

ACEEES

Academy for Co-creative Education of Environment and Energy Science

産官学国際連携による自立解決型 2S × 3E 人材の育成

Developing 2S x 3E human resources with leadership qualities through international Industry- Government-University cooperation



環境エネルギー協創教育院の目的

Purpose of Academy for Co-creative Education of Environment and Energy Science

人類は、安全性(Safety)と持続性(Sustainability)の確保された 2S 社会を求めて、エネルギー(Energy)を獲得してきました。その後、産業革命を経て経済(Economy)活動を活発化させ、環境(Environment)問題に直面しています。1970 年代以降、我が国はこの 3E を時代の要請に応じて政策的に調和させることで発展し、2S を当然のこととして国際的役割を担うまでになりました。2011 年 3 月 11 日の東日本大震災は、我が国のみならず全世界に 3E の根底にある 2S の重要性を再認識させました。我が国の復興・発展には、震災以前の歴史体験とは異なる 3E の調和が必要とされています。2S を前提とした 3E のバランスは、社会情勢や地域性にも大きく依存し、2S と 3E が時空間的に常に交錯するものです。それらの関係は、数学の言葉を借りれば、通常の四則演算ではなく、二つの異なる方向性を有するベクトルの外積(クロスプロダクト)であり、今まさに $2S \times (\text{クロス}) 3E$ 時代に突入しました。

環境エネルギー協創教育院では、環境とエネルギーの両分野において高度な専門性を有し、時空間的にその形態を変えていく問題を複眼的視点から判断できる俯瞰力、的確かつ迅速な自立的課題抽出・解決力、及び国際的リーダーシップ力を兼ね備え、イノベーションを牽引できる $2S \times 3E$ 時代を担う人材を養成することを目的としています。



Purpose of Academy for Co-creative Education of Environment and Energy Science

Human beings have acquired “Energy” in search of a 2S society that ensures “Safety” and “Sustainability”. Subsequently, we enhanced “Economic” activity through the Industrial Revolution, and now face “Environmental” problems. Since the 1970’s, our country has developed by harmonizing the 3E through policy measures, according to the requests of the times, and has come to play international roles taking 2S for granted. The Great East Japan Earthquake in March 2011 made not only Japan but also the entire world recognize once again the importance of 2S that underlie 3E.

The reconstruction and development of Japan require the harmony of 3E which is different from the historical pre-quake experiences. The balance among 3E that premise on 2S depends greatly on social circumstances and regionality, and 2S and 3E constantly cross one another spatio-temporally. Such relationship is not the regular four arithmetic operations, in mathematical terms, but the cross product of 2 vectors with different directionalities. We have just entered the $2S \times 3E$ era.

Academy for Co-creative Education of Environment and Energy Science has expertise in both environment and energy fields, and aims to nurture human resource that can lead the $2S \times 3E$ era, equipped with the bird’s-eye-view to judge the issues that transform spatio-temporally from multifaceted viewpoints, accurate and quick self-reliant ability to extract and resolve issues, and global leadership, so as to lead the innovation.

