HYDROGEN ENERGY

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Hydrogen is fundamentally a potential energy carrier that can minimize or eliminate air pollution emissions, thereby cleaning up the local environment. It also embodies a promising tool for solving the global climate change issue. When burned in a combustion engine, pure hydrogen produces relatively low emissions of nitrogen oxides with no sulfur oxides and particulates, and when consumed electrochemically in a fuel cell it produces none. In either case, no greenhouse gases such as carbon dioxide are produced, since no carbon is present.

Unlike conventional fossil fuels, however, hydrogen is not reserved as a natural resource in the form of molecular hydrogen, but it can be derived from various primary energy sources such as hydrocarbons, bio-mass, hydro, geothermal, photovoltaic, wind and nuclear. Importantly, this diversity of sources and means of conversion suggests that widespread use of hydrogen may help to reduce the political and economic insecurities associated with the current petroleum-intensive energy system.

A hydrogen energy system must therefore include a source of hydrogen (such as natural gas, petroleum, coal and biomass as energy contained feedstock, or water simply as 'raw material') and a means of producing hydrogen from this source. Unless the hydrogen is made on demand and at the point of consumption, it also requires hydrogen distribution infrastructure and storage, thus allowing end users to utilize hydrogen for producing electricity and/or heat with new technologies such as a fuel cell. Naturally, this whole hydrogen energy system from production through distribution and use must be both safe and economic, too. Challenges are a wide range of technical innovation and engineering necessary to make this whole system function effectively.

In an 1870 novel, Jules Verne wrote "…water decomposed into its primitive elements…will one day be employed as fuel, that hydrogen and oxygen which constitute it…will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable…" Although the status today is not exactly the way Verne envisaged, "a hydrogen energy system" is starting to emerge. For recent years, in particular, much progress has been achieved in these areas as seen in the increasingly intensified research and development programs both in the US and Japan. The speakers in this session will highlight exciting recent progress in making hydrogen energy systems more feasible while highlighting the remaining technical challenges.