



Tokyo Tech Academy of  
Energy and Informatics

Designing the Energy Society of the Future

# Tokyo Tech Academy of Energy and Informatics



Tokyo Institute of Technology



## Manabu Ihara

Director of Tokyo Tech Academy of  
Energy and Informatics

Head of the InfoSyEnergy Research  
and Education Consortium

Professor at the School of Materials  
and Chemical Technology

Building a society that harnesses sustainable energy is an urgent global challenge. The cost of renewable energy has dramatically been reduced in the past several years, and environmental, social and governance (ESG) investing has already started to have a major impact on the industry. In addition, certain technologies, such as leveraging hydrogen's ability to store chemical energy, are now recognized as essential for building a sustainable energy society. As we head toward 2030 and 2050, we will experience a social transformation for which research and development will be a key driver.

Furthermore, we are now able to process big data in bulk, and many methods of data science-based analysis have become relatively easy to use. As a result, information science is expected to help accelerate research and development in various fields.

The above circumstances have led to the establishment of the InfoSyEnergy Research and Education Consortium ("InfoSyEnergy") at Tokyo Tech in November 2019.

InfoSyEnergy's missions are to take the lead in developing a low-carbon or carbon-neutral sustainable society. While Tokyo Tech defines big data science as a combination of data science and AI analysis, InfoSyEnergy defines its sought-after "ambient energy society" as one in which the environment and economic advantage coexist without people having to worry about energy costs and protecting the environment. We aim to achieve such a society by making the most of big data science and creating new values and services through industry-academia collaboration.

In August 2020, Tokyo Tech's proposed Multi-Scope・Energy WISE Professionals doctoral degree program was selected as a WISE Program by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and the Tokyo Tech Academy of Energy and Informatics was established the following December as the educational arm of InfoSyEnergy. The integrated graduate program from master's to doctoral degree is designed to help students build a solid understanding of multi-disciplinary energy science, pursue research and development by taking advantage of big data science, and eventually develop into individuals capable of taking on leadership roles. The program provides sufficient financial support so that students are able to concentrate on their studies, and it also offers a number of opportunities that will be valuable for future global talent with doctorate degrees. Opportunities are available through international forums, research workshops, internships at overseas locations, among others, thanks to collaboration with InfoSyEnergy member companies and top-class universities around the world. We expect many of our students will become Multi-Scope・Energy WISE Professionals.



