



CEFIA
Cleaner Energy
Future Initiative
for ASEAN
ASEAN+3

23rd July 2024

**The 6th 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

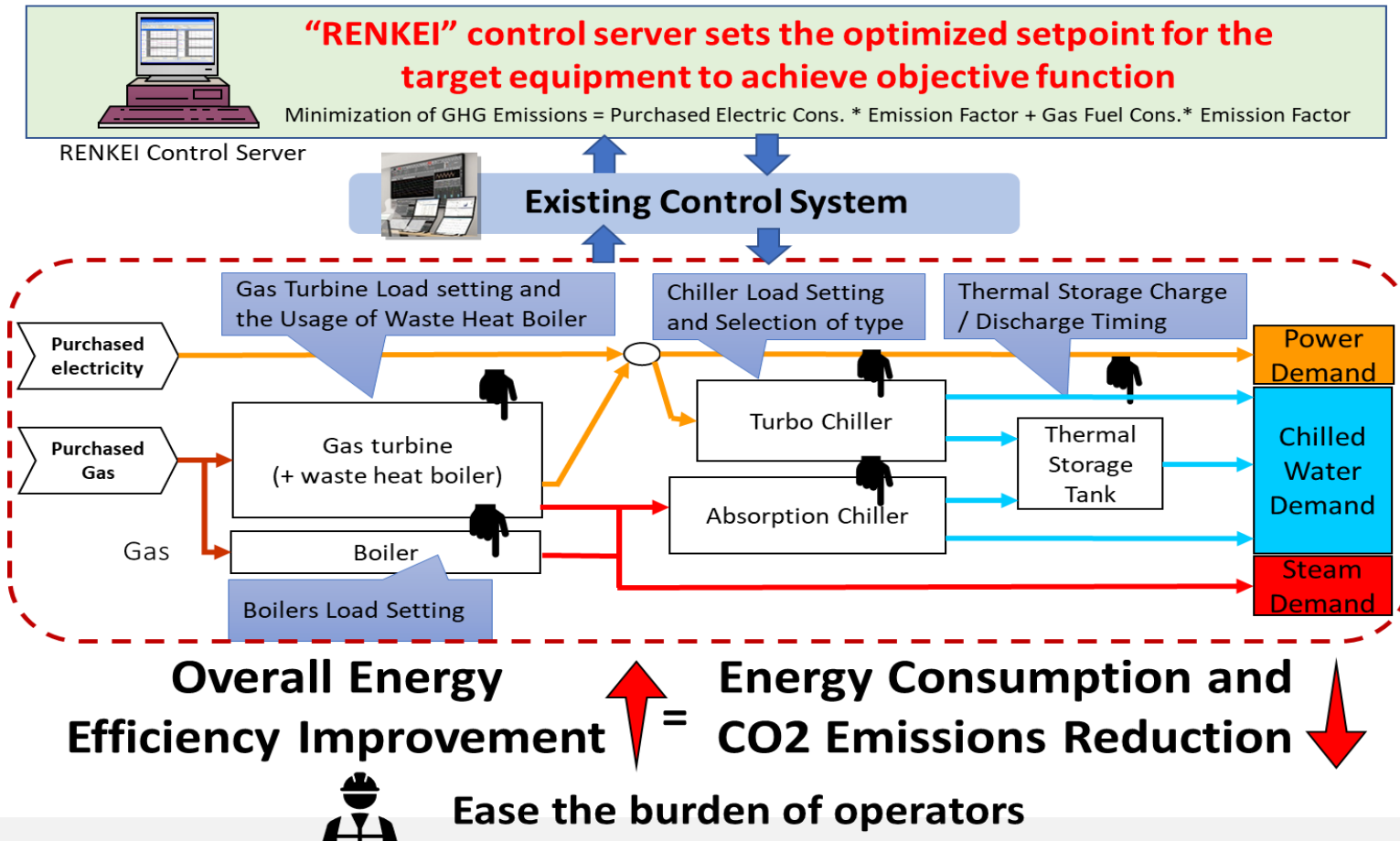
**Japan Electronics and Information Technology
Industries Association**

RENKEI Control

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

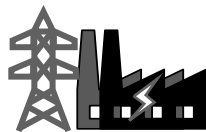
What is RENKEI control?

