

Global Hydrogen Energy Unit

Institute of Innovation Research, Tokyo Institute of Technology



Overview

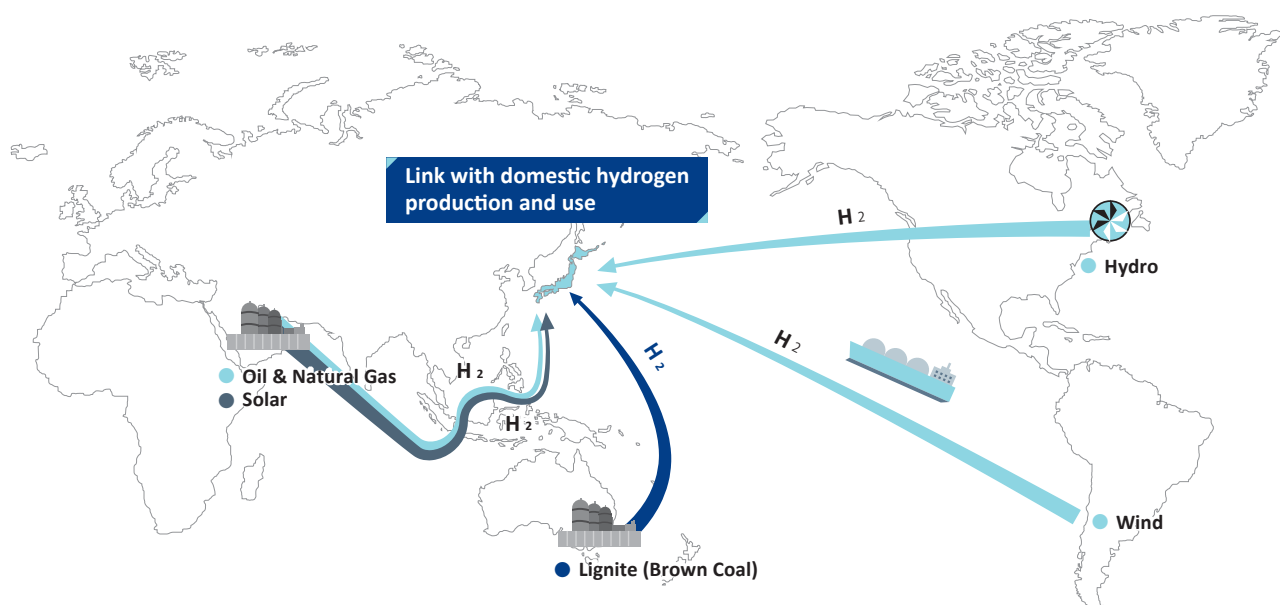
Hydrogen is a secondary energy source with high potential to contribute to the goal of realizing a low-carbon society and bringing about a change in energy structure. In order to make hydrogen energy a practical reality, however, it is necessary to explore the development of elemental technology and systems as well as industrial and social structures to identify and address issues of importance. The Global Hydrogen Energy Unit was established to evaluate a wide range of issues from a multilateral, subjective, and scientific perspective through industry-government-academia collaboration centered around Tokyo Tech. The unit also identifies bottlenecks in problem solving and determines development goals related to the technology and systems required to realize a hydrogen energy society.

Research Goals

The goal of the Global Hydrogen Energy Unit is to establish a global-scale hydrogen supply chain which converts unused overseas energy to hydrogen and transports it to Japan. Specifically, the unit plans to separate brown coal into CO₂ and hydrogen in Australia, store the CO₂ underground, and transport liquefied hydrogen to Japan for storage and conversion to energy. The unit will also link this with the use of hydrogen energy generated from renewable energy sources in Japan.

The Global Hydrogen Energy Unit conducts research on the organization of accurate and subjective information, creates new value, designs and evaluates systems, and identifies and solves technical development problems.