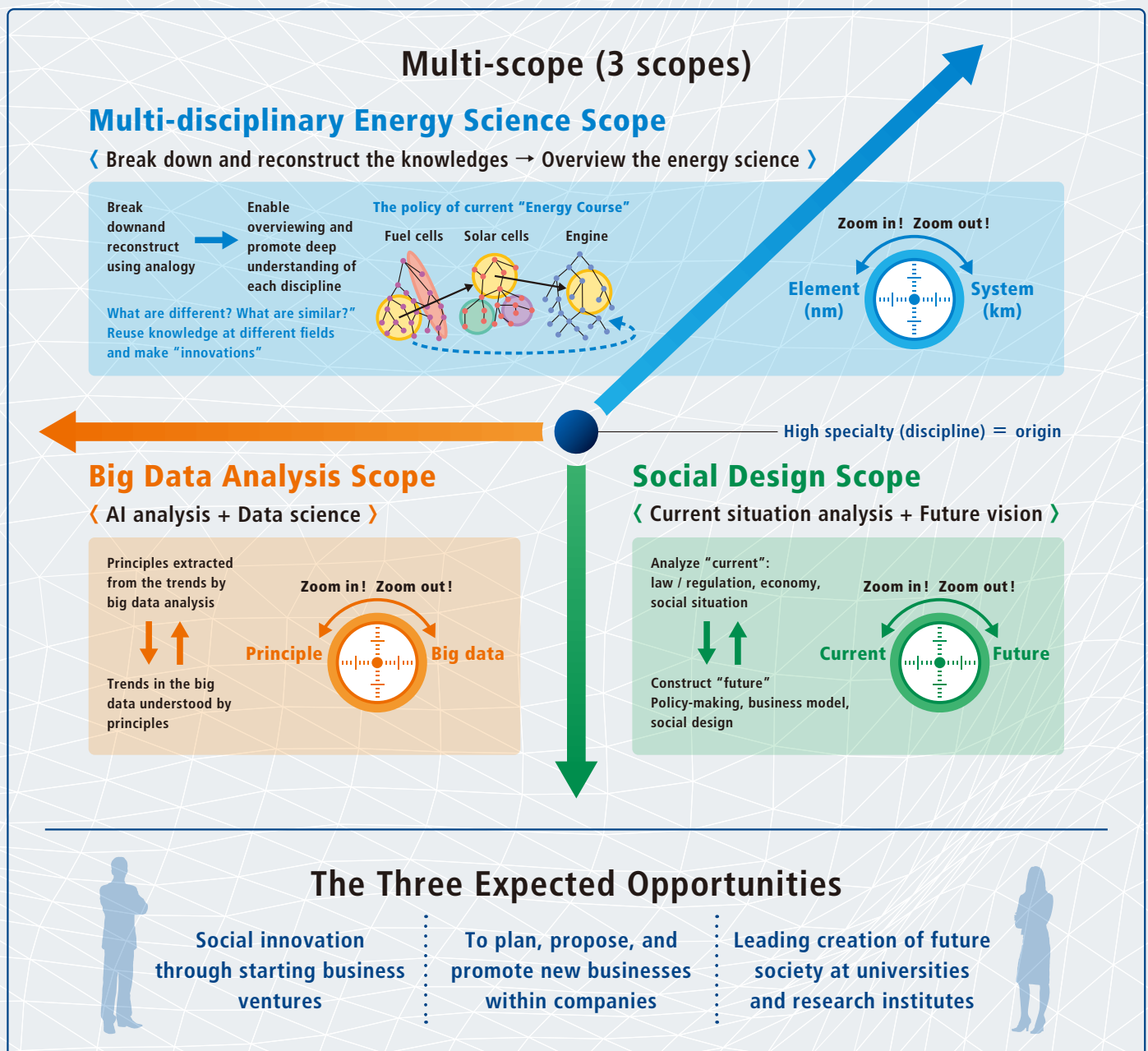
## Our Objectives

The goal of the Tokyo Tech Academy of Energy and Informatics is to develop Multi-Scope·Energy WISE Professionals who will help realize a sustainable, human-centric energy society free of usage constraints such as costs and CO2 emissions. This will involve using tools for the intelligent use of energy, such as AI-based big data analysis. After mastering multidisciplinary energy science, these individuals will transform and design this new energy society using big data science and their social design skills. We will achieve this through the Tokyo Tech Academy of Energy and Informatics program.

Developing Multi-Scope·Energy WISE Professionals will enhance the quality of Tokyo Tech's research in the field of Integrated Energy Science, one of our priority fields, as well as develop WISE Professionals capable of succeeding in the field. Achieving these two ends will also help us attain the goal of our Designated National University proposal, which is to drive Tokyo Tech's research quality to world-leading levels. This is why Tokyo Tech is devoting all its resources to cultivating and sending out Multi-Scope·Energy WISE Professionals into the world.

## What are Multi-Scope·Energy WISE Professionals?

They are individuals who have mastered multi-disciplinary energy science and will transform and design a new energy society through big data science and their social design skills. In other words, they are professionals who possess abilities in the following three scopes as well as the strong force of personality needed to engage and drive others.





# Tokyo Tech Academy of Energy and Informatics program

## Curriculum

1

### InfoSyEnergy Energy Science Courses

This group of courses provides students from diverse undergraduate educational backgrounds with a multidisciplinary education on the subject of energy. In AY2016, Tokyo Tech established an energy-related interdisciplinary graduate major that spans multiple schools or departments, the Graduate Major in Energy Science and Engineering, offering both master's and doctoral degree programs organized around the multidisciplinary energy science principle of reconstructing scholarly knowledge related to energy devices and systems based on similarities and differences through InfoSyEnergy Energy Science courses.

2

### InfoSyEnergy Big Data Science Courses

This group of courses pairs lecture and practical exercise sessions that primarily focus on helping students acquire fundamental knowledge and skills in the areas of data science (DS) and artificial intelligence (AI). In addition, students cultivate practical skills that go beyond the use of DS and AI as tools through exercise courses focused on big data science as it pertains specifically to the field of energy. By engaging in practical exercises using accumulated big data — acquired from sources such as the smart energy system that controls the energy devices in and around Tokyo Tech's Environmental Energy Innovation Building, and various research on energy devices — students acquire the ability to adapt and apply DS and AI to the field of energy.

