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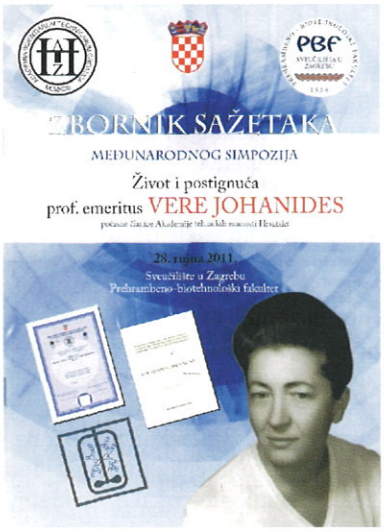
Remembering our Deserving Scholars

Prof. Emer. VERA JOHANIDES
Honorary Member
of the Croatian Academy of Engineering
1917 – 2000

In 2011 the Croatian Academy of Engineering marked the life and work of its honorary member Prof. Emer. Vera Johanides deceased in 2000 by a becoming symposium. On the occasion a memorial bust was unveiled in the park of the "House of HATZ", the headquarters of the Academy. In this way, the Academy paid tribute to one of its first members, a famous and recognized scientist in the field of biotechnology. This is the beginning of the ongoing activities of the Academy to remember our deserving members who have contributed throughout their life not only to Croatian science but also the world science in general. Namely, science knows no boundaries and is available to all people who by their actions tend to contribute to the prosperity of society, better and safer lives and welfare of the communities they live in. As the student of Prof. Vera Johanides from her first days at the Faculty of Technology and her partner at a later date I can proudly say that she has been just the person whose work deserves a lasting remembrance within the Croatian Academy of Engineering. Biotechnical Center of the Croatian Academy of Engineering was established just after her death and at the moment when the Croatian Academy of Engineering established the annual award for young researchers which carried her name and marked 10 years of uninterrupted award granting in 2011. Biotechnical Center of the Academy, together with the Faculty of Food and Biotechnology in Zagreb launched a project celebrating "the life and work of Prof. Emer. Vera Johanides" which, thanks to donors, members of the Academy and friends, associates of Prof. V. Johanides was successfully completed on November 21st, 2011. List of all donors is permanently inscribed on the memorial.



Prof. Emer. Vera Johanides died in August 2000 at the age of eighty-three. She died quietly, surrounded by her loved ones and thus did not provide the opportunity of parting from her with worm words to all those who knew her, who were her associates, who were her students, whom she throughout her life advised many times, directed to be better, to be even more successful.

During her life Prof. Vera Johanides collected a vast knowledge and experience which she selflessly passed on to her associ-

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ates and acquaintances to the last days of her life. The reader will perhaps only now for the first time learn something about the person who has in her long career of university professor trained a number of engineers, masters and Ph.D.s for industry needs, not only in Croatia, but also in all the areas which today have biotechnology built in development directions of their economy. Prof. Vera Johanides was the founder of biotechnology, and especially biochemical engineering in Croatia, which led to the founding of the first studies of biotechnology even back in 1956, the then part of the Faculty of Technology of the University of Zagreb.

She was born in Tompojevci, the municipality of Vukovar, graduated at Vukovar and stays permanently attached to the area. In 1999 she was one of the initiators and organizers of "The Ružička Days" in Vukovar. She finished her studies in Ljubljana where, by preparing her dissertation in the field of antibiotics in 1955, she acquired first experiences with antibiotics and industrial microbiology in general. She was elected Full Professor of Industrial microbiology and biochemical engineering at the Faculty of Technology of the University of Zagreb in 1964. As early as 1970 she participated in the organization of four post-graduate studies in biochemical engineering and the environment protection. Upon the establishment of the honorary title of Professor Emeritus she was among the first in 1997 to have received the highest rank of the University of Zagreb. Her scientific contribution consists of 110 scientific papers, 53 professional papers and several patents. As a member of many Croatian and foreign scientific societies she has been contributing to the promotion of science. She was vice-chancellor of the University of Zagreb, and for her scientific activities as the founder of biotechnology in this region and the contribution to biotechnology in the world she received many national and international recognitions and awards ("Lavoslav Ružička" and "Purkinja" Medals, Order of Merit for People with Silver Wreath, The City of Zagreb Medal, Charta Rabuziana Recognition, Fran Bosnjakovic Award). She was a signatory to the charter establishing the European Federation of Biotechnology in Interlaken on September 25th, 1978, the lifetime president of the Honorary Committee of Biotechnical Foundation of the Faculty of Food and Biotechnology of the University of Zagreb founded in 1996, and honorary member of the Croatian Academy of Engineering since 1993.

On the occasion of the symposium that was attended by donor representatives, Rector of the University of Zagreb, Prof. Aleksa Bjeliš, Ph.D. in his opening speech especially recalled the time when Prof. Emer. Vera Johanides was vice-chancellor of the University of Zagreb. Scientists from the Republic of Slovenia, Prof. Peter Raspor, Ph.D. and Prof. Aleksa Cimerman, Ph.D. pointed to a successful long term relationship with Prof. V. Johanides and declared her the First Lady of Biotechnology in this region.

Celebration of the work of Prof. Emer. Vera Johanides was jointly implemented by the Croatian Academy of Engineering and the Faculty of Food Technology and Biotechnology of the University of Zagreb in cooperation with the Biotechnical Foundation of the Faculty of Food Technology and Biotechnology, Croatian Society of Biotechnology and the donors from the industry. Organizing Committee consisting of the members of the Academy Prof. Marijan Bošnjak, Ph.D., Prof. Jasna Franekić, Ph.D., Prof. Srdjan Novak, Ph.D., Prof. Jagoda Šušković, Ph.D. and Prof. Đurđa Vasić-Rački, Ph.D. chaired by Prof. Jasna Kniewald, Ph.D. in a short period of three months has successfully performed this tedious task of organizing an international symposium.

Memorial bust of Prof. Emer. Vera Johanides is the work of sculptor Prof. Slavomir Drinković, Ph.D. whom we would take this opportunity to thank to, while future generations will assess the true artistic value of the work.

Although donors are listed on the pedestal of the memorial bust, we would also like to mention them here with gratitude since they have contributed to the task in this delicate moment for the economy. These are: Biotechnical Center of the Academy as coordinator and the Faculty of Food and Biotechnology of the University of Zagreb, Biotechnical Faculty of the University of Ljubljana – Republic of Slovenia, University of Zagreb, Faculty of Chemical Engineering and Technology Zagreb, Faculty of Food Technology Osijek, Croatian Society of Biotechnology, PLIVA Croatia Ltd., Zagreb Brewery Inc., the City of Zagreb, the City of Koprivnica, Biotechnical Foundation of FFB, the Center for environment protection and development of sustainable technologies of the Academy and the Foundation of the HATZ.