Global hydrogen supply chain



In order to realize a hydrogen energy society, universities, industries, and government agencies must be organically linked

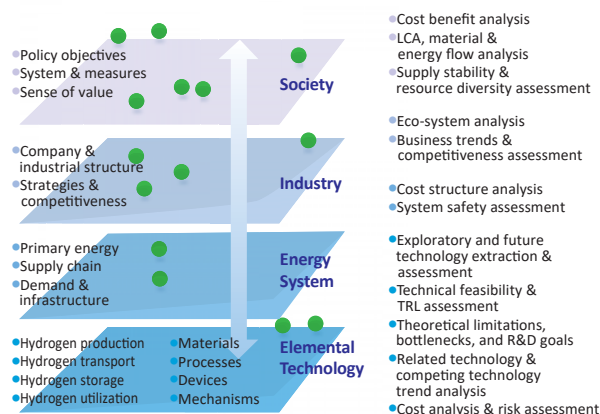
Q Why was this research unit established?

In order to realize a hydrogen energy society, it is essential to organically link universities that provide outstanding technology and research, industries that promote the commercialization of hydrogen energy, and governmental agencies that establish and execute policies. From our subjective position as a university, we established the Global Hydrogen Energy Consortium through industry-government-academia collaboration within the Global Hydrogen Energy Unit. The unit operates the consortium and facilitates multilateral assessment, the development of technology for elements and systems, and the exchange of information among members.

Q What are the strengths of this research unit?

Tokyo Tech has a wide range of achievements in energy-related research and education that it has accumulated over the years. In 2012, the Environmental Energy Innovation Building was completed at the Ookayama Campus and the original smart power grid management system "Ene-Swallow" was initiated. Experts in innovation and technical assessment are participating in the research along with specialists on campus to push technological and system advancements. Our strength is that this unique Research Unit can engage in global and open collaboration in a wide range of activities with other consortium members.

The Goal of the Tokyo Tech Global Hydrogen Energy Research Unit "Neutral, subjective, diversified evaluation (Technology Assessment)"



Unit leader
Ken Okazaki

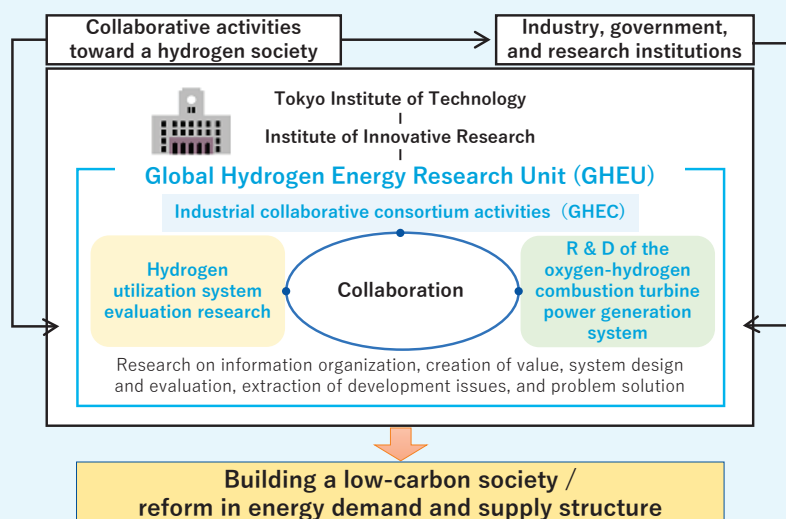
Profile

2015 Institute Professor (Professor Emeritus), Tokyo Institute of Technology
 2007-2011 Dean, Graduate School of Engineering, Tokyo Institute of Technology
 2000 Professor, Department of Mechanical and Control Engineering, Graduate School of Science and Engineering, Tokyo Institute of Technology
 1998 Professor, Department of Mechanical Engineering and Science, School of Engineering, Tokyo Institute of Technology
 1992 Professor, Tokyo Institute of Technology
 1984 Associate Professor, Toyohashi University of Technology
 1980 Lecturer, Toyohashi University of Technology
 1978 Assistant Professor, Toyohashi University of Technology
 1978 Doctor of Engineering, Department of Mechanical Engineering, Graduate School of Science and Engineering, Tokyo Institute of Technology
 1973 Bachelor of Engineering, Department of Mechanical Engineering, School of Engineering, Tokyo Institute of Technology