3

### InfoSyEnergy Social Design Courses

In this group of courses, students acquire and cultivate the fundamental knowledge of and grounding in the social sciences they will need to design and drive the energy society of the future. In addition to lecture courses instructed by full-time Tokyo Tech faculty members, students can take New Business Creation, Energy Policy, and Energy Econometrics courses, which are established with the full cooperation of Hitotsubashi University. Fully supported by the Institute for Liberal Arts, InfoSyEnergy Social Design courses will help students develop their social skills, creativity, and humanity. For example, the courses will enrich their humanity through looking into humanities-related subjects such as labor and the redistribution of wealth in the age of AI, and the state of the law, the nation, and democracy in the information space.

4

### InfoSyEnergy Practice Courses

In this course group, students develop their design thinking abilities by expanding on and synthesizing the scholarly knowledge they gained in the above three course groups. Students acquire the ability through exploring (interdisciplinary), crossing (transdisciplinary), and adding to (multi-disciplinary) the border between energy and information. More specifically, students choose courses suited to their own career paths from the following course subgroups:

#### ▪ InfoSyEnergy Product-service Design

In this course subgroup, students learn about subjects such as functional design and product architecture.

#### ▪ InfoSyEnergy Policy-making Workshop

In this course subgroup, students learn about national policies — including energy policies and electric power policies — as well as how national policy is decided.

#### ▪ Professionals and Value Creation

In this course subgroup, students develop multifaceted viewpoints by studying concrete examples of value creation and innovation from professionals with real-world experience as leaders of organizations such as foreign and domestic corporations, venture companies, NGOs, and NPOs.

**In addition to having the above opportunities for practical learning, students can participate in research, development, commercialization, and social implementation on the frontlines.**

#### ▪ InfoSyEnergy Joint Research Projects

Students participate as research assistants (RAs) in joint research driven by teams of consortium member companies and multiple faculty members.

#### ▪ InfoSyEnergy International Forum

As part of the curriculum, notable researchers from overseas partner institutions (primarily the world's top 16 universities that are consortium members) and business mentors from consortium member companies will be invited to an international forum featuring reports on research outcomes, debates, and more. By engaging in exchanges and group work in the same room with students from overseas, students will cultivate a global perspective and international collaboration skills.

#### ▪ InfoSyEnergy International Fieldwork

Students engage in fieldwork at foreign and domestic companies, municipalities, and other universities to gain real-world experience in settings where problems are occurring in real time. Through hands-on experiences in the field, students acquire workplace skills as well as problem-recognition skills.

5

### InfoSyEnergy Outreach

"How will my dissertation research ultimately serve society?" To answer that question, students will strive for holistic and multifaceted insights into the social significance, value, and other aspects of their own research approximately a year before completing their doctoral dissertations. They will then prepare reports on their findings as the final assignment of their educational programs. These reports will be used to evaluate their level of humanities and social science abilities, and serve as a "stage gate."

※InfoSyEnergy Outreach is a course of InfoSyEnergy Practice Courses.

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### Business and Overseas Mentorship System

The business and overseas mentorship system will help students develop multifaceted viewpoints. Every institutional member of the InfoSyEnergy Research and Education Consortium — which includes 25 member companies, 6 public institutions, and the world's top 15 universities — have selected program staff members who will serve as business or overseas mentors.

## Degree Policy

Those who are fully prepared to harness big data science to promote research and development in promising new energy devices and systems, design a groundbreaking energy society, and drive the forces of innovation.

### Multi-disciplinary Energy Science Scope

Those who have scholarly knowledge related to multi-disciplinary energy science classified and reconstructed through analysis of knowledge and parallels pertaining to energy devices and systems (profound expertise).

### Big Data Science Scope

Those who possess the aptitude to concretely synthesize AI analysis and data science as they apply to their own energy-related areas of specialization (expertise and skills).

### Social Design Scope

Those who have knowledge and skills in social science disciplines covering business innovation, finance, marketing, policy theory, econometrics, etc. In addition, they are equipped with the ability to persuasively motivate and engage others by sharing the social and economic value of their own R&D and business designs, and leadership competencies needed for success at a global level (expertise and quality as members of society).