By departure of Prof. Emer. Vera Johanides all of us have lost, the science in Croatia and abroad have lost, our economy has lost. We are grateful to her for everything she has done. Based on the results of Prof. Vera Johanides young ones continue her journey and build their own and our future.

Prof. Emer. Zlatko Kniewald

Annual Assembly of the

CROATIAN ACADEMY OF ENGINEERING

26th Annual Assembly of the Croatian Academy of Engineering was held in the small hall of the Vatroslav Lisinski Concert Hall on May 17th, 2011 (previous 25th one was held on March, 27th, 2010).

Just before the Assembly, the **Central Ceremony of the 300th Anniversary of the Birth of Ruđer Bošković** was held in the Vatroslav Lisinski Concert Hall. Along with the guests, the celebration was attended by top officials of the Republic of Croatia, president of the Croatian Parliament Mr. Luka Bebić and Croatian President Prof. Ivo Josipović, Ph.D. We are glad and proud that the Croatian Academy of Engineering was one of the main organizers of this favoured and successful event. Special issue of the Bulletin of the Academy Tehničke znanosti/Engineering Power will be dedicated to the celebration of the 300th anniversary of the birth of Ruder Bošković .

The Assembly was attended by 105 members of the Academy and the distinguished guests of the academic community. The Assembly was opened by Prof. Stanko Tonković, Ph.D., president of the Academy. After the welcoming speech, the Assembly began its work with the most relevant information about events between the two assemblies (all supporting documents are available from the Secretariat of the Academy on the address – *hatz@hatz.hr*). On May 14th, 2010 the Academy received from the City Office for General Administration of the City of Zagreb, the decision on registration of change of the Statute in the Registry of Associations of the Republic of Croatia and a certificate from the same office. Thus, the new Statute of the Academy, and consequently the Regulations on the Election of Members of the Academy became officially valid. According to the new Statute a new categorization of membership in the Academy was carried out in the summer and autumn of 2010. The most important novelty was the termination of Associate Members of the Academy and the transition of Associate and Full Members into the unique status of the Full Member of the Academy. The procedure was successfully completed, except for a small number of Associate Members whose documentation is expected. During the summer and autumn of 2011 Departments of the Academy (special responsibilities of the Department Secretaries) were expected to perform a very important duty, i.e. review and update the list of each Department, make proposal to transfer Associate Members into the Full Members of the Academy (where there would be room) and propose new Associate Members of the Academy. Upon consideration of proposals submitted to the Governing Board and the adoption of proposals at the Presidency, it was decided to carry out the election procedures and for the Assembly of 2012 to become **elective** for new members and associates. The possibility of electronic voting permitted by the new Statute proved to be extremely effective.

A successful conference entitled "Engineering Ethics and the Croatian Economy" was organized by the Academy at the Faculty of Electrical Engineering and Computing of the University of Zagreb on January 14th, 2011. Academy Awards were presented at the special ceremony of the Assembly (separate report).

Prof. Stanko Tonković, Ph.D.

Croatian Academy of Engineering

ACADEMY AWARDS for 2010

Lifetime Achievement Award "THE POWER OF KNOWLEDGE"

Prof. Jasna Franekić, Ph. D.

Professor Jasna Franekić, Ph.D. is full time professor with permanent title at the Faculty of Food Technology and Biotechnology (PBF) University of Zagreb. She was born on February 16, 1945 in Čelopek, Republic of Macedonia. She took her A levels at the Zagreb grammar school (II. Gymnasium), her B.Sc. degree from Faculty of Science, University of Zagreb (PMF), Masters degree at School of Medicine at University of Zagreb and Ph.D. degree at Faculty of Science. She has been working as a lecturer at the University of Zagreb Food Technology and Biotechnology Faculty (PBF) since 1972 .She has been lecturing on 13 undergraduate and 8 postgraduate courses at PBF and PMF, including the role of the Head of Postgraduate Toxicology studies from 1994 to 2007. Prof. Franekić's research specialty is genetic toxicology whereby she has published 74 scientific articles, of which 34 in CC/SCI scientific journals (impact factor 1.1-4.5). Prof. Franekić led 7 scientific projects of which one is international and participated as researcher on three international ones. She was a visiting researcher at Istituto Superiore di Sanita Roma, Italy in 1986,1988 and1990. As mentor, she supervised 19 graduate theses (6 of which received Rector's award), as well as 10 M.A. and 4 PhD thesis. She prepared 255 Technological feasibility studies. Prof. Franekić is a member of numerous scientific societies in some she carries important functions. She is a member of European Environmental Mutagen Society where she was Yugoslavian (1989-1990) and later (2006-2010) Croatian councilor and a member of International Programme Committee (1997) as well as a member of International Union of Microbiological Societies, European Microbiological Societies, European Societies of Toxicology and Federation of European Genetic Societies where she was Croatian representative from 1994-1996. From 2005 to 2007 Prof. Franekić represented Croatian Natural Society at World Conservation Union between 2005 and 2007. 1994 – 1997 she was vice-president of Croatian Biological Society and 1988 – 2002 she acted as its president. From 1991 to 1997 she was secretary of Croatian Genetic Society, its vice-president from 2002 to 2007 and president from 2007-2011. She was collaborating member of Croatian Academy of Engineering (HATZ) from 1994, and as full member since 2010, she was on the Committee for Awards and is currently on the Committee for International Cooperation and acts as secretary in the Bioprocess Engineering Department. From 1998 to 2005 she was a Member of Matriculate Committee for Biotechnical Science and since 2005 a member of the Natural Science Committee. Since 1993 she has been a member of Committee for toxins (now biocide) of the Ministry of Health of Republic of Croatia. She has been on the Society of Zagreb University Teachers, Scholars and other Scientists Board and president of the Award Committee for young scientists. Among prof. Franekić's numerous tasks at her Faculty, she was vice-dean for education (1997 – 2000) and vice-dean for science (2000- 2002).

Prof. Franekić was a member of Organizing and Scientific Committee at 18 congresses, 4 of which international and 7with international participation, where she was president. For her long-term contribution on the editorial board of the Nature ("Priroda") journal, she received an award in 1991. In 2000 prof. Franekić received Croatian Natural Society "Zdravko Lorkovic Medal" and Croatian Academy of Engineering Award "Rikard Podhorsky".

