



**CEFIA**  
Cleaner Energy  
Future Initiative  
for ASEAN  
ASEAN+3

**23<sup>rd</sup> July 2024**

**The 6<sup>th</sup> Government Private Forum on the Cleaner Energy  
Future Initiative for ASEAN(CEFIA)**

# **CEFIA RENKEI Control Flagship Project**

## **RENKEI Control**

**JEITA RENKEI Control Working Group**

**Azbil Corp.**

**Mike Suzuki**

**JEITA**

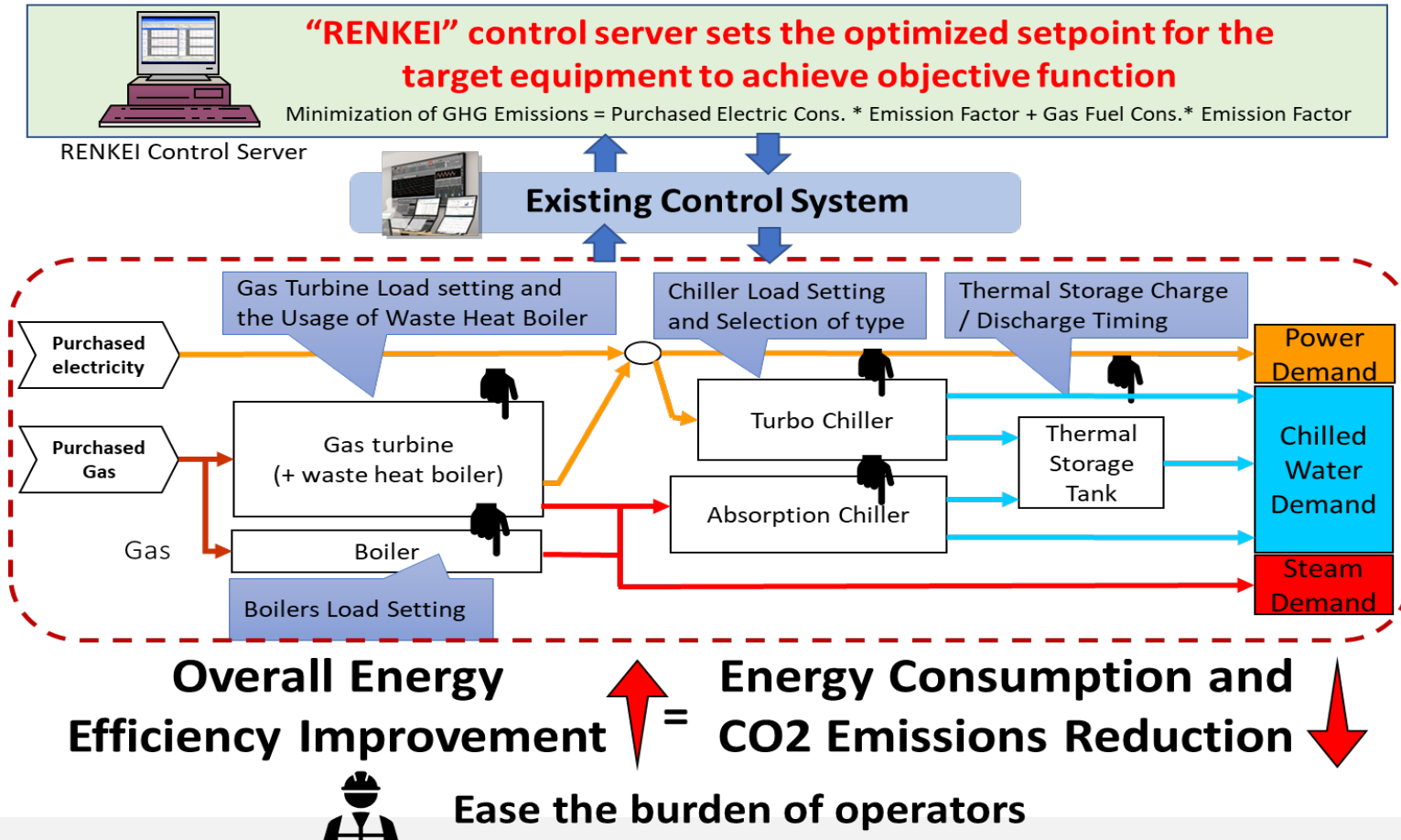
**Japan Electronics and Information Technology  
Industries Association**