環境エネルギー協創教育院の概要

Outline of Academy for Co-creative Education of Environment and Energy Science

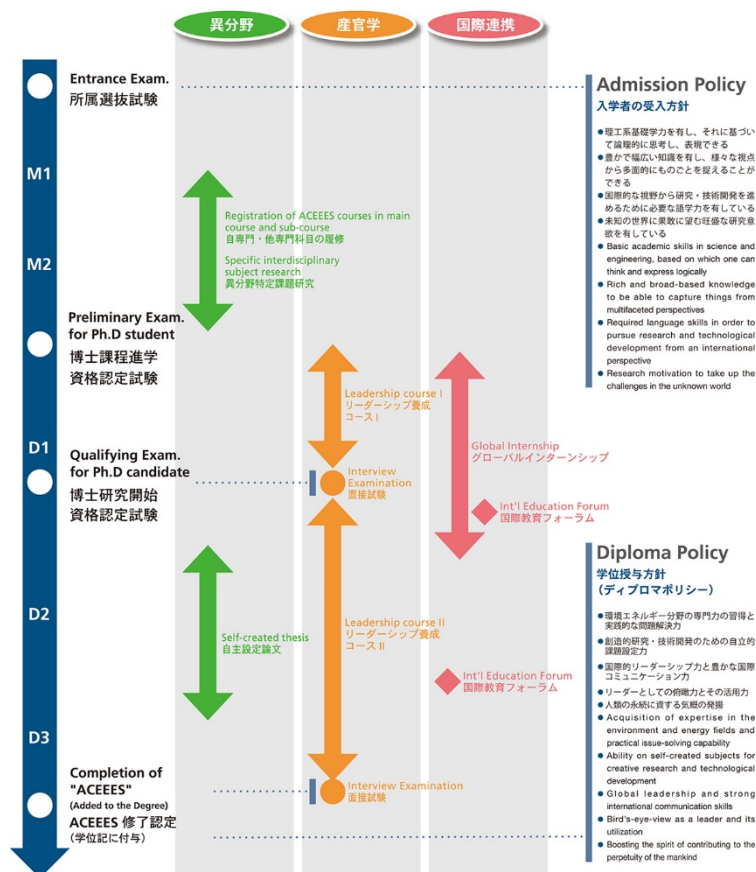
東京工業大学では、2S×3E 時代の到来を見越して、平成 21 年 11 月に 6 研究科 38 専攻の 220 名余の教員からなる全学横断組織「環境エネルギー機構」を全国に先駆けて発足させました。本教育院では、それぞれ異なる学術分野(ディシプリン)の教員から構成される環境エネルギー機構の 7 センター(エネルギー、宇宙環境、地球環境、都市環境、生命環境、分子環境及び社会システム)を母体とした異分野協創、産業界及び関係省庁等と大学が共同して教育を行う産官学協創、及び多数の海外大学・研究所等との協調による国際連携協創の三つの協創を軸に効率的かつ機動的な修士・博士の一貫教育を行い、イノベーションを牽引できる 2S×3E 時代を担うリーダーを養成します。

In November 2009, Tokyo Institute of Technology (Tokyo Tech) established Japan's first "Inter-Departmental Organization for Environment and Energy", which is a university-wide cross-functional organization consisting of about 230 faculty members from 38 departments in 6 graduate schools, in anticipation of the advent of 2Sx 3E era. In the Academy, 3 co-creative education form the axis, namely, Interdisciplinary Co-creation based on 7 centers in Inter-Departmental Organization for Environment and Energy (Energy, Space Environmental, Global Environmental, Urban Environmental, Bioenvironment, Molecular Environmental, and Social System) consisting of faculties from respective disciplines, Industry-Government-University Cocreation where the industries, related governmental ministries, and universities jointly offer education, as well as International Cooperative Co-creation through collaboration with multiple overseas universities and research organizations, in order to ensure an efficient and flexible integrated master's-doctoral education, and cultivate leaders who can play crucial roles in the 2S x 3E era by leading the innovation.



