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Energy

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Overview of Japanese Legal Regulation on Fusion Energy

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1. Introduction

In recent years, fusion energy has attracted increasing global attention as a potential next-generation energy source capable of contributing to carbon neutrality and long-term energy security. Unlike conventional nuclear fission power generation, fusion seeks to generate energy by fusing atomic nuclei, thereby replicating the mechanism that powers the sun.

In Japan, the government has also positioned fusion technology as an important future industrial and energy policy area. In particular, growing policy discussions concerning GX (Green Transformation), economic security, and advanced industrial competitiveness have accelerated interest in fusion-related technologies and investment.

At the same time, however, Japan does not yet have a comprehensive legal framework specifically designed for fusion energy facilities. As a result, an important legal and regulatory question has emerged as to how fusion facilities should be treated under the current Japanese legal system.

This article provides an overview of the current status of Japanese legal regulation relating to fusion energy.

2. Absence of a Comprehensive Fusion-Specific Legal Framework

At present, Japan has not enacted a comprehensive statute specifically governing fusion energy development or commercial fusion power plants.
Accordingly, fusion-related activities are currently regulated under existing legal frameworks depending on the nature of the relevant equipment, radioactive materials, and research activities involved.
One of the central legal questions is whether fusion devices constitute "reactors" under the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (the "**Nuclear Reactor Regulation Act**" or "**NRRA**").
Under Article 2, Paragraph 5 of the NRRA, a "reactor" is generally understood as equipment designed to generate energy through nuclear fission reactions. Historically, the regulatory framework of the NRRA has primarily been developed for conventional nuclear fission facilities.
Fusion technology, however, differs significantly from conventional fission reactors from both technical and safety perspectives. For example:

- fusion reactions generally require continuous external energy input;
- sustained runaway chain reactions are not expected in the same manner as fission reactors;
- the risk profile relating to core meltdown is considered materially different; and
- the characteristics of radioactive waste generation also differ from conventional nuclear power generation.

For these reasons, there is an emerging view in Japan that existing fusion devices may not necessarily fall within the category of "reactors" regulated under the NRRA.

3. Regulation under the Radioisotope Act

While fusion devices are not currently regulated as "reactors" under the NRRA, many fusion-related devices are generally understood to fall within the scope of radiation-generating equipment regulated under the Act on Prevention of Radiation Hazards Due to Radioisotopes, etc. (the "**Radioisotope Act**" or "**RI Act**").
In practice, existing fusion research facilities in Japan are commonly treated as "radiation generating apparatuses" under the RI Act because such equipment may emit neutron radiation or other forms of ionizing radiation during operation.
As a result, operators of fusion research devices may become subject to various obligations under the RI Act, including:

- licensing and notification requirements;
- radiation safety management obligations;
- appointment of radiation protection supervisors;
- monitoring and recordkeeping obligations; and
- operational safety controls.

Accordingly, although Japan does not yet maintain a dedicated fusion regulatory regime, certain fusion-related activities are already subject to regulatory oversight through existing radiation safety legislation.

4. Growing Policy Discussions Concerning Fusion Regulation

In recent years, policy discussions regarding the future regulation of fusion energy have intensified both internationally and domestically.
Globally, several jurisdictions have begun considering regulatory approaches that distinguish fusion from conventional nuclear fission regulation.
For example, in the United States, the Nuclear Regulatory Commission (NRC) has indicated a policy direction under which fusion facilities may be regulated under a framework different from traditional fission reactors. Similarly, the United Kingdom has promoted fusion development through policy initiatives led by the UK Atomic Energy Authority (UKAEA), while emphasizing the industrial promotion aspects of fusion technology.
Japan has also begun strengthening governmental support for fusion-related research and industrial development.
In addition, private-sector investment into fusion startups and related technologies has recently expanded worldwide, which may further accelerate future regulatory discussions in Japan.

5. Potential Future Legal Issues

As fusion technology advances toward commercialization, several legal and regulatory issues are likely to become increasingly important in Japan.
These may include:

(1) Classification of Fusion Facilities

Whether commercial-scale fusion facilities should remain outside the scope of conventional nuclear reactor regulation or become subject to a new category of regulation.

(2) Safety Regulation

Development of safety standards tailored to the technical characteristics of fusion systems rather than conventional fission reactors.

(3) Environmental and Radiation Regulation

Management of tritium, neutron radiation, radioactive materials, and waste generated through fusion operations.

(4) Licensing and Permitting

Creation of a dedicated licensing regime for construction and operation of fusion power plants and related infrastructure.

(5) International Competitiveness

Balancing safety regulation with industrial promotion and international investment competitiveness.

6. Conclusion

Fusion energy is increasingly expected to play an important role in future decarbonization and energy transition strategies. However, Japan currently lacks a comprehensive legal framework specifically designed for fusion energy development.

At present, existing fusion devices are generally understood to be regulated primarily under the RI Act as radiation-generating apparatuses, while remaining outside the conventional reactor regulation framework under the NRRA.

Nevertheless, as fusion technology moves closer toward commercialization, Japan will likely face growing pressure to establish a more comprehensive and fusion-specific regulatory framework. Future legal developments in this area may therefore become an important issue not only for the energy sector, but also for industrial policy, economic security, and international competitiveness.

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