# Lab Introduction and Possible Collaboration

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# Introduction

**Muhammad Aziz, Dr. Eng.**

**Associate Professor**
Institute of Industrial Science, The University of Tokyo

Scopus ID : 56436934500
ORCID : 0000-0003-2433-8500
Researcher ID : B-9248-2015
Homepage : epi.iis.u-tokyo.ac.jp
h-index : 32 (google scholar), 28 (Scopus)
Publication : Journals : 125, Books and Chapters: 23

**Principal Investigator** Energy and Process Integration Laboratory

**Ketua Umum** Ikatan Ilmuwan Indonesia Internasional (I-4)

**Journal Editors**

Carbon Resources Conversion (KeAi, Elsevier)
Energies (IF 2.707) Sustainability (IF 2.592) Processes (IF 2.753)
Applied Sciences (IF 2.217) Frontiers in Energy Research (IF 2.746)

**Research Areas**

Energy systems, Process design, Power generation, Carbon capture and storage, Hydrogen production, Renewable Energy, Energy conservation, Energy and exergy analysis, Exergy recovery, Electric vehicle, Batteries, Smart grid

# The University of Tokyo

- QS Global World Ranking **24th** (has been 2nd in 2011 after Harvard), THE 36th
- Established in 1877 (First Imperial university)
- Academic faculty staff 3,817

| Academic Staff | Male | Female | Total |
|---|---|---|---|
| Professors | 1,176 | 100 | 1,276 |
| Associate Professors | 815 | 107 | 922 |
| Lecturers | 236 | 50 | 286 |
| Research Associates | 1,090 | 243 | 1,333 |

- Others: Research assistant 35; Teachers at affiliated schools 41; Administrative staff 1,524; Technical staff 543; Medical staff 1,978
- Total students 27,453 (about 2,100 are foreign students)
- Five campuses: Hongo, Komaba, Kashiwa, Shirokane, Nakano
- Nobel laurates: 16 have been affiliated with Todai (11 alumni, 4 long-term academic members), 10 are officially listed as Tokyo's Nobel Laurates by university
- 5 astronauts

# Institute of Industrial Science

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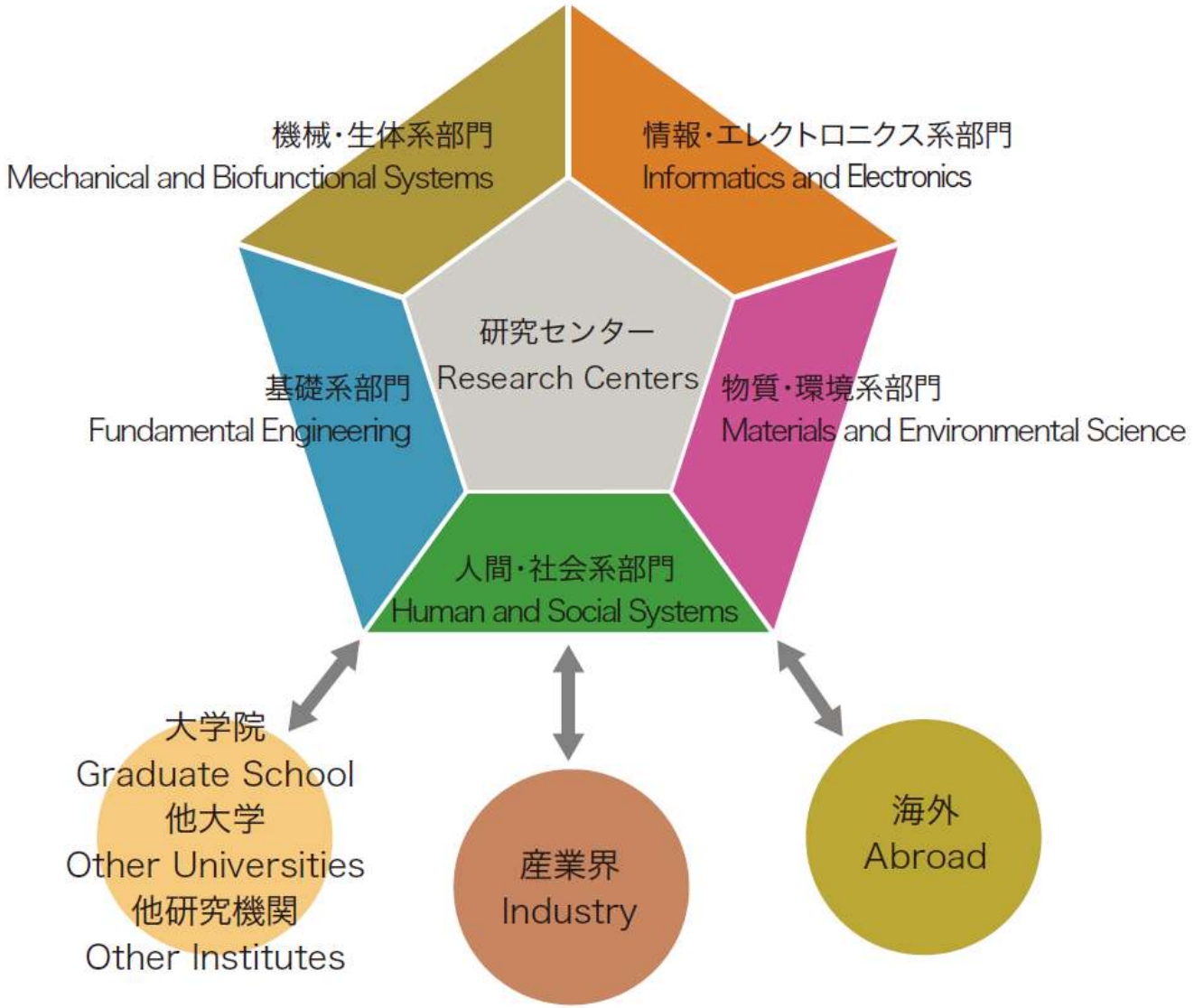



5研究部門と研究センター
Five Research Departments and Research Centers

1877 東京大学創立 / Establishment of the University of Tokyo

1886 工学部発足 / The Engineering College, the predecessor of the Faculty of Engineering, was absorbed by the main body of the University.