## Program Completion Process

### Completion Requirements

- 1 Attain four credits or more from the InfoSyEnergy Energy Science courses
- 2 Attain four credits or more from the InfoSyEnergy Big Data Science courses
- 3 Attain four credits or more from the InfoSyEnergy Social Design courses including one or more from restricted electives
- 4 Attain four credits or more from the InfoSyEnergy Practice courses including one from a required course and one or more from restricted electives
- 5 Pass the final examination

Those who have fulfilled all ISE completion requirements, in addition to having successfully completed a doctoral degree program in their Graduate Major, will receive a certification of completion of ISE added to one of the following degree designated by their Graduate Major: Doctor of Science, Doctor of Engineering, or Doctor of Philosophy.

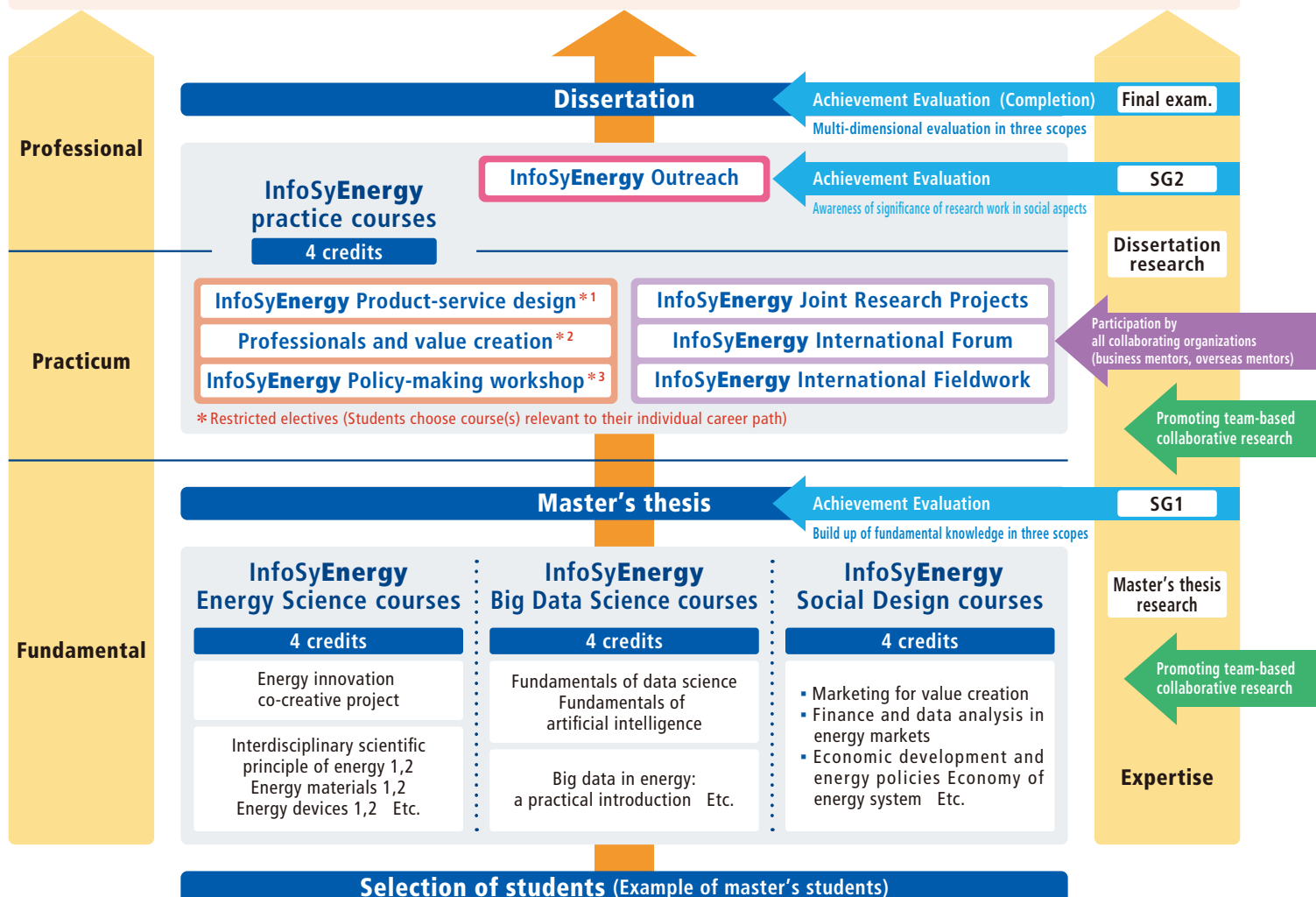
### Multi-Scope · Energy WISE Professional

