International Council of Academies of Engineering and Technological Sciences

The Role of Hydrogen in Our Energy Future

A Statement by CAETS, International Council of Academies of Engineering and Technological Sciences Brussels, Belgium June 1-2, 2006

Realizing that the problem of supply, distribution and utilization of available energy sources is of paramount importance for the sustainable development of our modern society, CAETS focused the Brussels meeting on the prospective use of hydrogen as an energy carrier. It engaged the views of experts of its member academies, many of which have already undertaken in-depth studies on these problems and formulated important advice to their national governments.

Recommendations on the use and potential of hydrogen were formulated, as were some general considerations on the energy problems the world is facing.

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Fossil fuels will remain the first and most important source of energy for the coming decades. However, since fossil fuel reserves are finite and their use releases greenhouse gases, the following actions are appropriate in order to meet the world's long-term energy needs:

- Promote energy-saving measures and enhance the efficiency of energy use.
- Develop nonconventional fossil fuels (i.e., tar sand).
- Use renewable energy sources. (It should be understood, however, that this is not the solution to the energy problem in the next decades).
- Consider nuclear energy for electricity.

Since "business as usual" energy scenarios are not sustainable, CAETS concludes and recommends urgent attention to the following issues:

1. Our governments should develop energy policies based on comprehensive long-term strategies, which include all major potential sources of energy. These strategies should give priority to RD&D projects that will improve energy efficiency and reduce CO_2 emissions. Any long-term energy policy should increase the supply of renewable energy and explore the potential of hydrogen as an energy carrier.

2. The transition from the present fossil fuels-based energy system to a sustainable hydrogen based economy will require time, major technical breakthroughs, and significant investments. Specific suboptimal transitional solutions will have to be developed in close cooperation between all stakeholders.

3. At the present time, the transport sector seems to be the most promising candidate for the first large-scale application of hydrogen. R&D to facilitate breakthroughs in fuel cell costs, fuel cell durability, and on-board hydrogen storage systems should be given high priority.

4. Large-scale production of electricity from hydrogen appears inappropriate from technical, economical and environmental standpoints. However, in cases of excess electricity capacity, production of hydrogen from electricity (electrolysis) could be economically viable. During peak demand for electricity, the stored hydrogen could be used to generate electricity by fuel cells to return to the grid.

5. In the short term, Natural gas conversion (reforming) will remain the primary source for hydrogen production. Although this is a rather mature technology, research on efficiency improvements should be continued. Small-scale natural gas reforming will be an important source for hydrogen during the transition to a full-scale hydrogen economy. Hydrogen from industry by-product (i.e., coke-oven gas and from the chlorine alkali industry) could also be collected and purified to supply part of the hydrogen.

6. Coal will remain an important source of primary energy for many decades, with a noticeable price advantage over natural gas. More RD&D is needed on carbon dioxide capture and storage, which will benefit both electricity generation and hydrogen production from coal.

7. If new high-temperature nuclear reactors are developed, research on hydrogen generation from nuclear heat should be promoted.

8. Wind energy-to-hydrogen and biomass-to-hydrogen are recognised as important potential technologies for hydrogen production. Exploratory and fundamental research on photo-biological and photo-electrochemical processes should not be neglected.

9. As reliable technical and economical data can only be obtained by practical experience, demonstration projects should be started in the various fields of hydrogen production, storage, transport and utilization. Information and campaigns on hydrogen must address public safety concerns in addition to the advantages that hydrogen use could bring to society in the long term.

10. Given the amount of work to be done, international cooperation (e.g., on the level of the IEA) is essential to provide guidance and support on key technical challenges and to push for worldwide standards and regulations for hydrogen end use products (e.g., vehicles using hydrogen as an energy source).

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