1942 第二工学部設立 / The Second Faculty of Engineering was founded in Chiba to cope with urgent demand for skilled engineers. It operated until 1951.

1949 生産技術研究所発足（5月31日）/ IIS was established as a result of the reorganization of the Second Faculty of Engineering (May 31st).

1954 第一回生産技術研究所公開開催 / IIS Open House was held.

試験高炉実験の開始 / Experimental blast furnace for iron production research started operation.

1955 観測ロケット研究開発の開始 / A project on rockets for space research was started.

1962 生産技術研究所の六本木への移転 / The main body of IIS transferred from Chiba to Tokyo.
大型実験設備を含む施設は本所附属の千葉実験所として残りました。/ Chiba Campus, called the Chiba Experiment Station, has accommodated oversize experiments.

1998 駒場Ⅱ地区キャンパス研究棟への移転開始 / The transfer to Komaba II Campus was started.

2001 駒場Ⅱキャンパスへ移転 / The transfer to Komaba II Campus was completed.

2004 国立大学法人化「国立大学法人東京大学」となる / All National Universities were transformed into National University Corporations, and the University of Tokyo was incorporated.

2005 総合研究実験棟（An棟）竣工 / Construction of the General Research Experiment Building was completed.

2012 生産技術研究所アニヴァーサリーホール（S棟）竣工 / Construction of IIS anniversary hall (S block) was completed.

Photo: Hiroshi UEDA

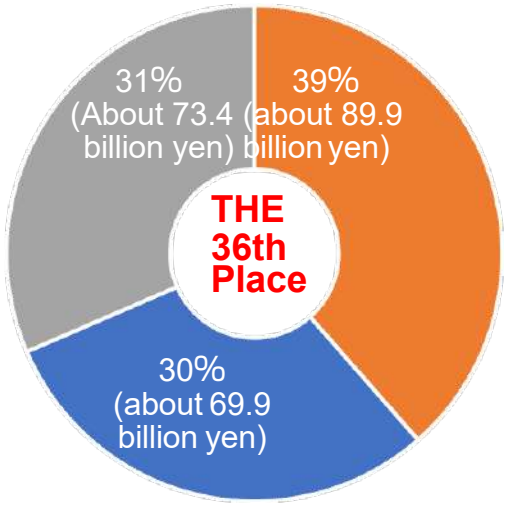
2017 千葉実験所の柏キャンパスへの機能移転 / The function of Chiba Experiment Station was transferred to Kashiwa Campus.

Photo: Yutaka SUZUKI

2019 設立70周年記念講演会・記念式典挙行 / The 70th anniversary of the founding of IIS was observed.

# Campus and Department Policies

- No policy to get an accreditation
- Nurturing the researcher
- No focus on ranking
- Dynamic classes, especially for graduate schools (updated per semester)
- No parallel classes
- Quarter system
- 120 credits for undergraduate
- 30 credits for master (6 credit for thesis, min 12 credits for selected major-specific courses and common fundamental lectures, min 6 credits of courses from other majors)
- 20 credits for doctoral (12 credits for dissertation, min 8 credits from lectures)
- Open university bonds (investment, ownership, strengthening the collaboration with industries and other stakeholders)




**Revenue (2016) ):** 23,332,800,000 yen

Operating Expense Subsidies
About 8,992,700,000 yen

External Funds (Including Public Funds)
About 6,995,700,000 yen

Own Revenue
About 7,344,400,000 yen

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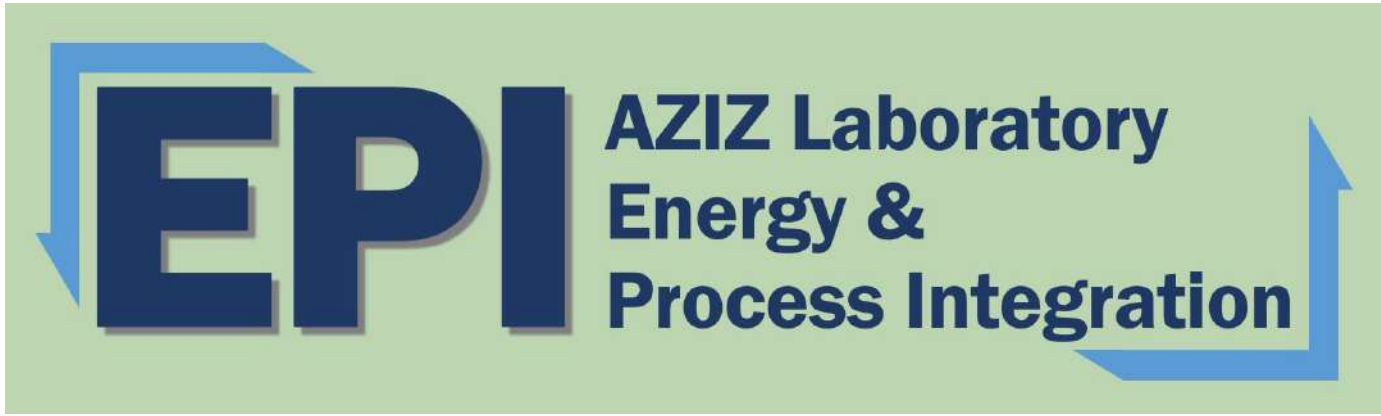
# *Aziz Laboratory, IIS, UTokyo*