**RENKEI Control**

- **What is RENKEI Control?**
- **Stakeholders for RENKEI Control Flagship Project**
- **What we have done from 2020 to 2023**
- **Plan for 2024**

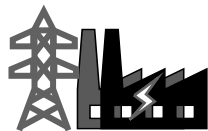
# What is RENKEI control?

**The Purpose of RENKEI Control**  
To improve energy efficiency in a short period without changing existing facilities



# Applicable Optimization by RENKEI Control

	Category	Applicable Optimization by RENKEI Control
1	Utility Plant	<ul style="list-style-type: none"> <li>▪ Boiler Plant Optimization</li> <li>▪ Turbine Plant Optimization</li> <li>▪ Boiler Turbine Plant Optimization</li> <li>▪ Co-Generation Plant Optimization</li> <li>▪ Chilled Water Plant Optimization</li> <li>▪ Air Compressor Plant Optimization</li> </ul>
2	Utility Plant and Demand Side	<ul style="list-style-type: none"> <li>▪ HVAC system in building side</li> <li>▪ District Cooling Plant Optimization with Demand Prediction for Building Side</li> <li>▪ Utility Plant and Manufacturing Plant Total Optimization</li> <li>▪ Smart City (Power and Heat) Total Optimization</li> </ul>



Utility Plants in many kind of industry.  
(Steam, Hot Water, Chilled Water, Electricity, Cogeneration)



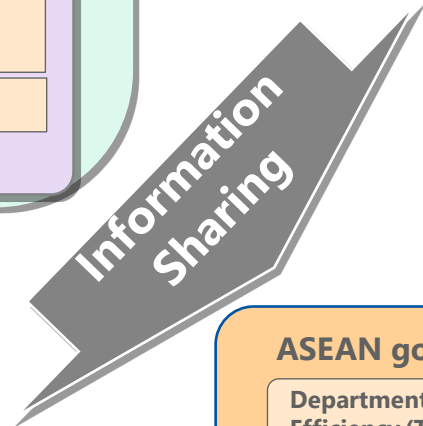
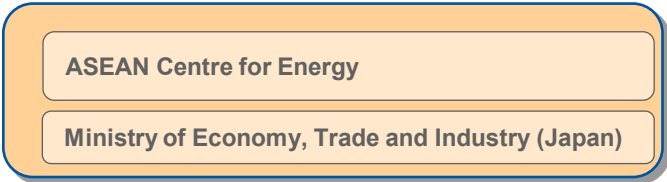
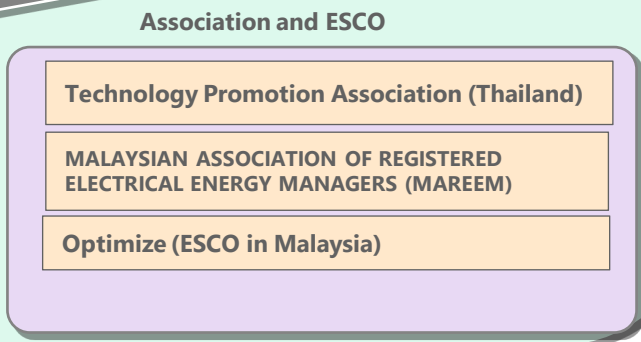
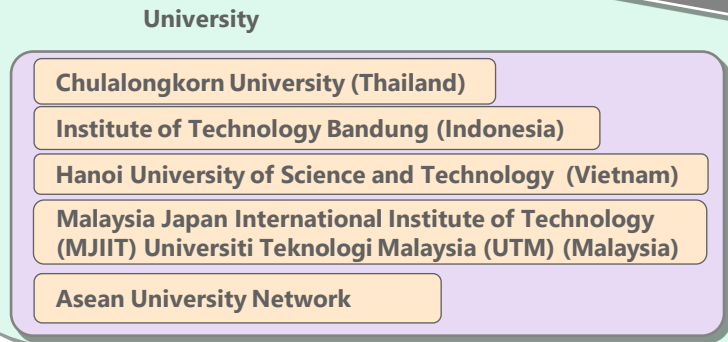
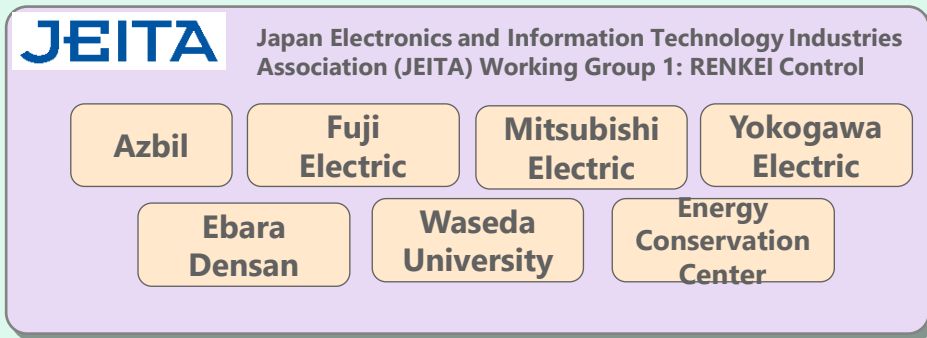
District Cooling Plant for Buildings