GHEU's research activities

As of July, 2018



Activity policy

Conduct the following items for building up a hydrogen supply chain in cooperation with industrial-academic-government members:

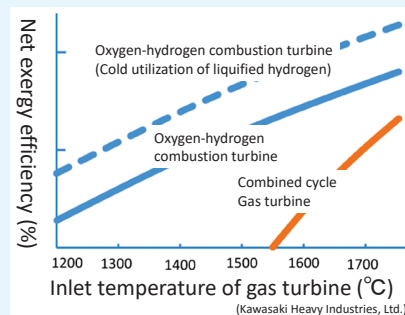
- (1) Collection, organization and analysis of correct information;
- (2) Extraction of bottlenecks and research problems;
- (3) Consideration of measures aiming at social implementation.

Based on this approach, promote activities for "Establishment of hydrogen energy utilization system based on unused energy" in cooperation.

Oxygen-hydrogen combustion turbine power generation system

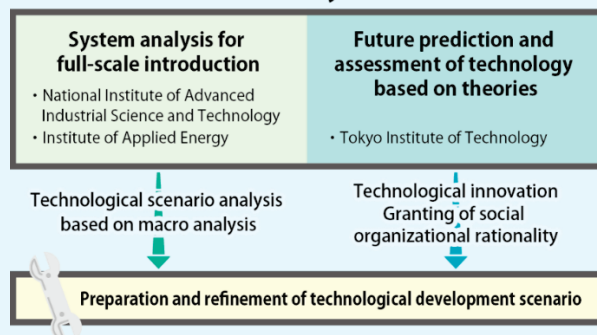
GHEU promotes the study of hydrogen power generation as a commissioned project of NEDO to lead the research and development projects such as hydrogen utilization (since 2018).

We are engaged in the research and development of a closed-cycle gas turbine system that is expected as an ultrahigh-efficiency power generation system beyond the existing open-cycle gas turbine and its implementation is expected. Its characteristics are as follows: (1) no generation of CO₂, NO_x, SO_x due to complete combustion of pure oxygen and pure hydrogen, (2) the ultimate high efficiency by taking advantage of the cycle characteristics of water vapor as a working medium obtained by direct combustion.



Hydrogen use system assessment study

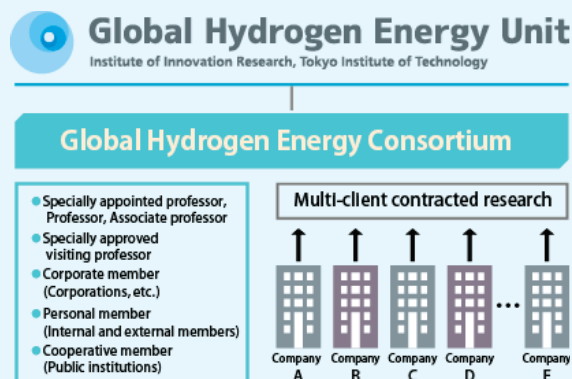
General outline of "Total system introduction scenario survey research"



GHEU promoted the survey research project called "Total system introduction scenario survey research" (NEDO commissioned project from 2016 to 2017) to refine a hydrogen introduction scenario by clarifying positioning of hydrogen in energy system as well as suggesting examples of specific introduction schemes, clarifying positioning of technologies under development and recognizing technologies to be reinforced in the future. Tokyo Institute of Technology conducted the survey analyses of research trend for element and system technologies regarding hydrogen energy, as well as technology assessments and future prospect of technologies based on related theories such as material science, thermodynamics, kinetic evidence and electrochemistry. By integrating these results, we presented a technology development scenario. To further develop this technological development scenario, we continue to extend the scope of this study.

