WFEO MEETING REPORT
UNITED NATIONS CSD-14

A. INTRODUCTION

The Commission on Sustainable Development (CSD) of the United Nations met in New York from 1st to 12th May 2006 to start its second implementation cycle. This session, CSD-14, focused on progress in the following areas: Energy for Sustainable Development; Industrial Development; Air pollution/Atmosphere; and Climate Change.

B. WFEO PARTICIPATION

Appointed by former WFEO President, Dato Lee Yee Cheong, Jorge Spitalnik and John Tuohy, respectively Chair and Vice-chair of the Federation Energy Committee represented WFEO in this Session that was devoted to energy issues. Mr. Emilio Colon also represented WFEO in one of the CSD-14 sessions. Former President Dato Lee attended the meeting as an invited panelist to discuss issues related to "Electrification, including rural electrification: overcoming infrastructure, financing, policy and institutional barriers".

C. CSD CONSTITUTION

Since the creation of the CSD in 1992, non-governmental groups have been given important roles to play as partners in sustainable development with the overall purpose of informing the Commission's decision-making processes. Agenda 21 recognizes the following nine major groups of civil society: Business and Industry, Children and Youth, Farmers, Indigenous People, Local Authorities, NGOs, Scientific and Technological Communities, Women, and Workers and Trade Unions. These Major Groups attended CSD-14.

The scientific and technological community, which includes, among others, scientists, engineers, and policy makers, is being represented by both WFEO and ICSU (International Council for Science). Arrangements were made with ICSU delegates to make jointly agreed statements for this group, and to equally share the facilities assigned by the U.N. to the group.

D. PARTICIPATION OF SCIENCE AND TECHNOLOGY COMMUNITIES

The position taken by the WFEO delegation was to stress the eminently technical nature of the issues discussed in this cycle, that required a serious observance of scientific principles and engineering criteria when searching for solutions of sustainability and development, namely within the context of energy use and climate change. This position was agreed and followed by our ICSU colleagues. In Annex 1, the different interventions of the Group representatives are included.

a. Energy Issues

One of our main messages was that all available energy sources, if feasible, need to be considered in the quest for sustainable development provided they use technologies that

- in the case of fossil fuels, substantially reduce GHG emissions or are associated with carbon sequestration, or
- in the case of nuclear power, confine and control radioactive waste, and ensure highest state-of-the-art standards of safety and non-proliferation of nuclear weapon-grade materials, or
- in the case of hydropower, assure compromise designs for agricultural land usage and population displacement.

b. Climate Change

The WFEO delegation supported the ICSU position presented by a number of experts, mainly from scientific and academic sectors, attending as ICSU delegates. The message was that, from the viewpoint of the Scientific and Technological Communities, there is an urgent need to stabilize greenhouse gas concentration by requiring emissions to be only a fraction of today's levels, since a number of thresholds now being approached are likely to be dangerous in terms of ice-cap melting and global rise of sea level. Its consequences in Small Island Developing States (SIDS) can become extremely serious.

c. Capacity Building

The lack of sufficient competent manpower and expertise needed to improve and update energy supply and industry related technologies, was stressed by many developing countries. Capacity building programs WFEO is

engaged in, were brought up as examples of tools that might be considered to solve many such shortcomings. Also, to address some of the related deficiencies, the issue of mobility of Engineers was referred to.

E. MAIN ISSUES

After two weeks of presentations and discussions by Government delegates, U.N. officials and Major Groups' representatives, although no consensus or majority voting were sought out or asked for, the following issues and propositions reflect the main concerns of great number of participants:

Sustainable Energy

1. In order to meet basic human needs and facilitate achievement of the MDGs; it will be necessary to provide energy for all and access to reliable and affordable energy services, giving particular attention to the rural and urban poor, especially women, who currently have no access to modern energy services for cooking, heating and electricity.

