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"Gheorghe Asachi" Technical University of Iasi, Romania

A SPECIAL ISSUE DEDICATED TO

SUSTAINABLE ENERGY SYSTEMS BY OPTIMAL INTEGRATION OF RENEWABLE ENERGY SOURCES

This special issue of *Environmental Engineering and Management Journal* includes a selection of the peer-reviewed papers written in the framework of research project: *Sustainable energy systems by optimal integration of renewable energy sources* (TÁMOP-4.2.2.A-11/1/KONV-2012-0041). The project is implemented in consortium by University of Debrecen and Széchenyi István University, Győr. The project is co-financed by the European Union and the European Social Fund.

The aim of the project was to develop cost effective solutions for minimizing the buildings energy needs and for using efficiently the renewable energy sources in the building sector.

According to Directive 2002/91/EC, buildings accounts for more than 40% of final energy consumption in the Community and is expanding. This trend will lead to higher carbon dioxide emissions in this sector. The Directive 2010/31/EU highlights that measures to improve further the energy performance of buildings should take into account climatic and local conditions as well as indoor climate environment and cost-effectiveness.

The European Council of March 2007 emphasized the need to increase energy efficiency in the Union so as to achieve the objective of reducing by 20% the Union's energy consumption by 2020 and called for a thorough and rapid implementation of the priorities established in the Commission Communication entitled "Action plan for energy efficiency: realizing the potential".

That action plan identified the significant potential for cost-effective energy savings in the buildings sector. The European Parliament, in its resolution of 31 January 2008, called for the strengthening of the provisions of Directive 2002/91/EC, and has called at various times, on the latest occasion in its resolution of 3 February 2009 on the Second Strategic Energy Review, for the 20 % energy efficiency target in 2020 to be made binding.

Moreover, 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, sets national binding targets for CO_2 reduction for which energy efficiency in the building sector will be crucial, and 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 provides for the promotion of energy efficiency in the context of a binding target for energy from renewable sources accounting for 20% of total Union energy consumption by 2020.

According to International Energy Agency Report the residential sector is the largest consumer of natural gas in Hungary. As such, the supplies of natural gas are of paramount importance in the cold winter months, as many homes depend on gas for residential use and heating. Equally important, the transformation sector accounted for around 30% of gas demand. The commercial sector accounted for 17% of gas demand, and industry accounted for another 13%. Daily peak demand in winter is typically 75-80 million m^3/d (it was 74.3 million m^3/d in 2009). The historical record for peak demand was 91.7 million m^3/d, reached in 2005.

The outlines of a number of alternative energy technologies are currently taking shape, which may give rise to great expectations. Most of these, however, are not yet ripe for the market, even considering the continuous increase of the prices of fossil fuels, and would not be viable without substantial state subsidies. It is yet difficult to predict the exact point in time of the market-price inversion of traditional and alternative energy sources. The impossibility of predicting the future changes of the price of natural gas only adds to the complexity of the situation, as the energy supply of any country should essentially be based on an energy source or energy source mix available in a safe and predictable manner, at an affordable price.

The project entitled "*Sustainable energy systems by optimal integration of renewable energy sources*" TÁMOP-4.2.2.A-11/KONV-2012-0041 is so complex and covers several research fields: building services, building energetic, intelligent buildings, building informatics, environment, climate, cellulose-farming, energy law, use of water-waste water, cost optimum, society.

In the project 7 Hungarian researchers were involved, doctors of Hungarian Academy of Sciences. Furthermore, worldwide recognized researchers were involved from Denmark, Iceland, Italy, Japan, Romania, Slovakia, United Kingdom, and USA. In the 11 working groups more than 120 researchers were involved, out of them 30 young researches and a high number of PhD students.

The international DEnzero Conference and exhibition was organized two times during the project implementation. The attendants came from four (2013) and five (2014) foreign countries. Besides the national conferences, the researchers of DEnzero project attended and disseminated the project results at numerous international Conferences on three continents: Europe, Asia and America. The main results of DEnzero project research were presented in 103 Journal articles and 106 papers in Conference proceedings.

The pages of all articles and papers exceed 1200. At the Hungarian Akadémiai Kiadó a scientific book of 403 pages was published with the title: *Sustainable energy systems by optimal integration of renewable energy sources*.

The researchers of "Intelligent Buildings" working group developed an innovative solution for utilization of solar energy for heating and cooling purposes. During the project implementation collaboration agreements with five companies were signed in order to assure the consultation possibilities for our young researchers in questions related to practice. In order to ensure the success of our applications in the forthcoming years, collaboration agreements were signed with universities from Romania, Slovakia, Turkey, Japan, Denmark, Italy and UK.

The project is implemented in consortium by University of Debrecen and Széchenyi István University, Győr.
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Guest editor:

Ferenc Kalmár
University of Debrecen, Hungary

Ferenc Kalmár (1974) is college professor at the Faculty of Engineering, University of Debrecen, Hungary. He is head of the Department of Building Services and Building Engineering and vice dean responsible for scientific affairs of the Faculty of Engineering. He teaches courses in Building Physics and Indoor Environmental Quality. His research interests include analysis of comfort in closed spaces, optimization of heating systems, building physics, efficient utilization of renewable energy sources in the building sector. He supervises doctoral thesis in the field of building energy and comfort. He authored more than 180 scientific books and papers published in national and international journals or proceedings of national and international conferences. He is co-founder and Editor-in-Chief of *International Review of Applied Sciences and Engineering Journal*.