

Preface

Japan has the world's third largest GDP and, fortunately, has experienced economic prosperity in recent decades. Because the country has few fossil resources, industries have efficiently imported raw materials and offered industrial products with high value and low cost. Japan has been successful through such industrial activities. However, stable resource imports present a risk, and the country has attempted to reduce this risk. Very efficient use of these imports and saving of resource consumption have been achieved, such that Japan has the most efficient energy utilization in the world.

Outlooks and discussion on Japan's future energy system are important for establishment of a bright future society, because the country needs to overcome risks to the supply of energy. Energy technology developments are keys to this energy system. These technologies have great diversity and numerous aspects, and each citizen has an opinion on future energy systems. Chemical engineering has the potential to quantitatively give an overview and analyze and optimize complex energy systems. A group in the Division of Energy Engineering, Society of Chemical Engineers, Japan (SCEJ) has reviewed future energy systems based on chemical engineering perspectives. Books discussing the potential of energy technologies and proposals for a future Japanese energy society based on this review were published as a first edition in 2005 [1, 2] and second edition in 2010 [3].

Following publication of the second edition, Japan suffered the Great East Japan Earthquake on 11 March 2011. This caused a drastic change in its energy system. The "Urgent Proposal for Energy Crisis in East Japan After the Great Earthquake" [4] was submitted by second-edition group members in March 2011. This was the first proposal on sustainable and feasible energy supply and demand for overcoming the crisis. This was followed by several other proposals from researchers and academic societies. The Temporary Committee for Urgent Proposals for Energy Systems After the Great East Japan Earthquake, SCEJ, organized in April 2011, continued with proposal improvement and publicity. The Committee on Future Energy and Social Systems (FUENSS), Center for Strategic Planning, SCEJ, was

formally established for taking over the Temporary Committee and subsequent discussions on future energy systems in 2012.

This book was planned as an activity of FUENSS and represents the third edition of the books. People were able to overcome difficult social situations after the earthquake if they had hope. This book was designed to review the potential of Japanese energy technologies beyond 2030, toward establishment of a bright future society in the country. Reducing energy and material consumption and CO₂ emission mitigation are key global topics for future societies. High-quality industrial technologies and methods cultivated from Japanese industrial developments have great potential to solve current problems.

Nevertheless, the digitization of products has promoted their commoditization, and it has become easy for new companies to enter the global market. Thus, Japan is losing its global market for commodities such as home electric appliances. However, the country has a unique manufacturing method called *Suriawase* or *Gijyutu-no-Suriawase* (optimized integration between related technologies), and its industries retain a large market share throughout the world, especially among material industries [5, 6]. *Suriawase* is harmonized matching between production processes, from raw materials, components, and equipment to final products, through strong mutual communication and cooperation between researchers, engineers, and organizations. The value of final industrial products can be improved to world-leader status through cost reduction, applying harmonized adjustments between processes based on *Suriawase*. *Suriawase* efforts by researchers and engineers have achieved high-quality industrial products, as typified by robust and low-cost automobiles, high-quality and stable electricity supply infrastructure, punctual train operation, and others.

Suriawase shows mutual cooperation and improvement achieved by people related to production processes, and have great potential for social contribution, although the ability of individuals is limited. In this book, the subject is confined to Japan for clear evaluation of the quantitative potential of energy technologies. However, these technologies can be used globally. All the authors hope that these technologies contribute globally, via mutual cooperation based on the *Suriawase* approach.

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