2. There was overall agreement that a judicious mix of energy from all sources will be needed in order to meet the rising global energy demand with optimal efficiency, with advanced, cleaner fossil fuel technologies playing an important role. The importance of developing renewable sources of energy was highlighted, but it was also noted that it will be some time before renewable energy sources are able to deliver the large amounts of energy required for bulk energy needs for most countries.

3. The transition to cleaner energy technologies at affordable cost remains essential. Global energy needs are so large and energy prices so volatile that all energy options will need to be explored, while preserving the integrity of the environment and ensuring socio-economic development.

4. Emphasis on the need for energy diversification is recognized. However, since energy from fossil fuels will provide the dominant share of energy supply in most countries for the foreseeable future, the need for cleaner fossil fuel technologies is being stressed. A number of technologies, including carbon capture and storage and carbon sequestration are possible options. Hybrid options, using fossil- fuel energy in combination with other energy sources, may be feasible.

5. Energy efficiency is to be considered indispensable to enhancing industrial development. Many countries have made energy efficiency central to their sustainable development strategies, and some have taken action on efficiency standards, labeling and regulations. Changing unsustainable patterns of consumption and production, with developed countries taking the lead, including through corporate social and environmental responsibility, is deemed a pressing goal.

6. There is considerable scope for improving energy efficiency in households, the transport sector and industry, including the energy industry, and by changing consumption and production patterns, behaviors and lifestyles.

7. Action is required to promote energy efficiency, including end use efficiency, public awareness campaigns and better technology options, like bus rapid-transit systems and application of proper vehicle fuel efficiency standards. A good example of sustainable urban transport systems is the use, in Brazil, of ethanol produced from sugar cane as motor fuel, reducing oil imports, air pollution and greenhouse gas emissions. Most cars produced in the country now have "flex-fuel" engines capable of using any mixture of gasoline and ethanol.

8. The development, use and transfer of cleaner energy technologies, including renewable energy, cleaner fossil fuel technologies and advanced energy technologies, supported by stable, predictable regulatory frameworks, has to be strengthened.

9. Success in providing access to electricity in rural areas has involved in some cases granting concessions to the private sector and, in others, direct public management with costs shared by government, donors, communities and households. Both approaches utilized decentralized, off- grid electricity systems often with renewable energy technologies.

10. Insecure land tenure, including in informal settlements, was identified as a key barrier to expanding the provision of electricity in urban areas.

11. Advanced fossil fuel technologies, such as carbon capture and storage, will be important to reducing greenhouse gas emissions, and will require technology development and transfer, including thorough development cooperation and technical assistance. Various projects have demonstrated the potential of renewable energy sources for servicing the urban and rural poor, including solar water-heaters and small-scale photovoltaic

applications. Large-scale wind farms and combined-cycle solar thermal power plants also have great potential, but renewable energy still represents only a small fraction of total energy supply.

12. Measures like targets, economic incentives and regulations that have been used to encourage renewable energy sources, including geothermal, solar, wind, biofuels and energy conservation, can be further strengthened. Inter-connecting national electricity grids improve efficiency and promote greater use of renewables.

13. The African continent possesses abundant energy resources, particularly hydropower and other renewable energy sources that can be developed with the assistance of international cooperation. Exploiting those resources, however, will require considerable additional investment,

14. The critical role of science and technology in enabling to balance environmental protection and social development with economic growth was stressed, particularly for ensuring energy security. More technological cooperation is needed on advanced energy technologies, including advanced, cleaner fossil fuel technologies.

15. Although there are different opinions on the role of nuclear energy in providing energy for sustainable development, nuclear energy was identified by some interested countries as a GHG-free supply option. For them the challenge lies in ensuring environmentally sound, socially acceptable and cost effective solutions and in addressing nuclear safety, spent fuel and waste management as well as public concerns, on these issues.