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



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



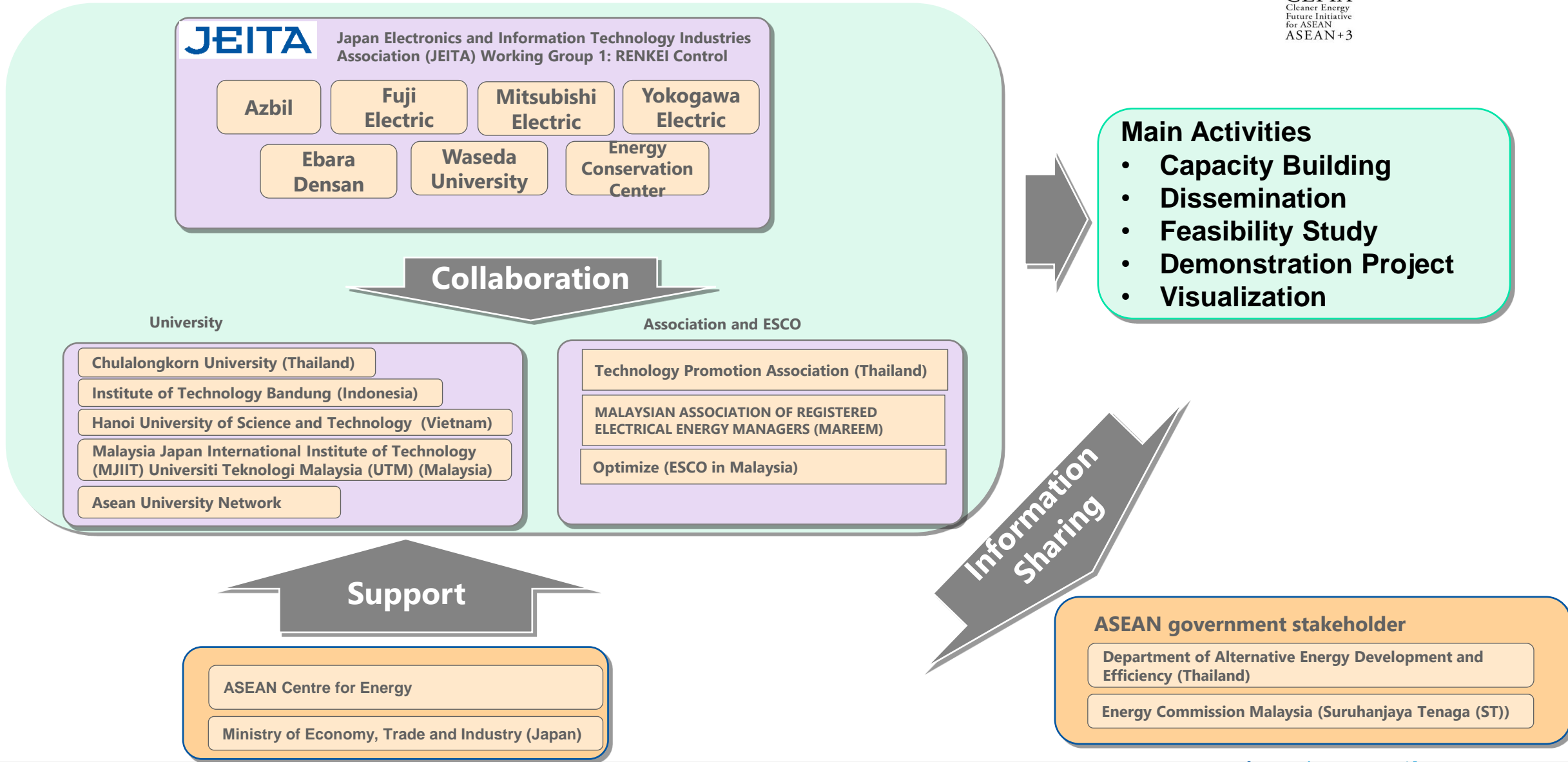
District Cooling Plant for Buildings



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

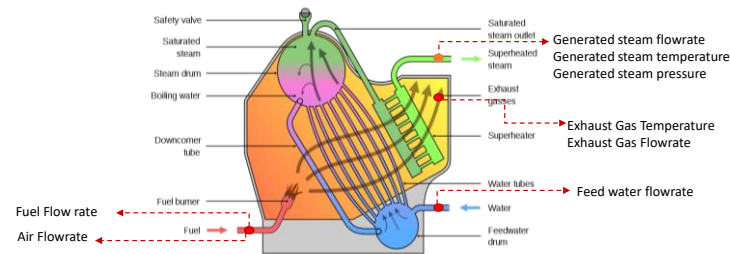
Thailand / Indonesia / Vietnam / Malaysia / Philippines