Annual Award "RIKARD PODHORSKY"

Klaudio Pap , Ph. D., Associate professor

Klaudio Pap, Ph.D. is associate professor on the Faculty of Graphic Arts. He was born on March 20, 1963, in Zagreb. After graduating from secondary mathematical school he studied at the Zagreb University Faculty of Electrical Engineering from which he graduated in 1988, in the field of Computer Technique. He defended his Master's degree in 1997 at the same faculty (today's Faculty of Electrical Engineering and Computer Sciences) in the field of computer sciences where he also defended his Doctor's degree in 2004.In 2004 he was elected with the Zagreb University as a scientific assistant and assistant professor for Computer Typography and Computer graphics courses. In 2005 he becomes assisting member of the Croatian Technical Science Academy. In 2010 he becomes higher scientific associate and associate professor with the Zagreb University. Four (4) of his scientific articles have been published in journals quoted in tertiary publications, thirteen (13) in secondary publications, forty nine (49) scientific articles from international conference proceedings, fifteen(15) scientific articles from domestic conference proceedings, nine (9) chapters in books, and five (5) books. He has taken part and is taking part in five (5) scientific research projects and four (4) technological research development projects of which he is the project manager of one (1) scientific project, and was the project manager of two (2) technological projects. He is the co-writer of lecturing textbook publications, three (3) in

the form of books and one (1) digital textbook. During of his work he takes part in research work, in computer development and application in the field of computer graphics, image and text processing, modeling and simulation with computers, web technology, digital printing and graphic programming languages. He has taken part in introducing new technologies and has respectively held numerous seminars, lectures and courses linked with the topic. He is co-author of five (5) development products and six (6) software packages. He is the co-author of three (3) patents and he has been awarded with thirty two (32) awards, ranging from the diamond award for digital printing in 1996 up to numerous contemporary awards for the "Infraredesign".

Prof. Josip Marušić, Ph. D.

Born on February 3, 1943 at Jamena. High school completed in 1961 at Vinkovci. Prof. Marušić got a degree in 1966, obtained M.Sc. title in 1980, and a doctoral degree in 1986 at the Faculty of Civil Engineering University of Zagreb. From 1967 until the April of 1981 worked in a Water Management company "Bid – Bosut" at Vinkovci. Since 1981 has been working at the Faculty of Civil Engineering University of Zagreb: from 1981 to 1986 as a senior lecturer, until 1991 as assistant professor, as associate professor until 1997., as full professor until 2001 and as full professor in tenure since 2001. He was the mentor to 117 degree and 4 master thesis, and a mentor of 1 and co-mentor of 2 dissertations. Prof. Marušić was the head and lead researcher of 4 and collaborator in 6 scientific projects at the Faculty of Civil Engineering and Faculty of Agriculture, Zagreb. From 1998 to 2002 he was the head of the Department of Water Engineering, and again from 2006 to 2008. From 2002 to 2006 worked as a vice dean of education. An advisor in the matters of water management, a chief coordinator in the projects of Croatian Waters company and the Ministry of Sciences and Technology from 1992 to 2000. He published in total 235 papers: 47 on international level, 22 in the proceedings of HAZU, 26 chapters in books and manuals, 30 in proceedings of domestic conferences with international participation and 29 in domestic scientific journals, and 81 research and professional papers. He is the head of 16 Scientific and Organizational societies and a member of 47 Review committees and Editorial boards in Croatia (35) and abroad (12). Editor – in – chief of the scientific journal "HRVATSKE VODE", since1992. Since 1971 he has been a member of 7 and the head of 3 professional and scientific societies related to civil engineering and water management. He obtained 41 awards, diplomas, credentials and credits for working in professional and scientific societies, and for publishing papers in Proceedings. Prof. Marušić is a member of international associations ICID, IAH, IWRA, since 1993. Since April of 2002 he is a full member of the Academy of Technical Sciences of Croatia. From October of 2005 a full member of the Scientific Committee for Traffic of Croatia Academy of Sciences and Arts, a head of Symposium Organization Committee "Water Management in Croatia ", organized by HATZ, February 2009. 2009 obtained the Annual award for science for the popularization and promotion of science in the field of engineering, and for scientific work in the water management of the Republic of Croatia.

Award for Young Scientists "VERA JOHANIDES"

Igor Karšaj, Ph. D., Assistant professor

Igor Karšaj, Ph.D. was born on December 22, 1975 in Virovitica, Croatia. He studied at the Faculty of Mechanical Engineering and Naval Architecture (FMENA), University of Zagreb from 1994. For achievements during 1996 he received "Davorin Bazjanac Award" from FMENA. He graduated in 1999 as one of the best students in his generation for what he received "Medal of FMENA". In 2001 Igor Karšaj, Ph.D. was employed as a young researcher at FMENA. He finished his thesis "Numerical modeling of large strain elastoplatic deformations" in 2006. "Alexander von Humboldt" Foundation covered him costs of four months scientific exchange at *Institut für Baustatik, Universität Karlsruhe*, Germany. In 2005 he received "*The Young Researcher Fellowship Award for exemplary research in computational mechanics*" from MIT University, USA. Croatian Ministry of Science , Education and Sport awarded him as the best young researcher in 2005. Same year he received Annual award of Society of University Teachers and other Scientists of Zagreb for young researchers. From 2006 he doing research in biomechanical behaviour of soft tissue. Main goal of his work was modeling of formation and growth of abdominal aortic aneurysm. He attended Summer School IUTAM School on Biomechanical Modeling at the Molecular, Cellular and Tissue Levels at International Centre for Mechanical Sciences Italy. In 2008 he was Fulbright Fellow under which he spent ten months at Texas A&M University, USA. From 2009 is Assistant Professor at Department of Engineering Mechanics, FMENA. He already published 9 papers in CC/SCI journals and more than 20 papers at scientific conferences.

Marko Mužić, Ph. D., Research assistant

Dr. sc. Marko Mužic was born on January 02, 1976, in Zagreb, Republic of Croatia. He attended high school in Zagreb and graduated in 1994. That same year he enrolled at The Faculty of Chemical Engineering and Technology, University of Zagreb, and graduated in 2001 with the thesis titled "Basic parameters of the gasoil

hydrodesulfurization process" which he completed under the mentorship by dr. sc. Katica Sertić-Bionda, full professor. From 2001 he is employed at The Faculty of Chemical Engineering and Technology as an assistant working on the project "The improvement of ecological parameters of leather production" with the lead researcher dr. sc. Željko Bajza, associate professor. In 2001 he enrolled in postgraduate masters studies in chemical engineering at The Faculty of Chemical Engineering and Technology. From 2004 he is working on the projects "Liquid petroleum fuels with improved environmental parameters" and "Advanced processes of hydrocarbon fuels desulfurization" with the lead researcher dr. sc. Katica Sertić-Bionda, full professor. In 2004 he transferred to the postgraduate doctorate studies in chemical engineering at The Faculty of Chemical Engineering and Technology. In 2006 he successfully attended the Advanced Separation Processes summer school at the TU Berlin, Germany. He earned his Ph. D. degree in chemical engineering in 2009 with the dissertation titled "Advanced process for desulfurization of petroleum fractions". As a coauthor he published a total of 34 scientific papers in journals (14 CC) or conferences.