Industrial Development

1. Achieving sustainable development goals requires energy use and industrial development but, in turn, they are major contributors to air pollution, atmospheric problems and greenhouse gas (GHG) emissions. Despite some progress in diversifying the energy supply, fossil- fuel based energy resources will continue to play a dominant role in the supply mix for the foreseeable future.

2. Many countries share a concern for energy security, which depends on the stability of supply, demand and pricing. In particular, the sustainable growth of industry depends on reliable, affordable, and sustainable energy supplies.

3. Strengthening South-South cooperation in the fields of renewable energy and advanced fossil fuel technologies was seen as a particularly promising option for information and data sharing on these technologies for the benefit of other developing countries. Such cooperation would benefit from effective assistance through capacity building and technological research and diffusion.

4. The international financial institutions may provide funding for feasibility studies and offer credit guarantees for cleaner technology investments in developing countries that would otherwise not be able to attract commercial financing. From the private sector, investments in modern energy for the poor and in clean energy from both fossil fuel and non- fossil fuel sources are needed.

5. Agriculture continues to be important to employment and GDP in many developing countries, and there is need to strengthen linkages between agricultural and industry, for example, through development of the agro-processing sector, including modern biofuels, and production of inputs for more sustainable agriculture.

Climate Change/Atmospheric Pollution

1. Significant climate change impacts are already being experienced in many parts of the world and building resilience and supporting adaptation measures, as well as reinforcing the functioning of the CDM, are an especially urgent need for vulnerable countries, in particular least developed countries (LDCs) and small island developing states (SIDS).

2. Rapid and more frequent climatic changes are now becoming increasingly apparent to most countries, and the next 5 to 20 years are expected to show more examples of adverse impacts, while current investments to mitigate the causes are said to be negligible.

3. Inadequate data-gathering, analysis and prediction is an obstacle to understanding and addressing climate impacts. This includes data on: (a) climate change impacts at the regional and national levels; (b) the short-term and long-term costs of inaction; and (c) impacts on LDCs and SIDS.

4. The value of reliable scientific knowledge and data for policy, planning and decision making is recognized as well as the need to maintain and improve global data collection and analysis capabilities related to the atmosphere/climate system and the impact of human activities on it. Hence, support for the work of the IPCC, Global Climate Observing System, the World Climate Research Program and the planned Global Earth Observation System of Systems is essential.

5. The lack of scientific research on the health impacts of many pollutants, as well as the limited research and development capabilities of many developing countries for improving their air pollution monitoring and abatement capabilities, is a serious barrier to reducing the health impacts of air pollution.

6. Cleaner energy technologies and renewable energy were emphasized for addressing the serious problem of urban air pollution, as well as problems of climate change.

7. Reducing air pollution, with particular attention to indoor air pollution from traditional biomass fuels and its health impacts on women and children, as well as outdoor air pollution, taking into account its relation to transportation, industry, urban development and energy production and consumption, needs greater priority. Expansion of modern energy services such as improved biomass and cleaner cooking fuels constitutes an important measure to mitigate indoor air pollution and to preserve the environment.

8. The rapid growth of private vehicle ownership in some developing countries, driven by population growth, economic growth and urbanization, is leading to increased urban air pollution.

9. In reducing energy consumption and air pollution and GHG emissions from motor vehicles, countries have made progress in (1) improving fuels and vehicle fuel efficiency and emission standards; (2) requiring catalytic converters and vehicle inspection and maintenance; (3) phasing out leaded gasoline; (4) introducing hybrid and flex-fuel vehicles in some countries; and (5) implementing long-term measures to promote a modal shift from road to rail transport.

10. Methods to address air pollution from international shipping and aviation need further consideration and development.

Major Groups & Capacity Building

1. Major groups' engagement at all levels, and major groups help to ensure that Governments carry out their responsibilities in attending to the social, economic and environmental aspects of sustainable development is encouraged and supported.