# Process Integration and Energy Laboratory

- Started from Mar 2019
- http://epi.iis.u-tokyo.ac.jp/
- Fields: mechanical engineering, chemical engineering, electrical engineering

**Researchers, etc.　研究員等**

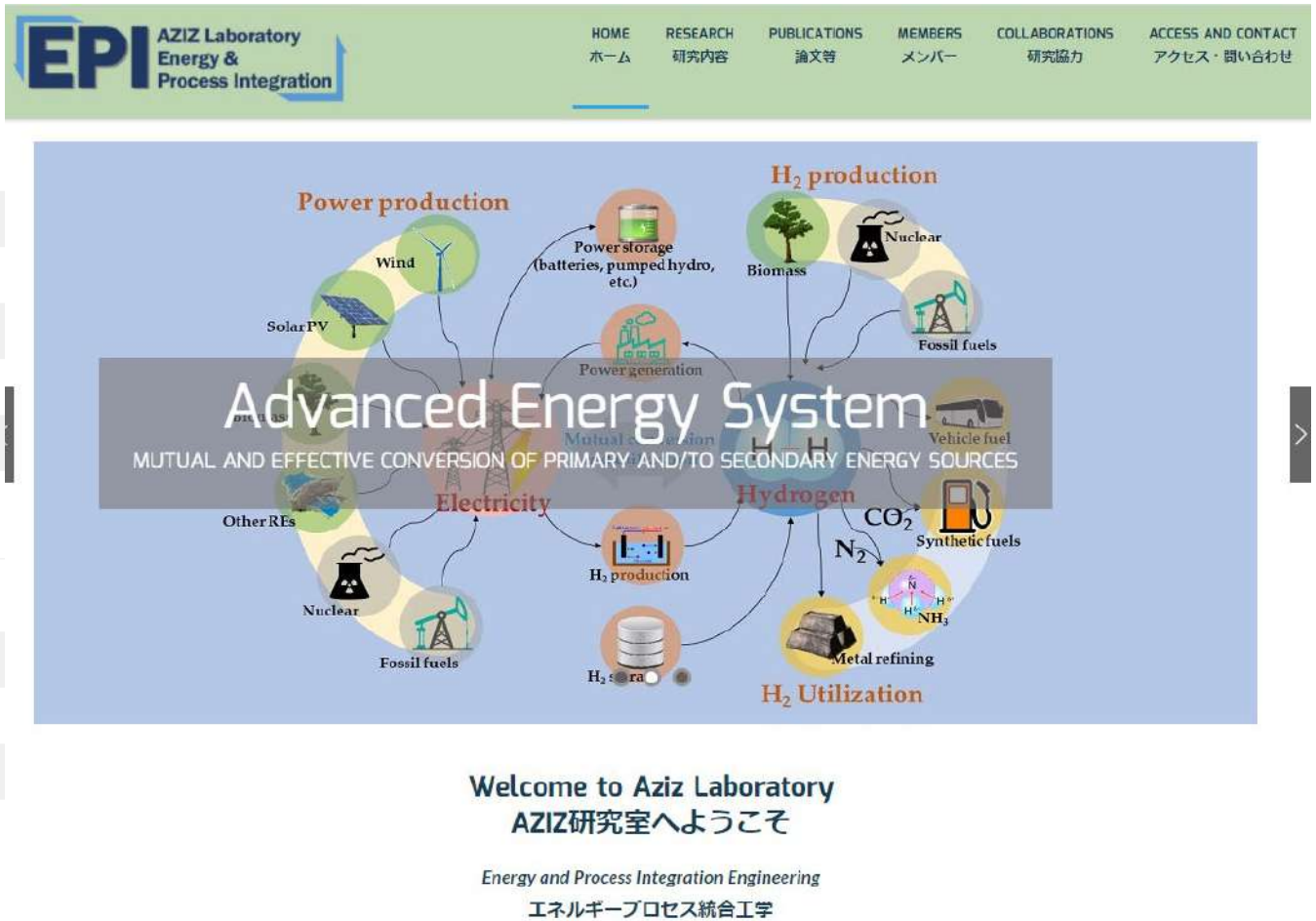
- Michihiko Yanagisawa (Research fellow, Kanken Techno Co., Ltd.)
  柳沢道彦（リサーチフェロー、カンケンテクノ株式会社）