Goran Molnar, Ph. D., Research assistant

Dr. sc. Goran Molnar was born in Zagreb, Croatia, in 1978. In 1996, he finished mathematical high-school in Zagreb. In 2001, he received the Diploma Engineer degree in electrical engineering from the Faculty of Electrical Engineering and Computing, University of Zagreb, course Industrial electronics. For successful achievements during the study he received the Josip Lončar bronze medal. The doctoral dissertation entitled *Synthesis of systems with minimum time-domain distortion* he successfully defended on the Faculty of Electrical Engineering and Computing and, accordingly, he received the title of Doctor of technical sciences in the field of electrical engineering. For an outstanding thesis and successful research activities he received the Josip Lončar silver medal. Since 2001, he has been employed at the Department of Electronic Systems and Information Processing of the Faculty of Electrical Engineering and Computing, University of Zagreb. His research interests include analog and digital signal processing especially filter design, software radio receivers, and digital system design. He is the author of 14 scientific papers in the field of synthesis of Hilbert transformers, constant-delay systems, equalizers, and systems with prescribed impulse response. Since 2001, he worked on the projects *Analog and digital system design based on optimization procedures* and *Design and implementation of efficient methods for digital signal processing*, supported by the Ministry of Science, Education, and Sports of the Republic of Croatia, under the leadership of Prof. Mladen Vučić. In 2002, he was a researcher on the project *Implementation of processor cores on programmable gate arrays*, which was also leaded by Prof. Mladen Vučić.

Anet Režek Jambrak, Ph. D., Assistant professor

Anet Režek-Jambrak, Ph.D. was born on 26th of December, 1980 in Zagreb. She graduated at University of Zagreb, Faculty of Food Technology and Biotechnology (1998-2002). She enrolled to postgraduate study at Faculty of Food Technology and Biotechnology (2004) and defended PhD thesis (2008), title: "*Ultrasonic effect on physical and functional properties of whey proteins*", and achieved academic title Doctor of Philosophy, biotechnical sciences, field of food technology. She employed in 2003. at the Faculty of Food Technology and Biotechnology, Department of Food Engineering. She became assistant professor in 2009, and 2011 senior research scientist. In 2005, for the purpose of scientific training she worked at Coventry University, Sonochemistry Centre, UK. In June 2009, she was visiting lecturer and researcher at University of Avignon, France. Topic of researches was novel food processing techniques (ultrasound and microwave). She published 29 scientific papers of which 18 are in CC/SCI databases, 6 papers in secondary databases FSTA, CAB Abstract, 2 papers in congress proceedings and 3 professional papers. She reviewed more than 50 scientific papers in 11 journals and one scientific book. She is member of editorial board of 3 international scientific journals and associate editor of 4 international scientific journals. She is winner of the Annual award from Croatian government for the best young researcher for the year 2008, winner of Annual award of "Biotechnical foundation" for the year 2008. She is winner of the annual award of "The society of university teachers, scholars and other scientists – Zagreb" for the year 2007. She is winner of support of "Biotechnical foundation" for the year 2005.

Each winner has provided for her or his CV proof-reading.

AWARDED MEMBERS OF CROATIAN ACADEMY OF ENGINEERING

State Awards for Science for 2010

Prof. Vilko Žiljak, Ph.D., Full Member of the Croatian Academy of Engineering with his Team

Prof. Vilko Žiljak, Ph.D. and Assoc. Prof. Klaudio Pap, Ph.D. – members of the Croatian Academy of Engineering, as well as Assist. Prof. Ivana Ž. Stanimirović, Ph.D. from the Faculty of Graphic Arts and Assist. Prof. Jana Ž. Vujić, Ph.D. from the Polytechnic of Zagreb are the winners of the Annual State Award for Science for 2010 in the field of technical sciences for their scientific discovery "Creating Printing Colors for the Visible and Infrared Spectrum." Vilko Žiljak serves as Vice President of the Academy. This year the same group of authors has been awarded with a dozen of top awards in the world – in Kuala Lumpur/Malaysia, Moscow/Russia, the Republic of Moldova, Pittsburgh/USA, Seoul/South Korea and Taipei/Taiwan. In Croatia they have received following annual awards: "Gold Marten" of the Croatian Chamber of Commerce; the Mayor of Zagreb Award, the Croatian Inventors Association Award and "Eduard Slavoljub Penkala" Award. Following patents have been registered: "Protecting portrait reproduction with safety portrait", ZRGB device for dual detection and "Infrared printing with process colors". New security technology has been certified by application in several areas of industry. On the occasion of the INFRAREDESIGN innovation, PIRA – international organization with headquarters in London organized a conference "Security Printing and Alternative Solutions 2011" in Zagreb. International conference "Printing 2011", organized by the Center for Graphical Engineering of the Croatian Academy of Engineering, has been devoted in large part to the technology of a new proposal on the management of dyes.

City of Zagreb Award for 2011

Prof. Vladimir Medved, Ph.D., Croatian Academy of Engineering member

Member of the Academy of Engineering professor Vladimir Medved, Ph.D. E.E., received the City of Zagreb Award for 2011. Professor Medved was awarded for successfull longyear research, teaching and professional activity through which he contributed significantly to the quality of bioengineering and biomechanics of human locomotion, and to the affirmation of the Faculty of Kinesiology, University of Zagreb, also at an international level. He lead numerous research projects on healthy and pathological human locomotion. He is visiting professor at Salerno University, Italy, where a new human movement laboratory facility is being developed, results of which will be applicable both to handicapped persons and in sports. In USA, he published a book *Measurement of Human Locomotion*, in which he syntesized scientific and experimental approach to human movement, applicable in sport science and in medicine alike. He is one among editors of the respectfull journal *Kinesiology* (section *Biomechanics*), and a very active member of the Croatian Medical and Biological Engineering Society and the Croatian Academy of Engineering. In the Academy, professor Medved assumed duties of Secretary of Department of Systems and Cybernetics and of Administrative Secretary-General (in 2006 and 2007), while since 2008 he serves as Chairperson of the Committee for International Cooperation.

Each winner has provided for her or his CV proof-reading.

South-East Transport Axis (SETA)
European Project from South-East Europe Programme (SEE)

The SETA project is related to the significant needs of transport linking of the north and south Europe by a corridor between the Baltic and the Adriatic Sea.

The City of Rijeka and Croatian Academy of Engineering (Center for Traffic Engineering) are professional and consultative partners (i.e. 10% partners) from the Republic of Croatia. Other partners include institutions from Austria, Slovakia, Hungary, Slovenia, the Czech Republic and Italy, the project manager being the Government of the Province of Burgenland, Austria. Duration of the project is set from January 1st, 2011 to December 31st, 2013.

