# ENGINEERING AND THE FUTURE OF HUMANKIND

**A Statement by the**
**International Council of Academies of**
**Engineering and Technological Sciences (CAETS)**
**Beijing, China, June 2 – 4, 2014**

## Introduction

The 2014 International Council of Academies of Engineering and Technological Sciences (CAETS) Convocation and the International Conference on Engineering Science and Technology 2014 (ICEST 2014) were held in Beijing on June 2-4, 2014 with the cooperation of UNESCO. With the theme "Engineering and the Future of Humankind," the event provided a forum for 1,800 engineers, scientists, entrepreneurs and government officials from CAETS member academies and the international engineering community to discuss the development of engineering and technological sciences and the future of humankind. The delegates were pleased to hear the keynote comments of Chinese President Xi Jinping and UNESCO Director General Ms. Irina Bokova.

The CAETS participants agree that engineering has always been an engine for human progress and that it must play an even greater role in developing technologies that support human society, because of the accelerating change of the technological world and the global scale of the principal problems. Simply put, the value proposition for engineering is *"creation of solutions serving the welfare of humanity and the needs of society."*

In the past century, the unprecedented and brilliant achievements of engineers and scientists around the world benefited humankind, fundamentally transforming people's lifestyles, enhancing their ability to create wealth, bettering their quality of life and prolonging their life spans. The technological advancements of the 20th century, such as electrification, air travel, radio and television, the computer and the Internet, have contributed to a radical change in human society and the evolution of today's modern civilization.

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## Challenges for the Future

The participants agree that, with the rapid development of economic activity and population growth, humankind will continue to face new major challenges in areas such as resource management, energy, sustainable development, disease control and climate change. To modulate these daunting challenges, society looks to engineering, science and technology for solutions. The need for technological innovation will be increasingly urgent, and may even require disruptive transformations in some areas. Engineers around the world must assume unprecedented, significant responsibilities. Advancements always come at some cost, and the cost-benefit ratio is largely determined by engineering.

The world's population is growing steadily and living conditions in many countries and regions must be improved. Imbalance between the supply and demand of energy and other resources has become pronounced, as evidenced by consumption of traditional energy sources: coal, oil and natural gas. Major technological breakthroughs and developments in new and renewable energy, clean fossil energy, advanced nuclear energy systems, energy storage, and energy efficiency can only be derived through engineering.

Environmental and ecological problems that pose threats to human safety and welfare have become increasingly serious. These include climate change; stratospheric ozone depletion; unsustainable material use; loss of biodiversity; forest decimation; desertification; air, water and marine pollution; acid rain; resource recovery; and treatment of wastes. Enhanced environmental engineering efforts are needed, and all countries must adopt state-of-the-art technologies to address these issues.

Engineering must create solutions to other challenging humanistic and societal problems, such as disaster management, disease prevention and control, food security, information network security and strategies for countering terrorism. With innovation in engineering, science and technology, guided by the wisdom of engineers and scientists, humankind's dream of achieving a better life for all and overcoming challenges will impact and change our lives tremendously.

## Change is Accelerating

The participants agree that, with social progress and the continuous efforts of engineers and scientists, evolving technology will support a new wave of scientific and technological revolution. The accelerating rate of change in engineering, science and technology throughout the world will give rise to new development opportunities, thus more powerfully driving the change in the future for humankind.

In today's world, new discoveries are being made, and new technologies, products, processes and materials are being developed more rapidly than ever before. In this age of "big data," vast amounts of information are being analyzed to gain invaluable insight into complex systems ranging from individuals to society at large. Interdisciplinary and integrated developments in information technology, biotechnology, new energy sources, and new material technologies will create new development opportunities for humanity and society. New creations such as social media, which owe their existence to prior engineering advances, are emerging to address problems and opportunities that were unforeseen only a few years ago. Major breakthroughs bring vitality to global economic and social developments, lead to industrial and social

transformations, and accelerate modernization and sustainable development. The innovative potential of humankind has outpaced the imaginations of all.

## Recommendations

Participants in the CAETS Convocation and ICEST2014 reached consensus on the following recommendations. Engineers and scientists around the world are called to join in efforts to:

**1) Promote innovation in all areas of engineering, science and technology to achieve a better life for all on the planet.**

Innovation is in the soul of human history. Every major invention in human history, electric motor, airplane, high-speed railway, nuclear power, mobile communication, the Internet and satellites, and genome sequencing profoundly changed human society. To meet the significant challenges of today's world, the engineering community needs to create innovations of greater scope and wider dimensions, and involve more fields. Faced with opportunities and challenges, engineers and scientists around the world should have the courage to pursue truth, to elevate engineering, science and technology to create great contributions in the 21st century. Engineering can help achieve the post-2015 Millennium Development Goals defined by the United Nations.

**2) Work with and in schools and universities to strengthen engineering education and to develop a new generation of talented engineering practitioners.**

Engineers who master high technologies are an integral part of the foundation for economic and social development and a decisive force for overcoming the technological challenges facing society. To nurture such talents, every country should strive to provide multi-level engineering education, expand international contacts, train engineers, and establish a professional engineer certification system to enhance professionalism. The internationalization of engineers and the cultivation of engineering talent through major projects will address the growing need for technological innovation.

