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SESSION 3:

TECHNOLOGY PERSPECTIVES FOR ENERGY POLICY

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TECHNOLOGY PERSPECTIVES FOR ENERGY POLICY

Messages from the IEA Secretariat and its Energy Technology Network

(Note by the Secretariat)

Improved energy technology solutions have a crucial role to play in addressing today's energy challenges. The IEA has an extensive energy technology network bringing together expertise from all around the world. The specialist Working Parties and associated Ad Hoc and Expert Groups within that network have articulated a number of messages concerning the potential of the various different energy technologies and how that potential can be realised. These messages provide an overview of approaches regarded as conducive to faster development and deployment of the energy technologies most likely to advance sustainability in production, transformation, transportation and use of energy. The attached document, reviewed by the Committee on Energy Research and Technology (CERT), combines these messages with findings of IEA Secretariat analysis.

TECHNOLOGY PERSPECTIVES FOR ENERGY POLICY

Messages from the IEA Secretariat and its Energy Technology Network

Ensuring dependable supplies of affordable energy is essential. But so is protection of local environments and the global climate. The world is heading towards a future where meeting both of these imperatives is in doubt. Governments are aware that a major energy re-think is urgent. Key energy technology pointers to address both challenges are presented here.

THE ENERGY TECHNOLOGY OPTIONS

EFFICIENT END-USE TECHNOLOGIES

Energy efficiency can be a very large contributor to curbing growth in energy demand and carbon emissions over coming decades.

Energy efficiency improvements are vital to maintain economic growth while containing the rise in primary energy demand and carbon dioxide emissions. End-use efficiency gains, especially in developing and transitional economies, are by far the largest contributors to the CO_2 emissions savings modelled up to 2030 in the IEA 2004 *World Energy Outlook's* World Alternative Policy Scenario, which supposes no technology breakthroughs.

Wider awareness is needed of the economic and social benefits energy efficiency offers.

The end-use sector embraces a vast range of technologies, so its potential for innovation is equally vast and should be explored through further RD&D. To realise that potential, all stakeholders, including the general public, need to recognise the economic and social benefits that more efficient end-use technologies can offer. To create markets for energy efficiency, consumer information is vital.

In transport, various technologies offer responses that are available today or hold growing potential for tomorrow.

In the transport sector, various available technologies can reduce emissions from fossil fuels in the short term, including technologies for greater fuel efficiency, for using compressed natural gas and for blending biofuels into gasoline and diesel. In the medium and longer term, deep reductions can be achieved through advanced, very low-emissions biofuels and through an eventual transition to vehicles run on hydrogen fuel cells or electric batteries.

Residential and commercial buildings' heavy use of energy could be cut sharply through standards and design-stage or retrofitted technology.

More than one-third of primary energy is consumed in non-industrial buildings such as dwellings, offices, hospitals and schools. Integrated building design linking insulation, advanced windows and lighting can cut heating and cooling needs while improving comfort. Energy needs can be further reduced by solar technology, on-site heat and power generation and computerised energy management.

Large industrial-sector energy savings are possible using available technology. Public-private partnerships speed deployment.

External energy demand in industry can be minimised through on-site power generation, combined heat and power systems, more efficient, integrated processes and equipment. Public-private partnerships can cut costs and speed adoption of these and other options like bio-based processes and feedstocks.

FOSSIL FUELS

Fossil fuels remain essential for global economic growth.

Fossil fuels will continue to dominate global energy supply until 2030 and beyond. Most growth in demand for fossil fuels is expected to come from developing countries to fuel economic growth.

Technology is crucial to optimise fossil fuel supply chains.

Technologies to enhance oil and gas recovery and to expand production of non-conventional hydrocarbons will remain crucial in maintaining and increasing energy accessibility. Technologies in the natural gas supply chain will also need further development if gas is to exploit its full potential.

Existing technology can increase power-plant efficiency and reduce CO_2 emissions.

Fossil fuels can – and must – be made more climate-friendly. Present state-of-the-art technology could raise efficiency in gas-fired power plants to almost 60%. Coal-fired plants could reach efficiency of 45% and further improvements are in sight. It is estimated that enhanced power generation efficiency gains could lead to worldwide CO_2 reductions of 1.8 gigatonnes per year.

"Zero Emissions Technologies", including CO_2 capture and storage, are within reach. RD&D is needed.

Another important path is CO_2 capture and storage (CCS). While large-scale uptake of CCS technologies is probably ten years away, significantly increased RD&D investment and strong enough incentives to reduce emissions could enable CCS to become an essential technology in the transition towards a sustainable energy system. Work is needed on permanence of storage, on demonstration and on establishing public confidence in CCS technologies. The concept of "Zero Emissions Technologies for Fossil Fuels" (ZETs) embraces a diverse range of technologies for fossil fuels, including CCS.

RENEWABLES

Policies must both support R&D and stimulate market demand.

Policy makers can reduce the added investments needed to bring renewables into the competitive mainstream by establishing a policy environment recognising the mutually reinforcing impact of policies to support R&D and policies to stimulate market demand.