Croatia, as the South-Eastern, Mediterranean and Danube European country with outstanding traffic and geostrategic position, represents an important road bridge in this part of Europe and the area of connection of the TEN (Trans-European Network – EU project) and PAN (Pan-European) transport corridors.

Therefore, the optimum transport link between the Adriatic and the Baltic Sea is considered in the area of the north Adriatic ports in the direction of Zagreb and western Hungary east of the Alps and Central Europe (Vienna, Bratislava), and further to the Baltic ports of Germany and Poland (Figure 1).

Figure 1. *European region for optimal connectivity of the Adriatic and the Baltic east of the Alps*

The SETA transport corridor is essentially the first stage of research and development of important European traffic route Adriatic – Baltic, i.e. south-north Europe within which solutions are elaborated and sought for a significant part of the general European traffic route going from the north Adriatic ports, Croatian areas in particular and the port of Rijeka via Zagreb, Koprivnica, Varaždin and western Hungary east of the Alps to the MEGA hub of central Europe in the area of Vienna-Bratislava based on modern and fast rail transport network (Figure 2).

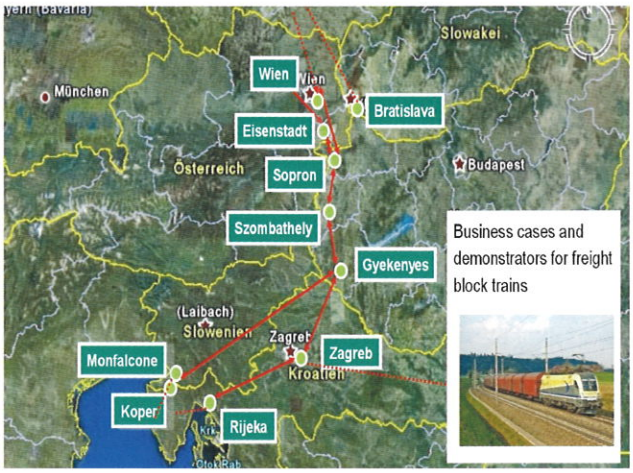

Figure 2. *SETA Transport Corridors*

At the same time the modernization of the railway line Rijeka – Zagreb and on to the Hungarian border is among top economic priorities of the Croatian Government.

With regard to the current traffic situation in Croatia, the EU-project SETA is a complete package which examines regional planning, infrastructure, intermodal sea/rail transshipment, development of the Adriatic ports, particularly the port of Rijeka, container terminals, warehouses, transport in the inner harbor with terminals in the hinterland in order to increase the capacity of the ports, modern train infrastructure towards Zagreb and the Hungarian border, marshalling facilities, connection to the river transport, optimal logistics solutions for the flow of goods and passengers within Croatia, as well as the inclusion in the network of European transport corridors.

At this stage of the project analysis of the transport infrastructure of the corridor in Croatia is being carried out, both of the current situation and the plans for improving the alignment of the corridor, intermodal transshipment and marshalling nodes, terminals, logistics and organization of the ratio in marine, rail and road transport, and databases for their processing are formed within a common transport model of all partners in the project.

Further considerations of transport needs and current requirements of individual users in the freight and passenger traffic are made along the corridor in sections from Rijeka via Zagreb to the Hungarian border, in order to align the traffic demand with the real supply of transport services in freight and passenger traffic.

At the same time the reasons for the emergence of bottlenecks in the intermodal hub for transshipment of cargo in

the maritime port of Rijeka are being examined, analyses are being made of the functionality of the logistics chain from the boat to warehouses and landfills or in particular the containers in the port (Figure 3), as well as further connections with dry terminals in the hinterland in order to reduce pressure on the environment and urban structure of the city of Rijeka and increase the flow of goods by land route corridor in the direction of Zagreb and the Hungarian border.

Figure 3. *Container Terminal in the Port of Rijeka*

Based on these studies, next steps in collaboration with other partners will be to define common methods for evaluation of proposed solutions and measures to remove bottlenecks, development of measures to increase capacity and efficiency in the freight and passenger traffic, as well as the feasibility and estimated degree of risk with continuous evaluation of environmental, energy, economic and financial parameters.

In order to raise the competitiveness of the transport route from the port of Rijeka, which has –with a natural depth of 20 meters – tremendous advantages for receiving the biggest ships in the Adriatic Sea, towards central and northern Europe to a higher level, it is necessary to develop the port of Rijeka and dry terminals in its surroundings in close relation to the modernization of the railway line to Zagreb and the Hungarian border, and to improve logistics and organization of transfer processes, thus increasing the efficiency of the entire multimodal transport chain.

Required research is also related to the parameters that are the basis for the definition and justification of realization of a modern railway transport corridor the starting point of which being a seaport. Key issues are related to the infrastructure, management of the road, taking the land and its impact on the environment, protection of existing facilities, used vehicles, energy consumption, technical and technological innovations on transshipment points in the port and dry inland terminals, logistics of intermodal connections of the maritime and rail traffic, port development, and statistical forecasts of expected development and justification of significant investments.

The participation of the Croatian Academy of Engineering on the SETA project has been motivated by several reasons. As an institution that brings together top experts in various technical disciplines it is extremely suitable for multidisciplinary projects, and in this particular case the area of transport, which has great significance in the economic development of Croatia. In connection with above mentioned a collaboration of the Center for Traffic Engineering of the Croatian Academy of Engineering has been established with the industry of railway vehicles Gredelj in Zagreb on the implementation of its prototype diesel-electric motor train for the Croatian Railways (Figure 4) as a pilot of passenger vehicles at the proposed SETA railway route Zagreb – Vienna.

Figure 4. *Diesel-electric motor train of TZV Gredelj, Zagreb*

In order to promote and introduce potential users in Croatia with the meaning and goal of the SETA project, such as national and regional institutions, the Croatian Railways, the Port of Rijeka, transportation companies, freight forwarding, freight terminals, etc., a national workshop on the topic has been organized and successfully held in the organization of one of its partners – the City of Rijeka.

Figure 5. *National workshop to introduce and promote the objectives of the SETA project in the City Council of the City of Rijeka on November 11th, 2011 under the auspices of the Mayor Vojko Obersnel, MA*

Prof. Nenad Dujmović, Ph.D.

News

5th World Science Forum
Budapest, Hungary

At the invitation of the organizer of the World Science Forum president of the Hungarian Academy of Sciences, Prof. J. Palinkas we participated in the work of the Forum which was held in the building of the Hungarian Academy of Sciences from October 16 – 20, 2011. The Forum was organized in order to review the development of an economy based on scientific knowledge, its abilities, social problems and long-term projections to 2030. The participants were acquainted with the projection of the population on earth of 9 billion in 2030, as opposed to today's 7 billion. Lack of food, drinking water, fuel, environmental disasters and climate change are problems that all the inhabitants of the earth will meet in the future. Therefore, this meeting under the auspices of the UN and especially UNESCO was organized at the highest possible level, in Hungary with the participation of the President of Hungary and president of the Hungarian Government, as well as the High Representatives and EU parliamentarians, ICSU, and the Princess of Jordan. At the opening of the conference the participants were addressed via a video link by the UN Secretary General Mr. Ban Ki Moon and the crew of the space station orbiting the earth, which indicated the importance and significance of the meeting.