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

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

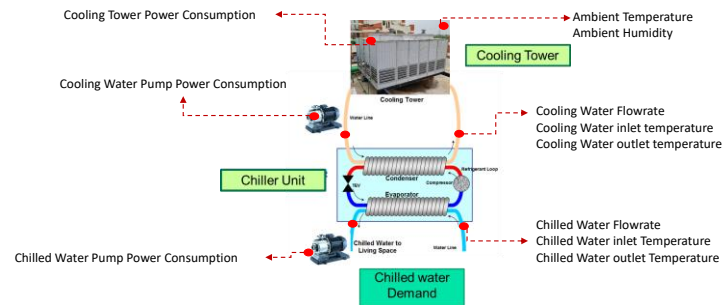
Measuring Points



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

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 st Day	8.00 – 8.20	Seminar 1 1.1 Introduction to CEFIA	Ministry of Economy, Trade and Industry ASEAN Center for Energy (ACE) Prof. Yoshiharu Amano, Waseda Univ. Azbil Corporation
	8.20 – 8.35	1.2 Introduction to APAEC and Collaboration with CEFIA	
	8.35 – 9.35	1.3 Introduction of Digital Transformation	
	9.50– 10.50	1.4 Introduction of Instrumentation Technology	
2 nd Day	8.00–9.30	Seminar 2 2.1 Introduction to RENKEI control	Azbil Corporation Yokogawa Solution Service Prof. Yoshiharu Amano, Waseda Univ. Center and Industrial Open Network Laboratory in Waseda University
	9.40–10.10	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 rd Day	8.00– 10.00	Seminar 3 3.1 Introduction to Feasibility Study	Azbil Corporation Azbil Corporation
	10.15–11.00	3.2 Hands-on Training Briefing (Self-Learning)	
4 th Day	8.00 – 9.45	Seminar 4 4.1 Potential Survey	TBD Prof. David Banjerdpongchai, Chulalongkorn Univ.
	9.50 –10.30	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 3rd E-learning of RENKEI Control

Harmonization of Equipment for Improvement of Energy Efficiency

Instructors:
Lee Peoy Ying, Azbil Corporation, Japan.
Koji 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

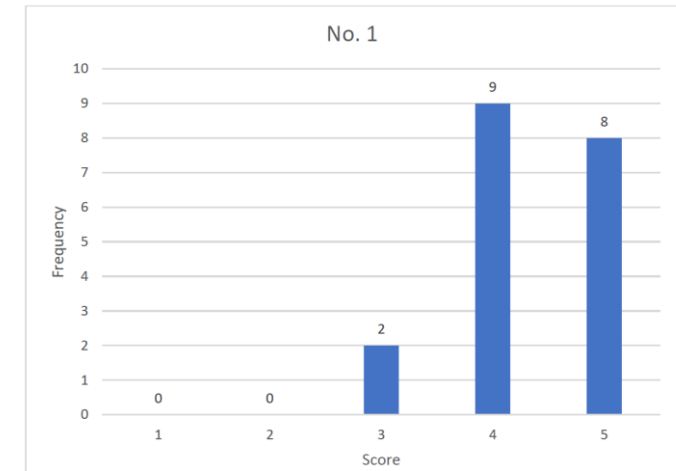
Free E-Learning
 Start Registration by 1 Feb 2024
 Can be accessed until 31 March 2024