Creating new engineering talent by itself is not enough; we also need to expand the diversity of views and needs reflected in our engineering designs. The complex global issues faced by society will require a wide spectrum of inputs, and the engineering community must represent the diversity of the stakeholders it serves.

**3) Strengthen international cooperation, expand academic networks and learn from each other to address major challenges facing human society.**

We live in a "global village" with a common destiny. All countries share wealth and woe. An issue in one region can affect other countries and regions. Making the world better is our common aspiration. Engineering contributions to the common wealth should be for the benefit of the whole of humankind. Engineering innovation requires both the wisdom of individual engineers and the infusion of a variety of ideas from all sectors of societies in all countries. As natural and social conditions vary from one country to another, solutions to development challenges may differ. It is incumbent upon the global engineering community to strengthen international communication by using modern information technologies, and to carry out joint research on important, basic technologies for major projects, in order to achieve collaborative innovation that may benefit humankind. Scientists and engineers should cooperate in public-

private partnerships among government, industry and academia, fostering precompetitive research that combines resources and efforts and avoids duplication of basic research.

**4) Work with governments to ensure that resources are available to deploy technologies in support of global economic and social development and environmental sustainability.**
Governments should recognize the central role of engineering, science and technology in supporting global economic and social development, and should join hands to support common engineering progress, break down technical barriers, and encourage high-tech transfers — especially from developed to developing countries — in order to benefit all societies. Governments should coordinate and facilitate cooperation among institutions, companies, and technology users to promote the deployment of technological achievements globally.

Governments should create an environment that fosters entrepreneurship to support the rapid conversion of engineering and scientific innovation to improved standards of living for society. Such an environment, however, must adopt sustainability as a primary design paradigm; economic development *per se* can't be allowed to overwhelm the earth's life support systems.

**5) Promote awareness and engagement with the public; promote the value proposition for engineering.**
Engineering, science and technology cannot advance without the engagement and awareness of the public. The general public benefits from and is a powerful driving force in the development of engineering, science and technology. It is necessary to create a worldwide atmosphere for learning and for communicating knowledge of engineering, science and technology, and to enhance the public's awareness of engineering, especially among young people. Engineers must listen to the public's concerns about the impact of technology on people's lives, and take those concerns into account in their work.

To address the public confusion about "what is engineering?" the global engineering community should adopt a common statement describing the value of engineering: *"Engineering creates solutions serving the welfare of humanity and the needs of society."* This statement can be used in public documents and pronouncements to distinguish engineering from other technological endeavors.

**6) Promote improved living conditions in the developing world.**
Engineering advances have not benefited all populations of the globe equally. The engineering community needs to redouble its effort to assist developing nations to improve the standard of living for their societies and improve world commerce, so that all people can lead useful and productive lives. Increased efforts in public health engineering are needed to decrease child and adult mortality and morbidity by improving sanitation and water quality and enhancing public and medical infrastructure systems, among other vital initiatives.

## CAETS Member Academies

National Academy of Engineering (ANI) Argentina
*www.acadning.org.ar*

Australian Academy of Technological Sciences and Engineering (ATSE) *www.atse.org.au*

Royal Belgian Academy Council of Applied Sciences (BACAS) *www.kvab.be*

Canadian Academy of Engineering (CAE)
*www.cae-acg.ca*

Chinese Academy of Engineering (CAE)
*www.cae.cn*

Croatian Academy of Engineering (HATZ)
*www.hatz.hr*

Engineering Academy of the Czech Republic (EA CR)
*www.eacr.cz*

Danish Academy of Technical Sciences (ATV)
*www.atv.dk*

Technology Academy Finland (TAF)
*www.technologyacademy.fi*

National Academy of Technologies of France (NATF)
*www.academie-technologies.fr*

German Academy of Science and Engineering (acatech)
*www.acatech.de*

Hungarian Academy of Engineering (HAE)
*www.mernokakademia.hu*

Indian National Academy of Engineering (INAE)
*www.inae.org*

The Engineering Academy of Japan (EAJ)
*www.eaj.or.jp*

The National Academy of Engineering of Korea (NAEK)
*www.naek.or.kr*

Academy of Engineering (AI), Mexico
*www.ai.org.mx*

Netherlands Academy of Technology and Innovation
(AcTI.nl) *www.acti-nl.org*

Norwegian Academy of Technological Sciences (NTVA)
*www.ntva.no*

Slovenian Academy of Engineering (IAS)
*www.ias.si*

South African Academy of Engineering (SAAE)
*www.saae.co.za*

Real Academia de Ingenieria (RAI), Spain
*www.raing.es*

Royal Swedish Academy of Engineering Sciences (IVA)
*www.iva.se*

Swiss Academy of Engineering Sciences (SATW)
*www.satw.ch*

Royal Academy of Engineering (RAEng), United Kingdom
*www.raeng.org.uk*

National Academy of Engineering (NAE), United States
*www.nae.edu*

National Academy of Engineering of Uruguay (ANI)
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