Participation in this significant event was only possible at the invitation of the organizers. World Science Forum is held regularly every two years. This year's Forum focused on issues of "The Changing Landscape of Science: Challenges and opportunities". Particular attention to the event, attended by about 400 participants from around the world, was devoted by the Hungarian authorities say, Mr. Prime Minister Viktor Orban at the opening and the President of Hungary Mr. Pal Schmitt at the closing of the Forum. It was personally attended by head of the General Assembly of UNESCO Mrs. Katalin Bogyay Two Nobel Prize laureates also took active part in the Forum, i.e. Mr. Ahmed Zewail of the California Institute of Technology, and Mr. Yuan Tseh Lee as a scientist, and president of the ICSU (International Council of Science). General Discussion topics were grouped into five thematic groups as follows:

1. "The Changing Landscape of Science: Challenges and Opportunities",
2. "The Changing Landscape of Science: Emerging Powerhouses in Science and Technology",
3. "The Changing Landscape of Science: Emerging Fields of Science",
4. "The Changing Landscape of Science: Higher Education`s Perspectives, Dynamics and Implications",
5. "The Changing Landscape of Science: Policy Implications and Drivers"

In addition to five plenary sections, there were also seven thematic sections organized by individual associations as follows:

1. UNESCO: "The Changing Landscape of Science: Higher Education`s Perspectives, Dynamics and Implications",
2. Leopoldina: Emerging and re-emerging infections",
3. Hungarian Academy of Sciences: "Networks",
4. AAAS: "Developing a coherent and compatible science enterprise",
5. YOUTH-WAYS: "Scientific collaboration in changing landscape of science: new generation of science and researchers",
6. ICSU: Long term perspectives on international science "Forsight Scenarios: What will international science be like in 2031?",
7. Brazil: "Sustainable Food Production".

The work of individual groups was based on introductory lectures presenting problems and individual debate and discussion.

At the conference Zoltan Barabas – Federation of Biotechnology and Pannonian Plant Biotechnology Association presented "Hungarian White Paper – Plain Facts about GMOs," by E. Balasz, D. Dudits and L. Sagi, Szeged 2011, 136 pages, ISBN 978-963-08 –1066-1.

Organizers of the Forum chaired by Prof. Jozsef Palinkas President of the Hungarian Academy of Sciences suggested the adoption of "Declaration on a New Era of Global Science" and "Recommendations" for its implementation.

During the final session in the building of the Hungarian Parliament the proposal of a joint declaration with the guidelines for implementation was read and approved, and the audience was addressed by the President of Hungary Prof. Pal Schmitt, Ph.D. President of the General Assembly of UNESCO Mrs. Katalin Bogyay and Princess Sumaya bint El Hassan, president of the El Hassan Science City and the Royal Scientific Society of Jordan emphasized the importance of long-term decisions of this meeting, while a member of the European Parliament Mr. Paul Rübig said that the final declaration represented a commitment to the EU and its 27 members. Next year it should be joined by Croatia. Unfortunately the official representatives of the Republic of Croatia or the Government did not attend this meeting. The next meeting of the World Science Forum is to be organized by the Brazilian government in Rio Janeiro in 2013.

Prof. Emer. Zlatko Kniewald
Prof. Jasna Kniewald, Ph.D.

DECLARATION OF THE BUDAPEST WORLD SCIENCE FORUM 2011 ON A NEW ERA OF GLOBAL SCIENCE

WORLD SCIENCE FORUM

Budapest

PREAMBLE

With the encouragement and support of our partner organisations, the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Council for Science (ICSU) and all invited organisations and fellow scientists, we, the participants of the Budapest World Science Forum held from 17 to 19 November in Budapest, recognizing the relevance of the outcomes of 1999 World Conference on Science (WCS) and taking into account the reports of the biannual World Science Forum (WSF), as well as the debates and the outcomes of this World Science Forum on the "Changing Landscape of Science: Challenges and Opportunities", adopt the present declaration.

Text adopted by the 5th Budapest World Science Forum on 19 November 2011 (definitive version)

1. The treasure of scientific knowledge and its underlying research approaches are a common heritage of humankind. More than ever before, the world will be shaped by science.
2. The first decade of the third millennium has witnessed steady and fundamental changes in the global landscape of science. The scale and scope of these transformations are so robust that a new milestone in the history of science has been reached, and a new era of global science has commenced. This new era presents challenges and opportunities bringing political, social and policy implications on a previously unseen scale.
3. The growing complexity of grand challenges including population growth, climate change, food supply, energy shortages, natural and technological catastrophes, epidemics, and sustainability require that the world's scientific establishments assume new roles.
4. New scientific fields have appeared and continue to carve out their niches in the general field of science.
5. The unforeseen spread of information and communication technologies, the inexpensive and instant access to information resources and databanks, and the fall of communication barriers between countries and communities have accelerated the accumulation and dissemination of knowledge.
6. The former triadic dominance of North America, Europe and Japan in global knowledge production has been seriously challenged, and a new multipolar world of science has emerged accompanied by the rise of new scientific powerhouses, which are now not only prominent actors in world economy but have become key players in cutting edge research and development activities.
7. In this new context of global science, science diplomacy is now an acknowledged tool to promote partnership among nations by fostering scientific co-operation.
8. Educational systems have received strong support from their respective governments to the extent that emerging countries currently produce more university graduates and PhDs than the developed world thus rearranging the entire global "knowledge map". In spite of these new developments the US, EU and Japan are still leaders in scientific performance and continue to invest heavily in research and innovation. The competition is more intense and more open than ever before in the world arena of science.
9. The expansion of scientific networks has also changed the circle of actors participating in research activities. A field once dominated by states and their research networks of national academies, learned societies, and universities is now complemented by a complex network of global companies, international organisations, and individual researchers who are attracted to the best available research infrastructure.
10. The accelerating "knowledge economies" have generated new migration patterns for scientists and increasing mobility. Both the winners and losers of brain drain are facing the need for more intensive co-operation between universities, public research organisations, and industry in both graduate and post-graduate education and the elite training of scientists.
11. The advancements in science have also shed light on new and previously unforeseen concerns. Climate change, the large-scale and irreversible impact of human civilization on the world's fauna and flora, an overconsumption of natural resources, and their respective consequences require stronger involvement from both scientists and society. Developments in many research fields (e.g. genetics, biotechnology, neuroscience, nuclear physics, etc.) have considerable moral and ethical implications that require an urgent and global dialogue between scientists and the broader public.

