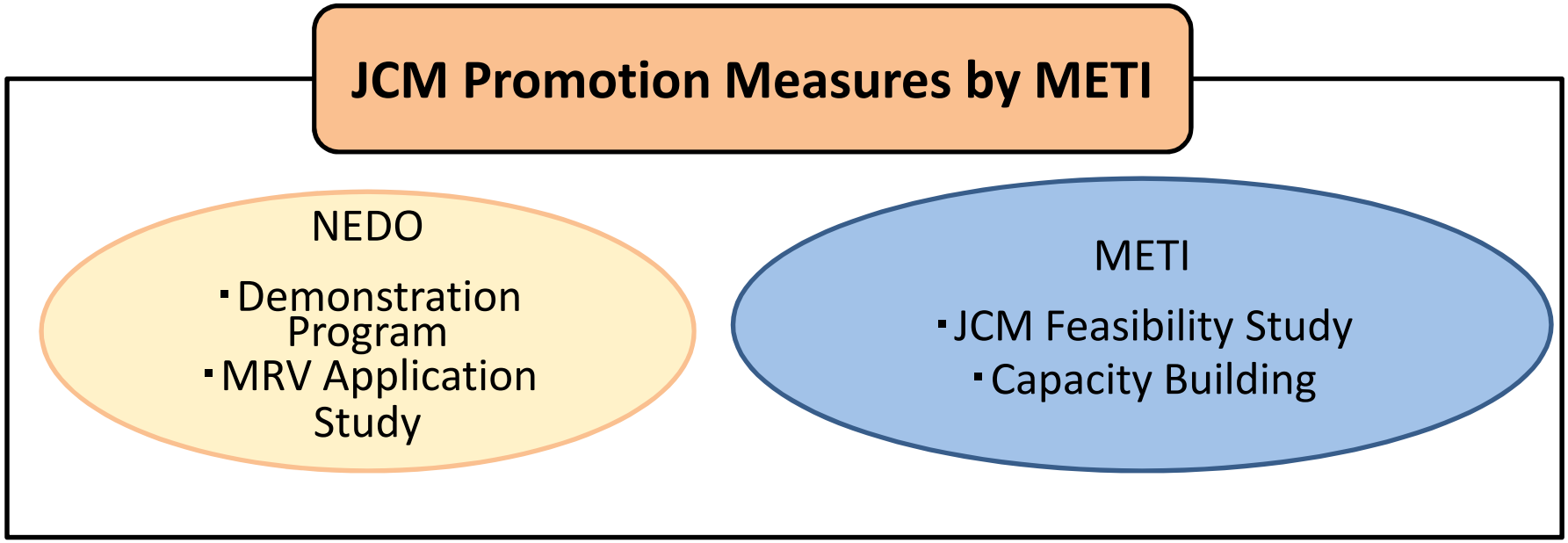
METI
Ministry of Economy, Trade and Industry

October 17, 2017

JCM Promotion Measures by METI and steps to be taken for their use

Global Environment Partnership Office
Ministry of Economy, Trade and Industry

Roles of METI and NEDO



- METI and NEDO have their respective JCM promotion measures.
- METI conducts JCM feasibility study and capacity building, with emphasis on policy recommendations to partner countries.
- NEDO conducts demonstration program and MRV application study, with particular focus on advanced technologies to be demonstrated.

Objectives of JCM Feasibility Study by METI - 1

(1) To make policy recommendations to partner countries with which Japan has already established or is likely to establish the JCM

(2) To propose project plans for disseminating low-carbon technologies and products, in combination with the policy recommendations

Through the above,

Taking into account specific circumstances of partner countries, METI-FS clarifies usefulness of the advanced low-carbon technologies, products and services, with a view to disseminating them to the countries and facilitating Japan's contributions to the global GHG emission reductions.

Objectives of JCM Feasibility Study by METI - 2

Policy recommendations to partner countries means….

Recommendations on policy tools to be established or improved in the countries in relation to advanced low-carbon technologies, products and services

Examples of combination of (i) technology to be introduced and (ii) policy tool to be established:

(i) Waste to energy - (ii) Waste management system

(i) High efficiency home appliances - (ii) Energy efficiency standards and labelling

(i) Renewable energy - (ii) Feed-in-tariff scheme

METI-FS seeks study projects in which recommendations on policy tools can be usefully made and which can evolve to JCM projects through public-private partnership.

Procedure for JCM Feasibility Study

Timeline

(1) Start of public invitation for FS proposals（close in a month)

(2) Selection process (takes appro. 3 weeks)

- Internal evaluation within METI
- External evaluation by experts
- Advance information sharing on shortlisted proposals with partner countries concerned

(3) Conclusion of the selection process

(4) Announcement of the selected projects

- Information sharing with the partner countries concerned
- Information sharing with the relevant agencies in Japan (MOFA, MOE, NEDO, etc.)
- Public announcement

(5) Contractual arrangements (take appro. 2 weeks) and commencement of project implementations

JCM Feasibility Study Selection Criteria (Excerpts)

- Will the study contribute to the development of a project which utilizes advanced low-carbon technologies and widely disseminates them?

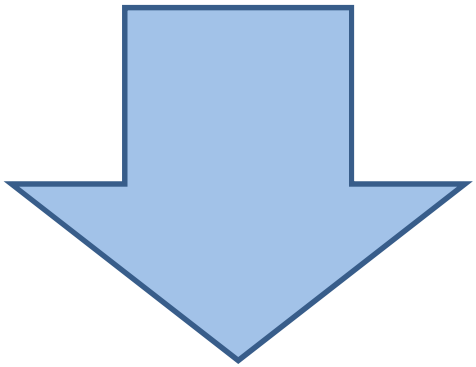
- Are the Government of partner country and the relevant stakeholders including companies willing to cooperate with the study proponent for smooth implementation of the study?

- Will the study result in a project which contributes to i) GHG emission reductions, ii) improved environment, iii) dissemination and promotion of environment- and energy-related technologies, and iv) improvement of energy efficiency, in the partner country?

- Is the study backed up by clear strategy to mitigate risks and costs associated with the project investment and competitiveness issues?

(Reference) Follow-ups of JCM Supporting Schemes

To improve the quality of JCM supporting schemes, follow-ups for FS and demonstration projects undertaken by METI and NEDO were conducted in 2015.



In the follow-ups:

- Pre-hearings, questionnaire and follow-up hearings were undertaken
- Selection criteria were reviewed.

Examples of selection criteria revised as a result of the follow-ups

- Are the executives of the project proponent seriously involved in the project development?
- Is the project proposed by sales or business development department of the proponent?
- Is the project plan in a good shape?
- Does the project show clear visions on how to resolve such issues as market competitiveness and financing?

Capacity Building Program by METI

Target country

JCM partner countries and potential partner countries

Objective

Improving understanding on JCM system

Budget amount

45 million yen in 2017

Program description

Trainee acceptance, expert dispatching

Target

Government officials, companies, research institutes, etc.

Benefits for partner countries

- Trainees can better understand JCM system with financial support from Japan.
- Through seminars, many trainees can have chances to learn at the same time.
- Trainees can deepen their understandings by directly seeing Japan's technologies through trainee acceptance and site visits
- Trainees can establish business relationships and communicate among themselves across different companies in Japan and partner countries.

In **Summary**

Tips to develop METI-FS projects

- Active proposals from the Thai side are most welcome!
- Cooperation with Japanese companies is crucial.
- Early consultations with METI (directly or via the Thai Government) are strongly encouraged, to ask such questions as:
  - ✓ *How can I find a Japanese company as a partner?*
  - ✓ *What are the options to finance my project?*
  - ✓ *How can I accommodate intentions of the Japanese Government from the beginning of the project development?*
- Back-up from the Thai Government is essential. Bring your project ideas to the Government for early advices and continued support!

Recent Development of NEDO's JCM Demonstration Project

Mr.Sumiya Kisanuki
Director General, Global Environment Technology Promotion Division,
International Affairs Department, NEDO

New Energy and Industrial Technology Development Organization

What is NEDO?

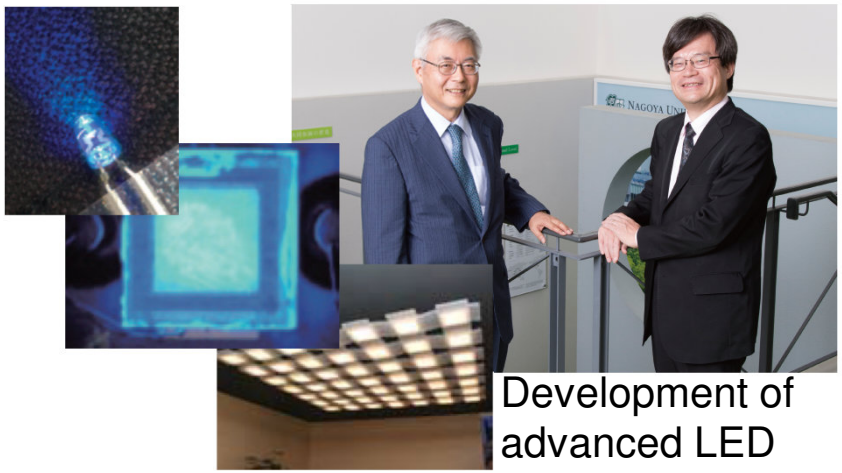
- NEDO is Japan's largest national R&D agency, focused on project management
- NEDO has engaged in technology development, demonstration projects and system improvement in order to

  address energy and global environmental problems and

  enhance industrial technology

NEDO's Activities

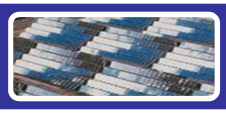
NEDO's R&D led to the creation of the solar cell market



NEDO's project leader is a Nobel Prize winner!

NEDO's Technology Development Activities


Energy Efficiency and Conservation

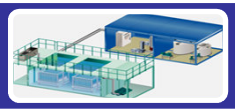

Renewable Energy

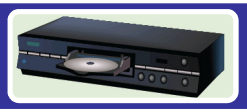
Storage Batteries

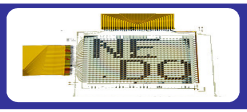

Smart Grids & Smart Community


Robots


High-efficiency Clean Coal


Water Treatment


Electronics, IoT



Materials & Nanotechnology

• NEDO Bangkok Office

Automatic Cell Culture System (For Clinical Use)

Micro-grid of PV and batteries

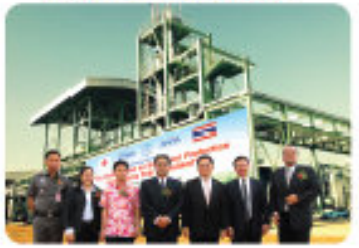
Energy-saving Cellulosic Sugar Production System from Bagasse

Knee Joint Prostheses and Three-dimensional Surgery Support System

Reducing Energy Consumption in Commercial Building

Bioethanol Production from Bagasse Using Enzyme Method

Bio-ethanol Production from Cassava Pulp



- NEDO has implemented more than 60 projects in Thailand since 1990's

JCM Promotion Scheme by METI & NEDO

NEDO

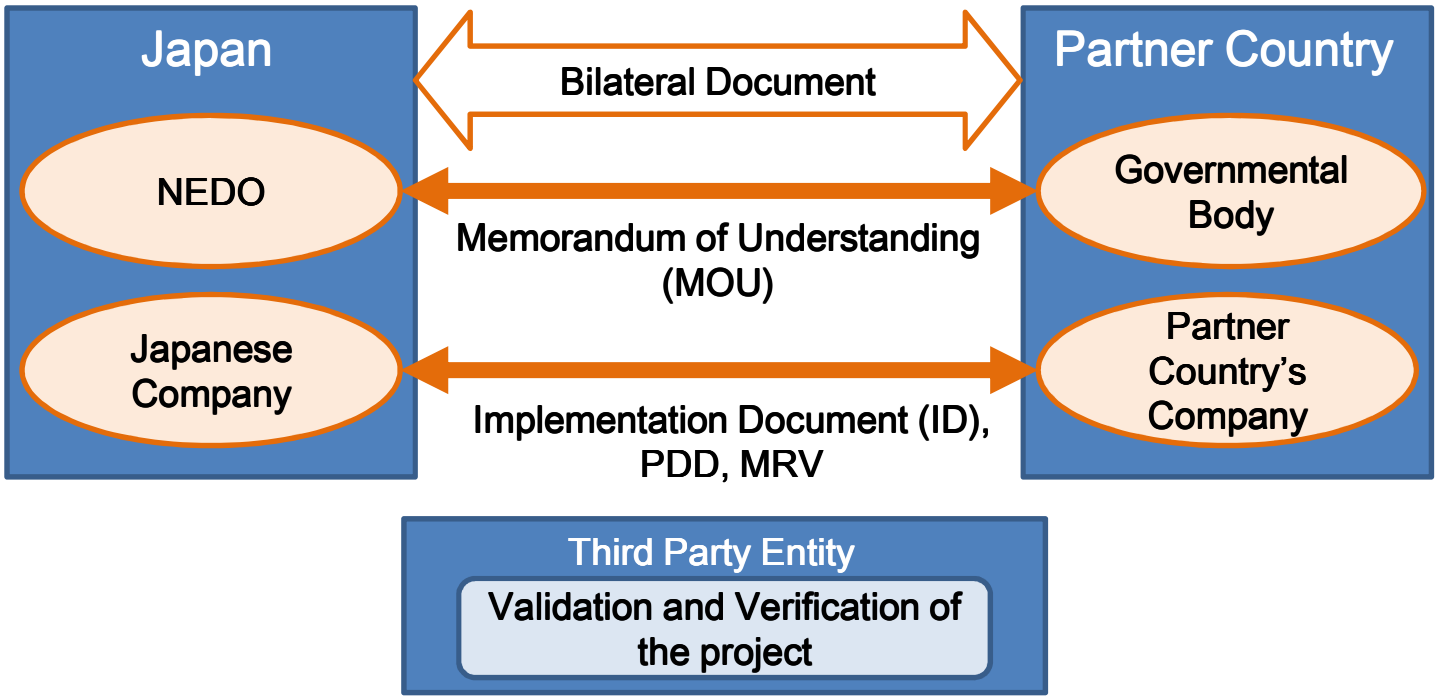
JCM Demonstration Projects	➢ To demonstrate the effectiveness of advanced low carbon technologies in the host countries ➢ To measure, verify and accredit the amount of GHG emission reduction with JCM methodology
MRV Application Studies	➢ To obtain verification under the JCM *the facility with low carbon technologies have already been installed on the purpose of aiming at the JCM utilization
JCM Feasibility Studies	➢ To study the feasibility of potential JCM projects

METI

Capacity Building Programs	➢ To increase technical experts

Outline of NEDO's Program

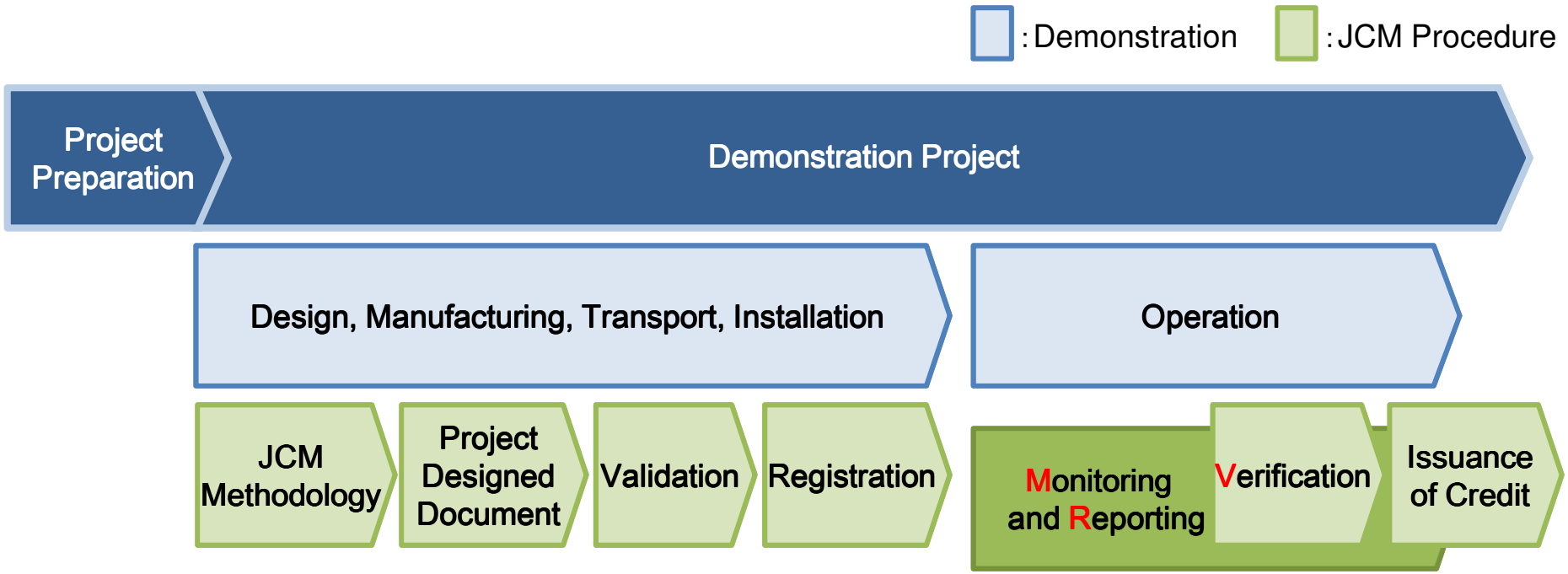
NEDO's JCM Demonstration Project



NEDO establishes MOU with ministry / agency of the partner country

- To develop a better communication channel between project participants
- To coordinate with related ministries to conduct demonstration project
- To provide solutions when any trouble occurs during demonstration period

Activity Flow of NEDO's Program



Costs:

- Shared between NEDO and project participants

Ownership of the installed equipment:

- During the project: Owned by NEDO
- After the project: Transferred to the project participant(s)

JCM credits:

- Shared among the project participants in accordance with their contribution

Benefits of NEDO's Demonstration Program

Introduce and optimize low-carbon technologies -Technical Solution-	➢ To achieve additional emission reduction ➢ To reduce the risk of first- adapting advanced technology ➢ To acquire know-how
Implement the project smoothly and foster -Project Formation-	➢ To provide solutions of any troubles during a project ➢ To promote the diffusion of the technologies ➢ To contribute to the development of public policies against climate change challenges
Confirm the quantitative effect of GHG reduction -JCM Utilization-	➢ To gain support for the process of JCM ➢ To be verified the quantitative effect of GHG emission reduction

Benefit of MRV Application Study

Obtain capacity-building for MRV

Receive supports by NEDO for the process of JCM

Use credits for the reduction targets

Obtain the validity and applicability

Knowledge transfer should be undertaken through the project

Preparing for Project

JCM Project(not supported for equipment installation)

【MRV Application Study by NEDO】

Project application and examination

Reviewing reduction amounts by the TPE

GHG emissions reduction

Preparing for MRV implementation

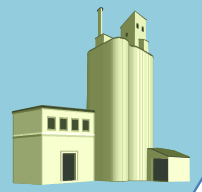
(Examining methods for applicability, dissemination and deployment)

MRV implementation

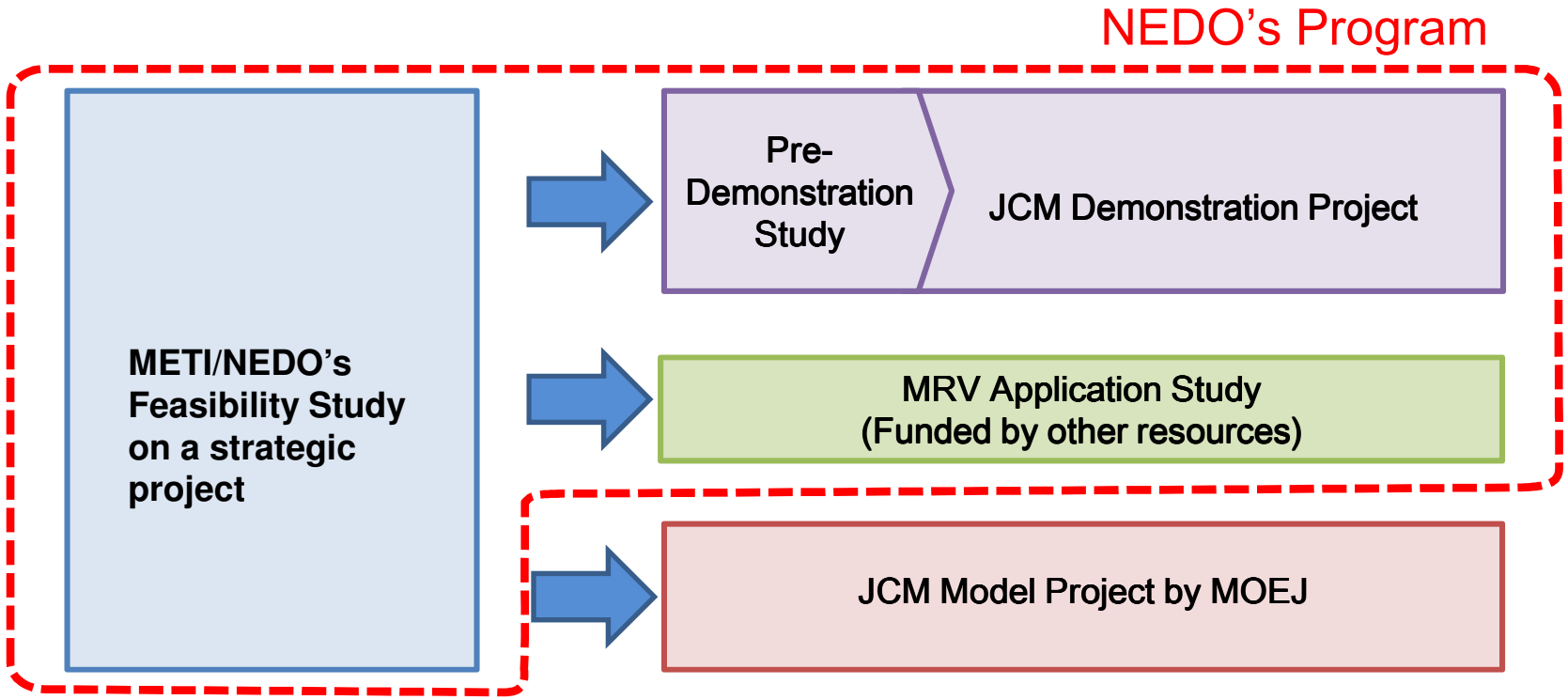
(Feedback)

(Application for Credits Issuance)

Continuing Projects



New Design of NEDO's JCM Program(tentative)



In order to establish resilient low carbon society and maintain sustainability of JCM

- Enhancing more mitigation action led by private investment
- Focusing low carbon technologies that are necessary to develop and optimize for the partner country in order to reduce the technical risk and realize the large scale deployment and /or broader deployment
- Visualizing and verifying contribution of more mitigation action
- Close Linkage to Government's Policy and/or official program in the Partner's Country

METI/NEDO would like to co-operate
with you
on low carbon development partnership!