#### Portraits

Social innovation through starting business ventures<sup>\*1</sup>

To plan, propose, and promote new businesses within companies<sup>\*2</sup>

Leading creation of future society at universities and research institutes<sup>\*3</sup>



# Collaboration with the InfoSyEnergy Research and Education Consortium

The InfoSyEnergy Research and Education Consortium is comprised of Tokyo Tech faculty members as well as members of corporations, public institutions, and top foreign universities that support education and research activities aimed at developing Multi-Scope Energy WISE Professionals. Enhancing the research and educational systems by strengthening collaboration with consortium members makes two things possible. The first is conducting graduate education in a setting close to the real world through, among other things, business mentors and overseas mentors. The second is providing points of contact between consortium members and students through international forums and similar opportunities. Achieving these two things helps students visualize and secure their own career paths.

## What kind of consortium?

**Over 70 Professors / Assoc. Professors participating from across all of Tokyo Tech's schools**

We will create an academia-industry collaboration platform for developing a new energy society and training the next generation of scientists.

**Organized into nine areas, teams design and conduct collaborative research**

Incorporating big data science into fields sharing our vision of an energy society, we engage in collaborations to pursue solutions that cannot be realized alone.

**"Multi-scope" energy education through academia-industry cooperation**

Going forward, we will create a cooperative system for education in "scopes": Specialized Discipline, Multi-Energy Science, Big Data Science, Space (from nano to society), and Time.

**Strategic student-industry matching, and a long-established education system**

Our workshops, symposiums, and other events will provide points of contact for students and industry members, while our scopes will provide education linked directly with career goals.



Holding workshops and symposiums

Establishment of study groups and review committees and dissemination of information

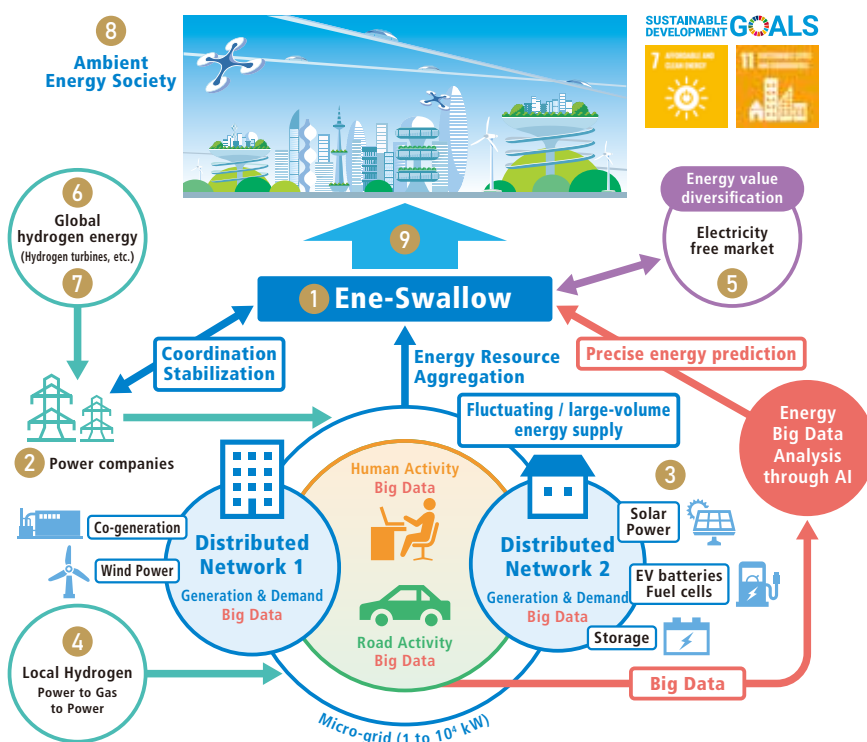
Team-based industry-academia joint research on specific themes