Integrated master's-doctoral course

ACEEES 修士・博士一環コース履修計画



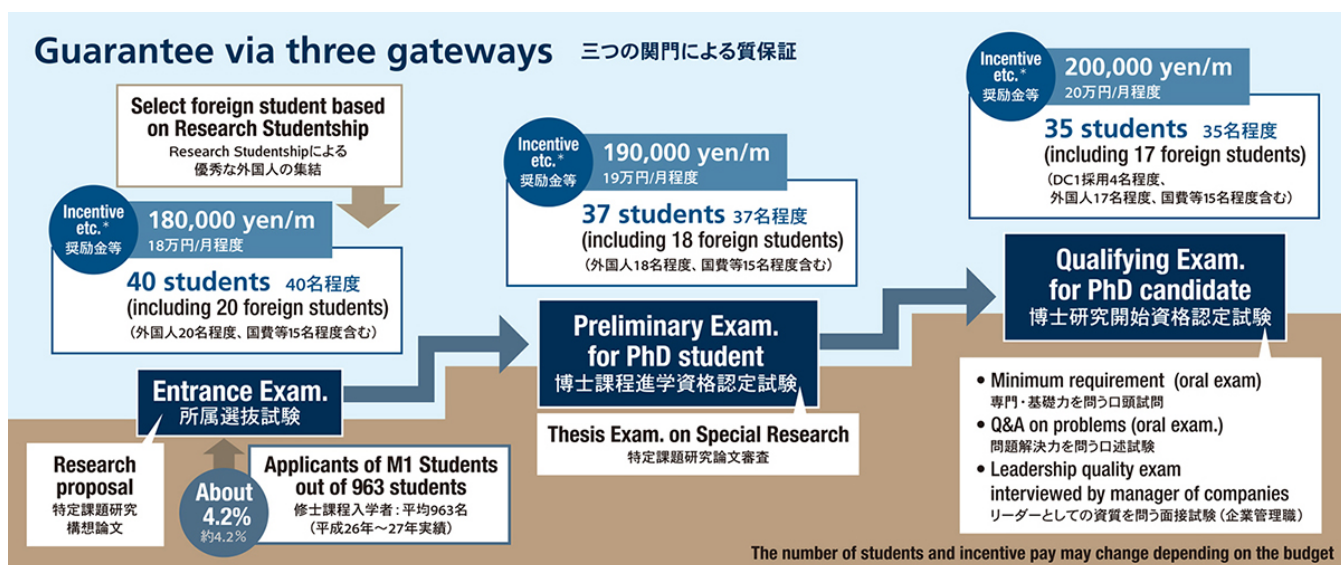
Degree conferred by ACEEES 環境エネルギー協創教育院で授与される学位

本教育院に選抜された学生が所属する大学院課程で選択するコースが授けられる博士(理学)、博士(工学)、または博士(学術)に「環境エネルギー協創教育課程」の修了を付記します。

The completion of "Academy for Co-creative Education of Environment and Energy Science" will be added to Doctor (Science), Doctor (Engineering) or Doctor of Philosophy (Ph.D.) given by the departments of the students selected by the Academy.

三つの関門による質保証とインセンティブ

Quality Assurance and Incentives through 3 Gates



本教育院では、学生の質を保証するシステムと、学生が経済的に独立し勉学に集中できる環境を整える奨励金・RA 雇用の制度を効果的に組み合わせることにより、国内外から優秀な学生を集結させ、環境エネルギー分野の2S × 3E 時代を担う次世代リーダーを輩出します。

【第一関門】コース編入試験（修士課程入学後半年以内）

本教育院の母体となる既存専攻の修士課程に入学した学生のうち、本教育コースの履修を希望する学生については、自専攻の特定課題研究（修士論文相当）から博士論文研究に至る一連の研究計画書及び異分野の協創コースの選択理由書、環境エネルギー分野におけるグローバルリーダー像に関する小論文を提出させます。

【第二関門】博士課程進学資格認定試験（修士課程入学後1年半～2年以内）

自専攻の特定課題研究（修士論文相当）及び異分野特定課題研究スキルの提出とその審査を経て、本教育院における博士課程への進学を許可する。進学を許可された学生は、グローバルインターンシップの履修が許可されます。

【第三関門】博士研究開始資格認定試験（Qualifying Examination）（博士課程進学後半年後）

博士論文研究を開始する有資格者、いわゆる Ph. D. Candidate となるための認定試験を次の項目について行います。

- ✓ 専門・基礎力を問う口頭試験（Theoretical minimum の保証）
- ✓ 課題解決力を問う口述試験（試験の10日前に通知される自専門の最新トピックについて、課題設定及びその問題解決を行い、その概要をプレゼンテーションします）
- ✓ グローバルリーダーとしての資質を問う面接試験（企業管理職が面接官に加わる：産官学協創）

The Academy effectively combines the system that guarantees the quality of students with financial incentive and RA employment systems that create the environment for students to be economically independent and concentrate on their study; thereby gathers talents from Japan and abroad, and produces the next generation leaders who can lead the 2S x 3E era in the environment and energy fields.

【First gate】Course entrance examination (within 6 months from enrollment in master's course)

Of the students enrolled in the master's course of the existing departments, which is the basis of the Academy, those who wish to take this Education course submit a series of research plan covering the range from the specific

subject research of one's own major (equivalent to master's thesis) to doctoral thesis, statement of reasons for selecting a co-creative course in a different field, as well as an essay on the image of a true global leader in the environment and energy fields. More than 3 faculty members from different disciplines closely examine the course admission request, and decide the students to be enrolled in the course.

