Preface

The energy sector is now experiencing unprecedented changes and challenges of various magnitudes involving a range of fields. Limiting polluting emissions is a continuing process, especially in the European Union, where successive directives such as *Large Combustion Plants* and *Industrial Emissions* have set new and more stringent limits on emissions. Based on analyses of available techniques, plants are forced to invest in emissions abatement, which leads to higher costs for generated energy. Efforts to combat climate change are moving in the same direction. Over two decades after the adoption of the Kyoto Protocol, agreement on global efforts was reached at the 21st Conference of the Parties to the 1992 United Nations Framework Convention on Climate Change. Although the agreement does not impose decisive limits on greenhouse gas (GHG) emissions, it creates the obligation to undertake actions leading to a decrease in such emissions. Recently, the USA and China, which jointly are responsible for almost 40% of global GHG emissions, ratified the COP21 agreement. In terms of the energy sector, this means that fossil fuels should be gradually eliminated from the energy mix. The European goal is the domination of energy supplies by renewable sources by 2050. However, existing abundant reserves of cheap coal, a source which has no economic competitor, should not be forgotten. Despite being characterised by relatively high emissions and a negative impact on the environment and human health, coal will continue to play a role in energy supplies. However, since only clean coal technologies will be acceptable, improvements in efficiency and abatement technologies constitute a plausible path for coal use.

Air quality is becoming even more important in the case of Poland. While emissions from the energy sector are strictly controlled and have decreased substantially over the past two decades, so-called 'low emissions', mainly from domestic heating and transport, constitute a real threat, particularly in winter, when permissible concentrations are often exceeded. Polish society has become aware of possible adverse impacts on health and projects have been undertaken aimed at reducing the associated risks.

The introduction of support systems for renewable energy sources has led to an increase in their share of power generation. On one hand, this helps to mitigate the air quality problem, but on the other, RESs, which are still characterised by high capital costs and a low capacity factor in Polish conditions, contribute to increasing energy costs for the end consumer. Additionally, their intermittent nature requires completely new working conditions within the electricity supply system, mainly the more flexible operation of classic fossil generators to cover the residual load. Their unpredictability also requires the maintenance of backup capacity in a state of readiness to balance disappearing supplies. Development of high-capacity storage technologies could help to overcome the balancing problems.

Changes also involve energy-intensive sectors. Industry is continuously improving the efficiency of its processes, leading to lower energy consumption.

There is growing evidence that we will face a fuel changeover in the area of transport, from fossil-fuelled to electric vehicles (not, notably, for the first time in history), modifying demands for crude oil and electricity. All of these considerations barely scratch the surface of the problem.

The presentations, over one hundred in number, related to all important areas of the energy (energy policy, renewable energy sources, power systems and equipment, energy conversion and management, mathematical modelling in energy and industrial processes, energy storage technologies, and nuclear energy) and fuel (gasification of coal and solid fuels, biomass and biofuels, catalysis, methods of reducing pollutants during combustion of solid fuels, waste conversion and management, environmental protection topics, alternative fuel for fuel cells, electrochemical power sources) sectors were presented at the Energy and Fuels Conference 2016, held 21–23 September 2016 in Cracow, Poland and organised by the Faculty of Energy and Fuels, AGH University of Science and Technology, with the collaboration of the Institute of Thermal Power Engineering of the Cracow University of Technology.

Following a successful conference, we invited delegates to submit full-length manuscripts related to their conference presentations. The manuscripts were submitted for peer review prior to final acceptance for publication in the scientific journal *E3S Web of Conferences*. The editors address special warm thanks to the reviewers, who earnestly reviewed the papers and provided many valuable comments and remarks aimed at improving their quality.

We also thank the international scientific committee and members of the local organising committee of Energy and Fuels 2016 for their timely support.

We hope that the readers of the journal will find the presented papers interesting, useful, and stimulating for their future studies in the area of energy and fuels.

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