**Students　学生**

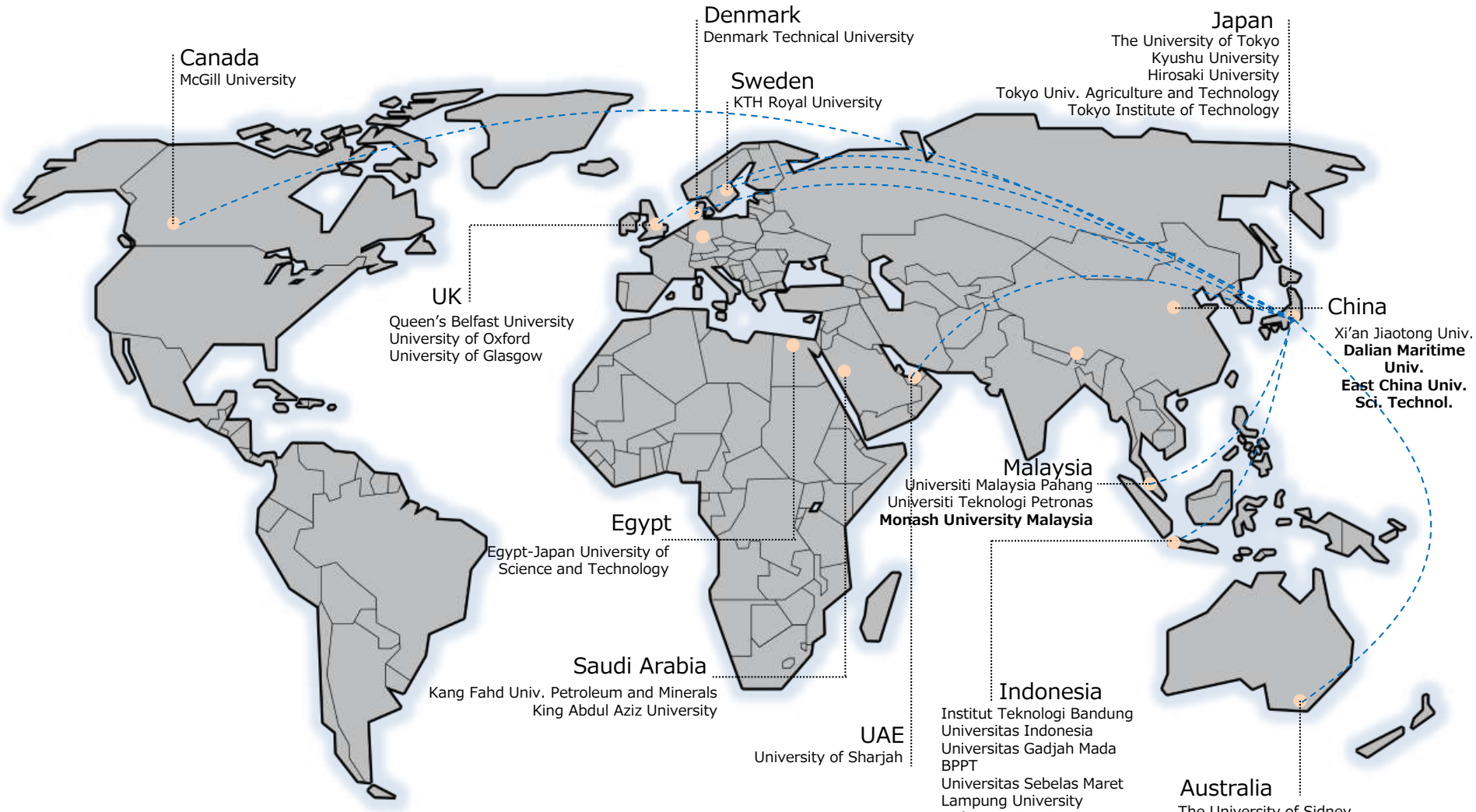
| | | | |
|---|---|---|---|
| D1 | Wen Du | 温 渡 | China |
| D1 | Hafif Dafiqurrohman | | Indonesia |
| D1 | Zhuang Sun | 孙 状 | China |
| M1 | Kyosuke Miyahira | 宮平恭輔 | Japan |
| M1 | Luthfan Adhy Lesmana | | Indonesia |
| M1 | Kazuma Kunihara | 國原一真 | Japan |

**Research/Internship Students　研究生・研究実習生**

| | | |
|---|---|---|
| Abraham Castro Garcia | Tokyo Institute of Technology | Japan |
| Muhammad Usman | Tokyo Institute of Technology | Japan |
| Tsamara Tsani | Tokyo Institute of Technology | Japan |
| Chanin Hakandai | Khon Kaen University | Thailand |



# Map of collaboration



**Canada**
McGill University

**Denmark**
Denmark Technical University

**Sweden**
KTH Royal University

**Japan**
The University of Tokyo
Kyushu University
Hirosaki University
Tokyo Univ. Agriculture and Technology
Tokyo Institute of Technology