Large-scale industry-academia projects through competitive funding

Promotion of research / education by collaborative research programs

## An energy society combining low-carbon large-scale power sources and distributed systems

### AMBIENT ENERGY SOCIETY



### Focused research themes

- 1 Grid cooperative, distributed real-time energy system
- 2 Technologies for a renewable baseload energy society
- 3 Light energy conversion device/system
- 4 Fuel cells, electrolysis, hydrogen, storage
- 5 Electricity free market, on-campus conceptual trading
- 6 Energy carriers, carbon-reducing catalysts
- 7 Hydrogen / biogas combustion, heat utilization
- 8 Future technologies
- 9 Technology trends, future scenarios, social systems, services

### Collaboration

Company : 26  
Local government, Public institution : 8  
University : 16

# Financial Aid System for Program Students

The following three support options create an environment in which doctoral students can be financially independent and free to concentrate on their studies:

In principle, all Tokyo Tech doctoral students **receive the Tokyo Tech Tsubame Scholarship** for Doctoral Students.

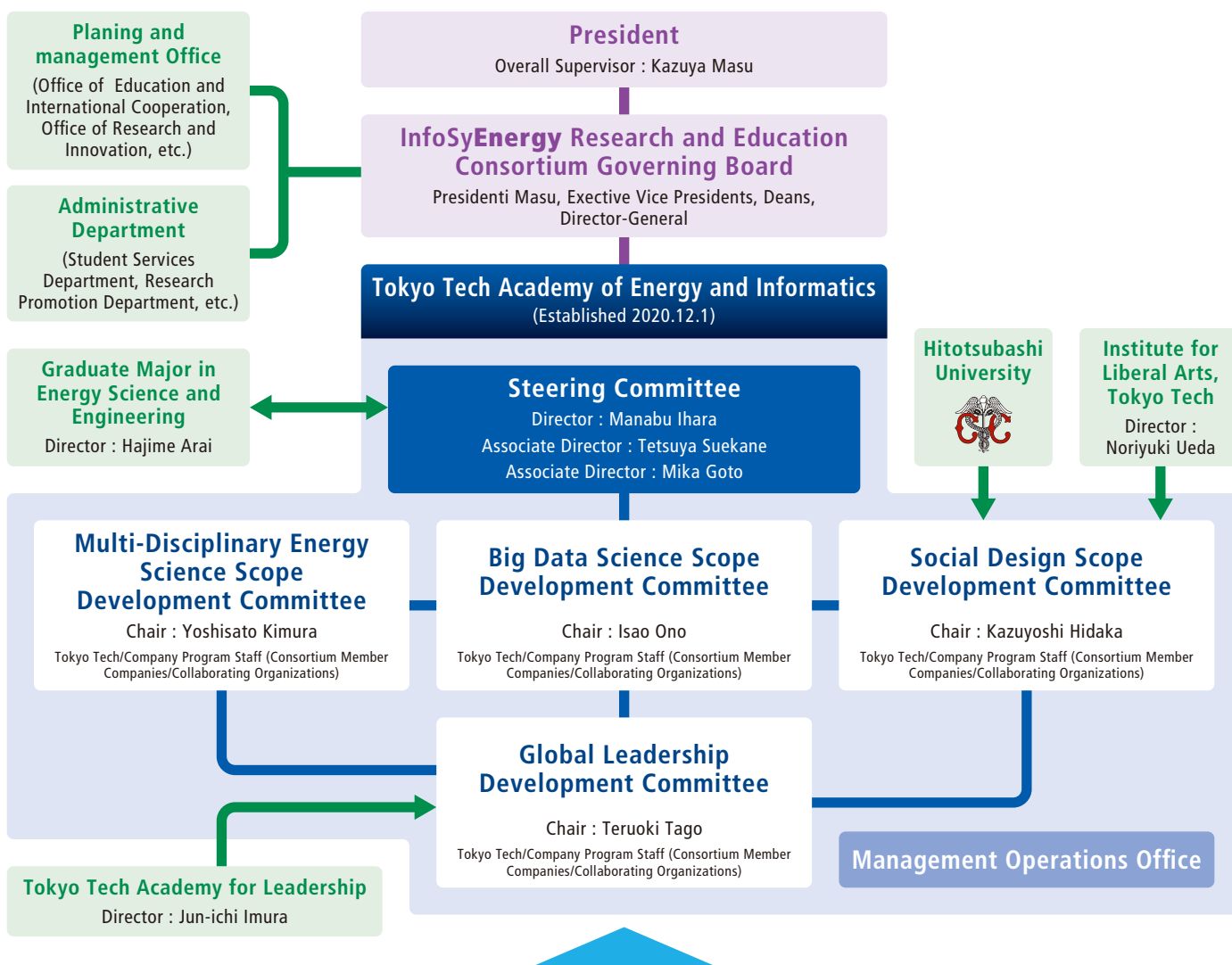
Students have opportunities to **participate in and receive financial support (RA) through the joint research with companies promoted** by the Tokyo Tech InfoSyEnergy Research and Education Consortium.