Industrial-academic cooperation consortium activity (GHEC)

Global Hydrogen Energy Consortium (abbreviated as GHEC) has been established as a platform of industrial-academic-government cooperation (July 1, 2015). With an intention to share information of participating corporations and researchers aiming at establishing a hydrogen supply chain and resolving technological problems relevant thereto, activities to realize hydrogen energy society are developed. We expect that the consortium activities may contribute to achievement of a new international best-mixed energy based on diversified energy resources including renewable energy in the long run. Please contact with GHEU head office if interested. We will send you a document of description.



Parties concerned (Titles omitted)

Teachers in charge	Unit leader	Institute Professor: Ken Okazaki
	Lead-managing professors	Professors: Manabu Ihara / Tomohiro Nozaki
		Professors: Jun-ichi Imura / Yuya Kajikawa / Yukitaka Kato / Koichi Shinoda / Tetsuya Suekane / Mamoru Tanahashi / Masaharu Tsujimoto / Shuichiro Hirai / Hideaki Fujita / Akira Yamada / Ichiro Yamanaka / Norihiro Nakai Associate professors: Koji Tokimatsu Specially appointed professors: Takuya Oda / Michio Hashimoto
Consortium members	Corporate official members (14 corporations)	IHI Corporation / Iwatani Corporation / Osaka Gas Co., Ltd. / Kawasaki Heavy Industries, Ltd. / Kajima Corporation / Chiyoda Corporation / Electric Power Development Co., Ltd. (J-Power) / Tokyo Gas Co., Ltd. / Toho Gas Co., Ltd. / Tokuyama Corporation / Toyo Kanetsu K.K. / Panasonic Corporation / Brother Industries, Ltd. / Mitsubishi Corporation
	Cooperative members (4 institutions)	Institute of Applied Energy National Institute of Advanced Industrial Science and Technology Japan Coal Energy Center Central Research Institute of Electric Power Industry
	Personal official members	Tadafumi Adschiri (Professor, Tohoku University) / Hiroshi Segawa (Professor, The University of Tokyo) / Junichi Sasaki (Muroran City, Hokkaido) / Yasushi Sekine (Professor, Waseda University) / Kan Ogata (MHI Solution Technologies Co., Ltd.) / Kenichiro Saito (ENEOS Research Institute, Ltd.) / Keiko Fujioka (Functional Fluids, Ltd.) / Ryo Nakajima (Techno2050 Nakajima P.E. Office) / Akiteru Maruta (Technova Inc.)

Contact point:

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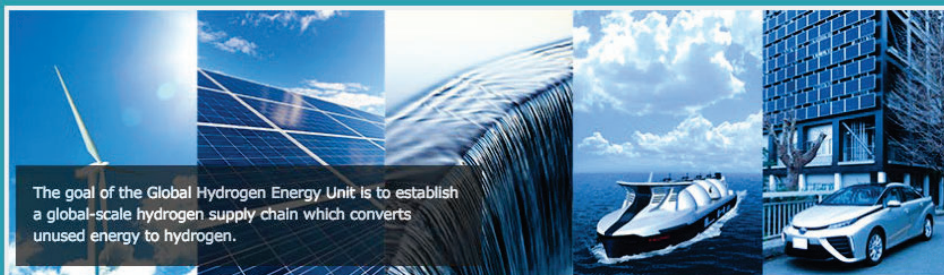
As of July, 2020



Tokyo Institute of Technology, Institute of Innovative Research
Global Hydrogen Energy Research Unit
東京工業大学 科学技術創成研究院 グローバル水素エネルギー研究ユニット

JAPANESE

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The goal of the Global Hydrogen Energy Unit is to establish a global-scale hydrogen supply chain which converts unused energy to hydrogen.

Activity status of the unit is updated as necessary on the website. Intention, activities and organization of the industrial-academic consortium, background of establishment of the unit and positioning of the organization in the university are described on the website in addition to records of organized symposiums and workshops.

<http://www.ghe.iir.titech.ac.jp/index-e.html>