RECOMMENDATIONS

In light of this declaration, we make the following recommendations:

1. Responsible and ethical conduct of research and innovation

   In this era of global science, the scientific establishment needs to implement continuous self-reflection to appropriately evaluate its responsibilities, duties and rules of conduct in research and innovation. A universal code of conduct addressing the rights, freedoms and responsibilities of scientific researchers, and the universal rules of scientific research should be shared by the world's scientific community. Furthermore, these rules and policies should be respected by the states and adopted by their national legislations.

   Scientists should strengthen their individual and institutional responsibilities to avoid possible harm to society due to ignorance or misjudgement of the consequences of new discoveries and applications of scientific knowledge.

   It is the responsibility of those who promote science and scientists to maintain the primacy of moral and social concerns over short-term economic interest in the selection and implementation of industrialised research projects.

2. Improved dialogue with society on scientific issues

   In times of rapid and fundamental changes in the social environment, the sciences should be supported in their co-operative efforts to describe and evaluate with the best available methods the consequences of policy actions and explorations of both natural and social sciences.

   Participation of societies should be promoted in order to make science more democratic and to build further trust in science. To this end societies must be prepared to knowledgably discuss the moral and ethical consequences of science and technology by strengthening policies to enhance awareness and public understanding of science and improving and broadening the scope of education.

3. International collaboration in science should be promoted

   Better international co-ordination is needed for science research projects focusing on global challenges. International co-operation is essential for decreasing the knowledge divide and regional disparities.

   The free co-operation and movement of scientists should be promoted by the elimination of harmful bureaucracy and false regulation and by providing the funds to further international co-operation.

   To avoid repetition, redundancy, and excessive expense in scientific research, the international scientific community should be involved in the development of an improved method to monitor past and present research activities and their results.

4. Collaborative policies to overcome knowledge-divides in the World

   The rapid development and increasing cost of science combined with the expansion of patent policies and regulations have further widened the knowledge and economic divide between the developed and developing world. In a world where the best science and the best researchers are attracted only by excellent research infrastructures, developing countries should be supported in their efforts to build their research capacities. However, co-funded actions for building capacities can only be successful if support is provided in a socially responsible way and if it creates a win-win situation for both the promoter and the recipient. Brain-drain and brain-gain policies should be co-ordinated for the joint benefit of all affected countries.

5. Capacity building for science needs to be strengthened

   Scientific discoveries are foundations for innovation and social and economic development. Investment in science provides a capacity for future development at a national level and an opportunity to face global challenges internationally.

   It is primarily the responsibility of governments to increase support for science and develop effective policies for technology and innovation.

   Comprehensive actions should be taken to strengthen the role of women in science and innovation and to expand the participation of women in science and science policy making.

   The socio-economic impacts of science and scientific capacity are well-documented. National parliaments and governments are urged to declare their commitment to seek scientific advice during the decision making process. An institutionalisation of such an advisory process is necessary; informed decisions result in great savings.

There is an urgent need to elaborate new, effective science policies at national, regional and global levels to better co-ordinate and monitor scientific research worldwide, to harmonise university education systems, and to facilitate global and regional scientific co-operation based on equity and participation.

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MÉXICO

19thCAETS Convocation

Preliminary Summary and Consclusions

June 30, 2011

CAETS

International Council of Academies of Engineering and Technological Sciences

DEPLOYMENT OF LOW-EMISSIONS TECHNOLOGIES FOR ELECTRIC POWER GENERATION IN RESPONSE TO CLIMATE CHANGE

Working Group Report
Executive Summary and Recommendations
1 September 2010

PROJECT BACKGROUND

The International Council of Academies of Engineering and Technological Sciences (CAETS) at its Council Meeting in Calgary, Canada, in July 2009 endorsed a project entitled *Evaluation of Strategies to Deploy Low Emissions Technologies for Electric Power Generation in Response to Climate Change*.

A CAETS Working Group was established comprising representatives of CAETS member academies[1]. At a meeting in Tokyo from 2 to 3 March 2010, members of the Working Group:

- Presented reports of the status of energy and electricity generation and related developments in their countries;
- Formed the view that there is limited extant evidence to enable a systematic evaluation of technologies for electric power generation in response to climate change, other than levelised cost of electricity and real option values; and
- Identified key issues for the deployment of low emissions technologies.

Following that meeting, members of the Working Group prepared a report entitled: *Deployment of Low Emissions Technologies for Electric Power Generation in Response to Climate Change*[2]. The report represents a joint effort to document the key technological issues being faced in the deployment of low-emission technologies for supplying electrical energy to meet the world's needs. The following Executive Summary, Collaboration and Issues and Recommendations are taken from the CAETS Working Group report.

[1] The representatives on the CAETS Working Group are listed below:
- Australia - Australian Academy of Technological Sciences and Engineering
  Dr Vaughan Beck (Chair) and Dr John Burgess
- Canada - Canadian Academy of Engineering
  Professor Robert Evans
- Germany – acatech
  Professor Dr Frank Behrendt
- India - Indian National Academy of Engineering
  Professor Hanasoge S. Mukunda
- Japan - Engineering Academy of Japan
  Dr Kozo Iizuka
- Korea - National Academy of Engineering of Korea
  Professor Myungsook Oh
- South Africa - South African Academy of Engineering
  Mr Willem du Preez
- UK - The Royal Academy of Engineering
  Professor John Loughhead

[2] See: www.caets.org

CAETS is the International Council of Academies of Engineering and Technological Sciences, Inc. It consists of those national academies of engineering and technological sciences that have satisfied an agreed set of criteria for membership.
It was established in 1978 and was incorporated as a charitable non-profit corporation in the District of Columbia (US) in 2000. Its Articles of Incorporation, Bylaws and Operating Procedures set down its objectives and governance arrangements. These documents and its membership and achievements are posted on the CAETS website, www.caets.org.

EXECUTIVE SUMMARY

There are massive technological and financial challenges involved in reducing greenhouse gas emissions from electricity generation while, at the same time, ensuring that sufficient electric power is available to meet the growing needs of the world. There are significant incentives and opportunities for CAETS to undertake collaborative work to facilitate the timely and cost-effective deployment of low-carbon generation technologies.

The primary challenge for the future of energy in a world combating climate change is that the global economy is predicted to grow four-fold by 2050, with commensurate benefits in improved standards of living, but the offsetting challenge that increased energy supply needed to support that growth must come from low-carbon-emission sources. Implementing low-carbon technologies on these scales will be costly, with high uncertainty and technical risk. Users will be paying a substantially higher price for the same service. The engineering challenge is also huge, to the extent that governments must provide strong leadership in technology development and deployment.