More R&D funding is needed for both new and mature renewables.

The newest renewables technologies, such as those for wind and solar energy, as well as several advanced forms of bioenergy technology, hold the promise of the greatest cost reductions. But substantial cost reductions are also possible with the more mature renewables. If ambitious but practical goals are to be met for expanding renewable energy's share in the fuel mix, then the issue of increased R&D funding must be addressed.

NUCLEAR POWER

Nuclear fission technology is moving towards lower cost and enhanced public acceptability.

Nuclear power can provide large-scale, CO_2 emissions-free centralised generation of electricity for countries favouring this option. For nuclear fission, next-generation technology promises enhanced safety, lower cost, speedier construction, improved waste management and resistance to proliferation of nuclear materials.

FUSION POWER

Fusion power could offer attractive safety and environmental features. Development could be faster.

Following experimental demonstration of fusion power, scientific and technical know-how and an agreed design are now available for the construction of the next-stage experimental reactor, ITER. Fusion offers attractive inherent safety and environmental features. Stronger political will and a "fast track" approach could markedly shorten the development period.

ELECTRICITY GRIDS

Investment should be encouraged to improve grid reliability, delivery of digital-grade power and integration of more renewable energy.

Advanced electricity network technologies, systems infrastructure and grid management tools are needed to enhance security of power supply and improve demand-side response capability. Grid upgrading is needed to ensure delivery of digital-grade power and to facilitate more integration of power from distributed and intermittent generation sources.

HYDROGEN AND FUEL CELLS

Hydrogen and fuel cells may be the key to low emissions, especially for transport. But breakthroughs and investment are needed…

Hydrogen and fuel cell technology may offer the key to low emissions in transport. Providing flexible energy storage, this technology is also an option for residential and industrial applications or for integration into electricity grids. But technological breakthroughs and cost reductions will be needed to achieve commercial maturity. Costs for various components such as fuel cell systems and hydrogen storage remain the major challenge. For the foreseeable future, fossil fuels with CCS or biomass appear to be the most competitive options for producing CO_2-free hydrogen.

… as well as co-ordinated approaches that facilitate widespread use.

Widespread adoption of hydrogen will call for common approaches on infrastructure planning for vehicle fuel supply, on codes and standards, and on deployment programmes.

LINKAGES BETWEEN SCIENCE AND R&D

Better linkages between science and R&D can trigger much-needed energy technology breakthroughs.

The process of research integration between the scientific and applied energy communities needs to be improved. Necessary revolutionary breakthroughs and accelerated evolutionary advances will only be possible through increased focus on basic sciences and stronger linkages with technology R&D programmes. International co-operation will also be essential.

R&D PLANNING

Good R&D planning and prioritisation ensure effective use of scarce resources.

Planning and prioritisation optimise energy technology R&D resources. Good priority-setting is a transparent process within a culture of evaluation. It is crucial to integrate stakeholders' aspirations as well as economic and environmental goals. Global energy-system challenges require an inspired campaign of long-term R&D, co-ordinated across areas of opportunity and among countries.

TACKLING THE ISSUES

THE ROLE OF GOVERNMENTS

Governments can create policy and regulatory frameworks that promote sustainability.

Through appropriate policy and regulatory frameworks, governments can foster development of a rational mix of the cleanest, most efficient and economical energy technology options at each stage in the long journey towards sustainable energy systems. Governments often need to play a leading role, especially in the early stages of R&D.

Governments and markets have complementary roles.

Governments and market forces have complementary roles to play in facilitating further development of clean, efficient technologies. For example, there is large scope for international collaborative benchmarking in particular sectors.

THE ROLE OF IEA

The convening power of the IEA provides leadership to help speed long-term innovation.

The IEA is uniquely placed to exert leadership in these promising areas, by bringing together national and disparate communities – notably from the realms of science, policy and technology – to rise to the challenge of accelerating long-term energy innovation. With its expertise in energy technology, combined with its international perspective on broader energy issues, IEA should continue to play a large role in proposing more effective measures enabling each technology to address both energy-supply and environmental issues

IEA's international network facilitates co-operation in developing cleaner, more efficient energy technology faster, at lower cost.

The IEA's energy technology collaborative structures enable countries to work together on energy technology R&D and dissemination of related information. Some 40 programmes bring together several thousand experts working on wide-ranging energy technologies. Their efforts contribute significantly to faster, less costly technological progress towards cleaner, more efficient, more economical energy technology solutions.

Lessons learned may be shared on a global scale.

An enhanced energy technology dialogue is needed with developing and transition economies. All stakeholders stand to benefit greatly from the exchange of energy technology experience and lessons learned.

The IEA Secretariat has recently issued numerous publications on high-profile topics such as carbon capture and storage, hydrogen, energy efficiency and renewables technologies. More are in preparation on these subjects, as well as a review of oil and gas upstream technologies and their impact on future supply. The IEA's Web site (http://www.iea.org) provides more information on current publications.

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