Thank you very much
for
Your kind attention !

http://www.nedo.go.jp/english/index.html
askJCM@ml.nedo.go.jp

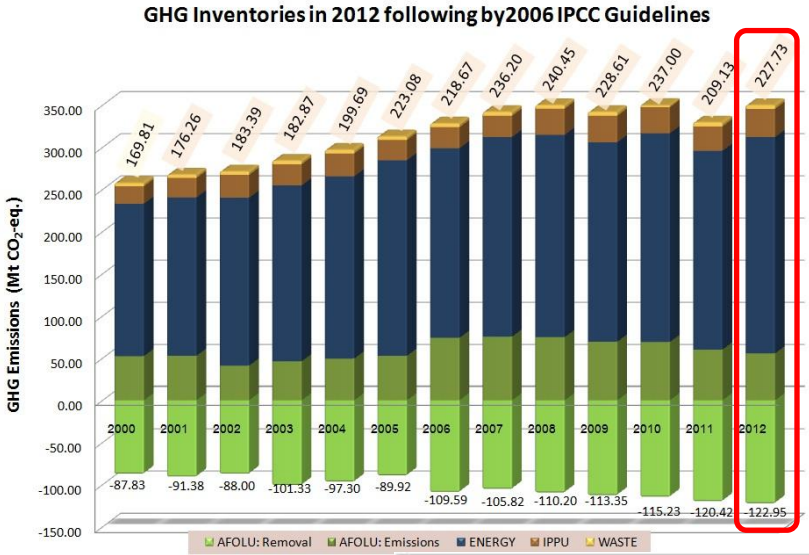
Implementation of the JCM in Thailand

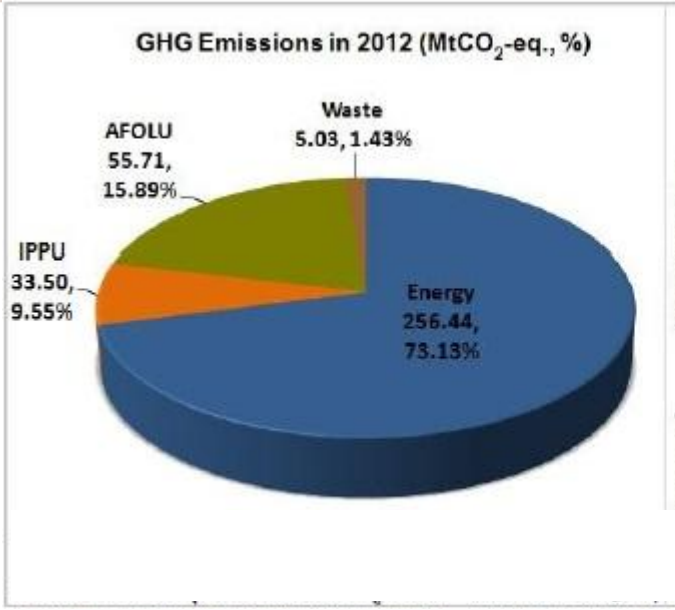
Mrs. Bongkoch Kittisompun

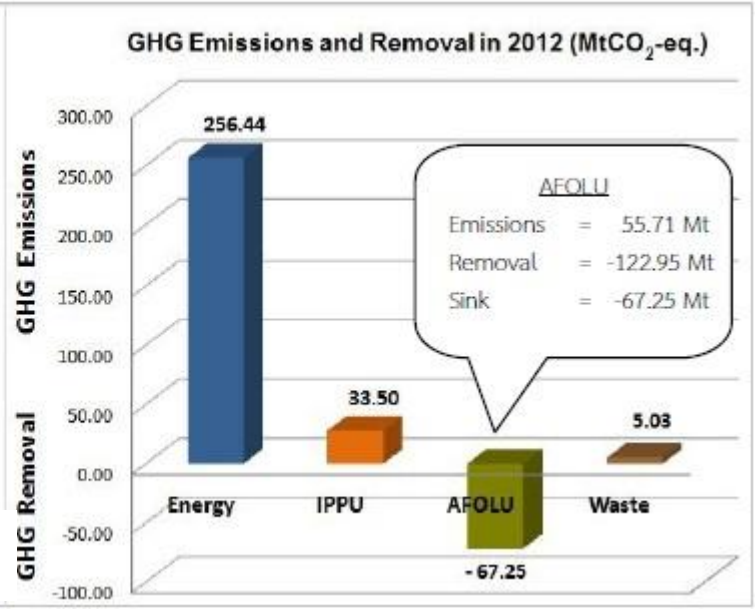
Session 2: JCM in Thailand

Japan-Thailand Joint Crediting Mechanism (JCM) Seminar, 17th October 2017

Thailand's greenhouse gas emissions in year 2000-2012







Thailand's GHG Mitigation goal

Pre-2020

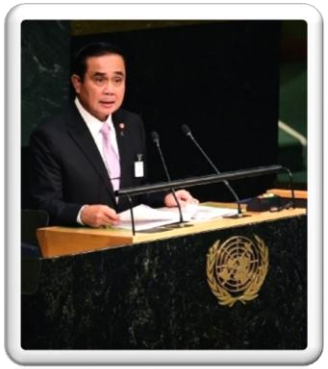
❖ Nationally Appropriate Mitigation Actions (NAMAs)

"Thailand will endeavor, on a voluntary basis, **to reduce its GHG emissions** in the range of **7 to 20 percent below the Business as Usual (BAU) in energy and transportation sectors by 2020**, subject to the level of international support provided […]"

Coverage: RE | EE | Bio-fuels | Transport

Post-2020

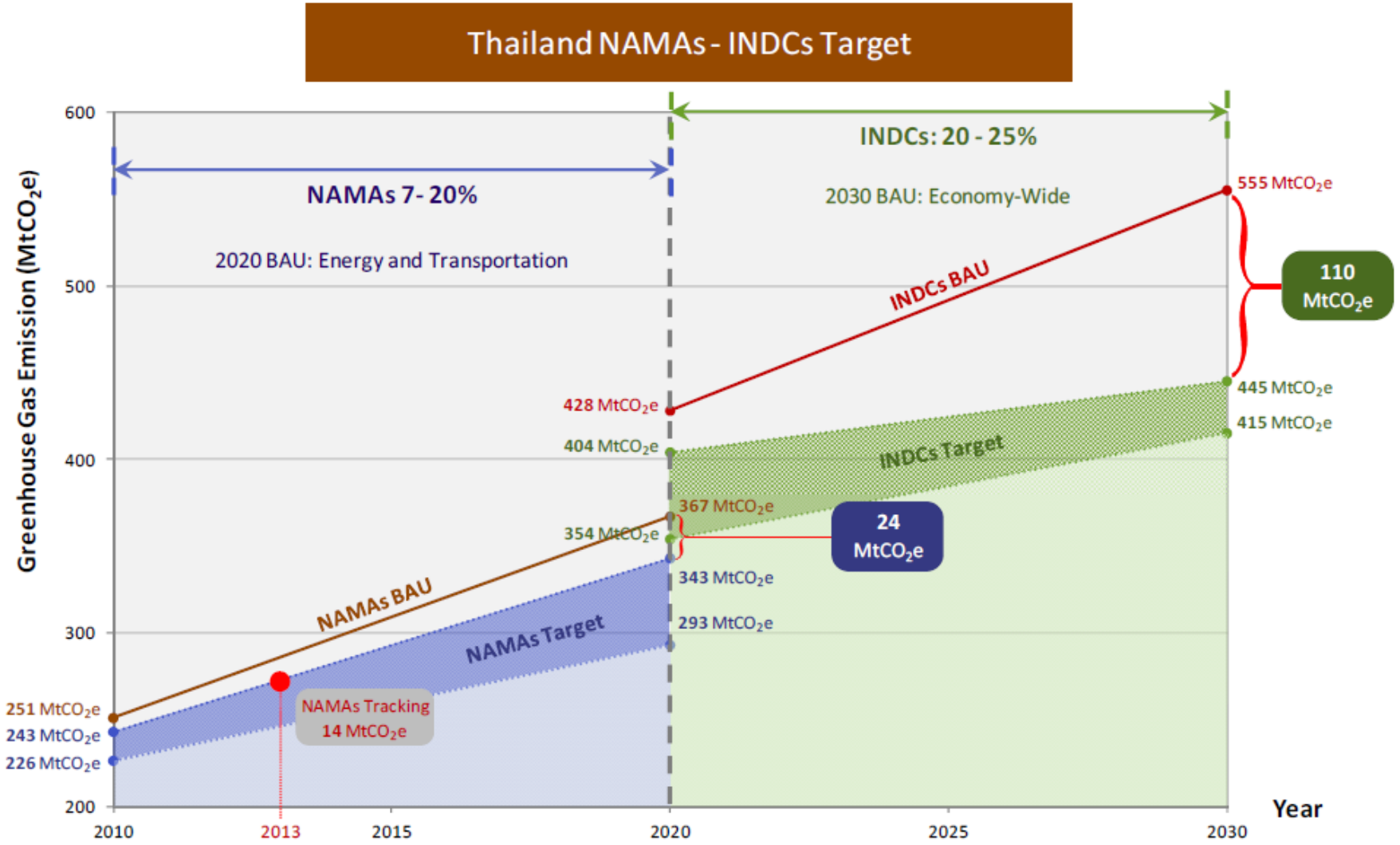
❖ Intended Nationally Determined Contribution (INDC)



"**Thailand intends to reduce its greenhouse gas emissions by 20 percent from the projected business-as-usual (BAU) level by 2030.** The level of contribution could increase up to 25 percent, subject to adequate and enhanced [support] through a balanced and ambitious global agreement […]"

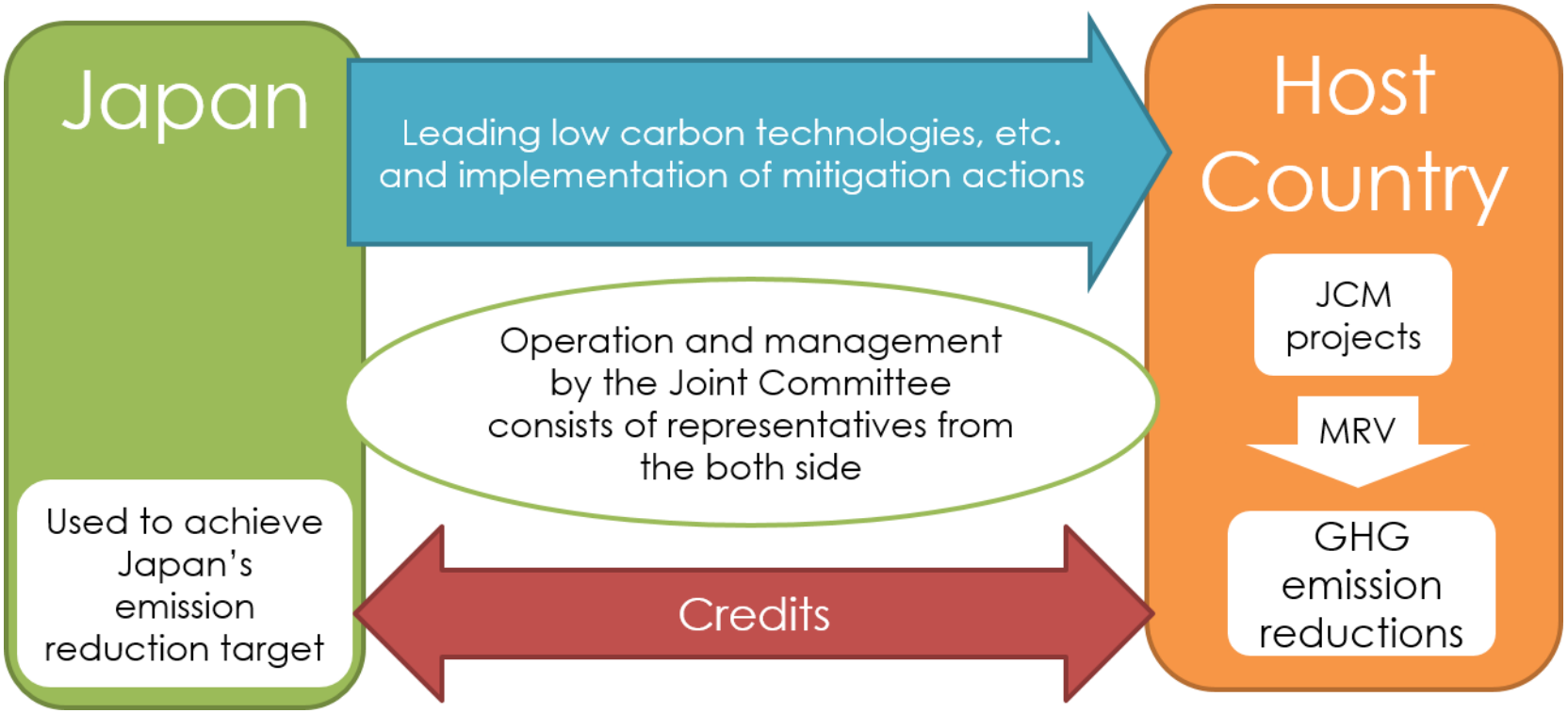
Coverage: Economy-wide — Inclusion of LULUCF will be decided later

Thailand NAMAs – INDCs Target



Basic concept of the Joint Crediting Mechanism (JCM)

- Implement jointly by both country
- Promote to diffuse leading low carbon technologies, products, etc.
- Evaluating GHG emission reductions by measurement, reporting and verification (MRV)



Role of JCM in achieving NDC target

Environmental integrity		JCM
Robust accounting	- avoid double counting - accounted for NDC targets and emission reduction	✓
Quality of units	- 1 tCO_2eq directly leads to an emission reduction of at least 1 tCO_2eq in the transferring country - additional - not over estimated - permanent	✓
Scope of NDC target	- Thailand's NDC covers economy wide and the target is more stringent than BAU emissions	RE, EE

Process Undergoing to Establish JCM Cooperation

May 2014 — Bilateral consultation between representatives of Japan government and Thailand's public and private agencies

August 2014 — Stakeholder consultation with private sector

November 2014 — Meeting of the National Committee on Climate Change Policy

January 2015 — Meeting of the Prime Minister Cabinet

"The Prime Minister Cabinet agrees in principle to initiate the bilateral cooperation between Japan and Thailand, and designates TGO to proceed the details further in accordance with related laws and regulations."

February to June 2015 — Consideration to agree on the text of the JCM Agreement between Japan-Thailand

October 2015 — Meeting of the Prime Minister Cabinet

"The Prime Minister Cabinet approves the MoC."

November 2015 — JCM Agreement signed by Japan-Thailand

Signing ceremony on November 19, 2015

The MoC was signed by

General Surasak Kanjanarat, Minister of Natural Resources and Environment, Thailand

and

H.E. Ms. Tamayo Marukawa, Minister of the Environment, Japan

Members of the Thai Joint Committee

1. **Deputy Permanent Secretary, Ministry of Natural Resources and Environment**	**Co-chair**
2. Director General, Department of Alternative Energy Development and Efficiency	Committee
3. Director General, Department of Industrial Works	Committee
4. Director General, Pollution Control Department	Committee
5. Secretary General, The Federation of Thai Industries	Committee
6. Secretary General, Office of Natural Resources and Environmental Policy and Planning	Committee
7. Executive Director, Thailand Greenhouse Gas Management Organization (Public Organization)	Committee and Secretariat

Members of the Japanese Joint Committee

1. **Representative of Embassy of Japan**	**Co-chair**
2. Representative of Embassy of Japan	Committee
3. Representative of Ministry of Foreign Affairs	Committee
4. Representatives of Ministry of Economy, Trade and Industry	Committee
5. Representative of Ministry of Environment	Committee
6. Representative of Embassy of Japan	Committee and Secretariat

Joint Committee Meetings

TGO organized Thai JC meetings for 6 times as;

Date	Purpose of Meeting
3rd December 2015	To prepare readiness for the first JC meeting between Thailand and Japan on 29th January, 2016.
5th January 2016	
31st March 2016	To summarize the results of the first JC meeting between Thailand and Japan.
5th July 2016	To summarize the issue on Carbon Credit Allocation for Japan.
8th August 2016	To prepare readiness for the second JC meeting between Thailand and Japan on 23rd August, 2016
8th August 2017	To prepare readiness for the third JC meeting between Thailand and Japan on 21st August, 2017

Joint Committee Meetings

- **TGO organized JC meetings for 3 times as;**

Date	Purpose of Meeting
29th January 2016	- Appointment of Co-chair - Adoption of Rules, Guidelines and Forms
23th August 2016	- Adoption of Rules, Guidelines and Forms - Adoption of 2 Methodologies - Designation of 2 Third Party Entities
21st August 2017	- Adoption of revised Rules and Guidelines, Forms and 1 Methodology - Adoption of 4 methodologies - Registration of 1 project - Designation of 2 Third Party Entities

Seminars and workshops

Date	Title of Meeting	Organizer
6th Nov 2015	JCM capacity building in Thailand	TGO and IGES
25th Jan 2016		
26-27th Jan 2016	A training for JCM TPE	TGO and IGES
7th Apr 2016	Opportunities and Development of JCM for the private sector (give information of the MOEJ funding for FY 2016 – First call)	TGO
6-7th Jul 2016	Japan-Thailand Joint Crediting Mechanism (JCM)	TGO and METI
27th Sep 2016	Developing JCM Projects in Thailand	TGO and ADB
30th Sep 2016	Workshop on writing PDD	TGO and IGES
5th Oct 2016	Opportunities and Development of JCM for the private sector (give information of the MOEJ funding for FY 2016 – Second call)	TGO
7th Apr 2017	Opportunities and Development of JCM for the private sector (give information of the MOEJ funding for FY 2017 – First call)	TGO
22nd Aug 2017	Workshop on the JCM	TGO and IGES

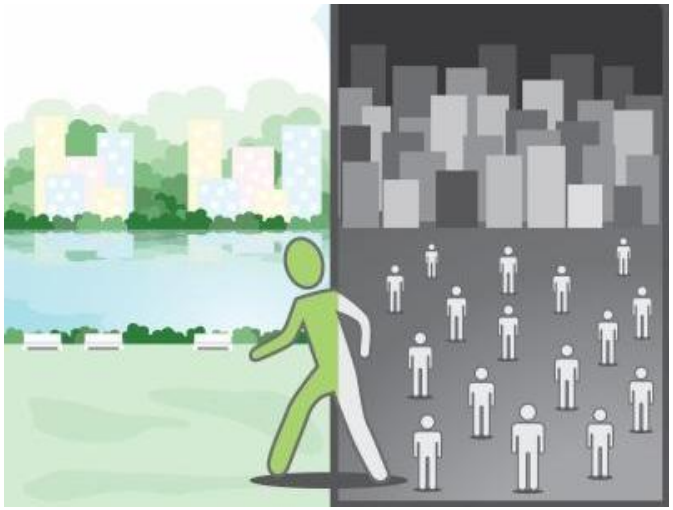
Ready Thailand to Combat Climate Change

Thailand Greenhouse Gas Management Organization (Public Organization): TGO

The Government Complex, Ratthaprasasanabhakti Bldg., 9th Fl., 120 Chaengwattana Rd.,
Laksi, Bangkok 10210

Tel. +66 2141 9790 Fax. +66 2143 8404 www.tgo.or.th

www.tgo.or.th




Current status of JCM in Thailand

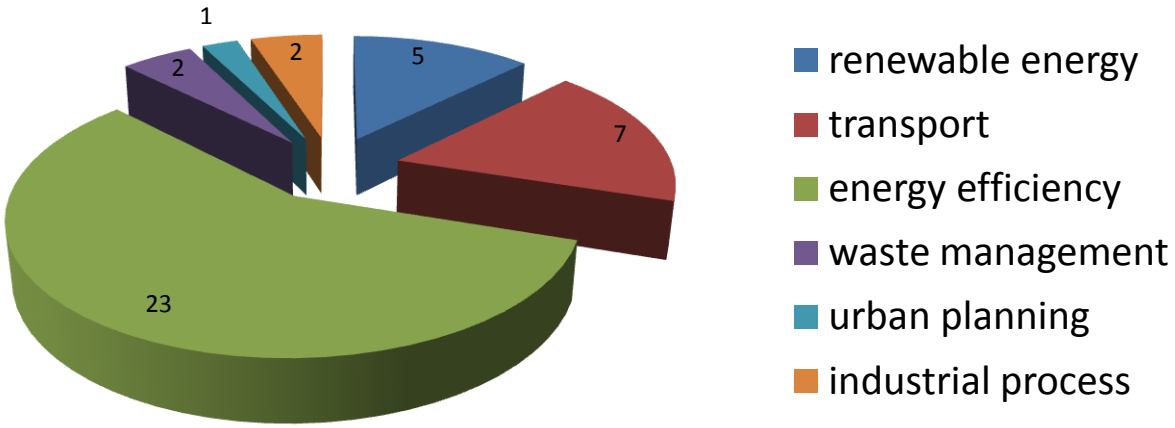
Dr. Paweena Panichayapichet

Session 2: JCM in Thailand

Japan-Thailand Joint Crediting Mechanism (JCM) Seminar, 17th October 2017

Type of Feasibility studies supported by METI, NEDO, MOE

Project type	Number of studies
Energy efficiency	23
Renewable energy	5
Transport	7
Waste management	2
Industrial process	2
Urban planning	1



JCM Model Projects by MOE

The budget for projects starting from FY 2017 is 6.0 billion JPY (approx. USD 60million) in total by FY2019

(1 USD = 100 JPY)

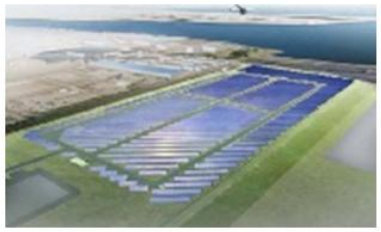
※Includes collaboration with projects supported by JICA and other governmental-affiliated financial institute.

Government of Japan

Finance part of an investment cost (**less than half**)

Conduct MRV and expected to deliver at least half of JCM credits issued

International consortiums
(which include Japanese entities)

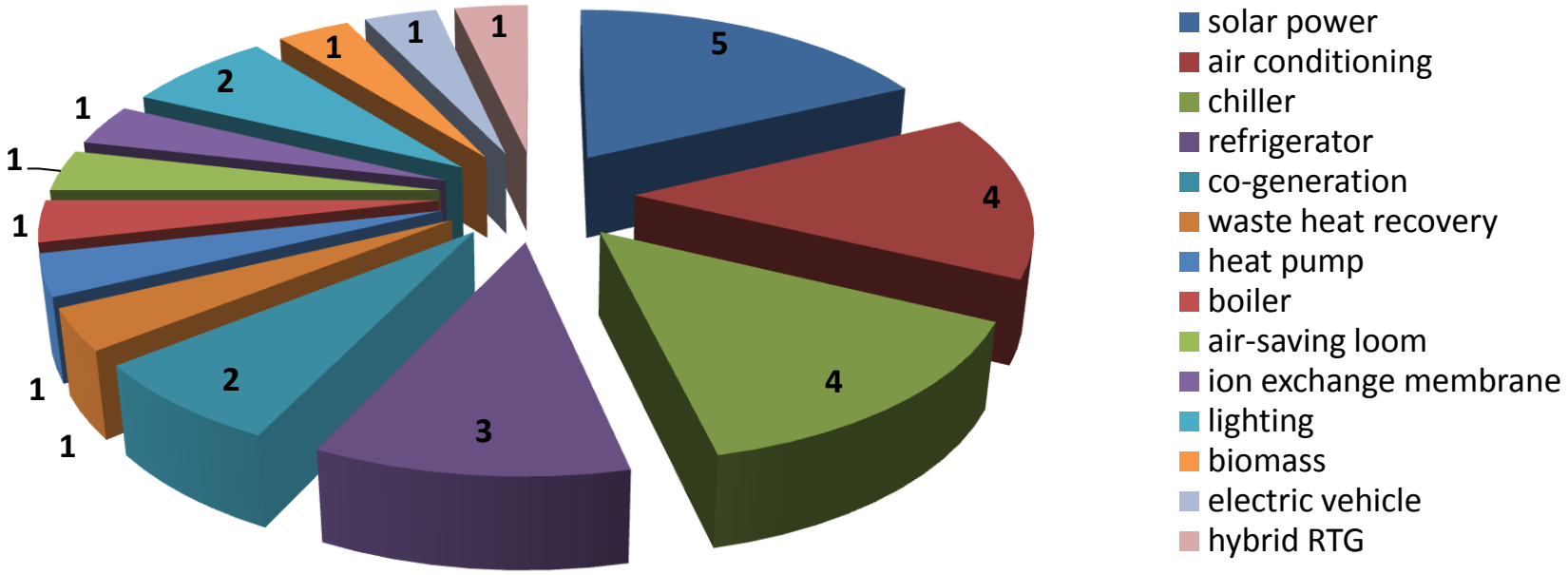


- Scope of the financing: facilities, equipment, vehicles, etc. which reduce CO_2 from fossil fuel combustion as well as construction cost for installing those facilities, etc.
- Eligible Projects : starting installation after the adoption of the financing and finishing installation within three years.

