

Advanced Nuclear Power Generation

● Outline of technology

Nuclear power has excellent supply stability, and it emits no carbon dioxide in its generation process. It is currently the only clean base load energy sources in Japan. It is a source of energy that can address both carbon dioxide emissions reductions and economic development since it is capable of stably supplying electrical power necessary for economic development at a relatively low cost.

It is necessary to improve domestic and international mainstream light-water reactor application technologies and to develop advanced nuclear power generation technologies such as the innovative fast reactors through 2050. More specifically, the matters to be addressed include technology development for the next-generation of light-water reactors to improve safety, economic efficiency, and reliability drastically; fast reactor cycle technology to improve the efficiency of the uranium resource utilization considerably; and the development of small and medium reactors in compact sizes to address power demands in developing nations and islands states.

● Technology development roadmap

Japan has successively constructed light-water reactors, and it currently has 55 light-water reactor units with nuclear power providing about 30% of Japan's total generation. The light-water reactions have a considerably lower frequency of unplanned stops compared to those reactors in other nations. We thus have the world's top-level technology, human resources, and industry size in all aspects, from technology development to design, production, construction and operation. On the other hand, our nuclear reactor manufacturers have been slow to enter the international market, and international recognition of the nuclear reactors we have developed is low. In addition, there is little standardization of reactors because nuclear power plants have been individually designed and constructed for each site to address the individual demands of the domestic utility companies.

While drastic expansion in the international market is expected, the nuclear reactor manufacturers in the U.S., France and Russia have been actively expanding their business so that they can participate in new construction markets over the world with support from their respective governments. The

nuclear reactor manufacturer in Korea is competitive with certain components. China is also developing its own reactors based on technologies introduced from other countries. In such circumstances, Japan needs to maintain and improve its level of technological development with the government's assistance through its investment in research fields with high investment risks and large ripple effects.

To address the domestic needs for the replacement of reactors expected around 2030, we will promote the development of next-generation light-reactor application technology to drastically improve safety, economic efficiency, reliability while utilizing the achievements that our light-water reactor development programs and operations have yielded so far. Specifically, technologies to reduce the generation of spent nuclear fuel and to address seismic isolation will be developed. Meanwhile, cooperation between the government and the private sector will be necessary to address the development of innovative technologies that may become the domestic and global standard with international standardization while there is a global trend of re-recognition of the use of nuclear power and an increase in international cooperation on the issue.

Furthermore, we will promote the development of fast reactor cycle technology to improve the efficiency of uranium utilization drastically and reduce radioactive waste substantially, with an objective to build a demonstration reactor and a related cycle facility by 2025 and commercialization of the technology before 2050. It is important to seek to obtain a position as a global standard reactor through multilateral or bilateral forums for cooperation such as GNEP (Global Nuclear Energy Partnership and GIF (Generation IV International Forum) with this research and development.

Moreover, the development of small and medium reactors to address the needs of developing nations and island states will be promoted in order to expand our technology into an international market different from that of our large next-generation light-water reactors. Specifically, we will promote the development of innovative basic technologies while advancing both the international expansion of our nuclear industry and international cooperation under the framework of GNEP and other organizations. This will utilize our experience and skills to improve the economics of reactors with drastic size reductions and maintenance cost reductions.