Smart City

Energy Supplier    Energy Consumers

# Stakeholders for RENKEI Flagship Project Overview



## ■ Start from Team Building in Year 2020 (Invitation to Japan)

- We invited government and academic representatives from Indonesia, Thailand, and Vietnam to Japan and conducted the following visits:
- Yokogawa Mitaka office and a tour of the EMS at the Musashino Clean Center.
- Azbil Fujisawa Technology Center and a tour of the BEMS for this center.
- Waseda University Shinjuku Demonstration Center and demonstration of the integration of DR and HEMS.
- Fuji Electric Yamanashi Factory and a tour of the FEMS for this factory.

# What we have done from 2020 to 2023

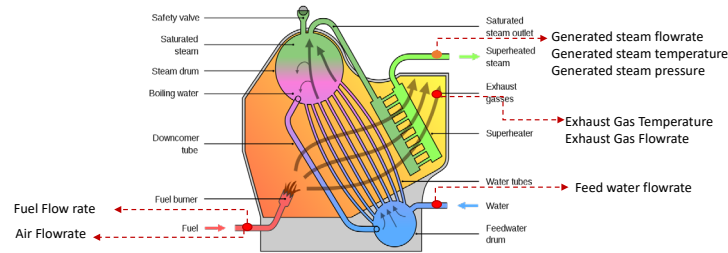
## Capacity Building for University Students through Webinar

Thailand / Indonesia / Vietnam / Malaysia / Philippines

$$\text{Boiler Efficiency}(\eta) = \frac{\text{Energy out}}{\text{Energy In}} = \frac{\text{Heat of Generated Steam}}{\text{Energy of Fuel}}$$

- Where,
- Heat of generated steam = Flowrate of generated steam X enthalpy of generated steam
  - Energy of Fuel = Fuel consumption X Heating Value of Fuel
  - Enthalpy of generated steam is depending on the generated steam temperature and steam pressure

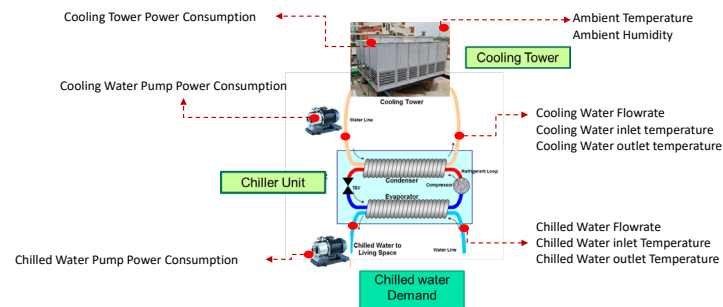
### Measuring Points



$$\text{Efficiency} = \frac{F_{chw} \times (T_{chw, in} - T_{chw, out}) \times CP}{\text{Total Power Consumption}}$$