Type of JCM Model Projects

Project type	Number of projects	GHG reduction (tCO_2/y)
Energy efficiency	17	72,691
Renewable energy	6	27,179
	23	99,870

number of project categorized by technology



JCM Model Project

Energy Saving at Convenience Stores with High Efficiency Air-Conditioning and Refrigerated Showcase

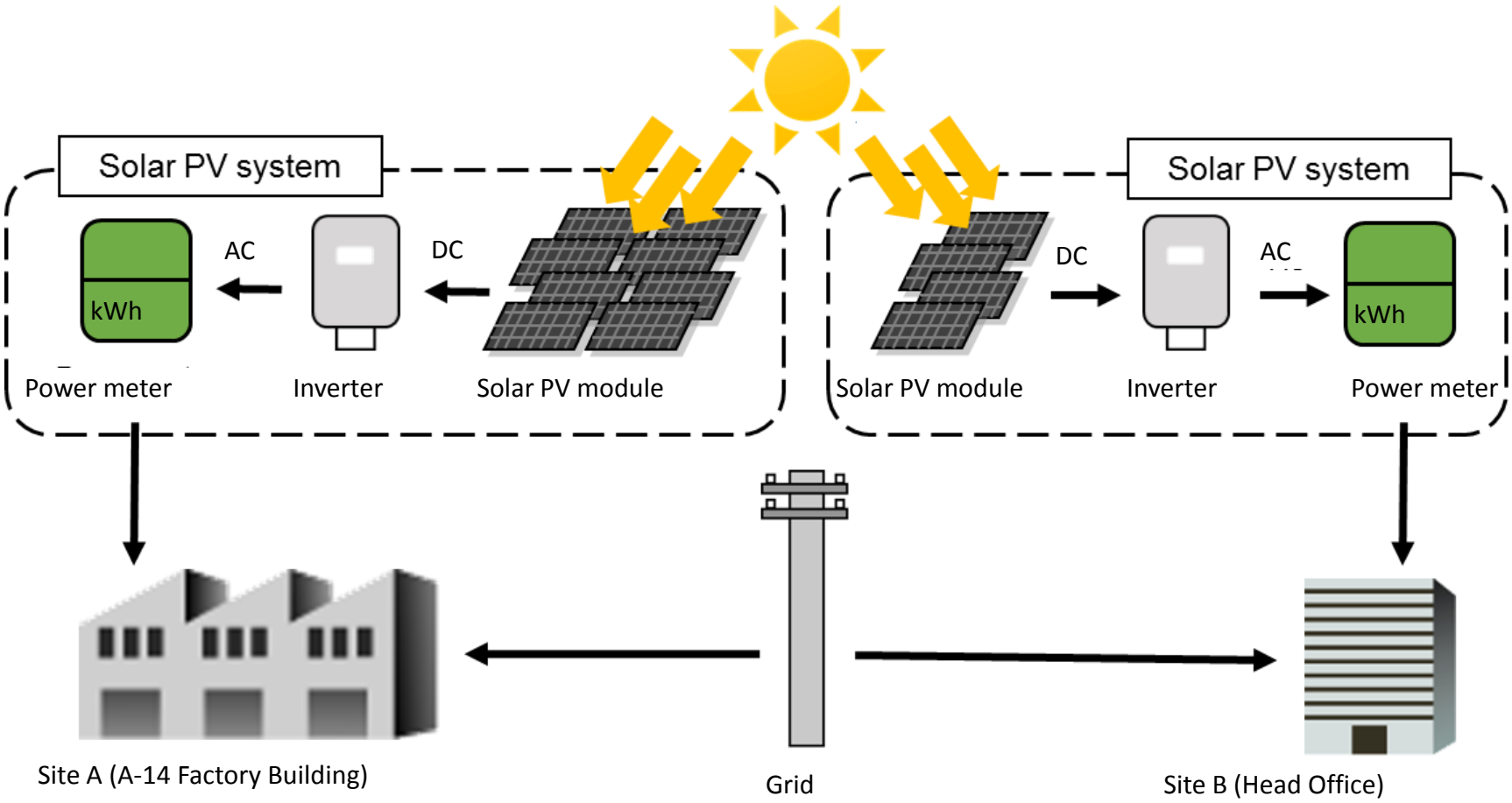
JCM Methodologies

Methodology code	Title	Submission	Complete-ness check	Public input	Approval
TH_AM001	Installation of Solar PV System	25 July 2016	28 July 2016	29 July to 12 Aug 2016	23 Aug 2016
TH_AM002	Energy Saving by Introduction of Multi-Stage Oil-Free Air Compressor	3 Aug 2016	5 Aug 2016	6 -20 Aug 2016	Version 1.0 23 Aug 2016
		3 Aug 2017	4 Aug 2017	5 -19 Aug 2017	Version 2.0 21 Aug 2017
TH_AM003	Energy Saving by Introduction of High Efficiency Centrifugal Chiller	5 Aug 2016	8 August 2016	9 - 23 Aug 2016	21 Aug 2017
TH_AM004	Installation of Energy Saving air Jet Loom at Textile Factory	1 Aug 2017	4 Aug 2017	5 -19 Aug 2017	21 Aug 2017

JCM Methodologies

Methodology code	Title	Submission	Complete-ness check	Public input	Approval
TH_AM005	Energy Saving by Introduction of Non-Inverter High Efficiency Centrifugal Chiller	2 Aug 2017	4 Aug 2017	5 -19 Aug 2017	21 Aug 2017
TH_AM006	Installation of Displacement Ventilation Air Conditioning Unit in the Cleanroom of Semiconductor Manufacturing Factory	3 Aug 2017	4 Aug 2017	5 -19 August 2017	21 Aug 2017

JCM Methodologies: TH_AM001
Installation of Solar PV System



JCM Methodologies: TH_AM001
Installation of Solar PV System

Calculation of project emissions

$$PE_p = 0$$

PE_p : Project emissions during the period p (tCO_2/p)

Calculation of reference emissions

$$RE_p = \sum_i EG_{i,p} \times EF_{RE}$$

RE_p : Reference emissions during the period p (tCO_2/p)

$EG_{i,p}$: Quantity of the electricity generated by the project solar PV system i during the period p (MWh/p)

EF_{RE} : Reference CO_2 emission factor of grid electricity and captive electricity (tCO_2/MWh)

JCM Methodologies: TH_AM002

Energy Saving by Introduction of Multi-Stage Oil-Free Air Compressor

- Multi compression stage for higher energy efficiency
- Oil-free for clean working environment

JCM Methodologies: TH_AM002

Energy Saving by Introduction of Multi-Stage Oil-Free Air Compressor

Calculation of project emissions

$$PE_p = \sum_i \left(EC_{PJ,i,p} \times EF_{elec} \right)$$

PE_p : Project emissions during the period p (tCO_2/p)
$EC_{PJ,i,p}$: Power consumption of project air compressor i during the period p (MWh/p)
EF_{elec} : CO_2 emission factor for consumed electricity (tCO_2/MWh)

Calculation of reference emissions

$$RE_p = \sum_i \left[EC_{PJ,i,p} \times \left(SP_{RE,sc,i} \div SP_{PJ,sc,i} \right) \times EF_{elec} \right]$$

RE_p : Reference emissions during the period p (tCO_2/p)
$EC_{PJ,i,p}$: Power consumption of project air compressor i during the period p (MWh/p)
$SP_{RE,sc,i}$: SP of reference air compressor i under the specific conditions ($kW \cdot min/m^3$)
$SP_{PJ,sc,i}$: SP of project air compressor i calculated under the specific conditions ($kW \cdot min/m^3$)
EF_{elec} : CO_2 emission factor for consumed electricity (tCO_2/MWh)

JCM Methodologies: TH_AM003

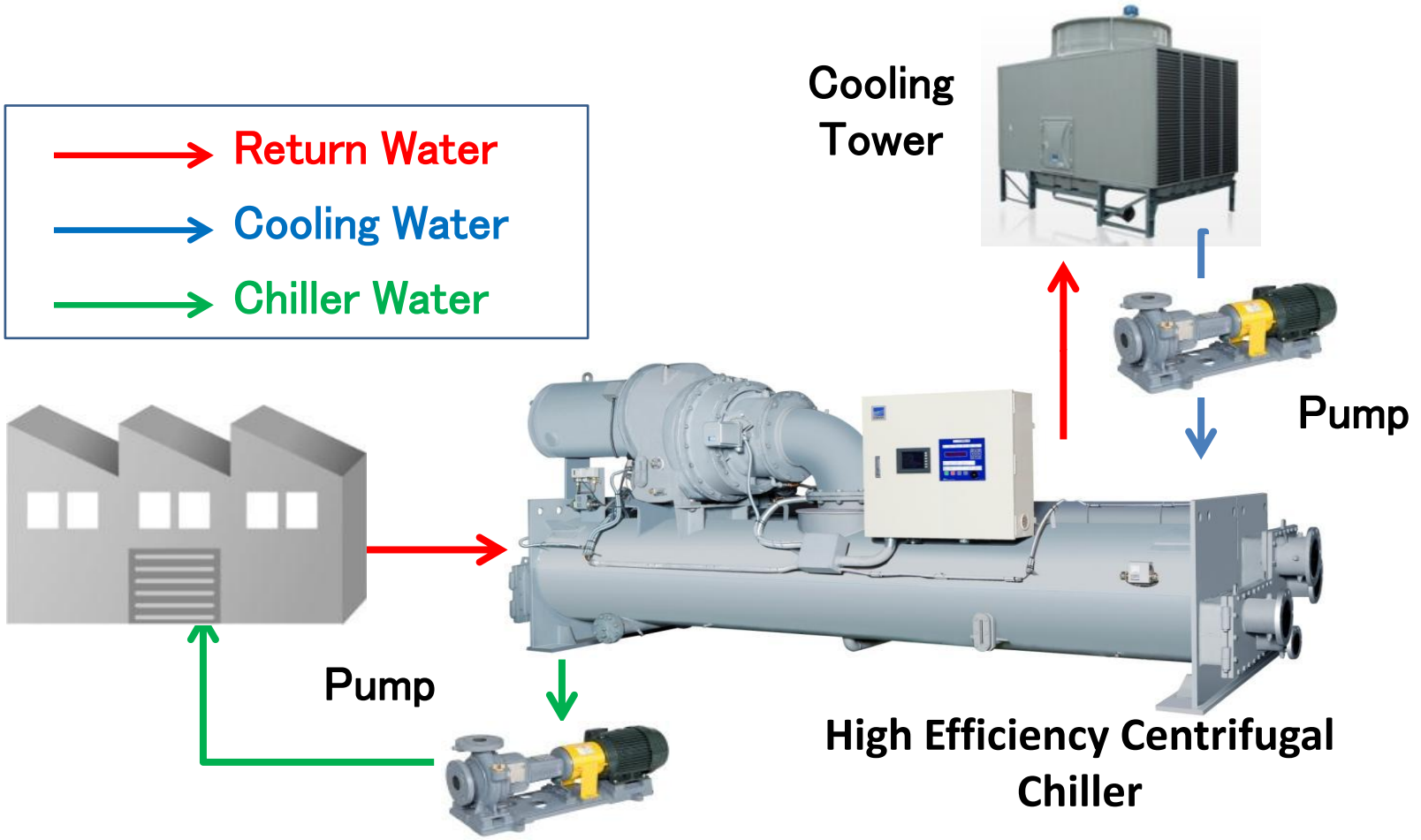
Energy Saving by Introduction of High Efficiency Centrifugal Chiller

■ High-efficiency centrifugal chiller for air conditioning

- High COP (high energy efficiency)
- ODP of the refrigerant (HFC-134a) used is zero for the ozone layer protection

JCM Methodologies: TH_AM005

Energy Saving by Introduction of Non-Inverter High Efficiency Centrifugal Chiller



JCM Methodologies:

TH_AM003: Energy Saving by Introduction of High Efficiency Centrifugal Chiller
TH_AM005: Energy Saving by Introduction of Non-Inverter High Efficiency Centrifugal Chiller

Calculation of project emissions

$$PE_p = \sum_i \left(EC_{PJ,i,p} \times EF_{elec} \right)$$

PE_p : Project emissions during the period p (tCO_2/p)
$EC_{PJ,i,p}$: Power consumption of project chiller i during the period p (MWh/p)
EF_{elec} : CO_2 emission factor for consumed electricity (tCO_2/MWh)

Calculation of reference emissions

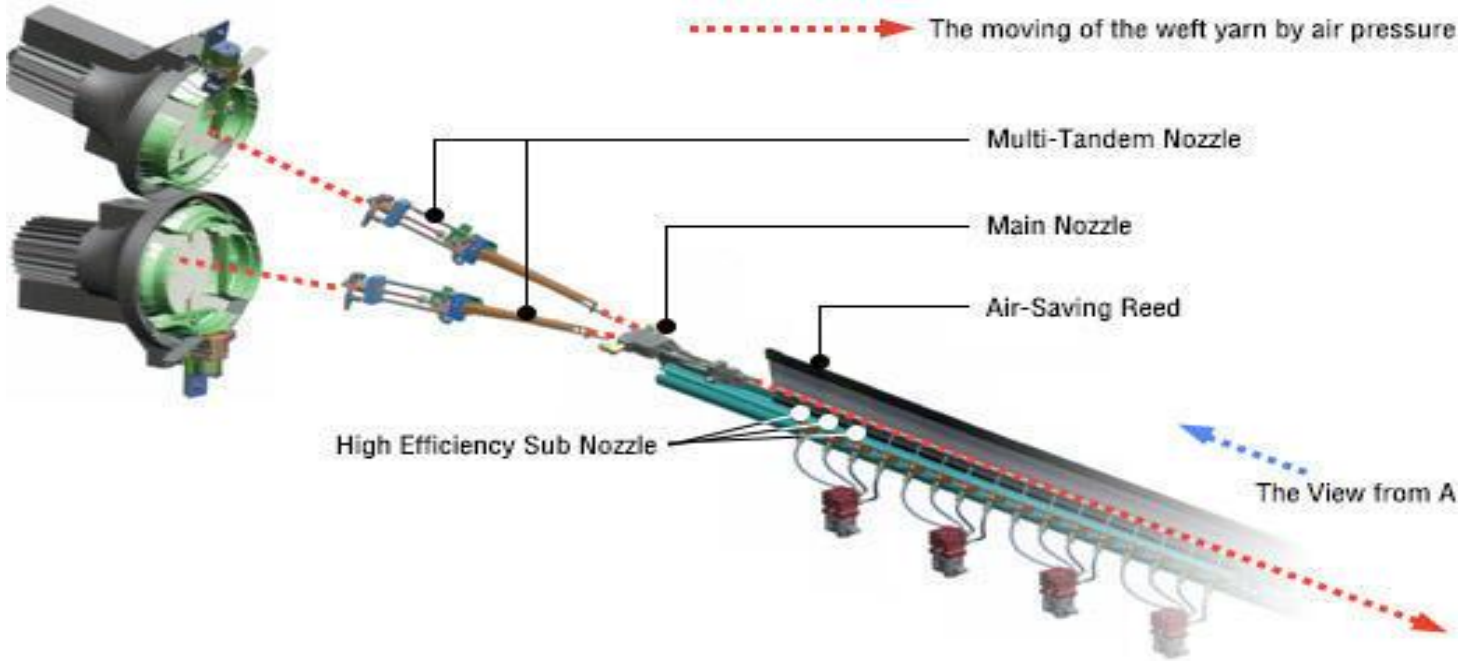
$$RE_p = \sum_i \left[EC_{PJ,i,p} \times \left(COP_{PJ,tc,i} \div COP_{RE,i} \right) \times EF_{elec} \right]$$

RE_p : Reference emissions during the period p (tCO_2/p)
$EC_{PJ,i,p}$: Power consumption of project chiller i during the period p (MWh/p)
$COP_{PJ,tc,i}$: COP of project chiller i calculated under the standardizing temperature conditions (-)
$COP_{RE,i}$: COP of reference chiller i under the standardizing temperature conditions (-)
EF_{elec} : CO_2 emission factor for consumed electricity (tCO_2/MWh)

JCM Methodologies: TH_AM004

Installation of Energy Saving air Jet Loom at Textile Factory

Energy saving air jet loom " Toyota JAT810" produced by Toyota Industries Corporation



Air-Jet weft insertion system

JCM Methodologies: TH_AM004
Installation of Energy Saving air Jet Loom at Textile Factory

Calculation of project emissions

$$PE_p = \sum_j \left(SEC_j \times \sum_i \left(SAC_{PJ,i,j} \times AP_{PJ,i,j,p} \right) \times EF_{elec,j} \right)$$

PE_p : Project emissions during the period p (tCO_2/p)

SEC_j : Specific electricity consumption of the air compressors at the project factory j (kWh/Nm^3)

$SAC_{PJ,i,j}$: Specific air consumption of the project air jet loom type i at the project factory j (Nm^3/m)

$AP_{PJ,i,j,p}$: Amount of fabric woven at the project air jet loom type i at the project factory j during the period p (m/p)

$EF_{elec,j}$: CO_2 emission factor for consumed electricity at the project factory j (tCO_2/MWh)

JCM Methodologies: TH_AM004
Installation of Energy Saving air Jet Loom at Textile Factory

Calculation of reference emissions

$$RE_p = \sum_j \left(SEC_j \times \sum_i (SAC_{PJ,i,j} \times AP_{PJ,i,j,p}) \div \left(1 - \frac{RR_{i,j}}{100}\right) \times EF_{elec,j} \right)$$

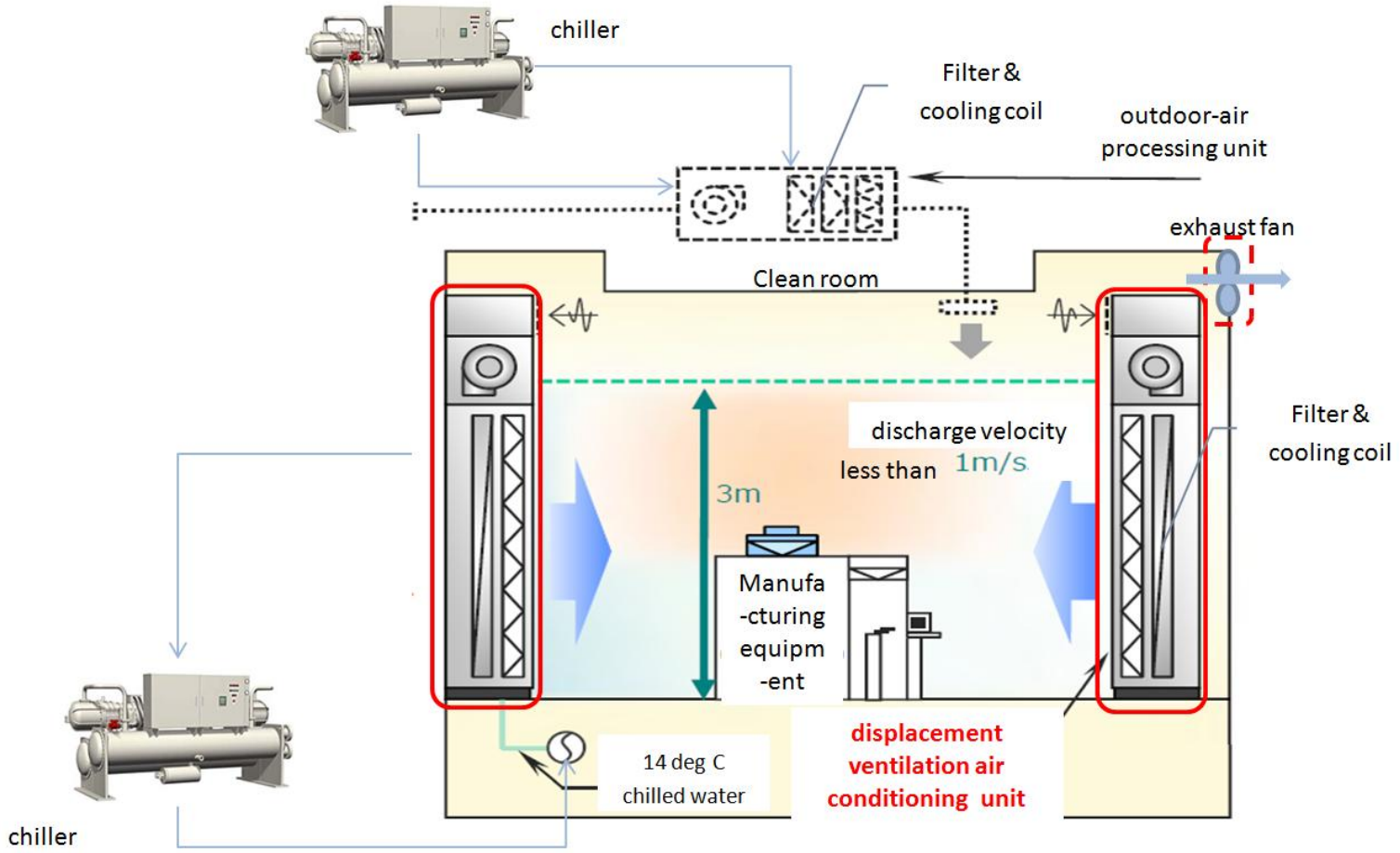
Where:

RE_p	: Reference emissions during the period p [tCO_2/p]
SEC_j	: Specific electricity consumption of the air compressors at the project factory j [kWh/Nm^3]
$SAC_{PJ,i,j}$	: Specific air consumption of the project air jet loom type i at the project factory j [Nm^3/m]
$RR_{i,j}$	: Reduction rate of specific air consumption of the project air jet loom type i at the project factory j [%]
$AP_{PJ,i,j,p}$	: Amount of fabric woven by the project air jet loom type i at the project factory j during the period p [m/p]
$EF_{elec,j}$	: CO_2 emission factor for consumed electricity at the project factory j [tCO_2/kWh]
i	: Identification number of the project air jet loom type, differentiated according to, for example, models
j	: Identification number of the project factory