BOOK NOW

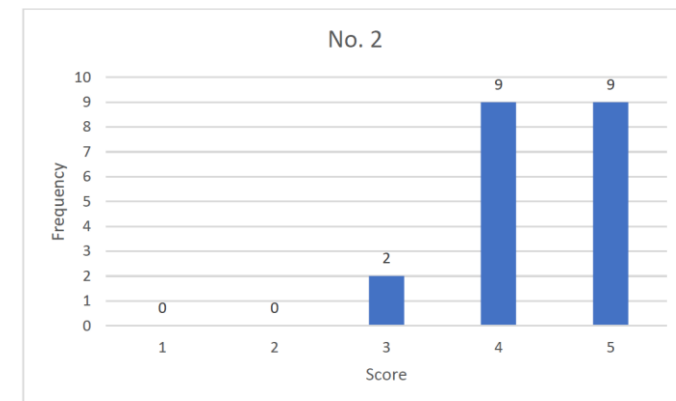





1. You can apply this knowledge to your work.



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

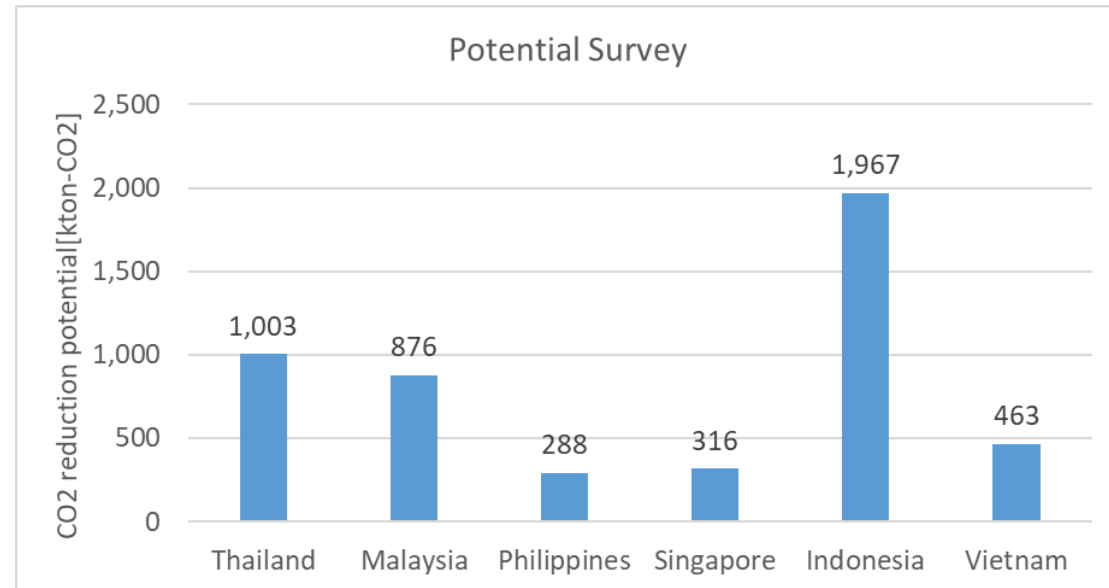


What we have done from 2020 to 2023



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

RENKEI Potential		Expected fuel saving TSD/year	Expected CO2 emission reduction tSD/year
		2,308,000	473,140
Section	Air Compressor	EXPECTED HIGH ENERGY SAVING	
Compressed Air Blender (CAB1)	HIGH		
Compressed Air Blender (CAB2)	HIGH		
Compressed Air Blender (CAB3)	LOW		

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

Compressor system: multiple compressors
 Load operation: Yes, but preferred to lower loads
 No. of compressors: 2
 No. of compressed air transfer: 0
 Blending Control Method: Individual, Dispatch Pressure Control
 Main electric consumption: 4,700,000 kWh/yr
 Electricity tariff: 4 JPY/kWh
 Main electric power: 20,000,000 TWh/yr
 CO2 emission factor of electricity: 0.82 kg/TOJ
 Yearly CO2 emission: 4,731,400 tSD/yr
 Expected energy efficiency: 10%

Other 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 Blender (CAB)	Info	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	Connection to other blenders
Compressed Air Blender 1 (CAB1)	Type of CO2HP	S	S	S										
Compressed Air Blender 2 (CAB2)	Type of CO2HP	1	1	1	S	S								
Compressed Air Blender 3 (CAB3)	Type of CO2HP				S	S								
Compressed Air Blender 4 (CAB4)	Type of CO2HP				S	S								
Compressed Air Blender 5 (CAB5)	Type of CO2HP						S	S						
Compressed Air Blender 6 (CAB6)	Type of CO2HP								S	S				

*Type of CO2HP: C - Compressed Air System, S - Series, B - Interconnecting
 Control of CO2HP: 1 - Load Control, 2 - Load control + ROP, 3 - BOP + ROP, 4 - Load control + Inverter, 5 - Load control + Inverter, 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	55	55	37	35					
Rated Pressure capacity	bar	20.4	21.4	21.4	24.4	24.4	21.4	21.4					
Minimum Operation Pressure	bar	8	8	8	8	8	8	8					

Part IV: Operation Information

Operational data	Unit	Period
Operating time	hr	24
No. of operating compressors		1
Average load % of operating compressor	%	80%
Unit method	hr	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	
Blender total 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))
- 1st Energy Week International Conference (FY2021) at Manila sponsored by ACE and ENAP4.0
- 1st 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