【Second gate】 Preliminary examination to enter doctoral course (within 1.5 to 2 years from enrollment in master's course)

Enrollment in the doctoral course of the Academy is admitted following the submission and screening of specific subject research of one's own major (equivalent to master's thesis) and specific interdisciplinary subject research. Students admitted to enroll are permitted to take up global internship. Also, students are paid an incentive pay of 190,000 yen/month etc.*, in order to provide for an environment to dedicate themselves to the co-creative education program.

【Third gate】 Qualifying examination for Ph.D. candidates (6 months after enrollment in doctoral course)

The qualifying examination to become qualified to commence a doctoral research, the so-called Ph. D.candidate, is conducted on the following items:

- Oral examination to test specialized and basic skills (guarantee of theoretical minimum)
- Oral examination to test issue-solving capability (set a theme and resolve the issue on the latest topic in one's specialized field notified 10 days prior to the exam, and present the outline)
- Interview examination to confirm the qualification as a global leader (company managers also join as interviewers: Industry-Government-University co-creation)

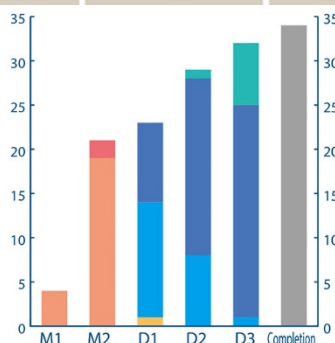
カリキュラム Curriculum



	M1	M2	D1	D2	D3
ACEEES Students (124)	12	29	31	26	26
Female Students (19; 15%)	0	5	7	2	5
International Students (39; 31%)	2	13	11	5	8

Progress of ACEEES Education Program
Total ACEEES students:165 (FY2012-FY2017)
Female students: 17%, International Students: 35%

Step 1	Step 2
The 1st Gate (Entrance Exam.)	ID Co-creative Courses Specific ID Research
Step 3	Step 4
The 2nd Gate (Preliminary Exam. for PhD Student)	The 3rd Gate (Qualifying Exam. for PhD Candidate)
Step 5	Step 6
Global Internship	Leadership Development Courses
Step 7	Certificate of Completion
Self-created Thesis	



グローバルインターンシップ Global Internship

Global Internship in FY2012-2019
Global leaders must have the global mindset, communication and leadership

● Host Institutions for Global Internship 117 institutions

36 Companies, National administrative org.
81 Universities, Research institutions

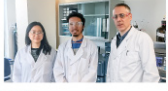
Education Research Internship
Gaku OKUMA
Major Department
Dept. of Materials Science and Engineering



Host Company
Forschungszentrum Ailich / Germany

Duration Jun. 2016 – Aug. 2016
I conducted research on the sinter forging test in stress-strain relation at Institute of Energy and Climate Research (IEK), Forschungszentrum Ailich. Through this experience, I got confidence to work hard together with young excellent researchers.

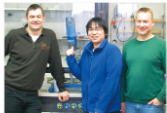
Education Research Internship
Sjaikhurizal EL MUTTAQIEN
Major Department
Dept. of Life Science and Technology
Graduate Major in Life Science and Technology



Host Company
Cristal Therapeutics(Pharmaceutical company) / The Netherlands

Duration Sep. 2016-Nov. 2016
The main consideration I chose Cristal Therapeutics for my internship place is because of the linearity of this company's core business with my own research therein Tokyo Tech (nanomedicine). Moreover, doing internship at company gave me valuable and challenging experience, such as scaling-up process, how we build team work with other department member, and managerial skill to achieve project goal. Indeed, these experiences are very useful for my future career as a researcher.

Company Internship
Hisanori MASHIKO
Major Department
Dept. of Applied Chemistry



Host Company
Wacker Chemie AG (Chemical manufacturer)
Burghausen / Germany

Duration Sep. 2013 – Dec. 2013
I had been inspired by a lot of experiences and learned the leadership in the global company through discussions with Doctors who take the majority of managers positions.