JCM Methodologies: TH_AM006

Installation of Displacement Ventilation Air Conditioning Unit in the Cleanroom of Semiconductor Manufacturing Factory

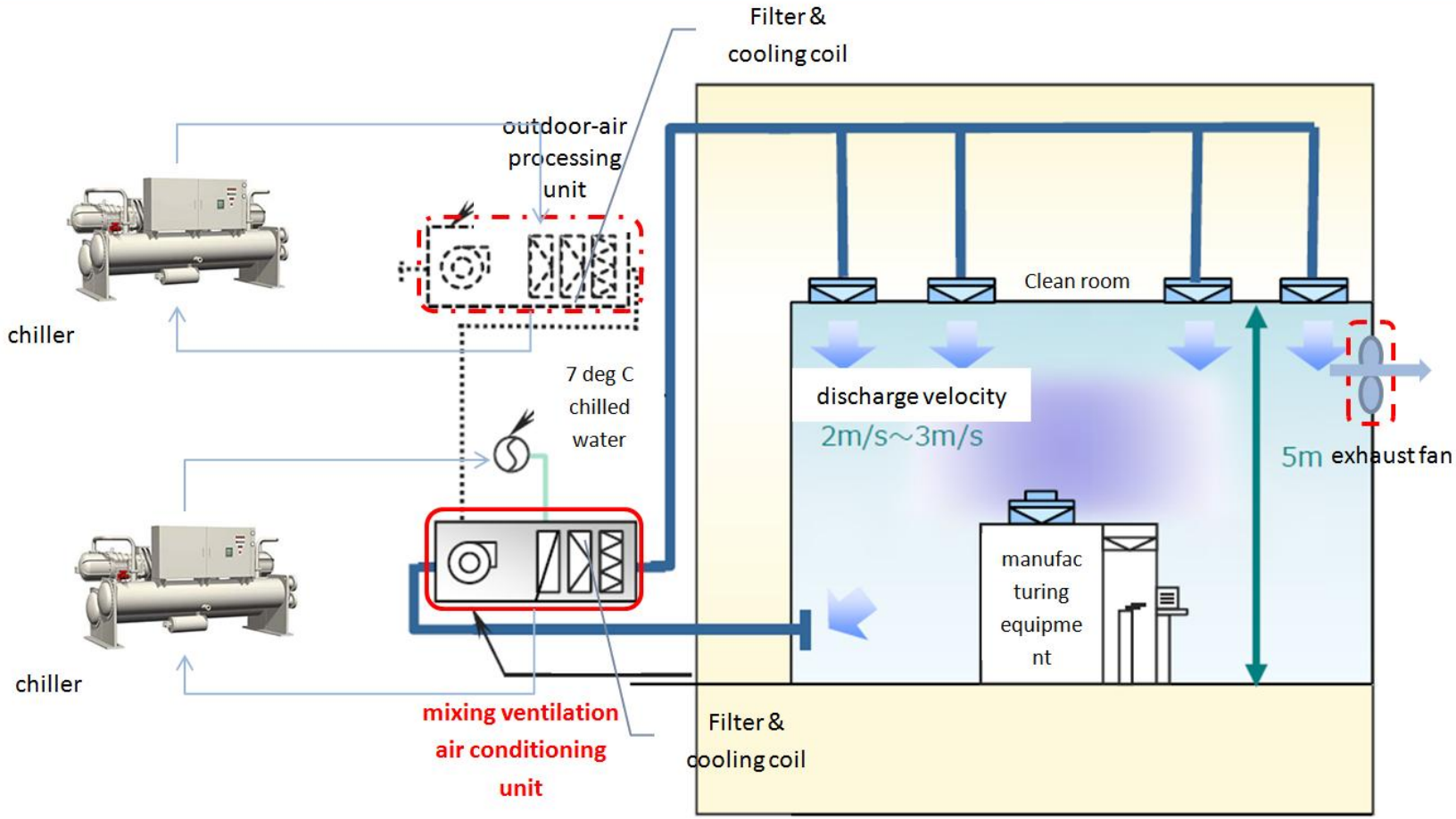
Outline of the technology applied



JCM Methodologies: TH_AM006

Installation of Displacement Ventilation Air Conditioning Unit in the Cleanroom of Semiconductor Manufacturing Factory

Outline of the reference technology



JCM Methodologies: TH_AM006

Installation of Displacement Ventilation Air Conditioning Unit in the Cleanroom of Semiconductor Manufacturing Factory

Calculation of project emissions

$$PE_p = \sum_i \sum_j \sum_k \left(EC_{PJ,DV,i,j,k,p} \times EF_{elec,k} \right)$$

PE_p : Project emissions during the period p (tCO_2/p)

$EC_{PJ,DV,i,j,k,p}$: The amount of power consumption by the displacement ventilation air conditioning unit i in cleanroom j of the project factory k during the period p (MWh/p)

$EF_{elec,k}$: CO_2 emission factor for consumed electricity in the project factory k (tCO_2/MWh)

i : Identification number of the displacement ventilation air conditioning unit

j : Identification number of the cleanroom

k : Identification number of the factory

JCM Methodologies: TH_AM002

Energy Saving by Introduction of Multi-Stage Oil-Free Air Compressor

Calculation of reference emissions

$$RE_p = \sum_i \sum_j \sum_k \left(EC_{PJ,DV,i,j,k,p} \times \frac{L_{RE,j,k}}{L_{PJ,j,k}} \times EF_{elec,k} \right)$$

RE_p : Reference emissions during the period p (tCO_2/p)

$EC_{pJ,DV,i,j,k,}$: The amount of power consumption by the project displacement ventilation air conditioning unit i in cleanroom j of the project factory k during the period p (MWh/p)

$L_{RE,i,p}$: Motive power of reference mixing ventilation air conditioning unit(s) supplying air to cleanroom j in the project factory k (kW)

$L_{PJ,i,p}$: Motive power of project mixing ventilation air conditioning unit(s) supplying air to cleanroom j in the project factory k (kW)

$EF_{elec,k}$: CO_2 emission factor for consumed electricity in the project factory k (tCO_2/MWh)

Designation of Third-Party Entities (TPEs)

Company name	Designated date	1. Energy industries	2. Energy Distribution	3. Energy demand	4. Manufacturing industries	5. Chemical industry	6. Construction	7. Transport	8. Mining/mineral production	9. Metal production	10. Fugitive emissions from fuels	11. Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	12. Solvent use	13. Waste handling and disposal	14. Afforestation and reforestation	15. Agriculture
Lloyd's Register Quality Assurance Limited (LRQA)	23 Aug 2016	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●		
Bureau Veritas Certification Holding SAS (BVC)	23 Aug 2016	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●	❍ ●
Japan Quality Assurance Organization (JQA)	21 Aug 2017	❍ ●		❍ ●	❍ ●	❍ ●					❍ ●			❍ ●	❍ ●	
Japan Management Association (JMA)	21 Aug 2017	❍ ●	❍ ●	❍ ●											●	

❍ **Validation** ● **verification**

The first Registered JCM project

Project_ code	Title	Submission	Public comments	Received Comments	Request of registration	Complete-ness check	Regis-tration
TH001	Introduction of Solar PV Systems on Rooftops of Factory and Office Building	30 June 2017	17 July – 4 Aug 2017	0	8 August 2017	15 August 2017	21 August 2017

491 tCO_2/y

Office building 195.84 kW

Factory building 798.72 kW

Ready Thailand to Combat Climate Change

Thailand Greenhouse Gas Management Organization (Public Organization): TGO

The Government Complex, Ratthaprasasanabhakti Bldg., 9th Fl., 120 Chaengwattana Rd., Laksi, Bangkok 10210

Tel. +66 2141 9790 Fax. +66 2143 8404 www.tgo.or.th

http://ghgreduction.tgo.or.th/jcm/

DENSO
Crafting the Core

JCM Feasibility Study on High Efficiency Automotive Air-conditioner in Thailand

Pradit Mahasaksiri
DENSO International Asia Co.,Ltd(DIAT)
17th October , 2017

Definitions/Abbreviations

COP	Coefficient of Performance
CS	Cold Storage
GHG	Green House Gas
H-MAC	High efficiency Mobile air conditioner
JAPIA	Japan Auto Parts Industry Association
ＪＣＭ	The Joint Crediting Mechanism
LCA	Life Cycle assessment
LCCP	Life Cycle Climate Perforamnce
MAC	Mobile Air conditioner
METI	Ministry of Economy, Trade and Industry
N-MAC	Normal Efficiency Mobile air conditioner
NTSEL	National Traffic Safety and Environment Laboratory (Japan)
PCM	Phase Change Material
SAE	Society of Automotive Engineering
US EPA	United States Environmental Protection Agency

AGENDA

1. Background
2. Project Outline
3. Corporate Profile
4. UNEP workshop 2015
5. Purpose of our project
6. Schedule

1.

Purpose of our project

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1. Purpose of our project

1. As the top manufacturer of Mobile Air Conditioner (MAC) , DENSO has been promoting GHG reduction around the world.

2. We started collaborating with KMUTT* to survey the efficiency of MAC on hot climate region like Thailand.

3. DENSO would like to contribute to GHG emission reduction in Thailand under JCM** program.

* KMUTT: King Mongkut's University of Technology Thonburi

** JCM : Joint Crediting Mechanism

2.

Background

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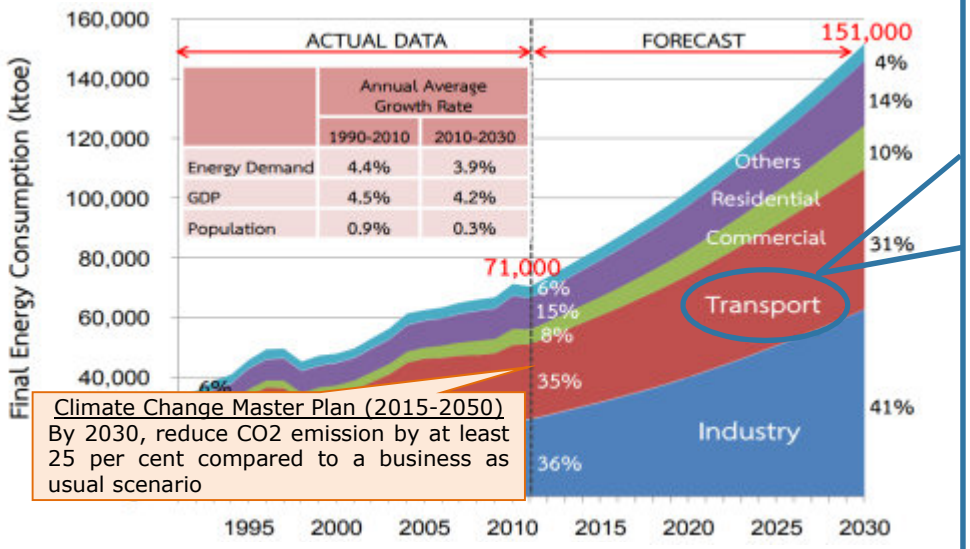
2-1 Transport Sector in the Thai Climate Change

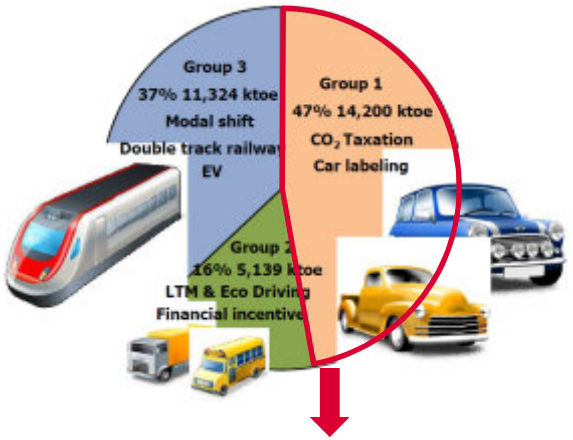
According to Thailand Energy Efficiency Development plan (2015-2036),Transport sector accounts for 69%(30,213ktoe) of total power saving

Energy Consumption in the Past and Forecast



Climate Change Master Plan (2015-2050)
By 2030, reduce CO2 emission by at least 25 per cent compared to a business as usual scenario

Source: MoE (2011), Thailand 20-Year Energy Efficiency Development Plan (2011-30)



Energy saving target in 2036 = 44,059ktoe

Measures
- Group 1: **Transport(30,213ktoe) 69%**
- Group 2: Industry 11,802 ktoe 27%
- Group 3: Residential 991ktoe 2%
- Group 4: Commercial 1,053ktoe 2%

Source: Energy Efficiency Development Plan (EEDP2015)

Energy high efficiency in transport sector is vital to achieve the climate change goal.

2-2 Global GHG reduction activities by DENSO

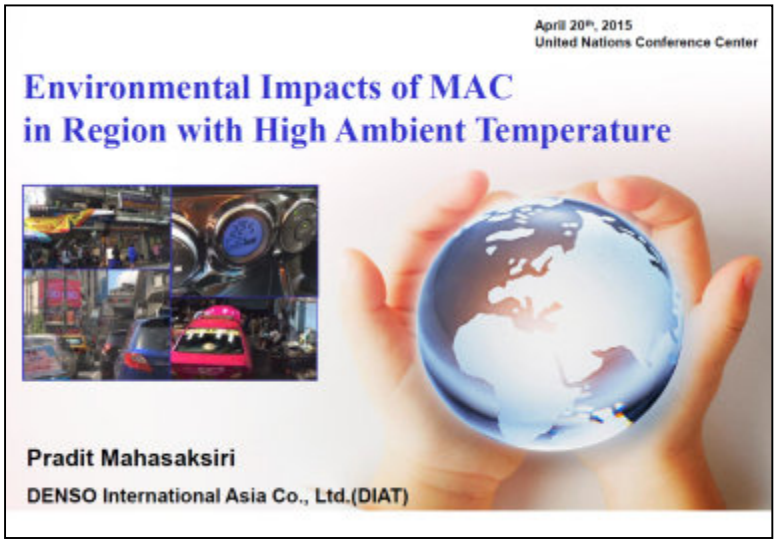
<EPA GHG Regulation>
Jointly OEMs and SAE,
-Promoting High efficiency MAC* to generate Fuel economy incentive

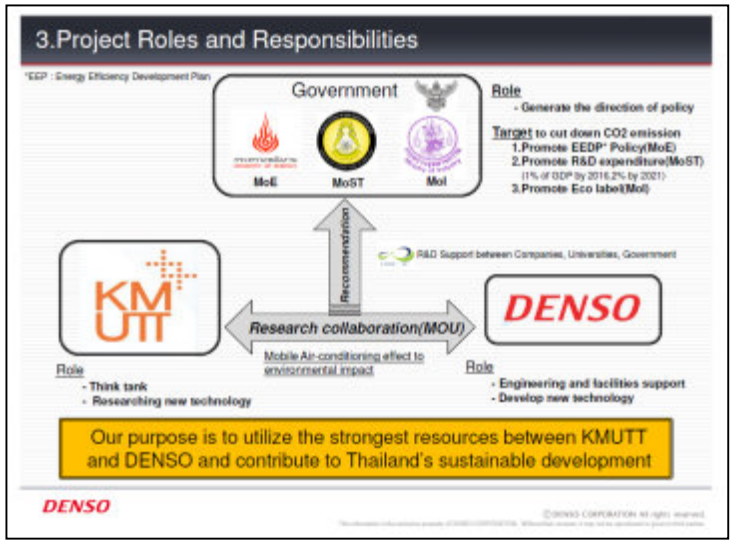
-Promoting new refrigerant to reduce global warming impact greatly.

<Post CO2 regulation>
Jointly CLEPA** (MAC suppliers),
-Proposing policy planning that can appeal high efficieny MAC
<MAC Directive>
Jointly OEMs
-Promoting Eco friendly refrigerant.

<FE regulation:Stage4>
Jointly OEMs and policy maker
- Completed a test method that can qualify high efficiency MAC

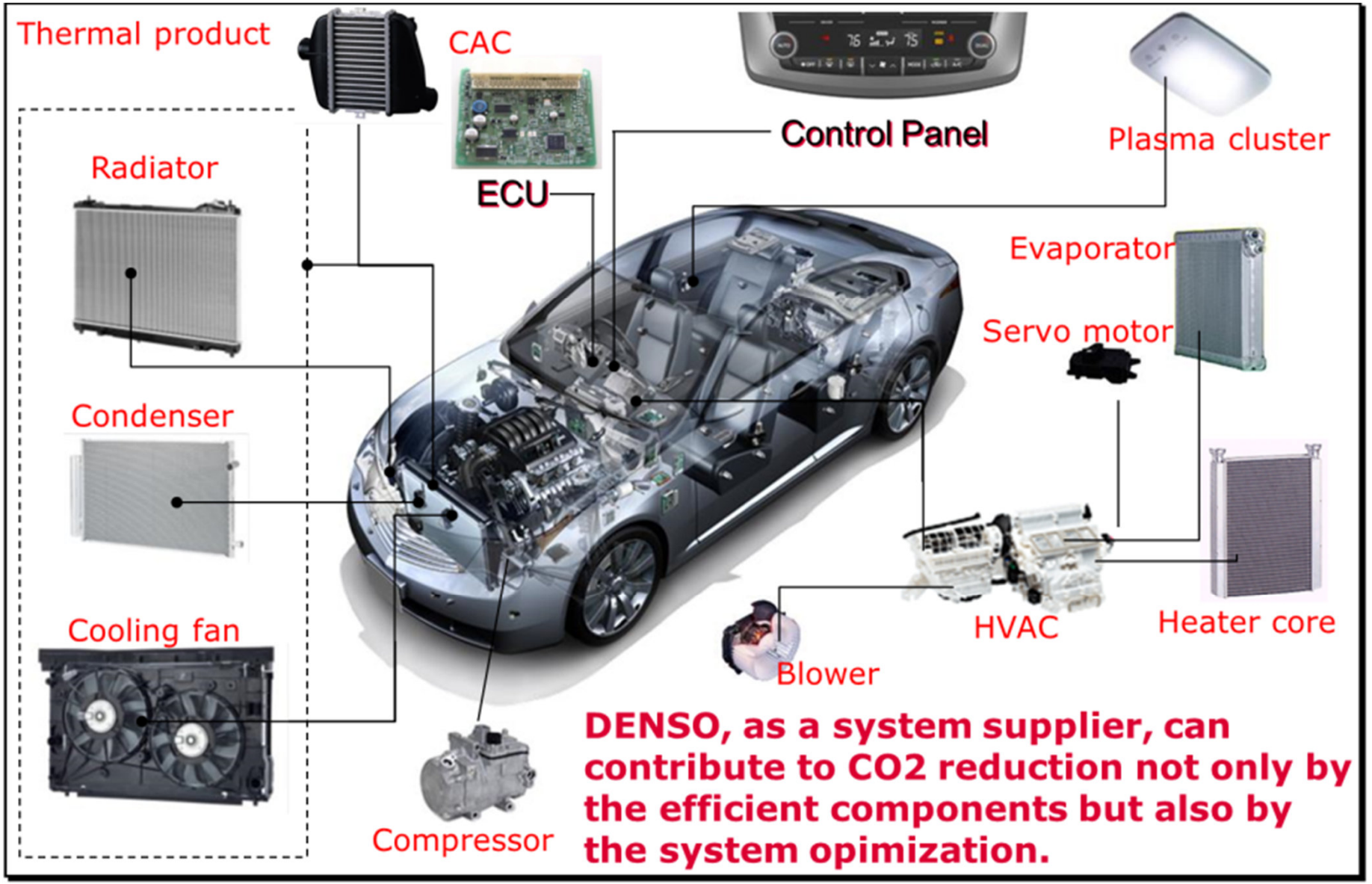
*MAC : Mobile Air Conditioning ** CLEPA : Europe auto parts industries association





DENSO has been suggesting the importance of MAC environmental impact & promoting high efficiency MAC.

2-3 DENSO Products(Thermal product)

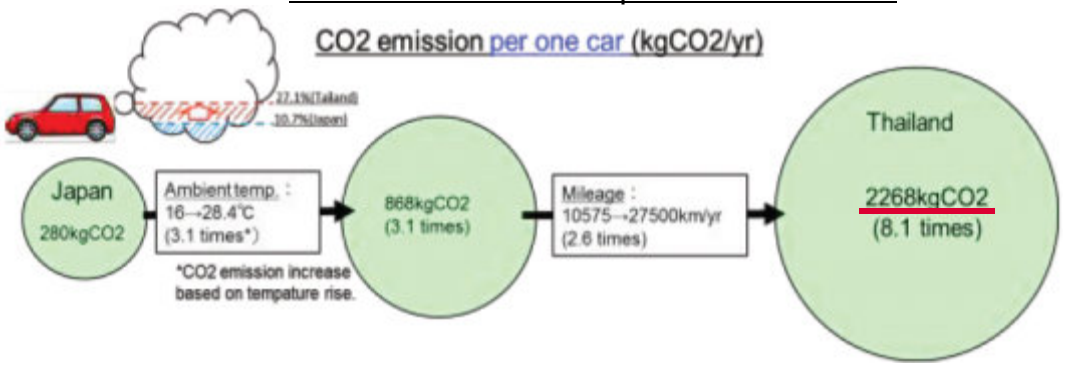


2-4 Potential CO2 Emission Reduction on the Field

Assumption :
-2016FY Sales number for Thailand (about 720,000)
-DENSO Share 50% = **360,000Units**
-20% of efficiency improvement

2016FY Sales number for Thailand	
Passenger vehicle	262,255
SUV	108,255
MPV	6,578
PU	327,859
Van	10,128
total	715,075
DENSO AC share	50%

2015 UNEP Workshop in Thailand*1,2,3



*1 Driving distance information
http://www.mlit.go.jp/jidosha/iinkai/seibi/5th/5-2.pdf
http://www.kobayashi.co.th/business/page/no3-9.htm
http://www.meti.go.jp/meti_lib/report/2012fy/E002762.pdf
*2 Annual average temperature
http://www2m.biglobe.ne.jp/~ZenTech/world/infomation/kion/thailand_bangkok.htm
*3 Ambient temperature and fuel economy information
Test Method for Determining the Annualized Fuel Economy Impact for A/C Usage
GM、SAE symposium Scottsdale. September 27,2011

Potential CO2 reduction = 2268kgCO2×20%×360,000
Total = 162,000ton-CO2/year*

*Based on calculation

- ✓ It is possible to reduce CO2 emissions by about 162,000ton-CO2 /year by using DENSO High efficiency air conditioner.
- ✓ 450kgCO2 saving(2268x20%) is equivalent to 16.4CO2g/km and comparable to10% of Passenger Car CO2* emission in Thailand.
  (*2016, 163g/km: average fuel economy of new sales vehicle in Thailand

3.