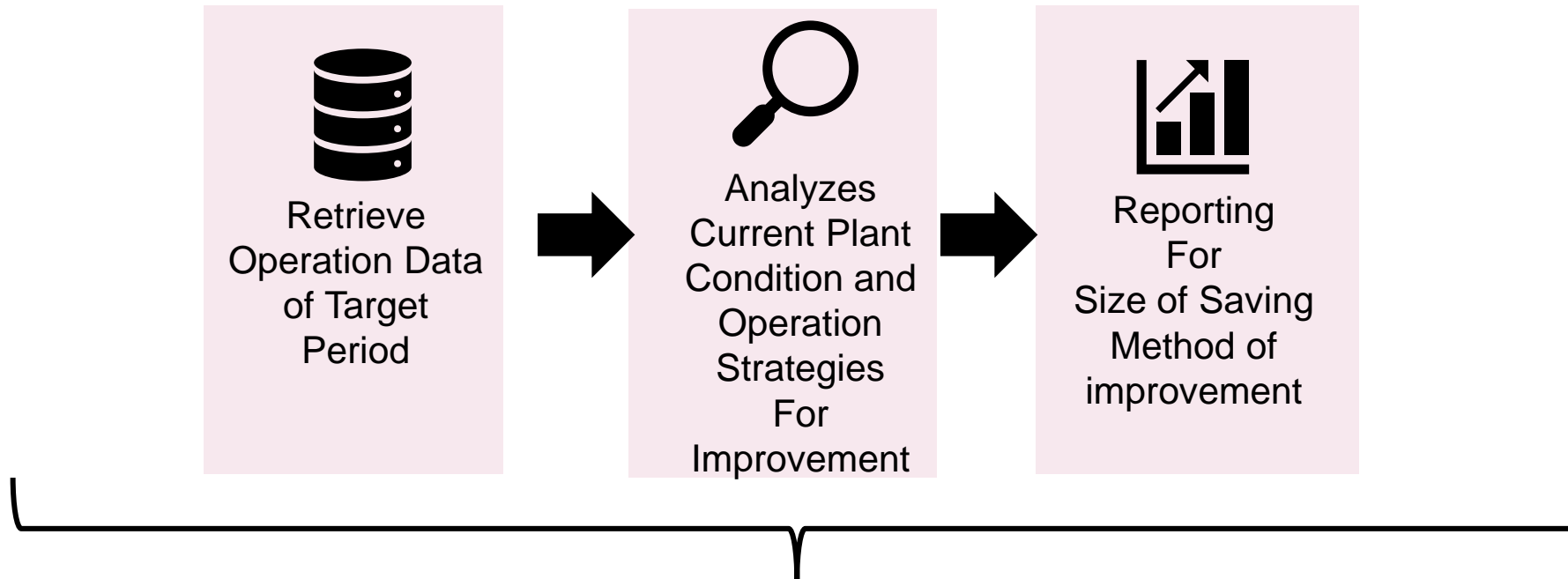
Information sharing with ASEAN Government and ACE

- 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.

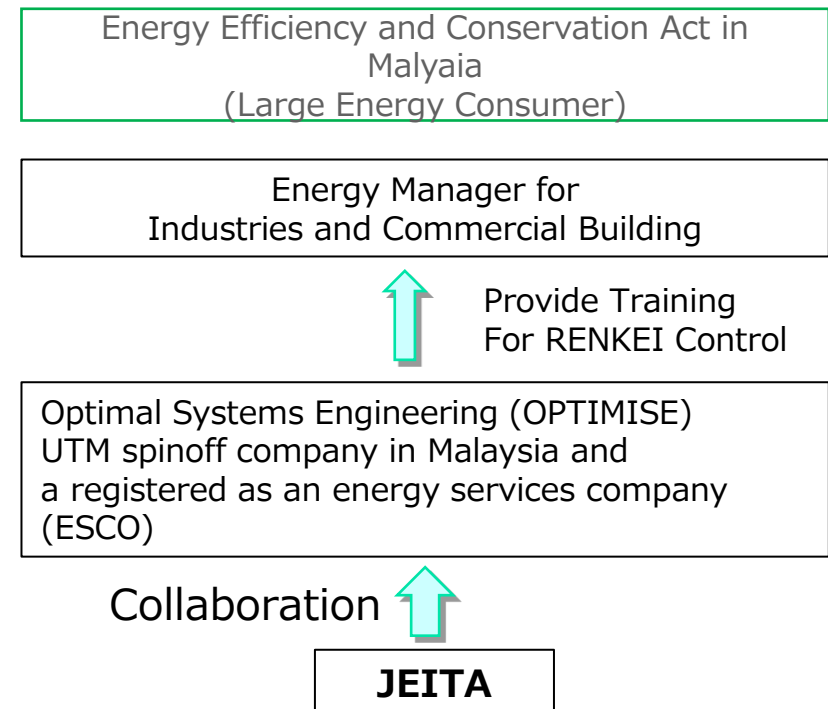
Capacity Building for Energy Auditor and Energy Manager (RENKEI Control Training Program)

- 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