**UK**
Queen's Belfast University
University of Oxford
University of Glasgow

**China**
Xi'an Jiaotong Univ.
**Dalian Maritime Univ.**
**East China Univ. Sci. Technol.**

**Malaysia**
Universiti Malaysia Pahang
Universiti Teknologi Petronas
**Monash University Malaysia**

**Egypt**
Egypt-Japan University of Science and Technology

**Saudi Arabia**
Kang Fahd Univ. Petroleum and Minerals
King Abdul Aziz University

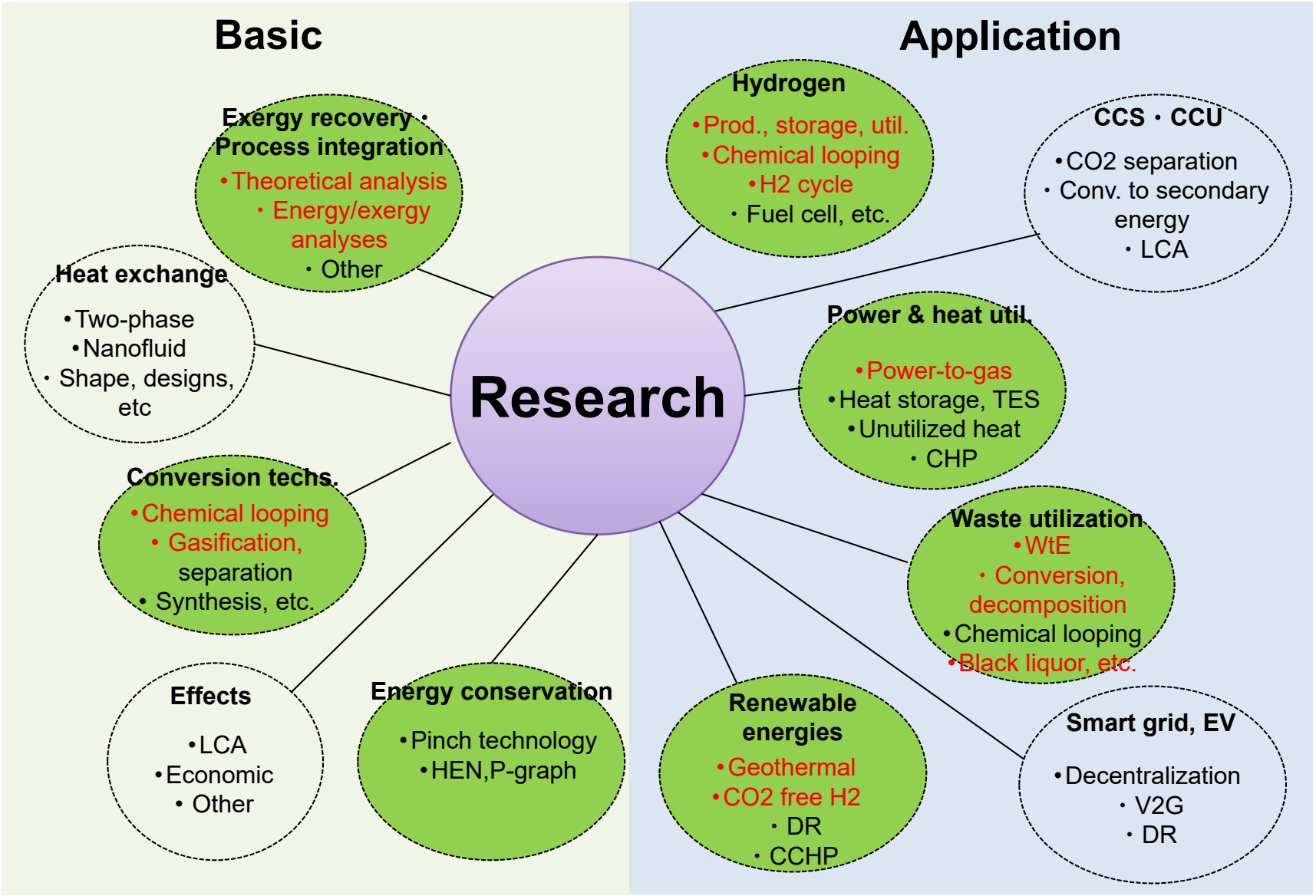
**UAE**
University of Sharjah

**Indonesia**
Institut Teknologi Bandung
Universitas Indonesia
Universitas Gadjah Mada
BPPT
Universitas Sebelas Maret
Lampung University
Malang University
Universitas Islam Indonesia
Ahmad Dahlan University
**Binus University**
Universitas Pendidikan Indonesia
**Airlangga University**
Institut Teknologi Kalimantan

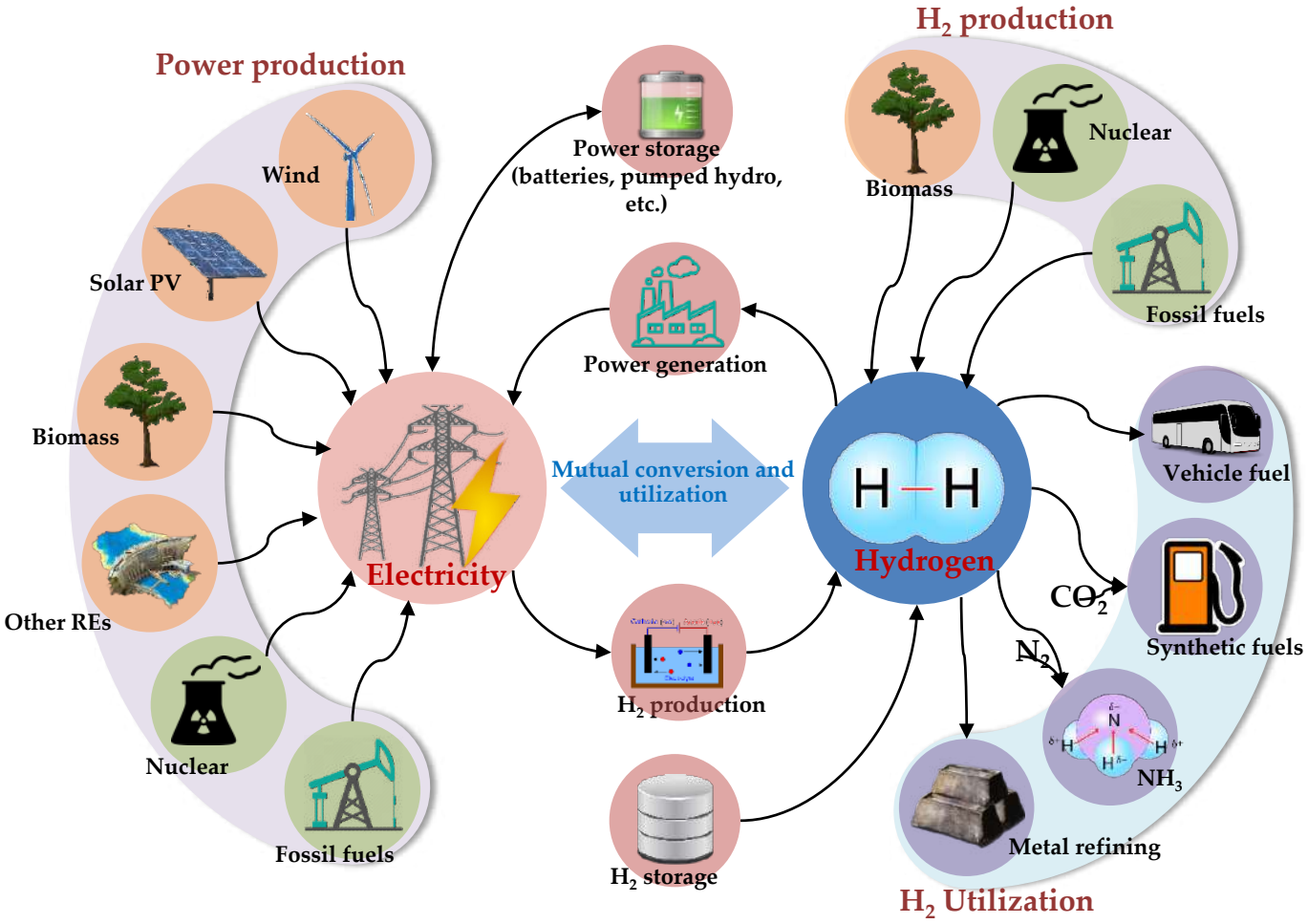
**Australia**
The University of Sidney
University of Tasmania