2. Special consideration is to be given to enhancing means of building capacities in developing countries, increasing the transfer of appropriate technologies, and strengthening education and training, with financial and technical assistance from developed countries and international organizations.

3. Insufficient research and development funding and low levels of appropriate technical skills affect the ability of developing countries to innovate, absorb and use advanced energy technologies, including advanced fossil fuel technologies.

4. Improving and simplifying CDM procedures could help to address community energy and sustainable development needs. Capacity building efforts would enable developing countries, particularly African countries and SIDS, to benefit more fully from the CDM.

5. The continued need for training, capacity building and promoting greater awareness regarding the advantages of energy efficiency in industry, government and households was highlighted. Capacity building and training aimed specifically at decision makers would enable better decision-making on public transport and infrastructure projects in developing countries.

6. There remains an urgent need for capacity building in science and engineering, enhanced funding for research and development, and support for climate-related observational networks. Technical training of engineers and workers is considered critical for competitiveness.

F. FOLLOW UP

These items and propositions will serve as starting points for the following Session of CSD (CSD-15) that will take place in 2007 to make recommendations and take decisions on the subjects of Energy for Sustainable Development; Industrial Development; Air pollution/Atmosphere; and Climate Change.

Jorge Spitalnik
Chair WFEO Energy Committee
26 May 2006

ANNEX 1
Group Members' Interventions

Joint WFEO-ICSU

3 May 2006

Quality of life is strongly related to available energy services. Meeting the world's rapidly growing energy demands will require utilizing a diverse mix of all available and feasible energy sources and technologies. This includes fossil fuels, nuclear energy, renewables as well as the need for energy conservation and efficiency. In fact it will require drastically increasing the efficiency with which energy is converted, delivered and used.

Although energy technologies are rapidly developing, it is widely acknowledged that existing solutions are not yet sufficient for meeting the world's growing energy needs in a sustainable manner. Much more work will be needed for a new generation of clean technologies for heat, fuels, and electricity to reach the mainstream market. These advancements must be supported with great urgency.

Some examples of important energy R&D topics are:

- In the field of photovoltaics, achieving cost reductions for highly efficient silicon and thin film solar cells.
- As regards biomass, increasing the efficiency and versatility of combustion and gasification systems.

For countries which want to include nuclear energy among the energy sources , a new generation of nuclear power plants is being developed that address the issues of waste disposal, safety and nonproliferation of nuclear materials. However, priority must be placed on increasing the share of modern renewable technologies in the world's energy mix.

Air pollution results primarily from the combustion of fossil fuels, from various industrial emissions, and large -scale biomass burning in some parts of the world. In addition to the urgent need to develop clean technologies for reducing greenhouse gas emissions, it is also critical to develop technologies that reduce as much as possible air pollution. Current scientific understanding on the impacts of air pollution on human and ecosystem health provides ample evidence to warrant urgent action.

The scientific and technological community would like to emphasize that there is scientific consensus, documented in the reports of IPCC, that the increase in greenhouse gases in the atmosphere due to human activities is altering the Earth's climate, bringing about a general global warming.

Even if greenhouse gas emissions were stabilized at present levels, the global warming trend and sea level rise would continue for hundreds of years, due to the atmospheric lifetime of some greenhouse gases and the long timescales on which the deep oceans adjusts to climate change.

Consequently, action is needed now in order to reduce greenhouse gas emissions. Urgent action is needed also to design and start implementing strategies to mitigate and adapt to the consequences of climate change, both in relation to environmental impacts and socioeconomic consequences.

The scientific and technological community has identified in its discussion paper presented to this CSD session a list of obstacles to accelerate progress in the areas of energy, air pollution, climate change, also in the context of industrial development. We would like to highlight here only three of these obstacles:

- The need for major capacity building efforts in science, engineering and technology:
- The vast majority of R&D work is carried out by a small number of industrialized nations.
- The need for enhanced R&D funding. For instance, government investments in renewable energy resources have been declining since the mid-1980s, and the share of public R&D support directed towards renewables needs to be increased.
- The need for enhanced support to climate related observational networks and international scientific cooperation programs. It is deplorable that in its 3rd assessment report in 2001, IPCC reported that observational networks were declining in many parts of the world.