$F_{chw}$  = Chilled water flowrate  
 $T_{chw, in}$  = Chilled water temperature inlet to refrigerator  
 $T_{chw, out}$  = Chilled water temperature outlet from refrigerator  
 $CP$  = Specific heat of chilled water  
 Total Power Consumption = Power of (Refrigerator + Cooling Tower Fan + Chilled Water Pumps + Cooling Water Pumps)

### Measuring Points



Date	Time (Thailand Time Zone)		Speaker
1 <sup>st</sup> Day	8.00 – 8.20	<b>Seminar 1</b>	Ministry of Economy, Trade and Industry ASEAN Center for Energy (ACE) Prof. Yoshiharu Amano, Waseda Univ. Azbil Corporation
	8.20 – 8.35	1.1 Introduction to CEFIA	
	8.35 – 9.35	1.2 Introduction to APAEC and Collaboration with CEFIA	
	9.50– 10.50	1.3 Introduction of Digital Transformation 1.4 Introduction of Instrumentation Technology	
2 <sup>nd</sup> Day	8.00–9.30	<b>Seminar 2</b>	Azbil Corporation Yokogawa Solution Service Prof. Yoshiharu Amano, Waseda Univ. Center and Industrial Open Network Laboratory in Waseda University
	9.40–10.10	2.1 Introduction to RENKEI control 2.2 Introduction to subsidies and policy in Japan	
	10.10–11.00	2.3 Special Lecture on Energy Management System Shinjuku R&D	
3 <sup>rd</sup> Day	8.00– 10.00	<b>Seminar 3</b>	Azbil Corporation Azbil Corporation
	10.15–11.00	3.1 Introduction to Feasibility Study 3.2 Hands-on Training Briefing (Self-Learning)	
4 <sup>th</sup> Day	8.00 – 9.45	<b>Seminar 4</b>	TBD Prof. David Banjerdpongchai, Chulalongkorn Univ.
	9.50 –10.30	4.1 Potential Survey 4.2 Special Lecture on Supervisory model predictive control of air conditioning system in building	

# What we have done from 2020 to 2023



## Continue this Capacity Building through e-learning (Thailand)

- From FY2021-FY2023 Total around 100 students got this course.




### The 3<sup>rd</sup> E-learning of RENKEI Control

Harmonization of Equipment for Improvement of Energy Efficiency

**Instructors:**  
*Lee Peoy Ying*, Azbil Corporation, Japan.  
*Kaji Takahashi*, Ministry of Economy, Trade and Industry, Japan.  
*Septia Buntara Supendi*, ASEAN Centre for Energy, Indonesia.  
*Prof. Yoshiharu AMANO*, Waseda University, Japan.  
*Tomoyuki Ikeyama*, Yokogawa Corporation, Japan.  
*Prof. David Banjerdpongchai*, Chulalongkorn University, Thailand

**Course Highlight**  
 Introduction of Instrumentation Technology  
 Introduction to RENKEI Control  
 Introduction to Feasibility Study (FS)  
 Introduction of Digital Transformation  
 Introduction to subsidies and policy in Japan