# Expertise Area

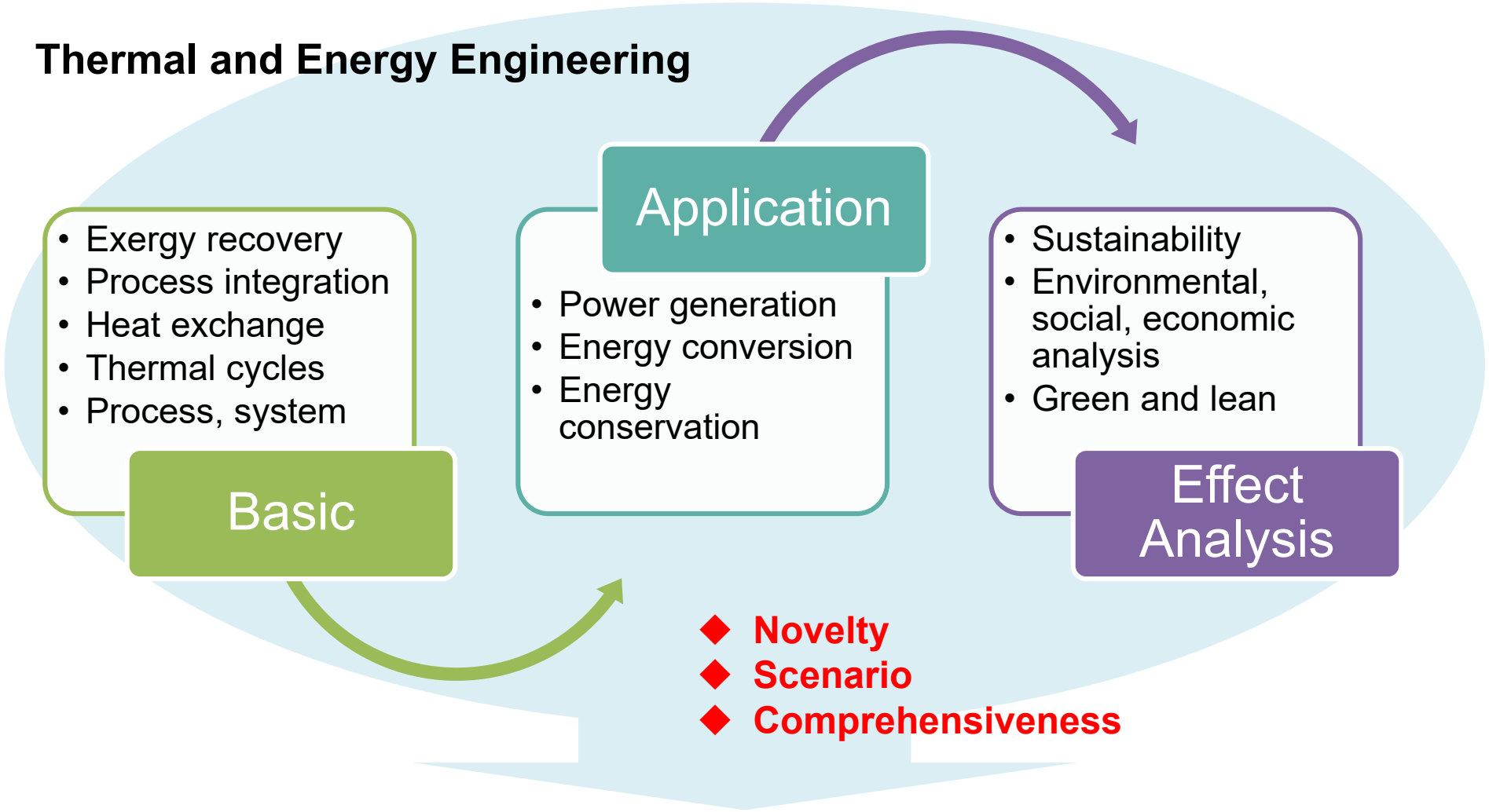
**Covered area: theoretical simulation, experimental studies, demonstration evaluation**