11 May 2006

Climate change is real. The increase in greenhouse gases in the atmosphere, due to human activities, is indeed altering the Earth's climate, bringing about a general global warming. This is documented in the reports of IPCC.

Consequently, the actions aimed at reducing greenhouse gas emissions, which are discussed at this CSD session, are overdue. Urgent action is needed also to design and start implementing strategies to mitigate and adapt to the

consequences of climate change which we will not escape, both in relation to environmental impacts and socio - economic consequences.

There is a need for enhanced support to climate related observational networks and research at all levels, in particular international scientific cooperation programs and assessments.

Some of the most important international scientific undertakings were referred to already this morning by the WMO representative. It is deplorable that in its 3rd assessment report in 2001, IPCC reported that observational networks were declining in many parts of the world. We hope that the launching of the Global Earth Observation System of Systems (GEOSS) will lead to more and better climate related data and information. We must make sure that the developing world will also benefit from GEOSS. In this vein, we welcome efforts made to follow-up the climate change related commitments agreed by the G8 summit meeting in Gleneagles, UK, in 2005, including the specific support for climate data and interpretation for Africa.

Quality of life is strongly related to available energy services. Meeting the world's rapidly growing energy demands during the coming decades will require utilizing a diverse mix of all available and feasible energy sources and technologies. This includes fossil fuels, nuclear energy, renewables, as well as the need for energy conservation and efficiency. In fact it will require drastically increasing the efficiency with which energy is converted, delivered and used.

The world needs cleaner energy technologies, including cleaner fossil fuel energies. Enhancing R & D efforts in the field of modern renewable energies, in order to increase the share of renewables in the world's energy mix is a particularly urgent priority. Countries which decide to include nuclear energy among their energy mix must implement all appropriate regulatory measures addressing the issues of safety, waste disposal and nonproliferation of nuclear materials, including the application of state-of- the-art technologies to this end.

Although energy technologies are rapidly developing, it is widely acknowledged that existing solutions are not yet sufficient for meeting the world's growing energy needs in a sustainable manner. Much more work and innovation will be needed to bring about in the future a more revolutionary change of energy technologies for heat, fuels, and electricity. An example is hydrogen use in cars and public transport. These advancements must be supported with great urgency.

The Scientific and Technological Community has identified in its Discussion Paper presented to this CSD session a list of obstacles to accelerate progress in the areas of energy, air pollution, climate change, also in the context of industrial development. We would like to highlight here only two of these obstacles which must be addressed with priority:

- The need for major capacity building efforts in science, engineering and technology. The North-South gap in S&T capacity continues to widen. Governments concerned in developing countries should increase public investments in higher education and in R & D. North – South S &T cooperation should also be enhanced significantly, as well as relevant South – South cooperation.
- The need for enhanced R&D funding. For instance, government investments in renewable energy resources have been declining since the mid -1980s. In this respect we welcome initiatives such as REN21 and offer to provide scientific advice and input. To this end, we are launching in 2006 an International Science Panel on Renewable Energies and organizing an International Conference on Engineering for Sustainable Energy in Developing Countries, to take place by mid-2007.

In conclusion, Mr. Chairman, the S & T Community is committed to work nationally and internationally with governments, the private sector, all our Major Groups partners, and all relevant stakeholders towards finding scientifically sound and thoroughly engineered solutions to the problems addressed in this CSD cycle.

12 May 2006

During the coming decades, poverty reduction and socio-economic development will bring about rapidly growing world energy demands. Within a couple of decades, energy demand in today's developing world will overtake the demand of the developed countries, as implementation of MDGs is fulfilled. At the same time, we must achieve major reductions of greenhouse gas emissions.