Company Internship
Kyohhei HISANO
Major Department
Dept. of Environmental Chemistry and Engineering



Host Company
Nomura Research Institute India Pvt. Ltd. / India

Duration Aug. 2015 – Nov. 2015
I was involved in the project team at the Nomura Research Institute India Pvt. Ltd. as a consultant and learned the method of customer information collection and market research for Japanese company in India and Japanese government agency.

Education Research Internship
Sakiko ISHINO
Major Department
Dept. of Chemical Science and Engineering



Host Company
Dumont d'Urville station, Concordia station / Antarctica

Duration Dec. 2016-Jan. 2017
Under the scientific observational program of Dr. Joel Savarino of Laboratoire de Glaciologie et Géophysique de l'Environnement, I visited two Antarctic station at both coastal and inland, Dumont d'Urville and Concordia. It was particularly impressive that the sea ice extent was anomalously large in this year compared to usual even though the temperature was in the usual range, which resulted in the tragic condition for penguins to feed their babies. This made me wondering if any human activities damage even penguins through the environmental changes, although it cannot be judged at this stage.

Education Research Internship
Masaki ISHIZU
Major Department
Dept. of Chemical Science and Engineering
Graduate Major in Energy Science and Engineering



Host Company
Beam Engineering for Advanced Measurements Co. / USA

Duration Dec. 2016-Mar. 2017
I have been involved in the development of photo functional organic thin films different from my own specialized. Most employees are doctoral researchers who have different expertise and it has become a great learning to advance research while learning excellent research methods and logic.

Company Internship
Kisa FUJIWARA
Major Department
Dept. of Architecture and Building Engineering



Host Company
ZOF Architects LLP (architectural design office)
Portland / USA

Duration Aug. 2013 – Oct. 2013
I was involved in architectural design process utilizing the climate and environmental analysis. I got the motivation to learn a new skill to propose the superior space in environmental and energy.

Policy Internship
Weerakoon Samya PATALI
Major Department
Dept. of Value and Decision Science



Host Company
USDA National Agroforestry Center / USA

Duration Jun. 2015 – Sep. 2015
As my major assignment, I conducted research at National Agroforestry Center and the USDA Organic Working Group on how agroforestry conservation buffers could be used on preventing genetic and pesticide drift in organic farms.

本教育院では、海外企業、日本企業の海外拠点、海外大学・研究機関及び海外政策機関等とのこれまでの交流実績を有効に活用し、博士課程進学直後の半年間において、「グローバルインターンシップ」を義務付けています。このグローバルインターンシップは、新興国を中心とした日本企業の海外拠点へ派遣する海外企業インターンシップに加えて、これまで環境エネルギー分野で密接な交流実績がある海外の17機関（米国・プリンストン大学、マサチューセッツ工科大学、ジョージア工科大学、コネチカット大学、テキサス大学、ウィスコンシン大学、テネシー大学、英国・ケンブリッジ大学、仏国・パリ大学、ナント大学、リヨン大学、独国・シュツットガルト大学、ダルムシュタット工科大学、オランダ・ユトレヒト大学、チェコ・チェコ科学アカデミー、韓国・KAIST、釜山大学）以上の大学・研究所に3ヶ月以上の期間派遣する、専門力と国際コミュニケーション力の涵養を目的とした海外大学インターンシップを行います。

The Academy effectively leverages the track record of exchanges with foreign companies, overseas bases of Japanese companies, foreign universities and research organizations, as well as overseas policy organizations, and establishes a compulsory “Global Internship” within 6 months of enrollment in the doctoral course. Under this Global Internship, in addition to foreign company internships where students are dispatched to Japanese companies’ overseas bases mainly in the emerging countries, we conduct Foreign University Internship aimed for the development of expertise and international communication skills, sending students for over 3 months to 17 foreign universities (USA: Princeton University, Massachusetts Institute of Technology, Georgia Institute of Technology, University of Connecticut, University of Texas, University of Wisconsin, University of Tennessee, UK: Cambridge University, France: University of Paris, University of Nantes, University of Lyon, Germany: University of Stuttgart, Darmstadt University of Technology,

Netherlands: Utrecht University, Czech: The Academy of Science of Czech Republic, South Korea: KAIST, Busan University), with which we have a track record of close exchanges in the environment and energy fields.

Training camp-type field study through International Education Forum on Environment and Energy

国際教育フォーラム International Education Form

