

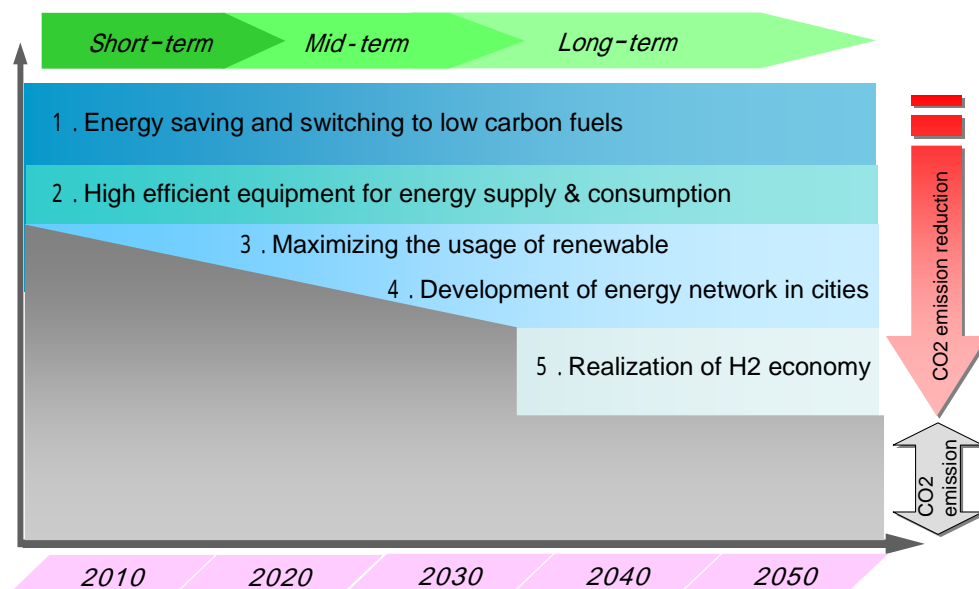
Hydrogen Economy for Low Carbon Society

Isamu Yasuda

Technology Research Institute, Tokyo Gas Co., Ltd., Japan

As the largest gas utility company in Japan, we Tokyo Gas are willing to contribute to realization of the future low carbon society (LCS) by developing and promoting low carbon-intensive energy supply and utilization technologies. It's not realistic to try to jump into an ideal LCS, and it's reasonable to define a transition scenario that can be implemented in the real world. The figure shows our multi-stage pathway which has 3 phases towards the LCS.

Transition to Low Carbon Society



For short-term solutions, 1) energy saving and switching to low-carbon fuels and 2) highly-efficient equipment for energy supply and utilization are effective and they're already in progress. Switching from heavy oils to natural gas for large-scale industrial heating purposes has quickly been penetrating in the market with the help of skyrocketing rise of crude oil price. Great efforts in industries and government have been devoted to promote wide use of highly-efficient appliances such as fuel cell CHP (combined heat and power) systems for residential markets and gas engine and gas turbine CHP systems for industrial and commercial markets. The Japanese government especially METI is leading the world's effort to fully commercialize the residential fuel cell CHP with annual funding of over 30 billion yen. The number of residential fuel cells installed at customers' homes all over Japan will be around 1,000 at the end of FY 2007. These systems can reduce CO2 emissions from residential houses by 45% under the best conditions. The key issue for the market penetration is cost reduction.

For mid-term solutions, 3) more use of renewable energy and 4) energy network in populated cities will be effective. Many projects are in progress to demonstrate the viability of gasification and utilization of biomass resources. In the near future, biomass wastes from industries and commercial sectors will be widely and highly utilized to reduce energy consumption and as a result

CO₂ emissions. A “Compact City” concept in which thermal and electrical energy demands in densely populated areas are integrated and aggregated will effectively maximize the overall energy use efficiency and thereby reduce CO₂ emissions from urban areas. The key issues for these mid-term solutions are the best mix of the available energy sources and efficient utilization technologies which depend on energy supply/demand characteristics of the targeted areas. Micro-grid technology will be essential for successful realization of the best mix, which can mitigate the fluctuating energy supplies from renewables by integrating them with more stable energy conversion systems such as fuel cells and other conventional CHP systems.

For long-term solutions, 5) hydrogen economy is expected to play an important role. Hydrogen in combination with stationary and mobile fuel cell technologies will greatly reduce CO₂ emissions; it can even realize a carbon-free society when hydrogen is produced from renewables or an ultra-low carbon society even when hydrogen is produced from fossil fuels with proper management of the byproduct CO₂ such as CCS. There is a big project called “JHFC (Japan Hydrogen and Fuel Cell demonstration project)” going on led by the Japanese government to demonstrate technical feasibility of hydrogen production and supply to fuel cell vehicles (FCV) and environmental advantages of FCV. More than 10 hydrogen refueling stations have been built and successfully operated in mega cities (Tokyo, Osaka and Nagoya). The fuel economy of FCV has been proved to be 3 times as high as that of conventional gasoline engine vehicles and the CO₂ emissions on the Well-To-Wheel basis are estimated to be reduced by 50% or more even when hydrogen is assumed to be produced from fossil fuels. Recently major stakeholders such as car OEMs, energy supply companies and engineering companies get together at the same table to discuss and share a scenario of transition to hydrogen economy in the transportation market sector. They have reached a consensus that the present demonstration phase will move on to an early market entry phase around 2015 and hydrogen supply infrastructure will have to be in place ahead of roll out of FCV. The key issues to pave this pathway are identified as significant cost reduction of both vehicle manufacturing and hydrogen production and supply equipment, who will pay for the new infrastructure establishment and byproduct CO₂ management including CCS when hydrogen is produced from fossil fuels. Government leadership and support are strongly expected.