development of mass storage systems that reduce the consequences of the interruptability of supply, thus reducing the need for fossil power backup.

• For a transition period, develope hybrid systems with fossil fuels to reduce interruptability. This could lead to hybrid generation with biomass fuel...

• Support from governments to achieve a real improvement in education and training in the relevant technologies to ensure that adequate use can be made of renewable energy technologies.

• Development of new energy vectors such as hydrogen, to extend the range of applications for each source of energy.

• The use of bioethanol should be analysed both in terms of life cycle which is well documented, and at the level of global problems of deforestation, reduced biodiversity and conflicts with food markets. Second-generation biofuels could be at least a partial solution to these problems.

• R&D to make use of the energy present in oceans and other water bodies in the form of waves, marine currents, tides, ocean thermal energy gradients or salinity gradients.

• R&D to improve the use of agricultural material such as manure, slurry and other animal and organic waste for biogas production has, in view of the high greenhouse gas emission saving potential, significant environmental advantages in terms of heat and power production and its use as biofuels.

In order to reduce greenhouse gas emissions within the EU and reduce its dependence on energy imports, the development of energy from renewable sources should be closely linked to increased energy efficiency.

It is necessary to set transparent and unambiguous rules for calculating the share of energy from renewable sources and for defining those sources. In this context, the engineers have a main task working actively in I+R+D.

4 Develop energy technologies:

Energy technologies play a central role in offering both competitiveness and sustainability in the energy sector while increasing security of supply The EU must therefore develop existing energy-efficient technologies as well as new technologies, in particular those devoted to energy efficiency and renewable energies (listed above).

Even if the EU considerably diversifies its energy mix, it will still be highly dependent on oil, coal and nuclear and must thus also pay particular attention to low carbon-output fossil fuel technologies, especially carbon capture and storage systems.

The Commission proposes an outline for a European Strategic Energy Technology Plan which will cover the entire innovation process, from the initial research to entry onto the market.

In relation with the development of new energy technologies, a non-exhaustive list is proposed below.

4.1 Fossil Fuels:

• Phase out the use of oil based fuel as an energy source in electricity generation and transport. It is especially necessary to intensify research in the transport sector into biofuels, natural gas, hydrogen and hybrid and electrical vehicles. Oil should be exclusively devoted to the manufacture of products.

• Gradual substitution of natural gas. In thermal generation it can be replaced by biomass and electricity production (mainly combined cycle) with integrated coal gasification combined cycle (IPCC).

• Massive use of clean coal technologies. The first scenario is to refurbish plants through the use of natural gas and the building of new power ultra supercritical, fluidised bed and in the adoption of integrated gasification combined cycle. In general terms the development of low carbon-output fossil fuel technologies. Technological development will allow these plants to incorporate CO2 capture and storage, and the creation of new plants using oxicombustion.

Coal can also be used for hydrogen production, which ultimately can be used as energy in the transport sector.

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4.2 Hydrogen:

• Need to continue research into hydrogen production systems with the aim of reducing costs.

• Mass production of hydrogen in the long term should come from renewable energies, although coal with CO2 capture and Generation III and IV nuclear is probably more competitive.

• Electricity generation by fuel cells has to be accompanied by CHP, and therefore has to be integrated into a scheme of distributed generation.

• In the long run the massive use of hydrogen should be aimed towards applications in transportation, for which the development of direct methanol cells is essential.

4.3 ICT, e –mobility, smart grids and electric cars

Information and communications technology (ICT) systems are the core of today's knowledge based society. Innovations in this area are adopted at tremendous speed and have been responsible for a quarter of GDP growth in Europe in recent years.

- ICT systems are responsible for 2% of global CO2 emissions and 10% of electrical energy consumption in industrial nations. To meet Europe‘s energy efficiency goals by 2020, it needs a high growth, low carbon economy. Research and rapid take-up of innovative energy efficient ICT solutions will be crucial.

- Intelligent metering systems that enable private and business customers to monitor consumption on-time and to recognize saving potentials are necessary.

- A low carbon society needs to be focused on the reduction of energy consumption and optimisation of operations and in the use of natural resources. For example, improving energy efficiency through upgraded technology, ie reducing power consumption through upgrade of the GSM network, modernization of switching systems for mobile communication, virtualisation (Dynamic Services), and smart metering.