**Target:**  
 Electrical/Mechanical/Chemical Engineers or Interested Learners

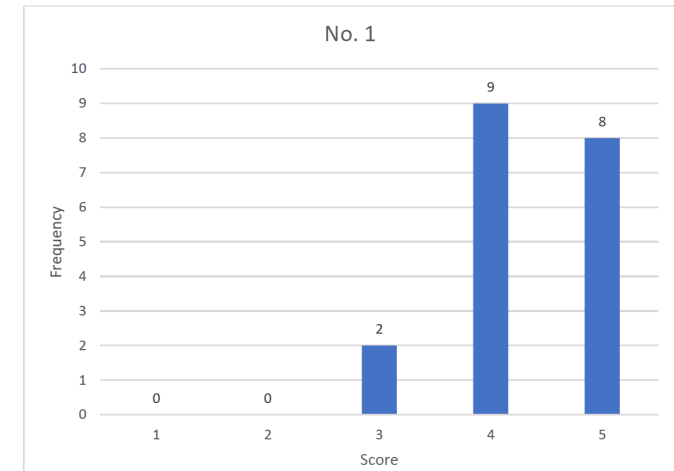
**Free E-Learning**  
 Start Registration by 1 Feb 2024  
 Can be accessed until 31 March 2024

**BOOK NOW**

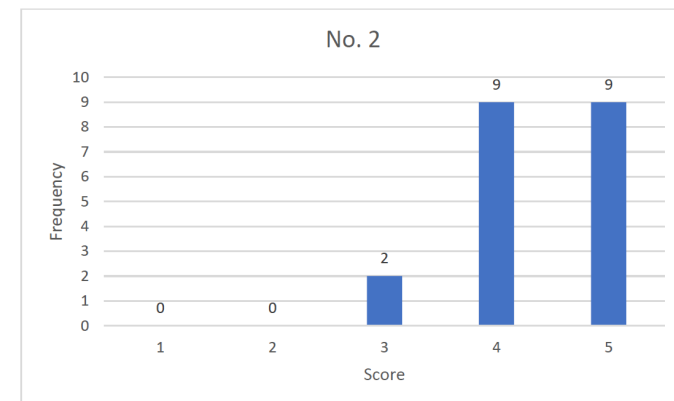





1. You can apply this knowledge to your work.



2. Appropriateness of content (e.g. completeness, order of topics, etc.)

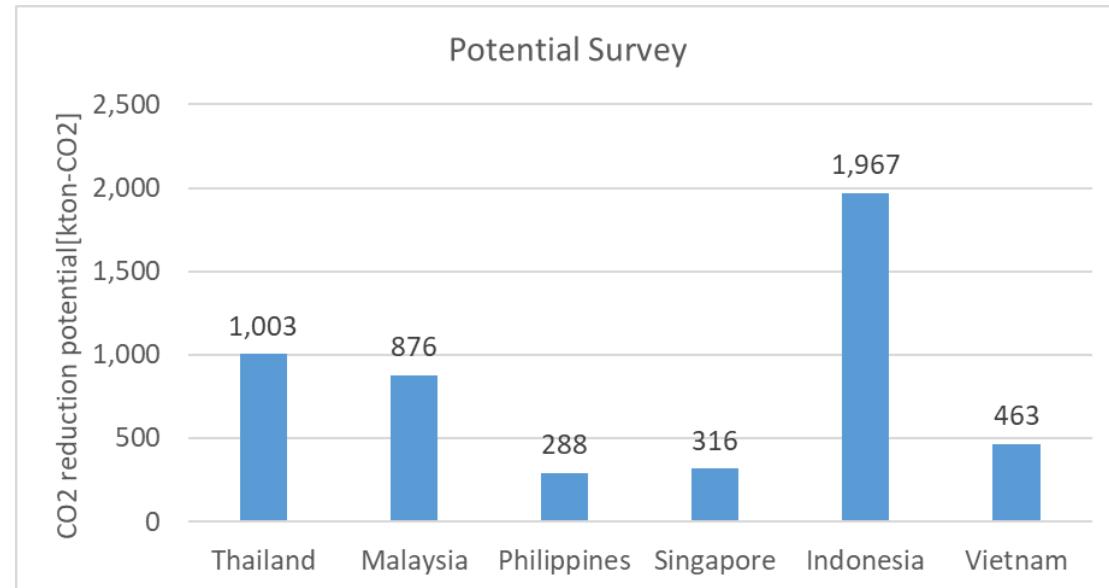




# What we have done from 2020 to 2023

## Research for Potential CO2 emission reduction by RENKEI Control

- Potential to reduce CO2 emission is 5 million tons per year from ASEAN region.