Doctoral students recognized as having stellar research abilities and potential can receive up to **2.53 million yen** (including Tsubame Scholarship and RA salary from academic supervisor) in support annually during their enrollment.

- The amount of support each student receives is determined by factors that include whether they are receiving scholarships such as the MEXT scholarship (international students) or the Tsubame Scholarship; whether they have been accepted as recipients of the JSPS Research Fellowship for Young Scientists; and whether they are receiving RA remuneration from joint research projects with consortium member companies or other projects.
- The amount of support is also determined based on research achievement and other factors (dissertation presentation, conference presentations, internship participation, etc.).

## Our Objectives

The Academy is managed by a university-wide system with the cooperation of the governing board including the president, of InfoSyEnergy Research and Education Consortium, more than 70 professors and associate professors, and many other member institutions.



Head	Managers	Vice Heads
Manabu Ihara	Tetsuya Suekane	Mika Goto / Kazuyoshi Hidaka / Teruoki Tago / Yusuke Shimoyama Yoshisato Kimura / Junichiro Otomo / Koichi Shinoda

▪ Prof. / Assoc. Prof (more than seventy)    ▪ Collaboration Members (Companies, Public Institutions, Local government, Universities)



# Student Recruitment

At Tokyo Tech Academy of Energy and Informatics, we implement two types of selection.

One is to pursue to be a "Registered Student" (2 stage selection).

And the other is to be a "Associate member student" which target for working and work experienced students.

Information may subject to change depends on year so please check the website for details and schedule.

## Admission for Registered Students

Selection process to become Academy of Energy and Informatics registered students is by **2 stage selection**.

### 【 Target 】

TITECH's Master's degree program students and Professional master's degree program students who are eligible to take main exam with the course "Energy Innovation Co-creative Project" in the 3rd-4th quarter offered in the Energy Course during their master's program

#### 1 Selection of ISE Candidate students 2 Times/ Year (Spring Semester, Fall Semester)

Selection Method : Screening of Application Documents



#### 2 Selection from ISE-Candidate student to a registered student (Main Exam) 1 Time/Year (Fall Semester)

Selection Method : Screening of Application Documents and Research Presentation in the "Energy Innovation Co-Creative Project", and an Interview if necessary.



#### 3 Registration

## Admission for Associate-member students (Adult students)

### 【 Target 】

Adult students who belong to the TITECH's graduate programs of all graduate schools  
(Master's degree program, Professional master's degree program and Doctoral degree program)

#### Selection of Associate-member Students 1 Time/Year (Spring Semester)

Selection Method : Screening of Application Documents

Please select and apply for either of the following programs.

#### InfoSyEnergy Special Certificate Program for adult students

Participate in events and activities designated by Tokyo Tech Academy of Energy and Informatics and pursue obtaining the program certificate with the required grades.

Required to attend at least five events and submit report(s). ※ To pursue to get Certificate

#### InfoSyEnergy Free Participation Program for adult students

Select and participate in events and other activities of your choice to improve your skills. ※ No Certificate

## Tokyo Tech Academy of Energy and Informatics (ISE) Management Operations Office

NE-24 2-12-1 Ookayama, Meguro-ku, Tokyo 152-8550

Environmental Energy Innovation Building (Ookayama North Bldg. 3) Room 613

management\_office@infosyenergy.titech.ac.jp



▪ Tokyo Tech Academy of Energy and Informatics (ISE)

<https://www.infosyenergy.titech.ac.jp/Academy/en/index.html>



▪ Tokyo Institute of Technology

InfoSyEnergy Research and Education Consortium

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