# Big picture of research motivation

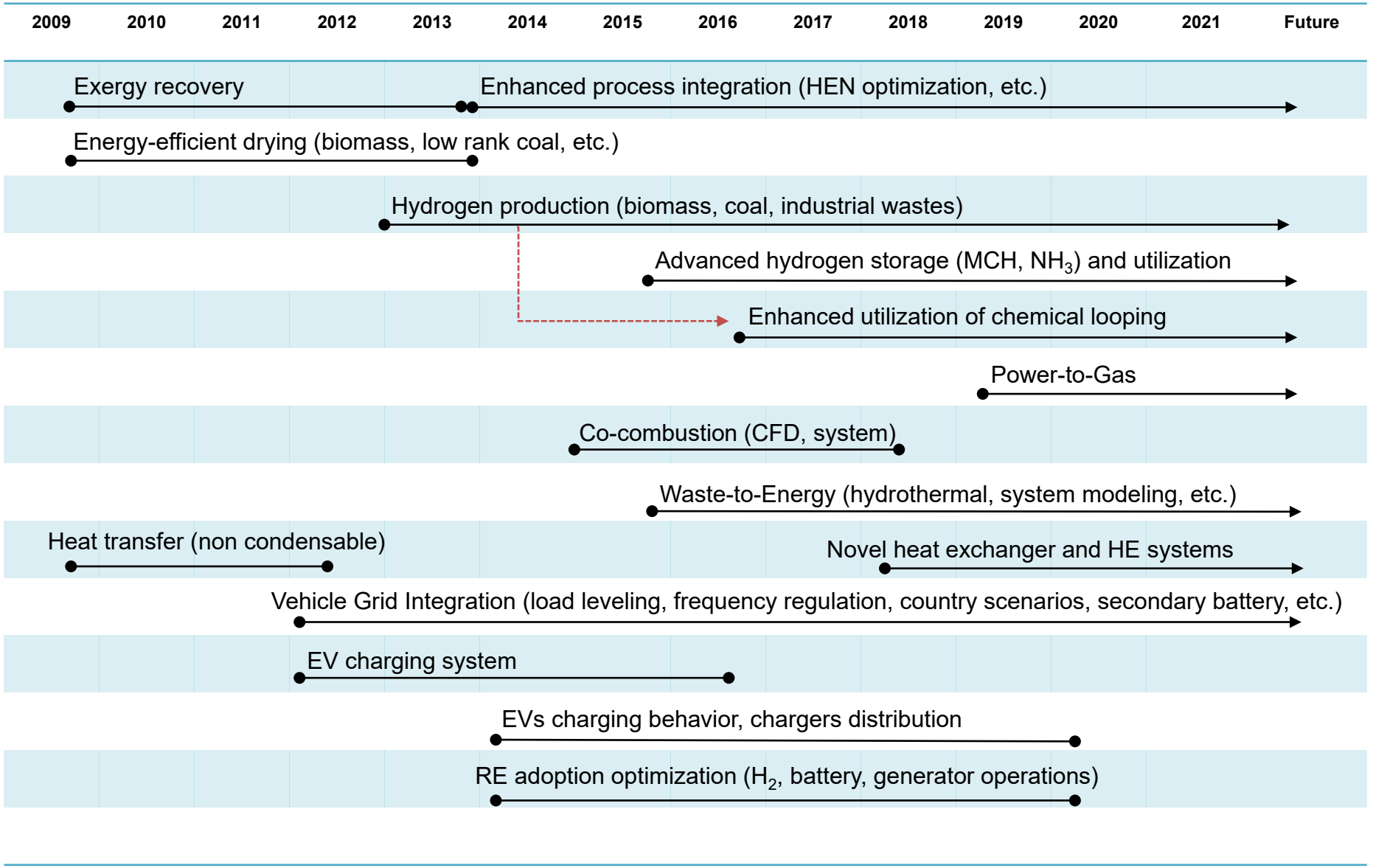


# Research Development




**Toward comprehensive knowledge creation**

# Research

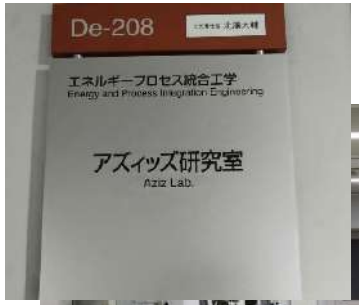

2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Future
Exergy recovery
Enhanced process integration (HEN optimization, etc.)
Energy-efficient drying (biomass, low rank coal, etc.)
Hydrogen production (biomass, coal, industrial wastes)
Advanced hydrogen storage (MCH, $NH_3$) and utilization
Enhanced utilization of chemical looping
Power-to-Gas
Co-combustion (CFD, system)
Waste-to-Energy (hydrothermal, system modeling, etc.)
Heat transfer (non condensable)
Novel heat exchanger and HE systems
Vehicle Grid Integration (load leveling, frequency regulation, country scenarios, secondary battery, etc.)
EV charging system
EVs charging behavior, chargers distribution
RE adoption optimization ($H_2$, battery, generator operations)

# Future Research Topics

- Efficient H2 production, storage and utilization
  - Low rank fuel and renewable sources to hydrogen
  - Direct ammonia production
  - Hydrogen cycle
  - Hydrogen combustion and co-combustion
- CO2 Utilization (including decomposition, conversion, etc.)
  - Effective methanol production
  - CO2 mineralization
- Chemical looping
  - Kinetics
  - Operating parameters, samples
  - Enhancements of oxygen carriers
  - Reactor developments: CFD, design, prototyping
- Ammonia borane production and utilization
- Gas abatement (environmental gases: NH3, CH4, etc.)
  - Thermal (with and without catalyst)
  - Plasma
- Mid and low temperature NH3 synthesis
- Low temperature (waste) heat to H2 and NH3
- Effective water splitting
- Life cycle analysis
- Heat transfer enhancements
- Redox-flow battery (organic)
- Electric vehicles utilization
- Battery management
- Used battery potential

# Lab at a Glance

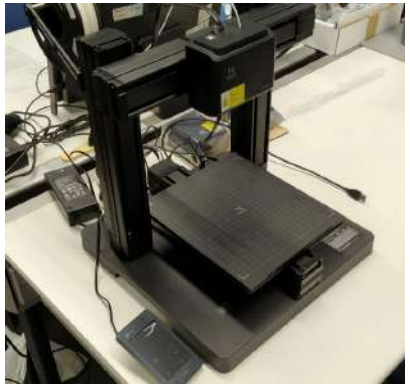
- Rooms: 1 Prof room + 1 student room + 1 lab. room (total 200 $m^2$)






Laboratory

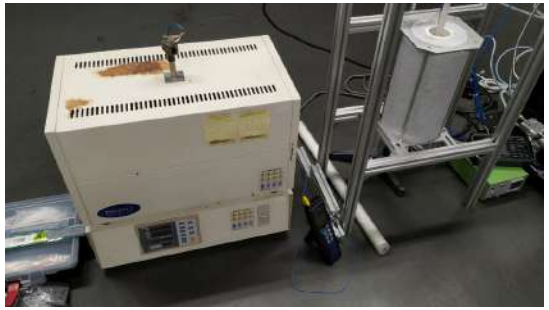
TG/DTA



3D Printer, Engraver

FT-IR

Mass spectrometry



Horizontal and vertical furnaces

GCs

Others
- UV-VIS
- Workstation
- Potentiostat/galvanostat
- Sunlight simulator
- Plasma generator
- Etc.