# What we have done from 2020 to 2023



## Capacity Building through ASEAN University Network(AUN/SEED-Net) supported by JICA

### Project Consortium Name

- Real Time Utility Network Energy Efficiency Optimization with RENKEI (R-TUNE)

### Consortium Members

- Universiti Teknologi Malaysia
- Waseda University Japan
- De La Salle University Philippines
- JEITA

### Expected Outcomes

- Knowledge Transfer Program (RENKEI CONTROL & P-Graph)
- Assessment Tool to Assess RENKEI control saving potential
- Detail Feasibility Study Package for RENKEI by P-Graph
- Capacity Building Program to disseminate these outputs

**RENKEI CONTROL ASSESSMENT FORM - COMPRESSORS**

**RENKEI Control Assessment Result**

<b>RENKEI Potential</b>		<b>Expected fuel saving</b> TSD/year	<b>Expected CO2 emission reduction</b> tBt/year
Section	Air Compressor	2,306,000	473,140
Compressed Air Blower (CAB1)	HIGH	<b>EXPECTED HIGH ENERGY SAVING</b>	
Compressed Air Blower (CAB2)	HIGH		
Compressed Air Blower (CAB3)	LOW		

**Part I: General information of air compressor (CA) system**

Compressor system: Multiple compressors  
 Load operation: Yes, but connected to power lines  
 No. of compressors: 2  
 No. of compressed air transfer: 0  
 Blowing Control Method: Individual Discharge Pressure Control  
 Main electric motor: 4,700,000 kWh/yr  
 Electricity unit: kWh/yr  
 Main electric motor: 20,000,000 kWh/yr  
 CO2 emission factor of electricity: 0.82 kg/yr  
 Yearly CO2 emission: 4,731,400 kg/yr  
 Expected energy efficiency: 10%

*Unit Control: Air Compressor Unit Control decides the running units of air compressors by using sequence logic to improve total efficiency.*

**Part II: Configuration of air compressor (CA) system**

Compressed Air Blower (CAB)	Info	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	Connection to other blower
Compressed Air Blower 1 (CAB1)	Type of COBP	S	S	S										
Compressed Air Blower 2 (CAB2)	Type of COBP	1	1	1										
Compressed Air Blower 3 (CAB3)	Type of COBP				S	S								
Compressed Air Blower 4 (CAB4)	Type of COBP				1	1	4		S	S				
Compressed Air Blower 5 (CAB5)	Type of COBP							1	4					

*Type of COBP: C - Control; 1 - Load; 2 - Load; 3 - Load; 4 - Load; 5 - Load; 6 - Single*  
*Control of COBP: 1 - Load; 2 - Load; 3 - Load; 4 - Load; 5 - Load; 6 - Single*

**Part III: Specific information of compressor system**

Air compressor specifications	Unit	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
Rated Motor Power	kw	37	37	37	37	37	37	37	37	37	37	37	37
Rated Pressure	MPa	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Minimum Operation Pressure	MPa	0	0	0	0	0	0	0	0	0	0	0	0

**Part IV: Operation Information**

Operational data	Unit	Period
Operating time	hr	24
No. of operating compressors	no.	1
Average load % of operating compressor	%	80%
Unit method	no.	20%

**Part V: Control System and Data Monitoring**

Control system hardware	Others	Others	No Control System
Data monitoring and measuring point	Measured Data Status	Logged Data Status	Logged data duration
Individual electricity consumption	Yes	No	
Total electricity consumption	Yes	No	
Discharge pressure	Yes	No	
Individual air flow rate	No	No	
Blower stop air flow rate	No	No	

*\*Please tick if the measured data or logged data is available. The logged data duration could be in days, weeks and months.*

