Climate change problem by greenhouse gas emission is a driving force to promote a hydrogen economy. Price rises of fossil fuel in recent years is due to a lack of supply for supporting an economic growth of the developing countries. The hydrogen fuel produced from water by using a sustainable energy is the best solution to the problems of a global warming and the end of cheap oil. Korean government announced a national master plan for a realization of a hydrogen economy and fuel cell industry last year. The demand for hydrogen fuel in 2040 is predicted to be more than 7 million tons per year. Nuclear hydrogen is a practical option to meet this massive demand of hydrogen, especially for a high populated country such as Korea where the potential of a natural energy is very limited. KAERI has set up a long term R&D project, Nuclear Hydrogen Development and Demonstration, to develop the relevant technologies. Current status and issue in the VHTR design methodology, the TRISO fuel, the thermochemical cycle, and the material issue will be presented.