Softwares
- ASPEN Plus
- HYSIS
- Pro/II
- Matlab
- Ansys Fluent


XRD

# Lab Management

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## Research Topics and Human Resources

- Map of research topics and schedule
- Human resources for different levels, targets, and time frames
- Inclusivity with new ideas from the members (for the next topics)
- New student or researcher means new topic possibility (different backgrounds, interests, mindset, etc.)
- Broader accessibility
- Timely ideas digging
- Dispatching students to the existing and new partners
- Periodical training, guidance and motivation
- Active for receiving research and internship students

# Lab Management

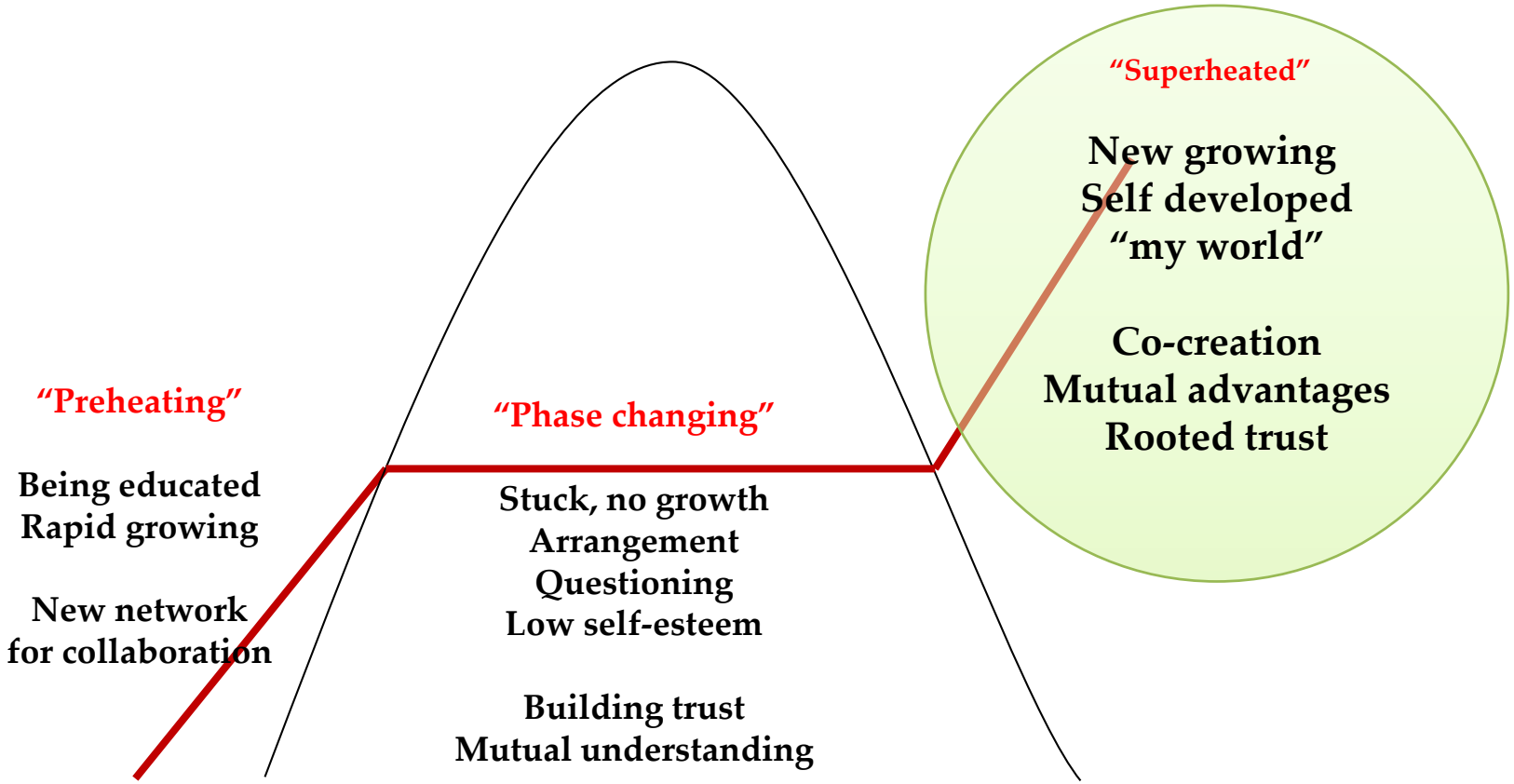
**Funding Resources (keep at total JPY 10 M per year)**

- Commissioned research funding
- Collaborative research funding
- Academic guidance
- Operational research funding (basically JPY 2.5 M/year, high flexibility, partly can be carried-over)
- Student operational cost (JPY 150,000 /student·year, high flexibility)
- Funding from return of indirect cost (high flexibility)
- Donations (most flexible, no time limit, wide coverage)
- Start-up funding (excellent researcher 2019, JPY 6 M for 2 years, valid for 4 years)

**Funding strategies**

- Make priorities
- Use from the inflexible ones
- Huge budgets: Employment, infrastructure, measurement device, and trip
- Schedule the trips or conferences

# Education and Collaboration as Processes



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