Corporate Profile

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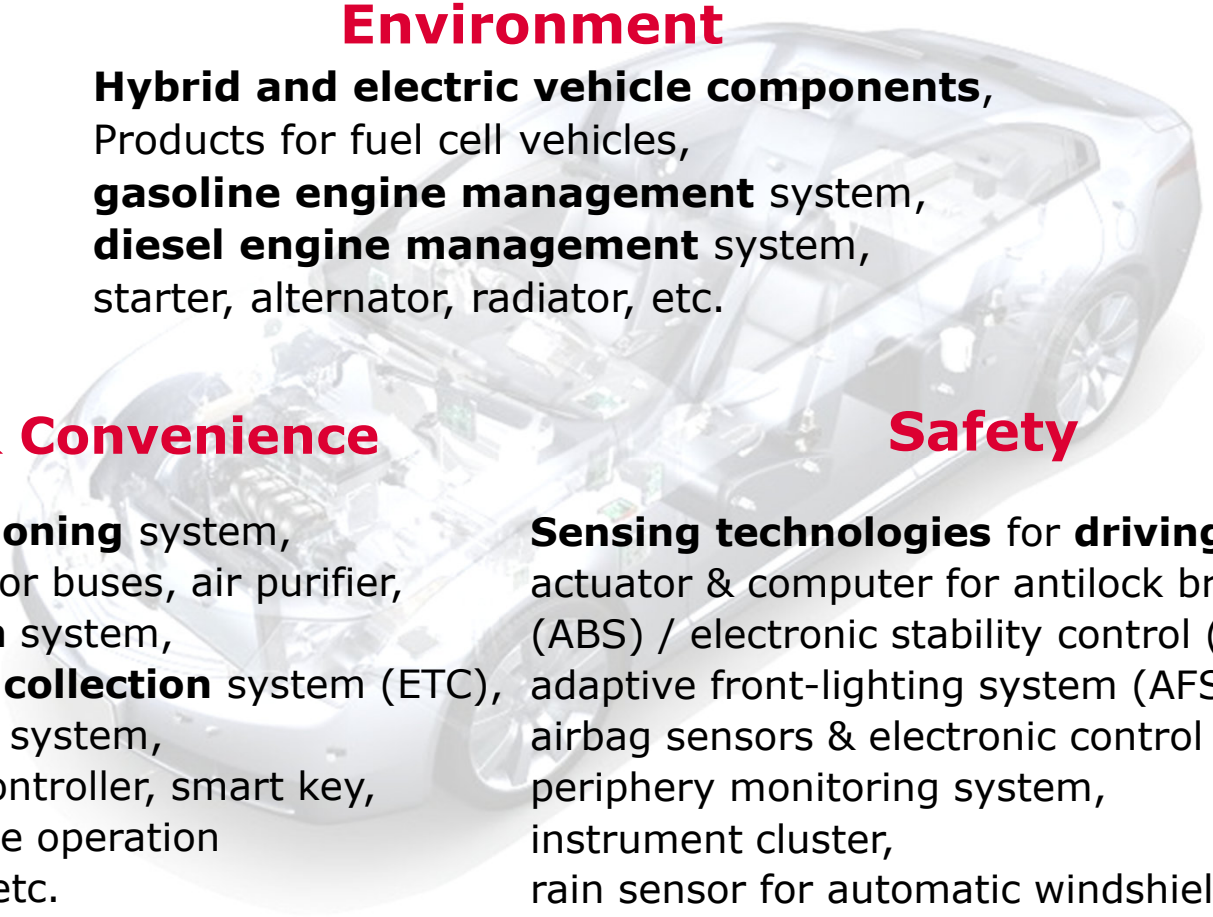
3-1. Profile

Established		December 16, 1949
Capital		187.4 billion yen (US$1.7 billion)
Revenue	Consolidated basis	4,527.1 billion yen (US$40.4 billion)
Operating Profit	Consolidated basis	330.6 billion yen (US$ 2.9 billion)
Employees	Consolidated basis	154,493
	Non-consolidated basis	38,914
Consolidated Subsidiaries		190 (Domestic 62, Overseas 128)
Affiliates under the Equity Method		36 (Domestic 13, Overseas 23)

Notes : U.S.dollar amounts have been translated, for convenience only, at the rate of 112.19 yen = US$1, the approximate exchange rate prevailing on March 31, 2017. Billion is used in the American sense of one thousand million.

as of March 31, 2017

3-2. Main products : Automotive Fields



Environment

Hybrid and electric vehicle components,
Products for fuel cell vehicles,
gasoline engine management system,
diesel engine management system,
starter, alternator, radiator, etc.

Comfort & Convenience

Car air-conditioning system,
air conditioner for buses, air purifier,
Car navigation system,
electronic toll collection system (ETC),
remote security system,
remote touch controller, smart key,
advanced vehicle operation
system(AVOS),etc.

Safety

Sensing technologies for **driving assist** systems,
actuator & computer for antilock brake system
(ABS) / electronic stability control (ESC),
adaptive front-lighting system (AFS),
airbag sensors & electronic control units,
periphery monitoring system,
instrument cluster,
rain sensor for automatic windshield wiper, etc.

3-2. Main products : Automotive Fields

Motors

Electronic

Gasoline EMS control
Diesel EMS control
HEV control

ECU

Semi-conductor

Information & Safety

Thermal control
Body system control

HUD

Meter Cluster

ETC

Millimeter wave Radar

LIDAR

Powertrains

Intake system

Gasoline EMS components

Diesel Common Rail system

Ex. gas treatment

Starter

Alternator

Hybrid system

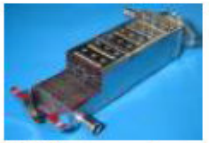
Thermal

HVAC

Compressor

Intercooler

Cooling system



EGR cooler

3-3. Main products : Non-Automotive Fields

Consumer and Industrial Products

①Home Appliances
②Heating and Cooling Equipment
③Auto ID Data Capture Devices
④Factory Automation Products

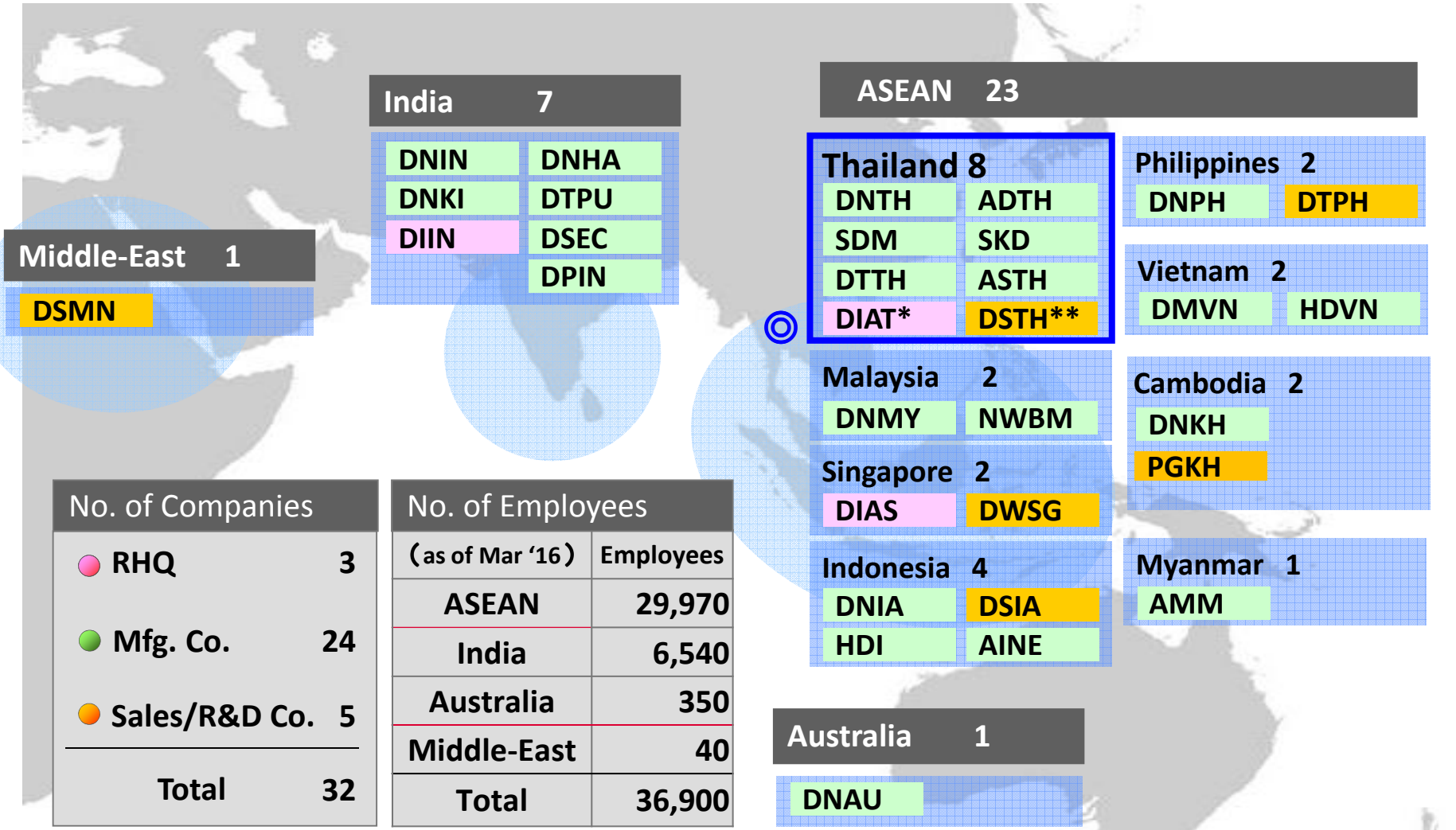
① 
② 
③ 
④ 

New Business Fields

①Micro Grid
②Electric Power Assist
③Security
④Healthcare
⑤Biotechnology(Micro Algae)
⑥Agricultural Support
⑦Cold Chain
⑧Community Network Solution Business

① 
② 
③ 
④ 
⑤ 
⑥ 
⑦ 
⑧ 

3-4. Network around ASEAN



No. of Companies	
RHQ	3
Mfg. Co.	24
Sales/R&D Co.	5
Total	32

No. of Employees (as of Mar '16)	Employees
ASEAN	29,970
India	6,540
Australia	350
Middle-East	40
Total	36,900

*DIAT:Denso International Asia(Thailand)Co.,Ltd
**DSTH:Denso Sales Thailand

4.

UNEP Workshop 2015

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UNEP

Environmental Impacts of MAC in Region with High Ambient Temperature

Pradit Mahasaksiri

DENSO International Asia Co., Ltd.(DIAT)

1. Car Sales and Average Temperature in ASEAN Region 18/28

Tokyo	16.1C
D.C.	14.5C
L.A.	17.2C
London	11.0C
Rome	11.8C
Beijing	12.1C

THAILAND
Average Temp.:28.4℃

MYANMAR
Average Temp.:27.4℃

LAOS
Average Temp.:28℃

VIET NAM
Average Temp.:28℃

Ave. Temp.=27.6C

PHILIPPINES
Average Temp.:26.5℃

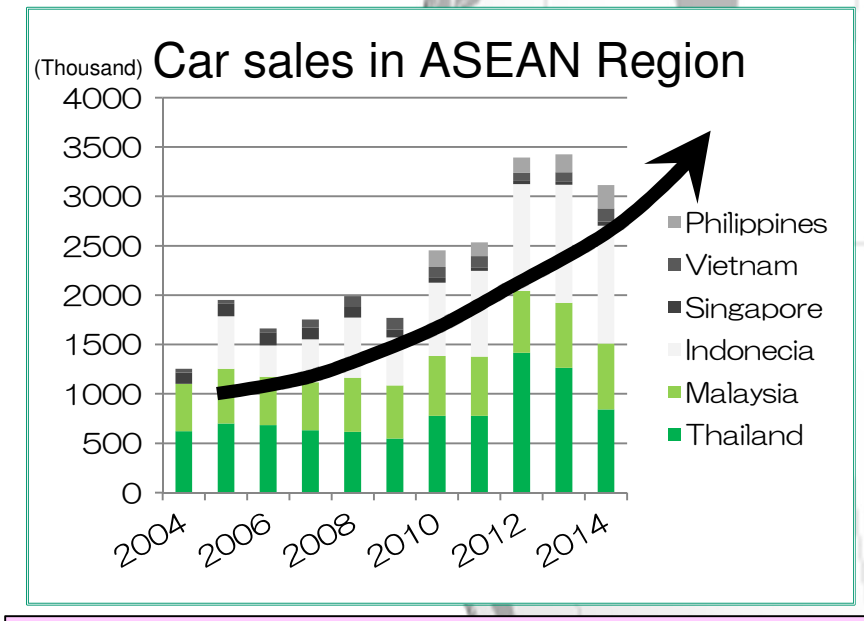
BRUNEI DARUSSALAM
Average Temp.:28℃

MALAYSIA
Average Temp.:27℃

SINGAPORE
Average Temp.:27.4℃

INDONESIA
Average Temp.:28.4℃

CAMBOGIA
Average Temp.:27.7℃



ASEAN region has particularly increased the number of car sales.We think that ASEAN region has a big environmental impact of MAC because of high temperature.

DENSO

2-1. Estimate MAC CO2 Emission in Thailand

4/12

Ratio of MAC CO2 emission

CO2 emission per one car (kgCO2/yr)

Japan
280kgCO2

Ambient temp. :
16→28.4℃
(3.1 times*)

*CO2 emission increase based on tempature rise.

868kgCO2
(3.1 times)

Mileage :
10575→27500km/yr
(2.6 times)

Thailand
2268kgCO2
(8.1 times)

Overall CO2 emis

Japan
16.64 million ton-CO2

Vehicle UIO* in
Japan : 59.4
Thailand : 6.27
(11

MAC CO2 emission in Thailand is about 85
market growth in the future.

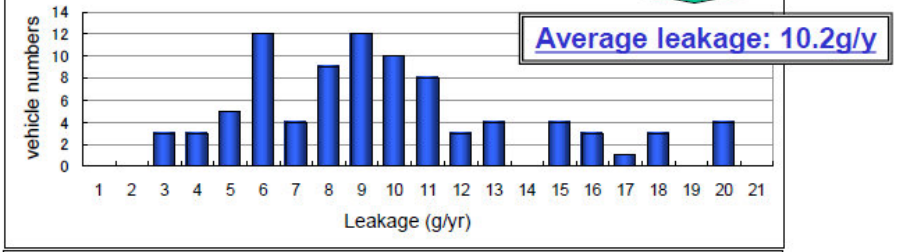
DENSO

3. JAMA Field Survey (2004-2005) : Refrigerant Leakage

JAMA : Japan Automobile Manufacturers Associate

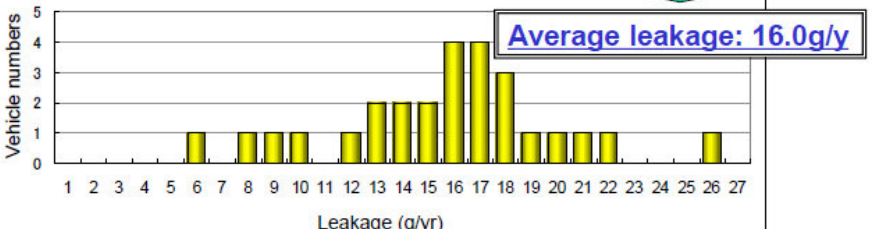
6/12

Region: Tokyo and Nagoya city (88 vehicles), Average temp. 16C



Average leakage: 10.2g/y

Region: Okinawa city (27 vehicles) Average temp. 22C



Average leakage: 16.0g/y

DENSO appealed on the importance of MAC environmental impacts such as fuel saving and low refrigerant leakage.

5.

Project Outline

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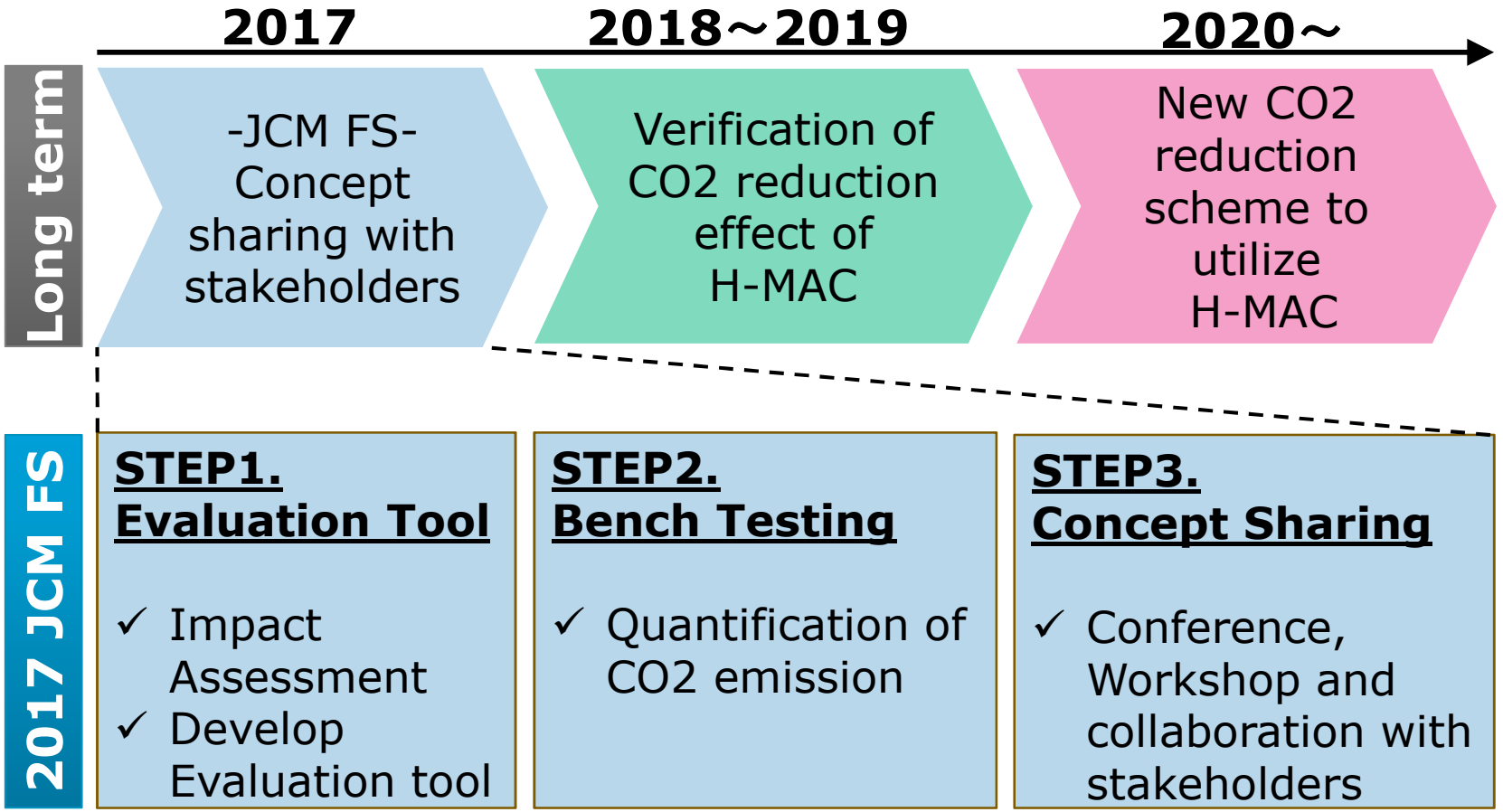
5-1 The aim of long term & FY2017 plan



Long term : New scheme suggestion for CO2 reduction
FY2017 : Concept sharing with stakeholders

STEP 1. Evaluation Tool

1. Evaluation Tool　2. Bench Testing　3. Concept Sharing

1-1. Impact Assessment

- ✓ Utilize the Life-Cycle Climate Performance (LCCP) developed by U.S. the Society of Automotive Engineers (SAE), and estimate CO2 emission due to MAC operation in Thailand.

- ✓ Gather unique information necessary to conduct LCCP analysis such as climate conditioning and driving cycle considering the traffic situation in Thailand jointly with KMUTT.

1-2. Develop evaluation tool to define high efficieny MAC

- ✓ Eatablish the simplified tool to reduce the burden on companies that conduct evaluations.
- ✓ Promote the development by receving assistance from SAE and KMUTT.

Evaluate environmental impacts utilizing Life-Cycle Climate Performance(LCCP)method

STEP 2. Bench Testing / 3. Concept Sharing

1. Evaluation Tool 2. Bench Testing 3. Concept Sharing

2. Bench Testing

- ✓ Conduct bench testing to quantify the CO2 mission reduction.

3. Concept Sharing

<Conference>

- ✓ Plan to have a conference between Thai and Japanese specialists in order to discuss the Japanese policy/regulation at the end of October 2017.

<Workshop>

- ✓ Hold the workshop in January 2018 to show the result of this study in Bangkok.

<Collaboration>

- ✓ Search for any collaboration opportunities with stakeholders so that we can accelerate the dissemination of high efficiency MAC.

Share fruitful information & discuss the future solution together with policy makers

5-2 Estimated merit

- **For end user**

・Fuel cost reduction
Fuel consumption improvement by high efficiency A/C is expected in Thailand where A/C is always used in hot climate.

・Extension of drive distance (including EV)
Driving distance shortens in case of using A/C.
Amount of EV charging station is highly less than petrol station.
Risk or anxiety of vehicle stop due to **battery shortage** could be reduced by high efficiency A/C.

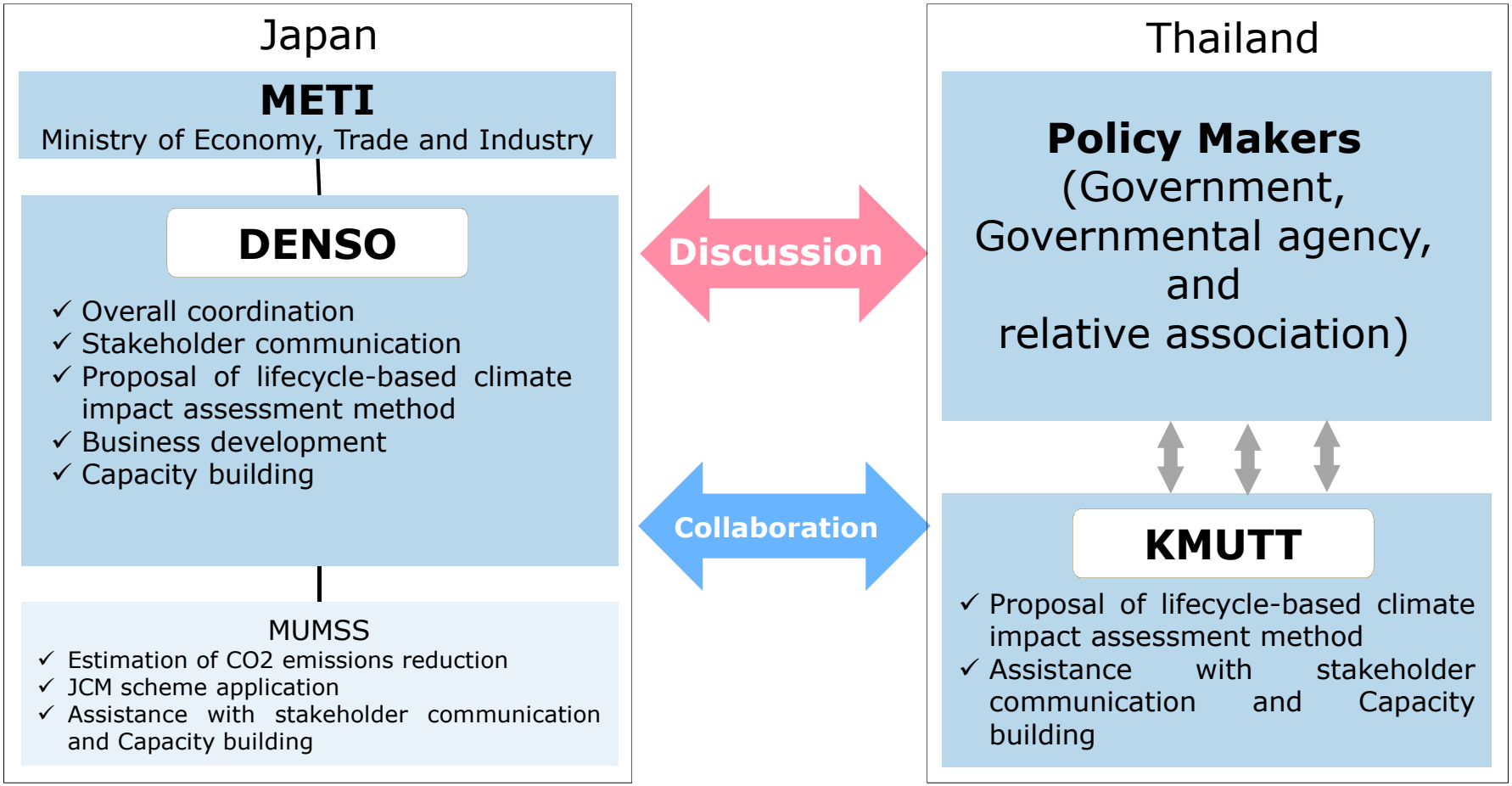
- **For government**

The following reduction in transportation sector could be estimated.