Financial modelling is a useful tool for evaluating critical energy generation and distribution infrastructure. A brief description is given of models that can be used to assess individual technologies and to aggregate a mix of technologies in response to demand scenarios. Because of the many potential low-carbon technologies and the variety of circumstances where they might be deployed, there is need for expert comment and evaluation of their technical and financial viability in order to inform public debate and government policy. This is a role that the engineering Academies around the world can undertake.

Electricity is increasingly being seen as the energy carrier of choice for transportation and there will be a movement towards an 'Electricity Economy'. The preferred means of road transport will most likely be the plug-in hybrid vehicle and electrical generation capacity will need to expand still further to meet this new market. To enable the increased use of low-emission technologies and to cater for the load-levelling potential of off-peak battery charging, the architecture of many existing grids will have to change, in particular with the introduction of smart grids.

With regard to the role of government, the relatively short timeframe, high risks and large costs involved in deploying new technologies mean that governments may need to take a leading role (for example, via policy development, regulation and funding support). At the basic R&D end of the development spectrum, there need to be further technical breakthroughs and cost reductions before renewable energy can supply a significant fraction of future energy needs. These will only be possible with continued long-term support by government. At the other end of the spectrum, innovative new technologies will need government support to continue to the demonstration and deployment stages, even though the decision to take a technology to that commercial stage is best made by the private sector. The global nature of energy and climate issues calls for more international cooperation, supported by governments, especially in the area of rapid deployment of low-carbon technology. Such international cooperation allows sharing of knowledge of the basic science and technology. Governments can also share the burden of investing in expensive demonstration projects.

More efficient combustion technologies, carbon capture and storage, nuclear power and renewables will all have a place in future low-carbon electricity generation. There are also many opportunities for improved efficiency in the end-use of energy, both by industrial and domestic energy users. Global deployment of existing best practice in energy efficiency would deliver enormous reductions in carbon emissions without large development expenditure or risk.

The less-developed economies will show the fastest growth rates in energy requirements. Each country will probably develop its own portfolio of electricity-generating technologies drawn from a wider global set. They will be forced to rely for some time on fossil fuels but will improve energy-conversion efficiencies through new technologies. Many now rely heavily on biofuels and more efficient production of such fuels will need to occur. Smaller, distributed generation based on renewables will continue to be a feature of electrical energy supply in developing countries. Nuclear power will make an increasing contribution to the energy mix. Small reactors without on-site refuelling may be especially appropriate for the needs of developing economies.

Renewable energy sources will make an increasing contribution to global electricity supply. However, the potential of renewable energy, over at least the medium term, is inevitably limited by its variability and large land requirements. Dependence on topography and natural endowments means that the contribution of renewables to national energy requirements will vary from country to country. The overall global picture shows a continued reliance on fossil fuels, with some nuclear generation, over at least the medium term up to 2030.

The distributed and intermittent nature of many kinds of renewable energy generation introduces new demands on the design of the whole energy supply system (including transmission and distribution). Measurement and control – using information and communications technologies – will be carried out within so-called smart grids, with demand management an essential component. Such systems will rely heavily on the availability and implementation of appropriate standards for physical interfaces, communication protocols and common data formats. Because of the associated information flows, the introduction of these new technologies into the power supply system will raise a suite of new social issues and concerns to do with privacy and individual freedom.

COLLABORATION

One of the main conclusions of the CAETS Working Group is that CAETS has a major role to play in acting as a hub for international collaboration of engineers, technologists and scientists in the crucial matter of providing the world with secure, low-emission electricity at the lowest possible cost.

That collaboration should include efforts:

- to convey to governments and the public the serious dimension of the technical challenges ahead;
- to develop better ways for selecting the best generating technologies;
- to encourage further development in key technologies;
- to disseminate authoritative information about the benefits as well as the costs of competing electricity generating technologies; and
- to influence governments to provide the level of financial support to ensure technological success.

The CAETS Working Group report contains a number of issues and recommendations for future CAETS actions. These all involve collaboration between member Academies as well as with other bodies. There should be collaboration on communicating the huge challenge posed by the future need for secure low-carbon electricity, on encouraging government investment, on developing better financial evaluation models for different technologies, on publicly disseminating technically sound information on energy technology issues and on setting priorities for further technology development.

ISSUES AND RECOMMENDATIONS

1. **ISSUE:** The generation of electrical energy must expand to meet the growing demands of the world for more energy, especially in the form of electricity. A global revolution is needed in ways that energy is supplied and used. In the face of that growth, greenhouse gas emissions from electricity generation must nevertheless be reduced. Governments and the public need to understand and acknowledge the massive technological, engineering and financial challenges involved.
   RECOMMENDATION: *The members of CAETS should collaborate in the vital task of communicating these challenges globally.*

2. **ISSUE:** While solutions to the problems of providing more electricity with lower emissions must reside in new technologies, the technological and financial risks involved are great. Accordingly, governments must provide strong leadership (for example via policy development and funding) to support further technology development and deployment.
   RECOMMENDATION: *CAETS should actively encourage and persuade governments to provide the required leadership, as well as communicate to both governments and the public the significant technical risks still to be overcome with technologies such as carbon capture and storage and geothermal energy.*

3. **ISSUE:** There is limited sound, objective evidence to support systematic evaluation and selection of competing technologies for electric power generation in response to climate change.
   RECOMMENDATION: As part of the strategy to advance knowledge in this field, *CAETS should lead an international cooperative effort to assess and improve quantitative methodologies for determining financial and technical risks associated with deploying new electricity generating technologies.*

4. **ISSUE:** There is a need for more informed public debate to enable formation of enhanced public policy.
   RECOMMENDATION: Using its favourable position for enabling international collaboration, *CAETS should lead and support the development and dissemination of authoritative information about electricity generating technologies in both its member countries and more broadly, in order to encourage informed public debate and public policy.*

5. **ISSUE:** While every means of reducing carbon emissions should be pursued, there are several priority areas for further technology development.
   RECOMENDATION: *CAETS should encourage focus on: Improved efficiency of energy end use and means of promoting efficient usage globally;*
   a. *Basic research leading to technical breakthroughs and cost reductions in renewable energy;*
   b. *Advanced nuclear reactors, as well as small nuclear reactors suited to distributed generation;*
   c. *Research, development and commercialisation of carbon capture and storage technologies; and*
   d. *New technology for electricity distribution networks, especially to optimise systems to handle fluctuating renewable sources and loads from charging electric vehicles.*

6. **ISSUE:** In view of the need for expanded use of nuclear energy for reducing emissions and meeting growing power needs, a global effort is required to ensure public understanding and resolution of major issues of concern in regard to safety and security of nuclear power generation.
   RECOMMENDATION: *CAETS should participate in this effort as well as cooperate in an exchange of experience in matters of safety and public attitudes in each country.*