## RENKEI Control Assessment Tool

# What we have done from 2020 to 2023



## Capacity Building for Industries

- Webinar for Thailand with Technology Promotion Association in Thailand (Over 100 Participants from industry side) (FY 2022)
- Presentation at Malaysian Association of Electrical Energy Manager (Mareem) Energy Efficacy Seminar (FY2023)
  - Joint Presentation with UTM (Prof.Sharifah)
- RENKEI Control Webinar for ASEAN (FY2021-2022)
- RENKEI Control Seminar in Thailand and Malaysia (FY2023 )

# What we have done from 2020 to 2023



## ■ Presentation at International Conference

- CEFIA forum (FY2020-2023)
- COP26/ Japan Pavilion (FY 2021) (Joint presentation with Prof. David Banjerdpongchai (CU))
- 1<sup>st</sup> Energy Week International Conference (FY2021) at Manila sponsored by ACE and ENAP4.0
- 1<sup>st</sup> International Conference on Sustainable Chemical, Energy and Environmental Engineering, Malaysia (FY2022)
- International Seminar on Chemical, Food, and Chemurgy Engineering Soehadi Reksowardojo (STKSR) (FY 2023)

# What we have done from 2020 to 2023



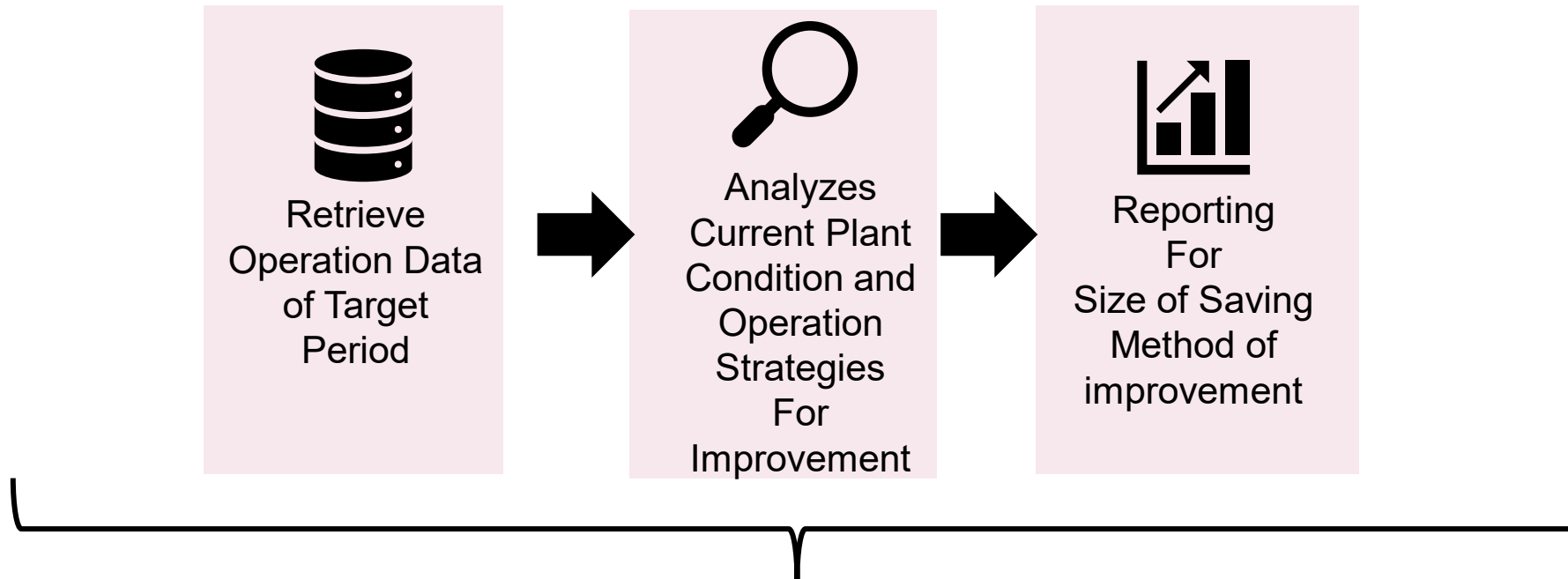
## Information sharing with ASEAN Government and ACE