・CO2 emission
・Fuel Subsidies
・Fuel consumption
・Petroleum import

High efficiency A/C would bring many benefit to both end users and government.

5-3. Project Organization and stakeholders



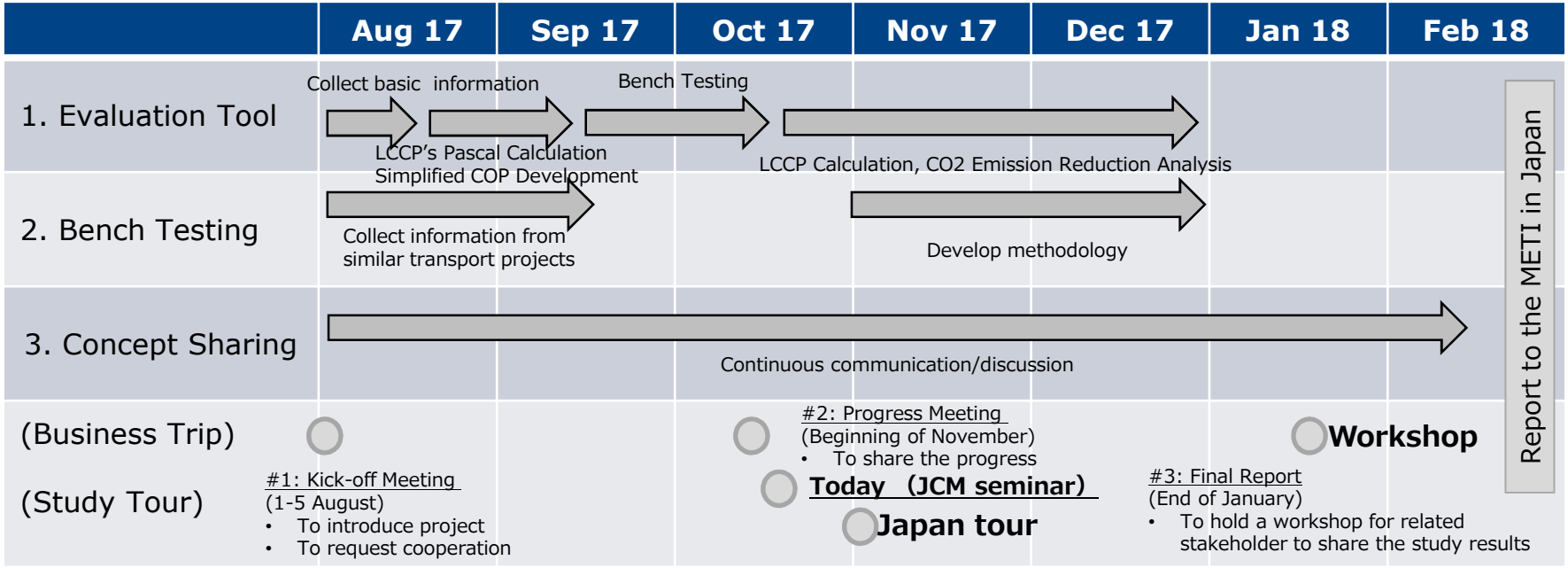
KMUTT & DENSO challenge jointly with CO2 reduction by MAC.
We'd like to discuss together with the various ministries.

6.

Schedule

DENSO
Crafting the Core

6. Schedule in FY2017



<u>Two fruitful events</u> to accelerate "our feasibility study for CO2 reduction by high efficiency MAC".

1) **Conference**;
   Concept sharing & discussion with policy makers.
2) **Workshop @ Bangkok** ;
   Report of feasibility study & propose for next action.

DENSO

Crafting the Core

<Thailand – Japan G to G candidate project>

Joint CO_2 credit mechanism × Gas turbine upgrade solution

- Feasibility study -

Future growth business research & development group,
Takasago power systems service dept,
Power systems service HQ,
Mitsubishi Hitachi Power Systems. Ltd

1. Climate change challenge

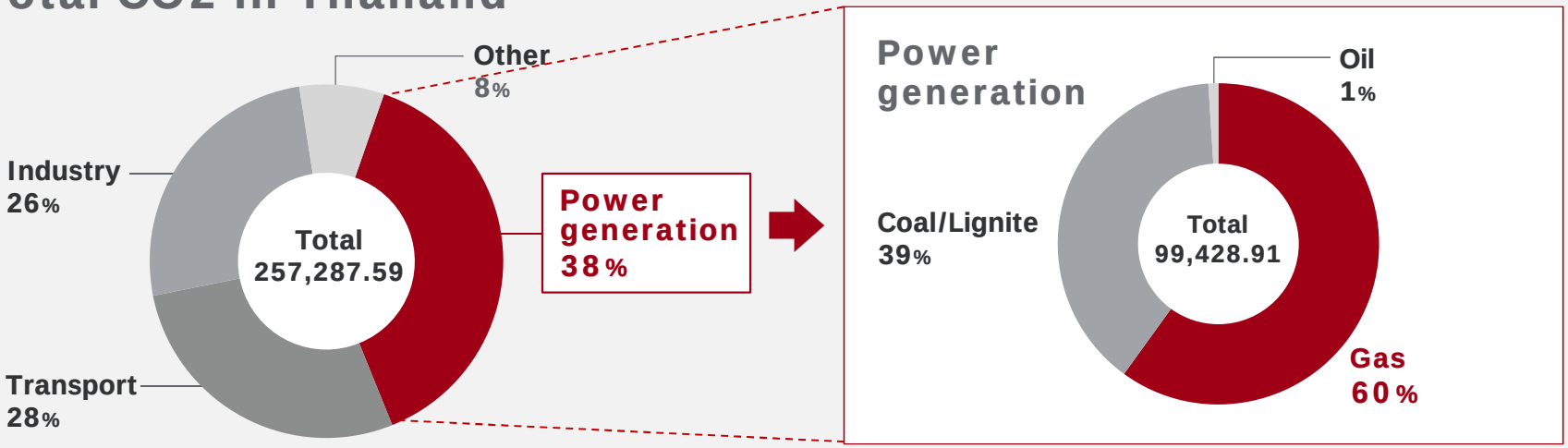
- Climate change with its consequences major threat to prosperity worldwide
- Through Paris agreement, 194 countries aims to limit temperature increase within 2℃
- Quick and realizable action is required.

PARIS2015
CONFÉRENCE DES NATIONS UNIES SUR LES CHANGEMENTS CLIMATIQUES
COP21·CMP11

2. Thailand CO_2 emission data

- CO_2 emission mainly from power generation sector in Thailand
- Power in Thailand mainly generated from natural gas
- Renovation of existing gas power plant has high potential for CO_2 reduction.

Total CO2 in Thailand



Unit:1,000 tons

	Oil	Coal/Lignite	Natural Gas	Total
Power Generation	1,152.35	38,750.96	59,525.60	99,428.91
Transport	65,942.77		5,924.08	71,866.85
Industry	11,230.21	34,158.03	20,717.81	66,106.05
Other	19,885.78			19,885.78
Total	98,211.10	72,908.99	86,167.50	257,287.59

Data Source：EPPO (Energy Policy & Planning Office)

3. MHPS proposed solutions

- MHPS contribution to solve the global warming challenge by providing eco-friendly & state-of the art energy solutions to the world in power generation sector.
- In addition to new products, we also think that renovation of existing facilities is an another key solution.

New equipment

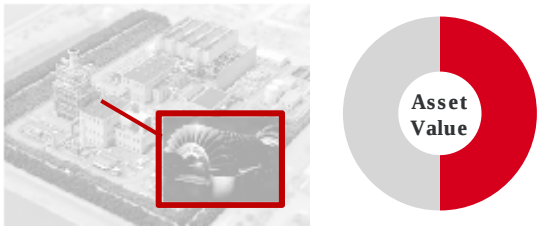
- Higher CAPEX
- Need time to build
- Huge CO_2 reduction

Existing facility

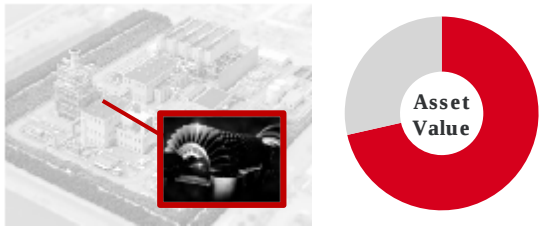
New Power Plant
<Scrap & Build>

Renovation

- Reasonable
- Quicker solution (<1yrs)
- Simplified process



Existing facility



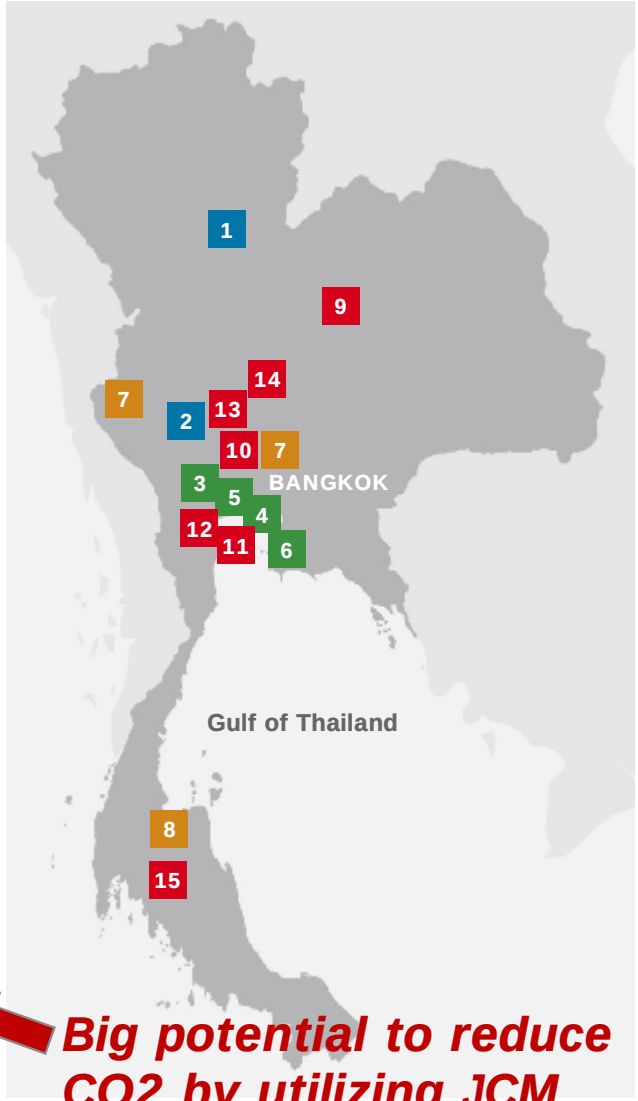
Renovation
<Existing asset utilization>

Renovation with unchanged traditional value is a Japanese trend. In 2016, industrial heritage in Meiji era (1898's and 1900's) were certified as world heritage of Unesco together with our MHPS's Nagasaki Factory

4. MHPS contribution to Thailand's electricity supply

【MHPS Turbines delivered in Thailand】

	Category	Plant name	Unit no.	Output	Delivery
1	Hydro	Sirikit	4	125MW x4	1972-1995
2		Srinagarid	5	120MW x3 180MW x2	1980-1991
3	Boiler Turbine Generator	South Bangkok	5	200MW x2 310MW x3	1971-1978
4		Bang Pakong	4	550MW x2 600MW x2	1984-1992
5		Ratchaburi	2	700MW x2	1998-2000
6		BLCP	2	717MW x2	2006-2007
7	GT	Nong Chok (No.4 Lan Krabue)	4	150MW x4	1995
8		Sai Noi (Suratthani)	2	150MW x2	1995
9	GTCC	Nam Phong	4	150MW x4 (2on1 x2B)	1990-1994
10		Wang Noi	6	350MW x6 (2on1 x3B)	1996-1998
11		Ratchaburi	4	700MW x2	2008
12		South Bangkok	2	700MW x1	2008
13		Gulf JP Nong Saeng	4	800MW ×2	2014
14		Gulf JP U-Thai	4	800MW ×2	2015
15		Khanom	2	465MW×2	2016



Big potential to reduce CO2 by utilizing JCM

5. JCM Feasibility study to Gas Turbine renovation

Ministry of Economy, Trade and Industry(METI)

NEDO

MHPS

MIZUHO

Mitsubishi Hitachi Power Systems, Ltd. (MHPS)

- Basic plan development
- Technical evaluations
- Business model proposal
- Business investment scale calculation
- Business scheme & schedule

etc.

Mizuho Information & Research Institute, Inc. (Mizuho)

- JCM scheme MRV structure planning
- Financial scheme study
- Economic evaluations
- Existing regulation study

etc.

6. MHPS's approach: "Gas Turbine Renovation × ICT" by JCM

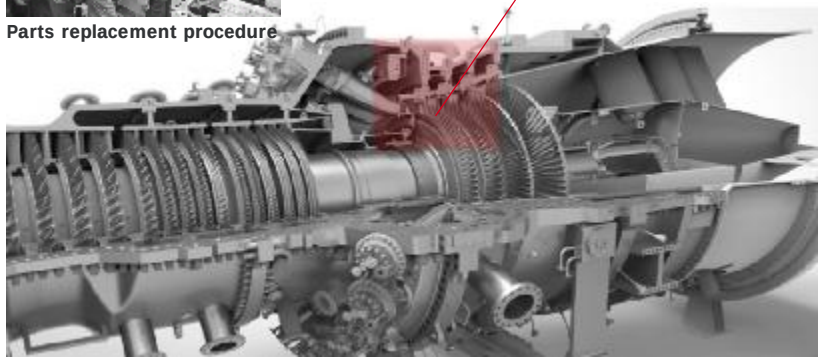
Gas turbine renovation solution × "MHPS Tomoni" ICT solution

<Example>
Gas Turbine Upgrade Program

CO2 reduction

Parts replacement procedure

■ Gas Turbine Blades & Vanes only replacement



Parts replacement only	Quick delivery (<1year)	Simple process
State of the art technology	Having experience	Huge Fuel cost saving

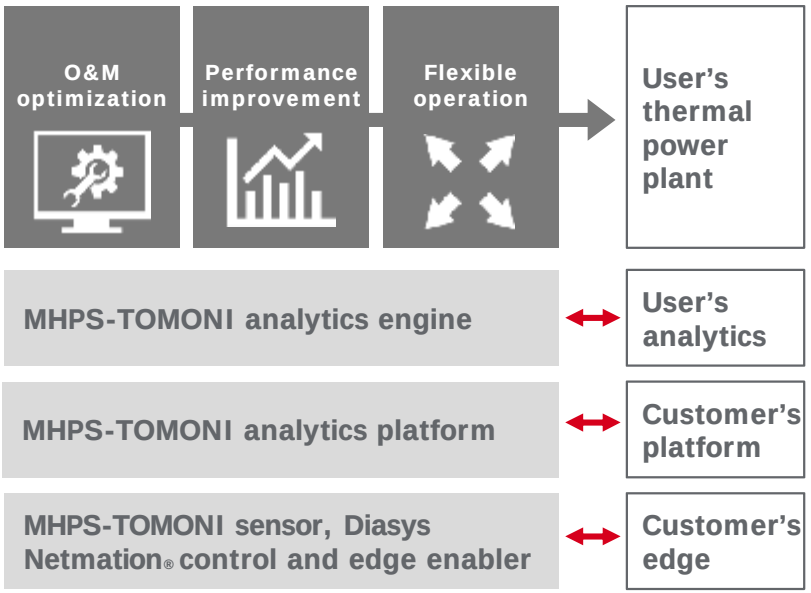
×

Introduction of "MHPS Tomoni"

CO2 monitoring

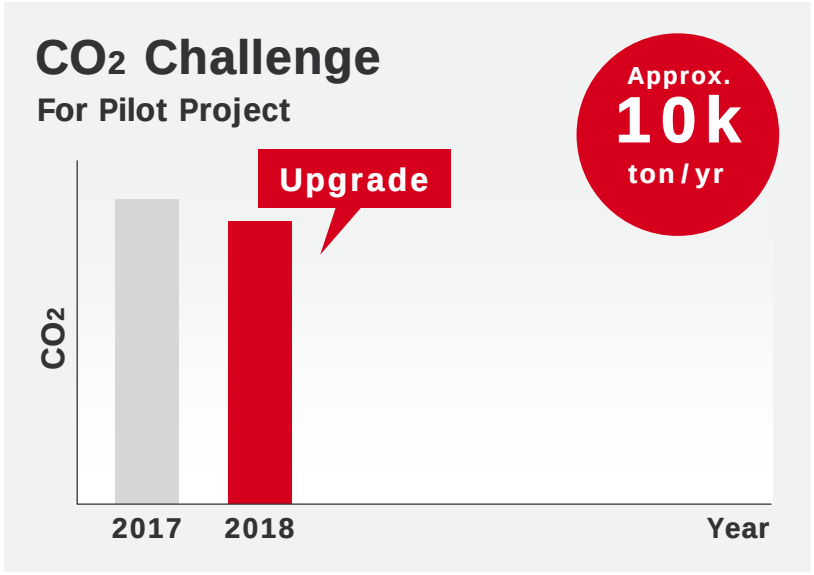
- Tomoni means "Together" in Japanese.
- It represents MHPS's bold move to revolutionize ICT solution for thermal power industries, together with customers.
- Our systems can be customized to work with user's existing platform to provide benefits of O&M optimization, performance enhancement and operability improvement.

MHPS Digital Solutions TOMONI



7. Future Vision(1): CO2 reduction in Thailand

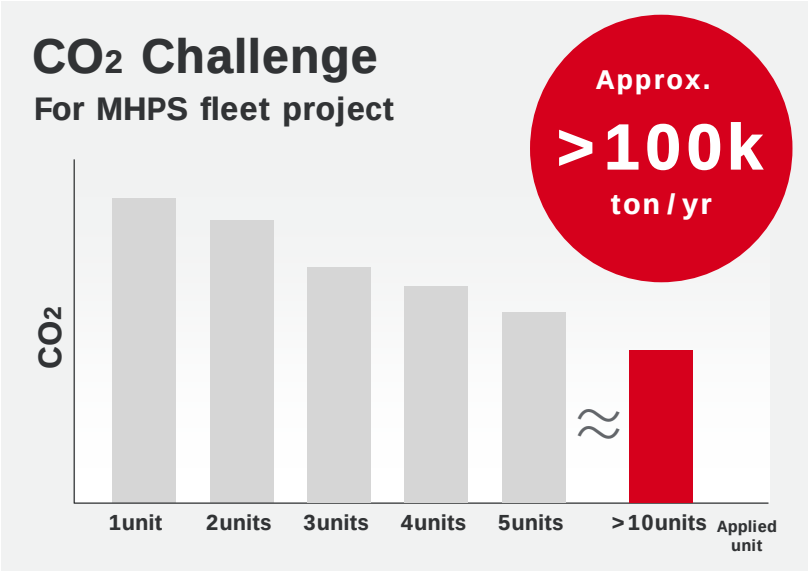
- **Feasibility study will be done for one power plant in Thailand**
- **STEP1: after feasibility study, first project will be implemented in Thailand through JCM scheme**



※ The above figures are for reference and may change after the detail feasibility study.

7. Future Vision(2): CO2 reduction in Thailand

- **STEP2: Renovation with JCM scheme can be expanded to the other projects in Thailand.**
- **If all MHPS supplied gas power plants in Thailand applies renovation with JCM scheme ….??**



※ The above figures are for reference and may change after the detail feasibility study.

7. Future Vision(3): Japan & Thailand contribution to ASEAN

Expansion to ASEAN countries

By utilizing well experience of Gas Turbine Upgrade × IoT × JCM collaboration in Thailand and Japan, the same solution will be expanded to ASEAN country.