- R&D into e-mobility and smart grids for energy management and battery-charging infrastructure for e-cars is required.

- Electromobility will become part of the energy supply network. Smart grids will help to increase the share of eco-friendly power generation. A prerequisite is the intelligent coordination of power generation, power distribution and electric vehicles as mobile energy stores. Because electric car batteries can be charged at variable intervals, daily and seasonal fluctuations in the share of renewable energies in the grid can be better utilized. The overall energy system will thus become more flexible and more eco-friendly.

- Electric vehicles (EVs) are propelled by an electric motor (or motors) powered by rechargeable battery packs. Electric motors have several advantages over internal combustion engines (ICEs): more efficient use of energy, environmentally friendly (not pollutant at point of use), have performance benefits, and most importantly EVs reduce energy dependence as electricity is a domestically generated..

Researchers and experts, most of them engineers, are working on improved battery technologies to increase driving range and decrease recharging time, weight, and cost. These factors will ultimately determine the future of EVs.

4.4 Carbon capturing and storage (CCS)

• Implement, in new and existing coal power stations, by building systems for CO2 capturing and storage, especially with technology IPCC for future hydrogen production.

5 Consider the future of nuclear energy:

Faced with increasing concerns regarding security of supply and CO2 emissions, nuclear energy has the benefit of being one of the low-carbon energy sources offering the most stable costs and supply. The decision whether or not to use nuclear energy is made by Member States. Nevertheless, the CE strategic energy programs emphasize the need to have a common and coherent approach with respect to security, safety and

non-proliferation as well as the dismantling of installations and the management of waste.

While bearing in mind that nuclear energy issues are not only technical but also political and social at national country level, some of the most recent technologies or those currently under R & D re listed below.

• Extension of the useful life of existing power plants (Generation II) to maintain the power and reduce the investment needed for new plants.

• Extend the life of existing nuclear power plants and increase to a reasonable limit the Generation III power stations.

• Construction of new power plants (Generation III) for better utilization of fuel and reduction of nuclear wastes, and greater security with less investment and shorter construction time.

• Promotion of research in advanced fission power station (Generation IV) to optimize a final solution to waste and to further increase security by avoiding the proliferation of power plants, accompanied by and an increase in economic competitiveness. This research is vital because the third generation power plants need to improve the adequate utilization of the fuel.

• Promoting research into fusion power, which may be the solution to cheap and clean electricity generation.

• Dismantling of installations and disposal and management of waste.

6. Key role of the European engineers

Engineers play a key role in all phases of the energy system, namely, innovation, R&D, fuels production, primary energy production, new energies, implementation of renewable energies, distribution, end use, environmental impacts, and wastes, as well as improving the efficiency of the use of the energy in machinery, transports, industrial processes and installations and finally promoting and facilitating the energy saving.

Once the trends and prospects of energy technologies, as well as the European and national regulations, are established it will be necessary to determine criteria for the solution of the energy problems in each country as well as at European level taking into consideration the optimisation of current technologies and the innovation, research, development and implementation of new technologies.

These criteria must take into consideration the preservation of the environment today and for future generations while continuing to improve economic and social conditions of our society.

This means that each country needs to establish a basket of energy suited to their abilities and technologies compatible with social and economic development and with environmental protection. For instance, there are three examples of statements which are made but which are not supported by evidence .

- coal is a dirty fuel,
- radioactive waste commits future generations to managing it

- renewable energies by themselves are capable of supporting the development of an advanced society.

On the other hand, it must be taken into account that recent UE legislation, the "climate package", has imposed certain requirements on countries.

Realising that no energy source can be the unique solution to the problem, but a country must invest in a basket based in the diversity of energy sources.

The knowledge and experience of the engineers can help decision makers to select an adequate basket of energy solutions which will avoid choices that may produce slow economic development in a country or region and avoid causing severe environmental damage.