Science and Technology will be essential to address these problems and to find solutions to ensure meeting the increase of energy demand in a sustainable manner.

The Scientific and Technological Community is committed to work with all other stakeholders to this end on the basis of scientific principles and engineering criteria.

WFEO
2 May 2006

Yesterday's panelists and today's session emphasized the relevance of supplying energy to small villages and rural areas in developing countries. However, in many developing countries, another problem exists that overshadows the energy supply to less densely inhabited areas. This problem is created by the huge poor rural inflow into main cities, resulting in concentrated energy needs in emerging slums in major cities and megacities. This demand can involve larger numbers of people than in the first case. Technologically, the solutions are different. In the geographically distributed case, small units are feasible favoring renewables use. In the second, the solution would go through large sized units not necessarily favoring renewable use. What comes as a first option to be solved is not for us to recommend but it is a dilemma for governments to deal with.

In any case, scientists, engineers and technologists of the Scientific and Technological Communities are able to give solutions that are right and feasible.

5 May 2006

Let me refer to the issue of Mobility of Engineers, a mechanism that is closely related to regional capacity building. Programs are under way to allow engineers chartered in a given country to practice professionally in another country, of course, under appropriate institutional agreements.

Developed countries in Europe and in the Pacific-North American region have already adopted programs of this type. Also, the countries of the American Hemisphere are developing a program to create the so-called "Engineer of the Americas". These activities and examples could be considered or followed in other developing regions of the world to compensate for the lack of sufficient competent manpower and expertise needed to improve and update technologies that were imported by countries of such developing regions. This lack of manpower and expertise was an obstacle or constraint repeatedly stressed in several occasions during this week's meetings.

8 May 2006

Technologies on energy production for SIDS need to start from effective programs in demand management and utilization of newer home and commercial buildings and equipment, as well as newer technologies which are more efficient energy users. Unfortunately many of the equipment made available are older technology and higher energy users because of costs and not viable anymore in developed countries. Reductions in the order of 20 to 30 % can be readily achieved.

Through Capacity Building efforts, SIDS can implement policies and programs to teach large populations on the use of the newer equipment and schemes for energy efficiencies. Utilities tend not to promote energy conservation because of its impacts on revenues and rate of return of current investments. Co-generation and other efficient energy production schemes need to be put in place and promoted by the lending institutions to reduce the initial costs, and placing part of repayment towards the end of the repayment period-following the Ballon approach.

The Technological Community, through WFEO, has started programs dealing with communities on energy infrastructure development, as well as its associated water and sanitation sectors. The initiative of Mobility for Engineers will assist in the technology transfer efforts.

ICSU
3 May 2006

At the beginning let me underline that we agree perfectly with the comment of the Brazilian delegate: Renewable energies – if correctly applied – are ecologically benign and constitute sustainable energy sources in the strict sense of the word.

In the following, I will concentrate on the cost aspects of renewable energies. In part – but not in all cases – the costs of renewable energies are higher than the costs of energy from non-sustainable sources. However, this is not a law of nature. As markets grow, costs will decrease. For many renewable energy technologies we see market growth rates of 30% per year (or even higher). At the same time, we determine promising learning curves, i.e. considerable price reductions. Further strong cost reductions will be guaranteed through science and technology:

As regards components of the energy system, this will happen through (i) higher efficiencies in energy conversion, (ii) lower material consumption (especially material sciences will play an important role), (iii) optimized manufacturing technologies and (iv) perfected new sustainable energy conversion paths.

In the overall energy systems area, the development of intelligent grids will be of crucial importance. Intelligent grids and distributed energy generation will (i) help levelling out statistical fluctuations from solar and wind energy and will (ii) adjust the load pattern – especially by means of load management – to the energy generation characteristics of the supply systems.

