Statement on Energy and Climate Change

This statement was written by the WFEO Standing Technical Committee on Energy (energy@wfeo.org). WFEO represents nearly 100 nations and some 30 million engineers worldwide (www.wfeo.org).

Following the IPCC's analysis and in particular its latest messages on the urgency of implementing not only greenhouse gas mitigation policies but also adaptation policies to the consequences of climate change, this statement is based on the reasoned opinions of Engineering Communities devoted to the design of energy systems around the World.

1. Energy production and use is at the core of climate crisis due to the resulting greenhouse gas emissions and requires effective action in two main directions. These include:
   a. Searching for greater energy efficiency and usage restraint from energy production to consumption. It is essential to decouple economic growth, a source of higher standard of living, from energy consumption: all the scenarios conclude that a breakthrough is essential in the evolution of global energy intensity, which must move from an annual rate of -1 to -1.5 %, observed historically, to a rate of -4 or -5%.
   b. Decarbonizing energy systems, both on the supply and demand sides, by promoting low-carbon technologies.

   These two levels can be activated by technological choices and changes in behaviour, sometimes encouraged by energy policies.

2. Renewable energies (mainly solar, wind, biomass and hydropower) have to be applied and further developed. The fact is that none of them is without environmental consequences, sometimes less apparent than for other forms of energy. While the integration of some of them (wind or photovoltaic energy) into the electricity grids can be a source of difficulties due to their variability, others, on the contrary, are virtuous in terms of stabilizing the system (hydroelectricity with reservoirs). Most of them are not very dense, their large footprint is a source of local opposition, but they all have the advantage of having a low carbon footprint.

3. Nuclear power has a very low carbon footprint and is stable and reliable in operation. Like hydropower, it can produce massive amounts of decarbonized electricity and thus make a substantial contribution to energy systems decarbonization. Nuclear power is essential in the fight against climate change. Although, safety and radioactive waste management are frequently cited as concerns, these concerns can be managed adequately at present including the reuse of some long half-life wastes. The main challenge for energy policy makers and engineers is to restore nuclear power rightful place through information and debate.

4. Fossil fuels (coal, oil and gas), which are responsible for a large proportion of CO_2 emissions, still account for the largest share of the global energy mix. While it does not seem possible to eliminate them quickly and completely, particularly in certain sectors such as transport, or in certain countries, they could be a transition energy when combined with carbon capture, use and storage technologies.

5. Electrification is certainly one of the key drivers of the energy transition. Particular attention must be paid to electrical systems, especially to assure baseload. The decommissioning of conventional fossil power plants and the massive development of variable renewable energies may pose problems of continuity and quality of electricity supply. Backup power plants, cost-effective and efficient energy storage technologies, development of demand flexibility, and the development of electrical networks will be needed to overcome the variability problem of renewables. The issue of access to energy in general and to electricity in particular remains a major challenge in many regions of the

world, to which different answers are likely to be required, whether for the supply of large developing megacities or for isolated and off-grid sites.

6. The search for greater resilience of energy systems raises questions about land use, scarcity of water, or use of raw materials (copper, lithium, nickel, cobalt, nickel, zirconium, platinum group metals and rare earth elements) that might lead to their early depletion. The shift in the dependence of energy systems, both on the supply and demand sides, from fossil fuels to some raw materials, components and equipment is a new challenge to which answers must be found, particularly in terms of circular economy and industrial development.

7. Effective national energy policies and international co-operation will be essential to implement the most effective policies to achieve the Net Zero Emissions goal. While it is undeniable that developed countries still account for a large share of emissions, (33% in 2021 compared to 40% in 2011), demographic trends highlight the major role of developing countries: in 2050, there will probably be nearly 10 billion people on the planet, compared to about 8 billion today and this growth will be observed mainly in developing countries, which will account for 87% of the world population. The search for solutions must be based on a prospective vision of energy consumption - marked by an aging population and increasing urbanization (55% of the world's population live in cities in 2022, 70% in 2050) and associated emissions. Climate policy choices - including support by developed economies to developing ones - cannot be conceived outside a global framework and effort.

8. The choice to focus on solutions that contribute effectively and immediately to the fight against climate change should not make us forget:
   a. the indispensable research effort to develop medium or long-term solutions that will find their place in the future like facilities using decarbonized hydrogen, other zero-carbon fuel, improved efficiency in electric mobility and buildings, storage technologies including use of off-peak grid electricity, solar power towers, Small Modular Reactors and nuclear fusion. Regarding very low carbon hydrogen or synthetic fuels, further R&D needs to be carried out to deal with usages difficulties, including storage safety and flammability risk, before full use of its potentialities could be implemented;
   b. the increasing need to adapt the economies, and in particular the energy systems, to climate change in order to protect the energy production facilities from the threat of rising sea level and extreme weather conditions; the consequences of climate change are already being felt on river navigation, irrigation, hydropower and thermal plant cooling;
   c. the link between energy and the Sustainable Development Goals. The search for solutions provided by engineers sometimes leads to energy choices that are in conflict with other sustainability requirements such as biodiversity and protection of indigenous people's habitats.

9. The paths towards sustainable energy systems will require rational and rigorous method for making choices, far from any dream or ideology, and should be based on the following principles:
   a. Adopt a systemic approach;
   b. Exploit the best mature technologies and associated capacity building, whilst also encouraging innovation and new technology development;
   c. Emphasize the real potential of any new technology, its adaptability and the easiness to transfer such technology;
   d. Give more importance to economic efficiency when global economic and social crisis provoked by unforeseen situations leave all actors under financial constraints;
   e. Implement more international cooperation between developed and developing countries in the fight against climate change.

10. It is essential to have a balanced approach between economic progress, social justice and environmental preservation that is fundamental to the energy security of a country. This is sine qua non for the acceptance by the citizens of the country to implement energy policies.