Engineers have an essential role in achieving and promoting a deep understanding of all phases of the energy chain, which is technically called a "life cycle analysis". For this reason, some relevant criteria must be taken into consideration, such as:

- End-use of photovoltaic energy (PV) produces no CO2, but in the manufacture of the cells, the handling process of the silicon emit large amounts of CO2,

- Biofuels have a negative balance of CO2 emissions, but require an energy exceeding that of today's vehicles,

- Vehicles with hydrogen fuel cells which are derived from natural gas have overall energy consumption and CO2 emissions similar to today's vehicles. These examples demonstrate, that it is necessary to analyze all phases of the energy chain to select sources and technologies which can form a countries energy basket.

Two energy sources are particularly capable of mass production and are often rejected. These are coal and nuclear energy.

Coal is a clean source in the medium term when the technologies for CO2 capture and storage are mature. One of the earliest technologies is the integrated gasification combined cycle (IPCC), it allows hybridisation with natural gas to facilitate the stage of transition and beyond that the production of hydrogen.

Nuclear energy has reached a very high level of security with the new Generation III, which will be even greater with the Generation IV. As for waste, this is now controlled and in future may be "burned" in the Generation IV plants. It would be technically irresponsible to not at least maintain installed nuclear power by renovating existing plants of Generation III once the extension of its life is no longer viable.

Both technologies can be applied in future to other sectors such as transport, through using electricity to generate hydrogen.

Coal and nuclear energy illustrate the clear need for diversification, since neither can be used on an exclusive basis. For example, according to different studies, if a country abandons nuclear energy in favour of coal with capture and storage, the cost of electricity generation would be very high (about 80 €/MWh only part of coal) and possibly would not have storage capacity that in any case would have been saturated in 25 years; if the a country built massive nuclear power plants of III Generation, the cost of nuclear generation would be lower (50 € / MWh), but would produce a

significant reduction of stockpiles of nuclear fuel, which could be not efficiently utilized by this type of plants. That is why a country should consider both forms of production _ 17% installed capacity for coal and 28% for nuclear would consume about half the storage capacity for CO2, and would set the average cost of generation from these two sources as 55 € / MWh).

The technical complexity of energy alternatives must be considered and for that reason there is a need for well trained engineers for making decisions or providing adequate information to those who have the responsibility to make decisions.

Eengineers are deeply involved in all phases related toith energy technologies and they have a fundamental role to play.

This practical approach would be assisted by FEANI, through a deep and permanent collaboration with the EU Institutions in the field of energy, developing initiatives to provide in Europe an adequate number of well prepared professional engineers to meet the climate and energy challenges.

7. Summary of EU Energy directives, communications, initiatives and programs

- Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity from renewable energy sources in the internal electricity market
- Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings
- Commission Green Paper, 22 June 2005, "Energy Efficiency - or Doing More with Less" [COM (2005) 265 final - not published in the Official Journal].
- Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC
- Communication from the Commission of 19 October 2006 entitled: Action Plan for Energy Efficiency: Realizing the Potential [COM (2006) 545 – Not published in the Official Journal]
- Communication from the Commission to the European Council and the European Parliament of 10 January 2007, "An energy policy for Europe" [COM (2007) 1 final - Not published in the Official Journal]
- Commission Communication of 10 January 2007: "Towards a European Strategic Energy Technology Plan" [COM(2006) 847]
- Commission Communication of 10 January 2007 "Sustainable power generation from fossil fuels: aiming for near-zero emissions from coal after 2020".]
- Communication from the Commission of 10 January 2007 entitled “Renewable energy road map_- Renewable energies in the 21st century: building a more sustainable future” [COM (2006) 848 final – not published in the Official Journal]
- Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions of 22 November 2007 entitled: "A European strategic energy technology plan (SET Plan) - Towards a low carbon future" [COM(2007) 723 final - Not published in the Official Journal]. [COM(2006) 843

- Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions of 13 May 2008 – "Addressing the challenge of energy efficiency through information and communication technologies" [COM (2008) 241 final – Not published in the Official Journal]
- EU energy security and solidarity action plan: second strategic energy review (D.G. for Energy and Transport) (2008)
- Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020
- Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006 (Text with EEA relevance)
- Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (Text with EEA relevance)
- Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (Text with EEA relevance)
- Council's unanimous adoption of the Nuclear Safety Directive on 25 June 2009 sets up a common legal framework and a strong nuclear safety culture in Europe
- Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Investing in the Development of Low Carbon Technologies. COM(2009) 519 final (7.10.2009)