NEXT RENOVATION
xxx power plant

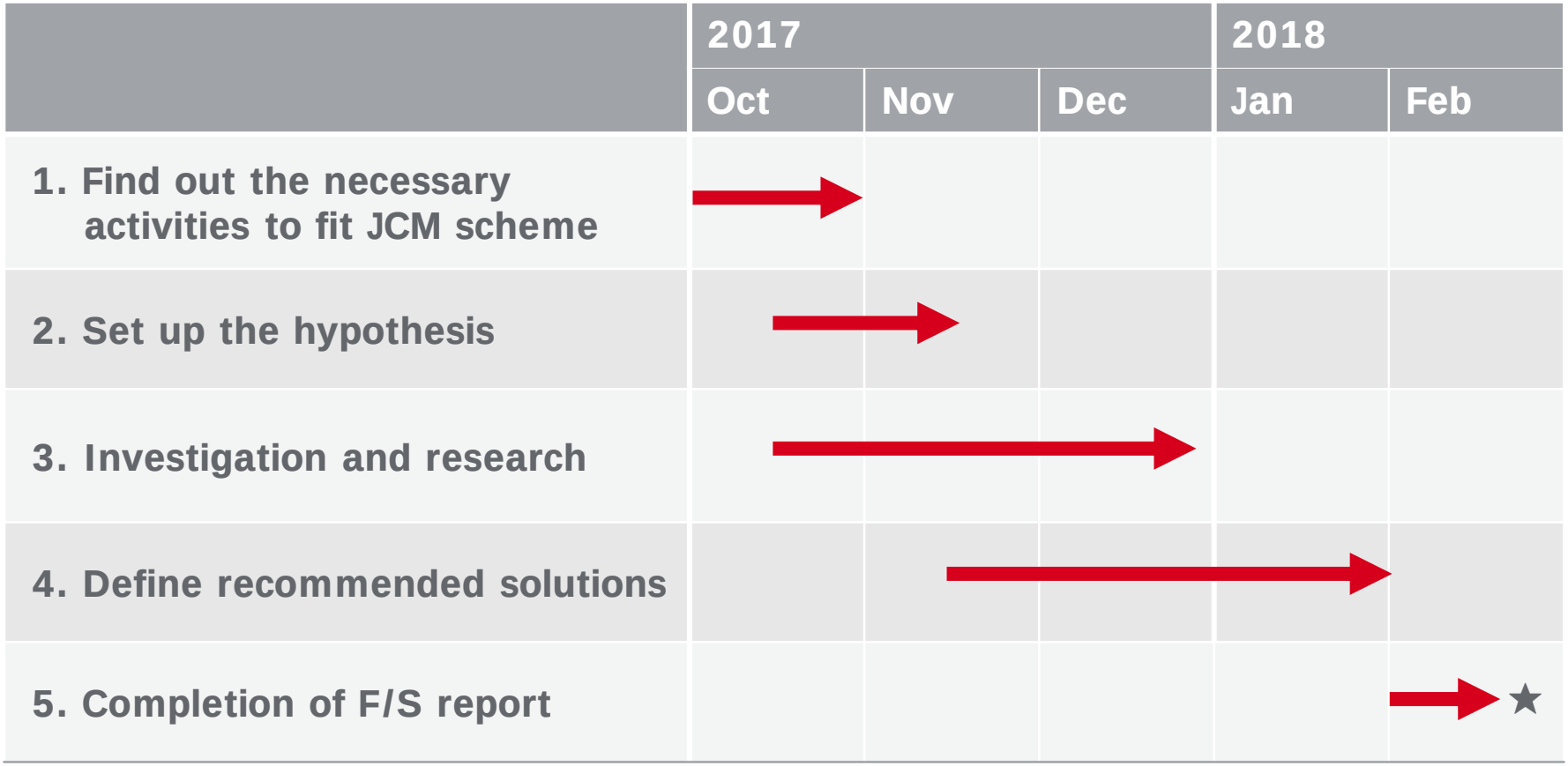
THAILAND

NEXT RENOVATION
xxx power plant

NEXT RENOVATION
xxx power plant

NEXT RENOVATION
xxx power plant

8. Feasibility study action road map



MHPS

Power for a Brighter Future*

Update on Energy Policies and Technologies of Thailand

17 October 2017
Amari Watergate Bangkok

Watcharin Booyarit
Bureau of Energy Efficiency Promotion

Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

กระทรวงพลังงาน
MINISTRY OF ENERGY

1. • **Thailand Overview**
2. • **Thailand's Energy Situation**
3. • **Energy Efficiency Plan (EEP 2015)**

Thailand Overview

Thailand at a Glance

- Land Area 513,115 sq.km.
- Population 65.7 million people
  - Male 32.3 million people
  - Female 33.4 million people
- Religion : the most strongly Buddhist countries in the world; however, all people are allowed full freedom to express their beliefs.
  - Buddhism 94.6%
  - Islam 4.6%
  - Christianity 0.7%
  - Others 0.1%
- GDP per Capita : 5,814.8 USD (2015est.)

Thailand's Ministry of Energy

Gen. Anantaporn Kanjanarat

MINISTER of ENERGY

กระทรวงพลังงาน
MINISTRY OF ENERGY

Energy Regulatory Commission (ERC)

Government Agencies

- Office of the Minister
- Office of the Permanent Secretary (OfEN)
  - Nuclear Power Plant Development Office
  - Bureau of Public Participation
  - Regional Energy Offices/ Provincial Energy Offices
- Department of Mineral Fuels (DMF)
- Department of Energy Business (DoEB)
- Department of Alternative Energy Development and Efficiency (DEDE)
- Energy Policy and Planning Office (EPPO)
- Public Organization
  - Energy Fund Administrative Institute (EFAI)

State Owned Enterprise and Public Company

- EGAT
- PTT

Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

DEDE Vision

"To be the knowledge-based organization and the center for sustainable development of alternative energy and energy conservation"

DEDE Mission

"To develop, promote, and support sustainable clean energy production and consumption in areas as appropriate, to develop clean energy technology for commercial purpose in domestic and international market, and to create energy knowledge-based network society for economic stability and sustainability of social well-beings.

Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

Director General
(Mr Praphon Wongtharua

Specialist

Internal Auditing Group

Deputy Director General
(Mr.Roya Juntaratana)

- Bureau of Energy Research
- Bureau of Alternative Energy Development
- Bureau of Solar Energy Development
- Bureau of Biofuel Development

Deputy Director General
(Danai Egkamol)

- Bureau of Energy Regulation and Conservation
- Bureau of Human Resource Development
- Bureau of Technology Transfer and Dissemination

Deputy Director General
(Mr. Yospong Guptaputra)

- Bureau of Central Administration
- Alternative Energy and Efficiency IT Center
- Planning Division

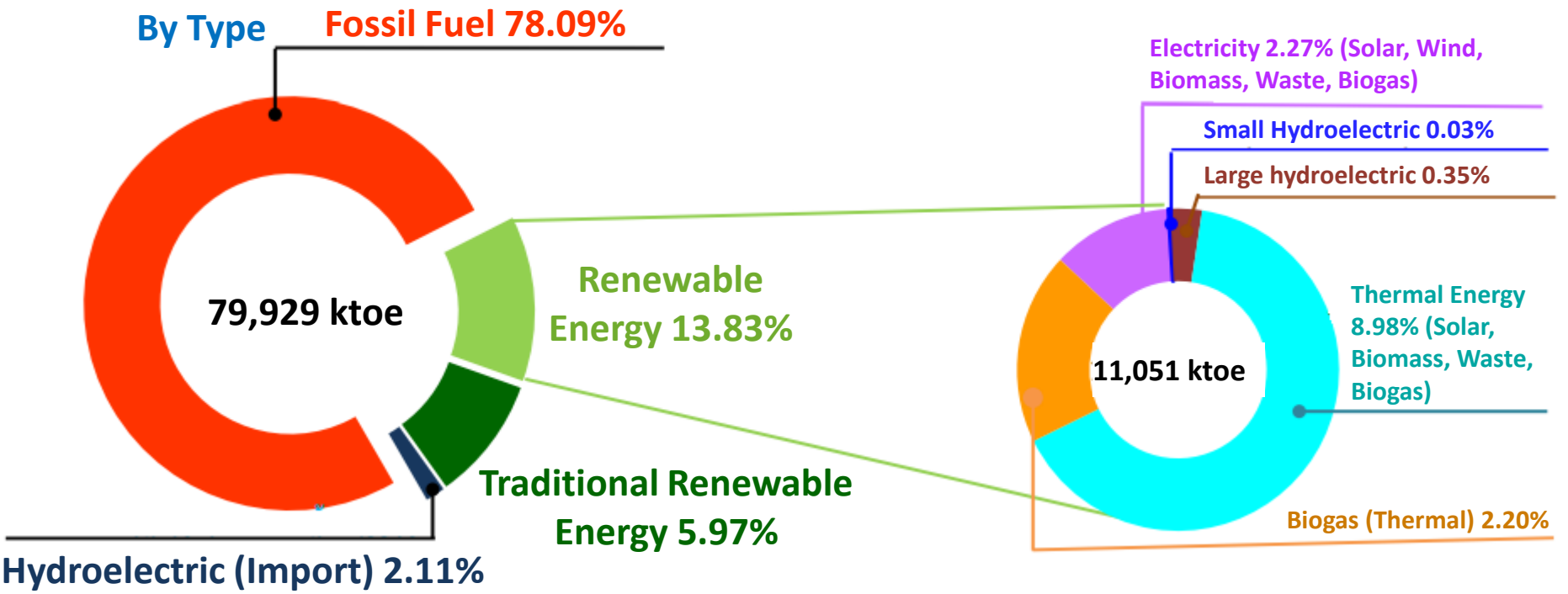
Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

Thailand's Energy Situation

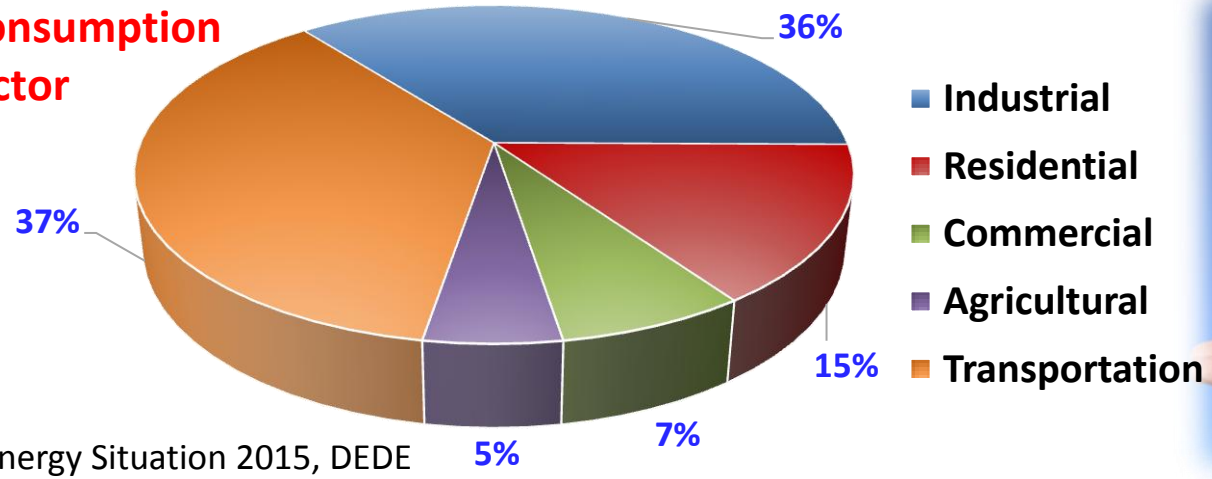
Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

Thailand Energy Situation 2016

Final Energy Consumption By Type



Final Energy Consumption by Sector



Source: Thailand's Energy Situation 2015, DEDE

Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

Thailand Integrated Energy Blueprint (2015)

Integration | Harmonized Time Frame | Better Balanced Focus

Security Economy Ecology

กระทรวงพลังงาน
MINISTRY OF ENERGY

PDP EEP AEDP GAS OIL

TIEB

THAILAND INTEGRATED ENERGY BLUEPRINT

PDP — POWER DEVELOPMENT PLAN
แผนพัฒนากำลังผลิตไฟฟ้าของประเทศไทย*

EEP — ENERGY EFFICIENCY PLAN
แผนอนุรักษ์พลังงาน*

AEDP — ALTERNATIVE ENERGY DEVELOPMENT PLAN
แผนพัฒนาพลังงานทดแทนและพลังงานทางเลือก

GAS — GAS PLAN
แผนบริหารจัดการก๊าซธรรมชาติ

OIL — OIL PLAN
แผนบริหารจัดการน้ำมันเชื้อเพลิง

EEP 2015 Overview

Goal to reduce Energy Intensity by 30% in 2036

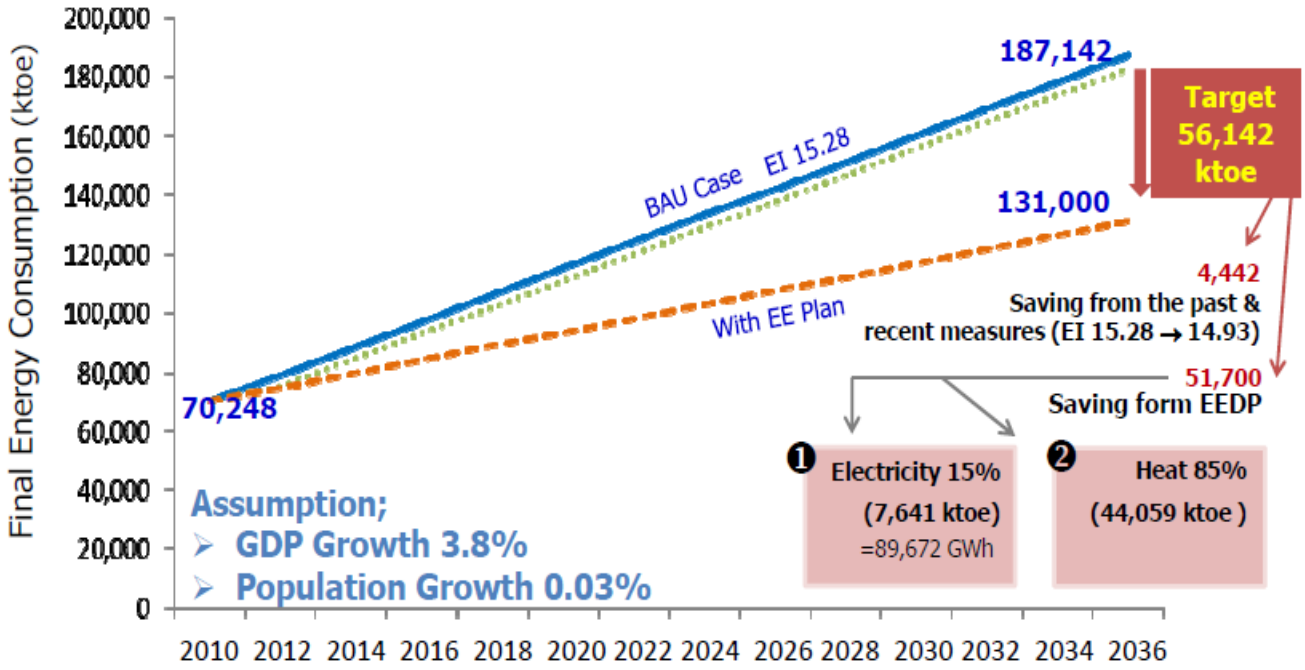
EEDP 2011 - 2030
= 25% Reduction

EEP 2015 – 2036
= 30% Reduction

EI (2010) actual **8.54** ktoe/billion baht

EI (2013) actual **8.23** ktoe/billion baht

EI (2036) forecast **5.98** ktoe/billion baht



Concept

- Long-term Implementation
- Combination of Compulsory & Voluntary Measures
- Performance-based Support

EEP 2015 Overview - Measures

3 Strategies – 10 Measures
4 Economic Sectors

1. Industry
2. Commercial
3. Residential
4. Transportation

1. Compulsory

- Enforcement of energy conservation standard (designated factory/building)
- Building Energy Code (BEC)
- Energy Standard and Labeling (HEPS/MEPS)
- Energy Efficiency Resources Standard (EERS)

2. Voluntary

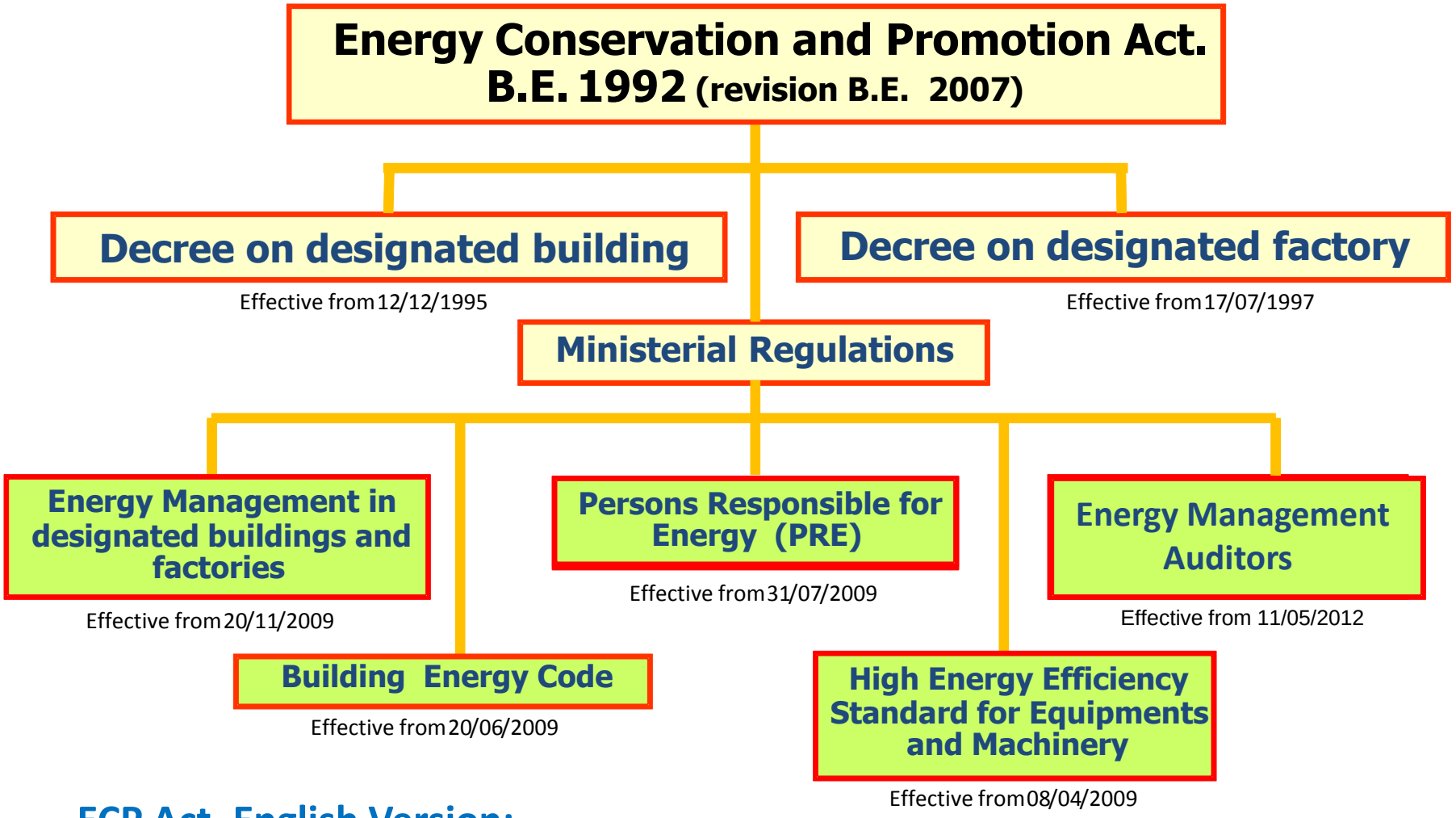
- Financial Incentive
- Promotion of LED (Light Emitting Diode)
- Energy Saving Measures in Transport Sector

3. Complementary

- Research and Development (R&D) in Energy Efficient Technologies
- Human Resources Development (HRD)
- Promotion of Public Awareness on Energy Conservation (PR)

EEP 2015 Measures

Legal Framework



ECP Act. English Version:

http://www.krisdika.go.th/wps/portal/general_en/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3g_A2czQ0cTQ89ApyAnA0__EIOAQGdXAwNDc6B8JG55dzMCuv088nNT9QtyI8oBX9cpBg!!/dl3/d3/L0lDU0lKSWdra0EhIS9JTlJBQUlpQ2dBek15cUEhL1lCSlAxTkMxTktfMjd3ISEvN19OMEM2MUE0MUkyQTdGMEE5SktQS0lUMUdDNg!!/?PC_7_N0C61A41I2A7F0A9JKPKIT1GC6_WCM_CONTEXT=/wps/wcm/connect/ksdkwebcontent_en/legal+translation/legal+english/law+group+e

EE1: Enforcement of Energy Conservation Standards

Overview

Designated buildings: 2,986 (874 in public sector and 2,112 in private sector)

Designated factories: 5,483

Royal Decree on Designated Buildings/Factories

One or more of the followings:
1. Power meter > 1,000 kW
2. Transformer size > 1,175 kVA
3. Total final energy consumption > 20 TJ

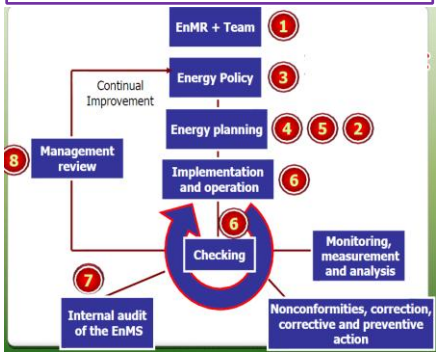
Type	Designated Factory/Building	
Electrical Meter	**< 3,000 kW**	**≥ 3,000 kW**
Transformer size	**< 3,530 KVA**	**≥ 3,530 KVA**
Energy Used	**< 60 million MJ/ year**	**≥ 60 million MJ/ year**
Number of Energy Manager	**1**	**2** **At least one is senior level**

- Requirements

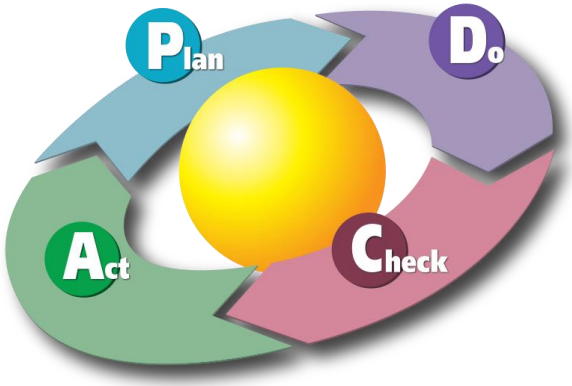
- ❑ Appoint Person Responsible for Energy (PREs)
- ❑ Conduct energy management as prescribed in ministerial regulation
- ❑ Submit energy management report within March of every year

EE1: Enforcement of Energy Conservation Standards

ISO 50001
Energy Managment System



8 Steps in Energy Management System



1. ESTABLISHMENT OF EM TEAM
2. PRELIMINARY ASSESSMENT OF EM SITUATION
3. FORMULATION OF EE&C POLICY
4. EVALUATION OF ENERGY SAVING POTENTIAL
5. SETTING OF TARGET AND PLAN FOR EE&C
   MEASURES (PRIORTIZATION, TIME FRAME, REPONSIBLE PERSON, BUDGET)
6. IMPLEMENTING AND MONITORING
7. INTERNAL AUDIT
8. MANAGEMENT REVIEW FOR IMPROVEMENT

C-PRE & S-PRE are involved in all steps

EE2: Building Energy Code

BEC Regulation

To prescribe types and sizes of buildings and also standards, rules and procedures for designing of energy conservation building.

New or retrofitted buildings being constructed which have total area of all stories equal to **2,000 m²** or more must be designed under the energy conservation requirements.

Currently mandatory only for government buildings. Voluntary for others.

1.Hospital

2.Education

3.Office

4.Condominium

5.Convention Hall

6.Theater

7.Hotel

8.Entertainment

9.Department Store

EE2; Building Energy Code (BEC)

Road Map according to BEC

1. Enforcement of the Ministerial Regulation

- Enforcement BEC standard
- Development of BEC auditor training
- Tightening BEC standard

✓ 9 types of new buildings
✓ total area ≥ 2,000 m^2
✓ In 2017, Starting enforce with new buildings area ≥ 10,000 m^2
✓ Down to small size in 5 years

2. Supporting new energy conservation building

- Energy building labels
- Financial incentives, for example government funds or low interest personal loans

✓ To support the new projects receive formal green building certification as LEED, TREES.