Optimizing the science and technology system – including the educational sector - in all countries will help to set up local manufacture of components of renewable energy systems. Eventually local production will help to make technology implementation easier in most cases.

4 May 2006

I am speaking as Chair of the Joint Scientific Committee of the World Climate Research Program. We are glad to hear of the recognition by the panel that climate change is a "here and now" issue and not just and issue for the future.

The scientific evidence and understanding makes it clear there are two major challenges society must confront urgently.

The first of these is the urgent need to mitigate to prevent the most severe impacts of climate change. Stabilization of greenhouse gas concentration requires future greenhouse gas emissions to be only a fraction of today's levels. We are approaching a number of thresholds which are likely to be considered dangerous. For example, we are dangerously close to reaching the threshold, or tipping point, where ongoing and essentially complete and irreversible melting of the Greenland ice sheet is inevitable. While this may take centuries it will eventually lead to a sea level rise, especially when combined with ongoing ocean thermal expansion and contributions from the West Antarctic Ice Sheet, which will be measured in meters. We must act soon if we are to avoid this and other potential calamities.

There are many options available for reducing greenhouse gas emissions. It is not a matter of which of these options is most effective. Given the magnitude and urgency of the task we will need to employ all options.

The second major challenge is how to adapt to ongoing climate change. Even if we do manage to reduce emissions significantly, there will be ongoing climate change. The impacts of climate change are already being felt and they will extend centuries into the future. Society needs to understand and predict climate change at the global, regional and local level if it is to effectively adapt to climate change. We have a reasonable understanding of climate change at the global level but there is an ongoing challenge to provide better understanding and predictions at the regional level to inform and underpin sound adaptation policies. Society must plan for a changing climate, institute policies that minimize the impacts of climate change, avoid disasters and exploit opportunities.

We strongly agree with Sir Gordon Conway that partnerships are essential to meeting both of these challenges. These partnerships must include the scientific community, including the World Climate Research Program and other global environmental change programs, governments, business and the broader public community.

5 May 2006

I would like to address the issue of integrated approaches and the role of scientific and technological communities Let me start by observing that two billion people are without access to affordable and clean energy services and as many are without a reliable access, yet, access is a key to achieving all of the MDGs. Growing energy services are needed also after MDGs have been achieved Energy security and reliability is yet another concern.

Deep emissions reductions are required for protecting human health, for avoiding transboundary air pollution and climate change. The challenge is to address all of these issues simultaneously and in an integrative manner – this can be met through multiple benefits from deployment and diffusion of advanced technologies, including efficiency improvement especially at end use, modern renewables and decarbonization of fossil energy sources.

Strategies for enabling widespread diffusion of advanced energy technologies need to encompass the whole "innovation chain", from basic research to early deployment and development of niche markets.

Scientific research and technological innovation are an essential foundation for such developments, including a more integrative, interdisciplinary approaches to overcome barriers that exist among the natural, social, engineering and health sciences.

The gap in science and technology capacity between the developed and most of DCs is still widening and is a major barrier to development. For example, developed countries employ per capita 12 times more scientists and engineers in

RD&D. I would also like to amplify the observation of Austria that public RD&D funding has been declining during the last two decades even in the OECD countries.

Yet, scientific and technical skills and infrastructure are required to develop, adapt and produce the technologies specific to the local needs; to introduce technologies into the market; and provide ongoing maintenance.

To achieve these goals, capacity-building at all levels must be given the highest priority. Given the highly complex and rapid nature of technological change, it is important that decision makers at all levels have timely access to accurate scientific and technological information and knowledge.

Hence there is a need for energy review and assessment reports, such as those by the World Energy Council, the International Energy Agency, IPCC, InterAcademy Council and ICSU.

It is my view, that there is also a need for a broader and comprehensive Global Energy Assessment to better understand transitions towards more Sustainable Futures. The science and technology community can make a major contribution toward these transitions - this will require enhanced RD&D funding, capacity building and international cooperation.