

Advisory Opinion

**Establishment of a global center of excellence
with realization of a world-leading large scale
power laser facility in which diverse expertise
can play an active role**



22 September 2023

Science Council of Japan

**Subcommittee on Energy Science and Technology
Committee on Comprehensive Synthetic
Engineering**

This Advisory Opinion is issued in accordance with the outcome of the deliberations of the Subcommittee on Energy Science and Technology of the Committee on Comprehensive Synthetic Engineering, Science Council of Japan.

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This English version is a translation of the original written in Japanese.

Executive Summary

1 Current Status and Problems

Power lasers can create extreme conditions which are not found on earth with relatively ease, and can create new science related to the exploration of the nature of the universe and matter, as well as a variety of new technologies useful to industry and the public, such as energy, materials, and devices. For this reason, it is becoming more and more important as a high-energy-density science using power lasers, and competition is getting more and more intense all over the world. Japan also has many achievements in this cross-disciplinary high energy density science and a competitive edge in power laser technology to promote it.

On the other hand, despite the global importance of high energy density science using power laser as well as our own competitiveness, Japan has yet to establish a core center for high energy density science, as the keystone of an all-Japan system in which diverse expertise can play an active role. In addition, while Japanese-originated technologies such as laser ceramics are being used in large-scale projects overseas, as quickly as possible, there are few projects in Japan that take advantage of elemental technologies as Japan's core technologies, and Japan also lags behind in their utilization.

It is necessary to quickly establish the core center with internationally competitive high-repetition, large power laser facilities that take advantage of Japan's superiority (including high damage resistance optics, laser ceramics, and semiconductor lasers), and to clearly define an academic research strategy that outlines a path for contributing to the sustainable development of various academic disciplines and a diverse society.

2 Contents of the Advisory Opinion

High-energy density science using power lasers, as an interdisciplinary field capable of realizing diverse “creation of intellect” and “realization of intellect”, has seen increasing global importance and significant leaps in development. Particularly, there have been significant advancements recently, such as technical breakthroughs in power lasers, achievement of scientific breakeven in laser fusion research and subsequent intensified efforts by the US government in promoting high-energy density science. In such rapid progress and dramatic changes, it is crucial for Japan not to miss the opportunity under its unique

strategy to establish a core facility that capitalizes on Japan's strengths to lead the world in this field. Hence, while incorporating opinions from diverse stakeholders, the following actions should be taken:

- To challenge the integration and consolidation of various Japan's competitive elemental technologies related to power lasers swiftly, accelerate system construction and implementation, and **pioneer the realization of high-repetition large-scale power laser facilities ahead of the world**. This will lead to **establish an internationally competitive core facility with power lasers that will drive diverse knowledge-driven co-creation and have competitiveness**.

- Additionally, to clearly outline the prospects for science and technologies pioneered at this core facility and the expansion of human and technological resources and to enhance an **"All Japan" system leading the world** in this field.

Through these efforts, nurturing the grand tree of high-energy density science that realizes diverse “knowledge creation” and “knowledge realization” will not only form a vast grove of scientific and technological creation which means cross-disciplinary laser science such as fundamental science, material science, life science, energy studies, communication, and process technology, but also contribute to the sustained development of Japan's academia and society.