Sustainable Development of Energy, Water and Environmental Systems

Under the pressure of security of energy supply and climate change, the European Union has started to implement a new energy-climate package of measures, reaching for obligatory targets of 20 % renewable energy in gross consumption, 10 % renewable fuels in transport, 20 % decrease of greenhouse gas emissions and 20 % increase of energy efficiency by 2020. It is only a stepping stone on the way to decarbonise the energy systems in the long run. Starting from 2018 newly-built and refurbished buildings will have to be energy neutral, meaning they will have to become very efficient in order to produce their own energy from renewable resources. The plan is to fully decarbonise power generation by 2050. The EU has also started to regulate CO_2 emissions per km driven for new vehicles, which will eventually force electrification of transport. In order to keep global warming under 2 °C, developing countries will have to decrease GHG emissions by 80-90 % by 2050. For Europe that will also mean significantly improving security of energy supply, regional development and increased employment in the European Union in new sectors, having positive macroeconomic and socioeconomic effects which will balance the increased energy cost in the short run. Europe has decided to engineer a way out of the fossil fuels trap.

These plans will have immense impact on mechanical engineering, which will have to enable technological revolution replace simple fossil fuel technologies with more complicated and efficient machines, often tightly integrated with its electrical, electronic and IT components. The buildings will become energy installations and power plants. Environmental protection and sustainable development will become the main area of application of mechanical engineering expertise. Renewable energies and energy efficiency will be the engine of growth in the XXI century. Engineering will come back to the central position in the economies of the future.

The Dubrovnik Conference on Sustainable Development of Energy, Water and Environment Systems, its 5th session with a record 400 papers and 320 participants from 55 countries, held in 2009 was dedicated to the improvement and dissemination of knowledge on methods, policies and technologies for increasing the sustainability of development, taking into account its economic, environmental and social pillars, as well as methods for assessing and measuring sustainability of development, regarding energy, transport, water and environmental systems and their many combinations. As sustainability is also a perfect field for interdisciplinary and multi-cultural evaluation of complex system, the Dubrovnik Conference has during the first decade of the 21st century become a significant venue for researchers in those areas to meet and discuss, share and disseminate new ideas.

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

The Report of the U.N. Brundtland Commission, Our Common Future, 1987.

This special issue of papers presented at the Dubrovnik Conference will try to help mechanical engineering researchers and experts to improve their insight into the problems and solution of the coming times.

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Guest Editor