- Thailand (FY2023)
  - Department of Alternative Energy Development and Efficiency (DEDE) Strategy and Planning Division
  - Agenda (CEFIA and RENKEI Control / Current Energy Efficiency Policy / Discussion about collaboration)
- Malaysia (FY2023)
  - Suruhanjaya Tenaga (Energy Commission) Energy Efficiency & Conservation (EE&C)
  - Agenda (CEFIA and RENKEI Control / Current Energy Efficiency Policy / Discussion about collaboration)
- Asean Center for Energy (FY 2022)

# What we have done from 2020 to 2023

## Demonstration Feasibility Study

- Indonesia Fertilizer Plant (Estimated CO2 Emission Reduction 8,000t-CO2/Year)
- Thailand Food Factory (Estimated CO2 Emission Reduction 900t-CO2/Year)
- Malaysia District Cooling (Estimated CO2 Emission Reduction 4,000t-CO2/Year)



Estimate size of CO2 emission reduction from Feasibility Study

# What we have done from 2020 to 2023



## ■ IEC standard for FEMS which include RENKEI Control

### ■ The FEMS international standard was **published in Sept. 2023**

- IEC 63376 INDUSTRIAL FACILITY ENERGY MANAGEMENT SYSTEM (FEMS)

### ■ FEMS can accelerate whole optimization with supporting RENKEI control.

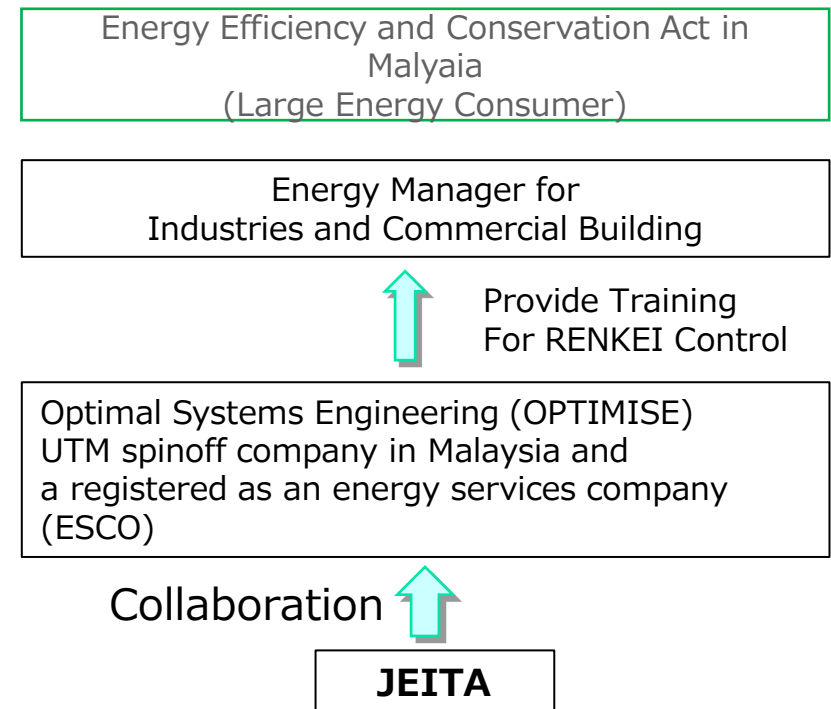
## Capacity Building for Energy Auditor and Energy Manager (RENKEI Control Training Program)

- Develop RENKEI Control Training Program Course for Energy Auditor and Energy Manager
- Develop RENKEI Control Assessment and Feasibility Study Tool which can be used by Energy Manager
- Workshop for Energy Auditor and Energy Manager

### Why Energy Auditor and Energy Manager?

Because Energy Efficiency laws and regulation often include following obligation.

- 1) Assign Energy Manager
- 2) Conduct Energy Audit
- 3) Reporting Energy Consumption and GHG emission
- 4) Improvement Plan for Energy Efficiency





Thank you for listening