3. Zero Energy Building

- Study green building design, economic value and the climate change of Thailand
- Zero Energy Building Plan

Target: Government and private new building total area ≥ 2,000 m^2

- Envelop system
- Lighting system
- Air conditioning
- Hot water system
- Renewable energy

EE2: Building Energy Code

BEC Regulation : Envelop and Lighting System

OTTV
OVERALL THERMAL TRANSFER VALUE

RTTV
ROOF THERMAL TRANSFER VALUE

A/C
AIR CONDITIONER

LPD
LIGHTING SYSTEM

RENEW
RENEWABLE ENERGY

WHOLE
BUILDING ENERGY

Group 1
Education
Office

8 Hours/day

OTTV ≤ 50 W/m²
RTTV ≤ 15 W/m²
LPD ≤ 14 W/m²

Group 2
Theater
Convection Hall
Entertainment
Department Store

12 Hours/day

OTTV ≤ 40 W/m²
RTTV ≤ 12 W/m²
LPD ≤ 18 W/m²

Group 3
Hotel
Hospital
Condominium

24 Hours/day

OTTV ≤ 30 W/m²
RTTV ≤ 10 W/m²
LPD ≤ 12 W/m²

EE3: HEPS/MEPS

MEPS: Minimum Energy Performance Standards

- Both voluntary and mandatory program
- Collaboration between DEDE and TISI
- Standards are set up by DEDE, but they are regulated by TISI.

voluntary certification mark
16 Products

mandatory certification mark
2 Products

HEPS: High Energy Performance Standard

- Voluntary program
- Collaboration between DEDE and EGAT
- Standards are set up by DEDE, and labeling programs are responsible by DEDE and EGAT

28 Products

11 Products

Insulator

Glazing Panes

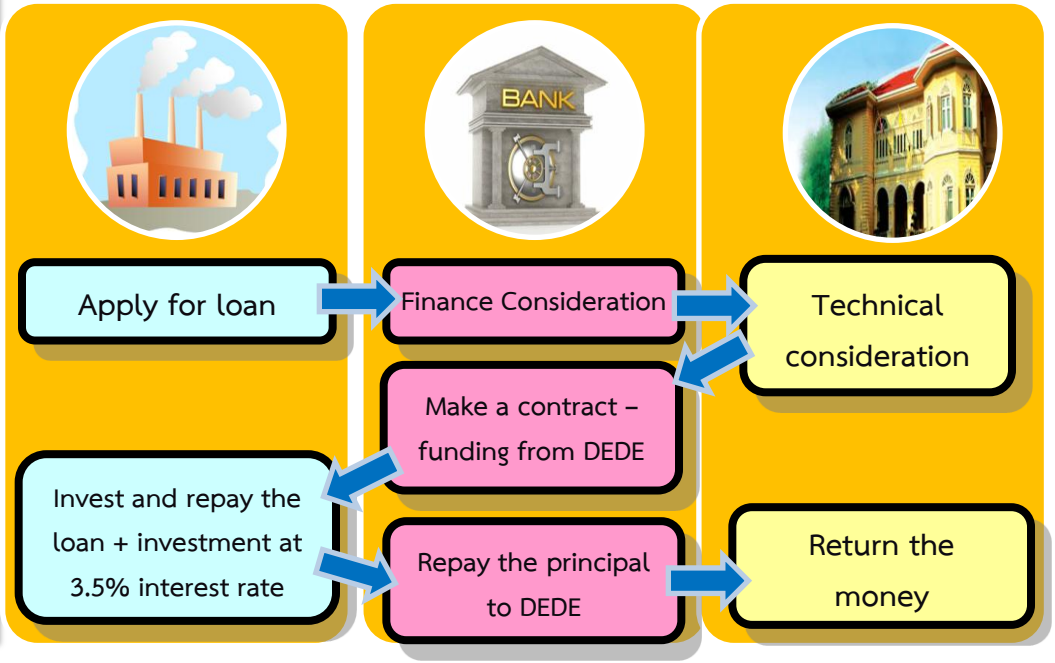
VSD

TISI: Thailand Industrial Standard Institute, EGAT: Electricity Generating Authority of Thailand

EE5: Financial Incentive – Revolving Fund

Criteria:

- Available for factories/buildings/project developers for both EE and RE (RE ~ 37%)
- DEDE loans the funding via financial institutions to familiarize the bank with EE/RE investment
- Maximum loan of no more than 50M baht with interest rate of no more than 3.5% (formerly 4%)
- Payback period of 7 years



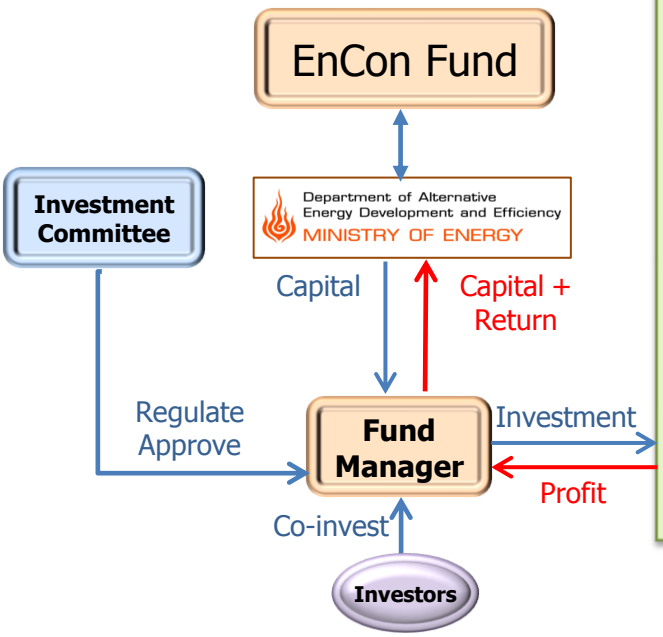
Phase	# of projects	Total investment (Mbaht)	Investment via ENCON Fund (Mbaht)	Investment via bank/applicant (Mbaht)	Energy saved (ktoe)	Energy saved (Mbaht)
1	78	3,427	1,902	1,525	98	1,805
2	83	3,330	1,735	1,595	99	1,713
3	98	5,878	2,702	3,176	93	2,329
4	12	1,282	377	905	13	421
5	24	2,042	489	1,554	17	539
6	55	n.d.	1,262	n.d.	7.6	245
Total	295	n/a	7,205	n/a	54.6	7,052

Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

EE5: Financial Incentive – ESCO Revolving Fund

Measure Overview:

Set up joint capital to promote investment in energy conservation and renewable energy development projects



Co-Investing & Investment Promotion Scheme

- ESCO Venture Capital
- Equity Investment (max 50 mb.)
- Equipment Leasing (max 20 mb.)
- Green House Gas
- Technical Assistant
- Credit Guarantee Facility

- Phase 1 Oct 2008 – Sep 2010
- Phase 2 Oct 2010 – Mar 2013
- Phase 3 Mar 2013 – Jul 2014

2015 on going
500 million Baht
Allocated from Gov's ENCON FUND

	All 3 Phases		
	FM1	FM2	Total
No. of project	81	45	126
Total Investment (MB)	3908.46	1040.23	4938.69
Inv. from ESCO Fund (MB)	524.25	370.92	895.17
Saving (ktoe)	21.99	18.73	40.72
Energy Saving (MB)	662.59	362.76	1025.35

มูลนิธิพลังงานเพื่อสิ่งแวดล้อม

2 Fund Managers

EE5: Financial Incentive – Direct Subsidy

Subsidy Incentive

Energy Efficiency Improvement for Small and Medium-sized factories (SME) via Investment Stimulus Project

ปรับเปลี่ยน
เครื่องจักร/อุปกรณ์
สนับสนุนเงินลงทุน
สูงสุด 30%

Overview

Technical Assistance

Financial Incentive

Applicants

Measure Overview

- **Eligible parties**: buildings, factories, SMEs and agricultural entities
- **Allocated fund**: 300 MBaht
- Subsidize 20-30% of equipment and installation cost
- Max of 1,500,000 Baht
- Payback period no longer than 7 years

Period: October 2015 - 2016

Target

- 200 Applicants
- Energy saving of 5 ktoe/year

Progress:

- Application deadline: May 14th 2016
- 213 Applicants
- Cuurently in technical assistance phase

Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

EE7: Energy Saving Measures in Transportation Sector

Target 2016 = 1,059 ktoe

EE7-1 Appropriate Diesel price — EPPO

- Adjust diesel price to reflect actual cost
- Projected reduction: 13,500 cars/trucks
- Reduce consumption 9.2 Mlitre

8 ktoe

EE7-2 Efficient vehicles — Excise Department

- CO2-based tax
- Eco stickers for cars
- Reduction in price of efficient vehicles

990 ktoe

ECO Sticker granted to 1,590 models since 2016

EE7-3 Efficient tire — DEDE

- Under progress – to determine appropriate efficiency

EE7-11 Electric Vehicles — EPPO

- EV for public transportation
- Charging station, batteries, motors

Infrastructure — DoEB

EE7-10 → Fuel pipeline transport — MoT

EE7-9 → double-track railway — MoT

EE7-8 → Mass rapid transit - EV

Energy management in transports

EE7-4 Logistics and Transport Management; LTM

- Comparison of energy consumption compared to best-practice
- Training for better LTM

Under progress

9 ktoe

33 ktoe

EE7-7 Standard Offer (ภาคขนส่ง)

- Offer financial incentive to projects @ 9MBaht per ktoe saved

From August onward

1 ktoe

17 ktoe

EE7-5 ECO Driving

- Training on ECO Driving – less energy consumption

Under progress

EE7-6 Logistics ESCO

- ESCO for transportation

Under progress

EE9: HR Development

Capacity Buildings

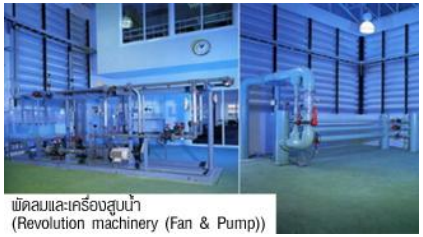
1. Train PREs
2. Promote highly efficient technologies and materials
3. Promote Best Practice for energy conservation

Bureau of Human Resource Development

Mini - Plant

For actual Hand-on Experience

เครื่องอัดอากาศ (Air-Compressor)



พัดลมและเครื่องสูบน้ำ
(Revolution machinery (Fan & Pump))

หม้อไอน้ำและชุดฝึกอบรมตัวดักไอน้ำ
(Boiler and Stream trap training unit)

เตาเผา (Combustion Furnace)

EE10: Awareness Promotion

"Thailand Energy Awards"

- Awareness Raising
- Participation
- Public Relation
- Increase Visibility

"ASEAN Energy Awards"

Department of Alternative
Energy Development and Efficiency
MINISTRY OF ENERGY

Thank You

www.dede.go.th

METI
Ministry of Economy, Trade and Industry

October 17, 2017

Recent policy trend for technology transfer and international collaboration of Japan

Global Environment Partnership Office
Ministry of Economy, Trade and Industry

G20 Hamburg Climate and Energy Action Plan for Growth (2017)

Those G20 countries who provide development assistance will strengthen their efforts to support partner countries in NDC implementation. They will further align their development cooperation activities with partner countries' NDCs as well as the goals of the Paris Agreement, without compromising support for other sustainable development goals.

NDC Partnership

We move forward to implementing our current and future Nationally Determined Contributions (NDCs) in line with the Paris Agreement. We will increase cooperation among ourselves and with non-G20 countries to facilitate mutual learning, good practice sharing and capacity-building, including through existing fora, inter alia, such as the NDC Partnership.

1. Domestic Actions

2. Joint Innovations

Domestic Actions taken by industries

- After the announcement of Keidanren(Japan Business Federation), **industrial organizations voluntarily set up emission reduction targets, prior to the Government's target setting**, and promoted efforts for their achievement.
- The targets are chosen by themselves amongst CO2 emissions, CO2 intensity, energy consumption, and energy intensity, in accordance with industry-specific characteristics and potential for technology introduction.
- Electric, Oil & Gas, Iron & Steel, Chemical, Electronics & Machinery, Automobile, etc., **115 major industrial associations have been seriously tackling with climate change actions** through their action plans.
- Action plans cover more than 50% of Japanese energy-originated CO2 emissions (roughly 80% of energy & industry sectors).

Examples of 2030 reduction target

	Target indicator	Baseline year	2030 reduction target
Japan Iron and Steel Federation	CO2 emissions	BAU	-9 Mil t-CO2
Japan Chemical Industry Association	CO2 emissions	BAU	-2 Mil t-CO2
Japan Cement Association	Energy intensity	2010	Less than -49MJ/t-cem (more than -1.4%)
Liaison Group of Japanese Electrical and Electronics Industries for Global Warming Prevention	Energy intensity	2012	More than -16.55%
Japan Automobile Manufacturers Association, Japan Auto-Body Industries Association	CO2 emissions	1990	-38%
Japan Aluminum Association	Energy intensity	BAU	-1.0GJ/t
The Shipbuilder's Association of Japan, The Cooperative Association of Japan Shipbuilders	CO2 emissions	2013	-6.5%
Japan Association of Rolling Stock Industries	CO2 emissions	1990	-35%

Outlook on National Energy & Environment Strategy for Technological Innovation towards 2050 (NESTI 2050)

○ Looking ahead to 2050, **Japan has identified a number of innovative technologies with potential to make huge impacts on emission reductions**, while assuming that the entire energy system will be optimized with the realization of "super smart society" (Society 5.0). **R&D of the prioritized technologies will be promoted in the medium-to-long term**, while identifying and addressing technological challenges.

Identified target technology fields

Technologies :
(1) that are innovative and not the extension of the existing efforts but discontinuous and impactful
(2) with the potential for widespread adoption and significant emission reductions
(3) that require medium-to-long-term investment and combined forces among industry, academia and government
(4) in which Japan can take the lead or demonstrate our superiority

Energy Systems Integration Technologies
so that various components (i.e. energy production, transport, consumption) are networked by ICT and energy system is optimized by AI, big data and IoT

Core Technologies for Systems
namely, next generation power electronics, innovative sensors and superconductivity

Each innovative technologies

Energy Saving	1 Production process	○ Membrane Separation / Catalysts
	2 Structural material	○ Ultralight and super heat-resistant
Energy storage	3 Storage Battery	○ Metal-Air Batteries / All-Solid-State Batteries
	4 Hydrogen	○ CO_2 free hydrogen
Energy generation	5 Photovoltaic	○ Perovskite structure / Quantum dot
	6 Geo-Thermal	○ Hot dry rock geo-thermal / Supercritical geo-thermal
7 Capture and Effective Usage of Carbon Dioxide		

Ⅲ. Enhanced R&D systems

1. Forming R&D Structures as Unified Government Agencies
2. Creation of Innovation Technology Seeds and Flexible Positioning
3. Mechanisms to Encourage Industry Investment in R&D
4. Promotion of International Coordination and Joint R&D

Leading the world through innovation while keeping mitigation efforts and economic growth compatible with each other.

NESTI 2050

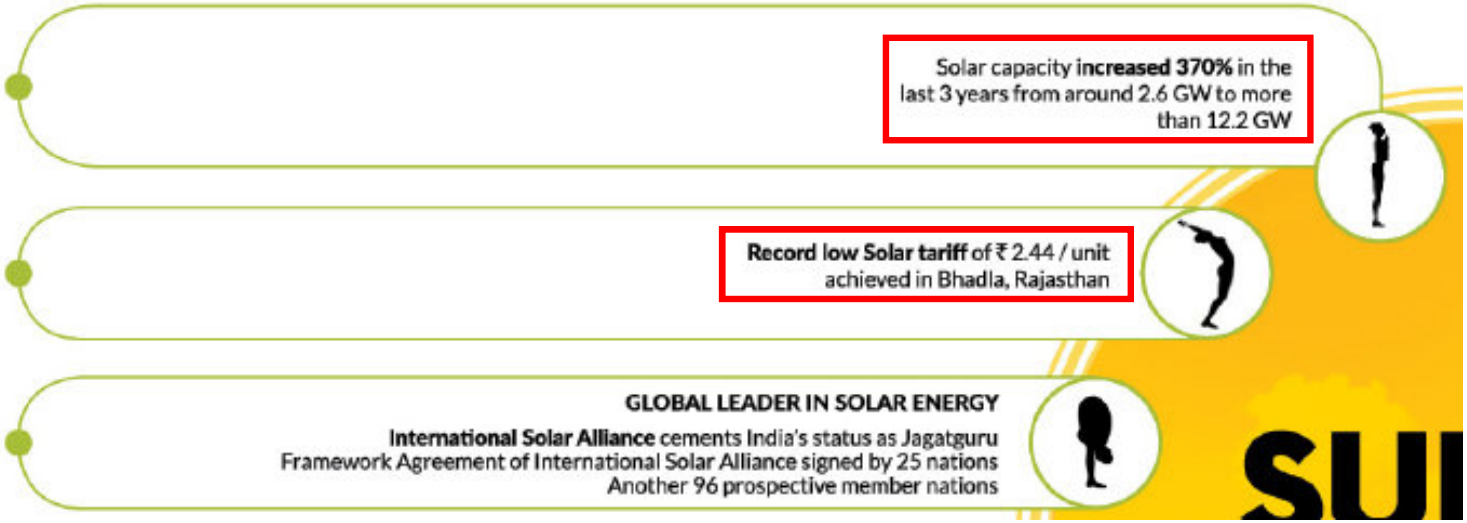
1. Domestic Actions

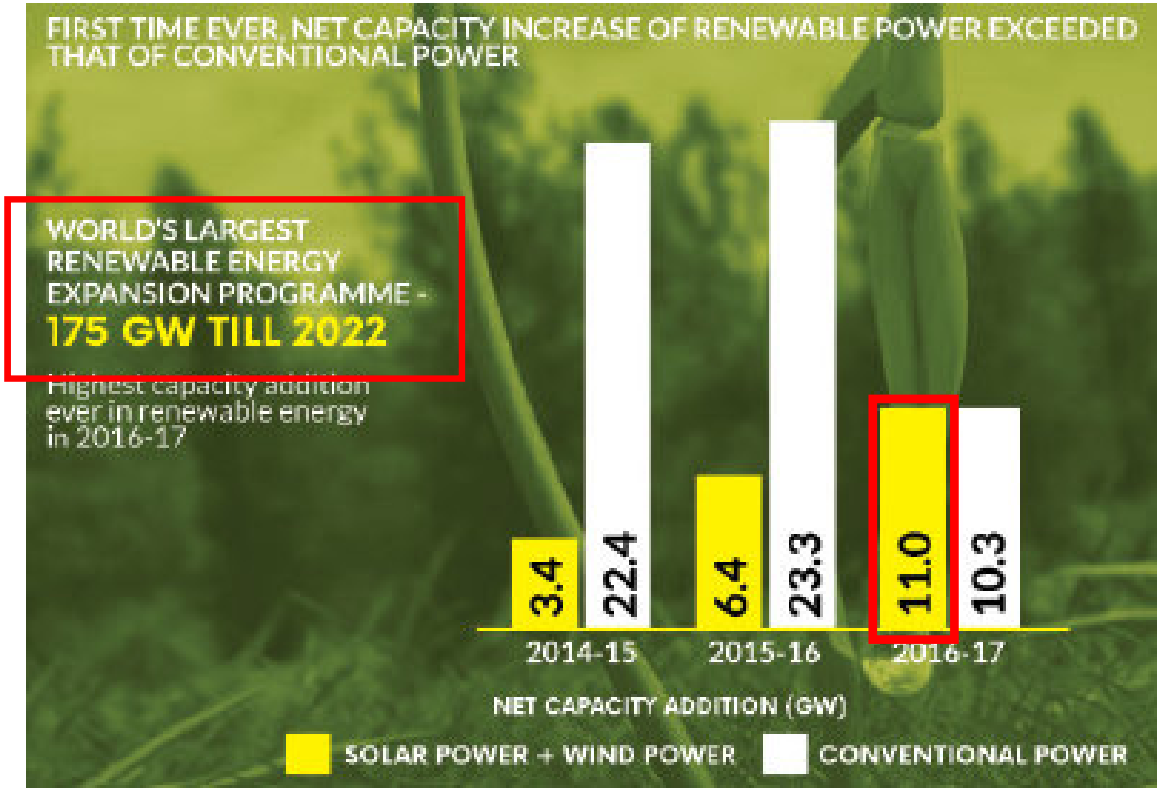
2. Joint Innovations

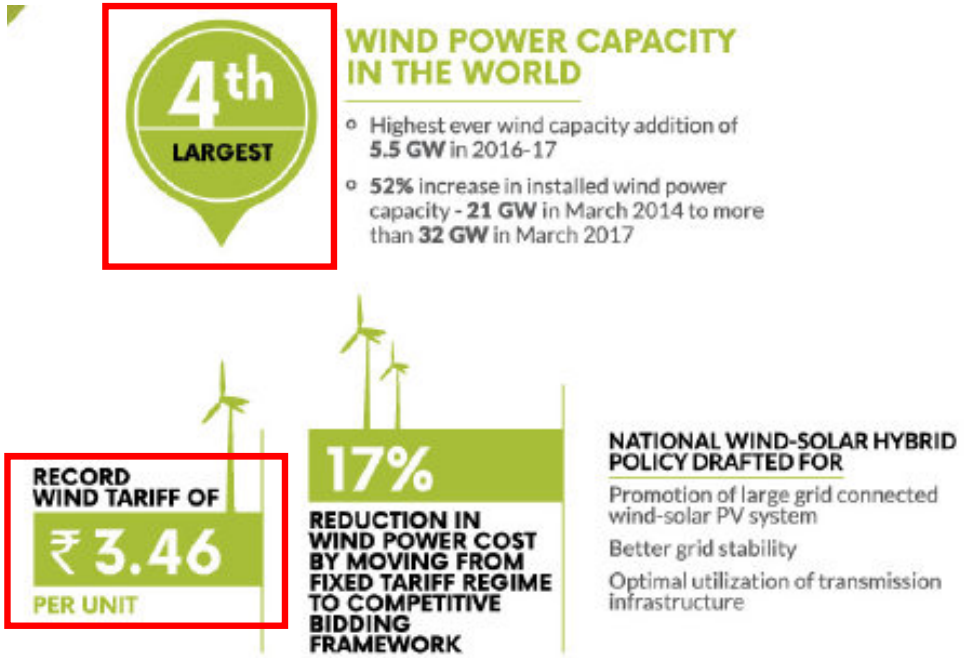
Innovation in emerging economies is NOT necessarily a Linear catch-up

Source;

ACHIEVEMENTS & INITIATIVES
of
Ministries of Power, Coal, New & Renewable Energy and Mines
Government of India







Joint Innovation with India

Indian Government & Industries

Japanese Government & Industries

Addressing challenges of

Renewable energy industries

- ○Solar
- ○Wind
- ○Grid stabilization

etc.

Digitalization of Energy-intensive industries

- ○Electricity
- ○Iron
- ○Petroleum
- ○Cement

etc.

①Formation of Joint Projects

②Feasibility Study

③Human Resources Development

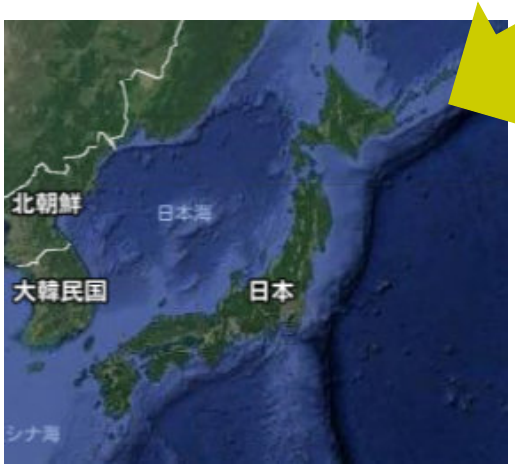
Japanese Companies

Joint Innovation with Saudi Arabia

- ✓ Through bilateral cooperation between Japan and Saudi Arabia, both countries are promoting low-carbon energy supplies ahead of the rest of the world.
- ✓ At Japan-Saudi Arabia Summit Meeting on 13 March, collaboration in studies on technology including formulation of master plan was agreed.

Low-carbon energy supply

Low carbonizing energy supply such as crude oil and hydrogen by CCS

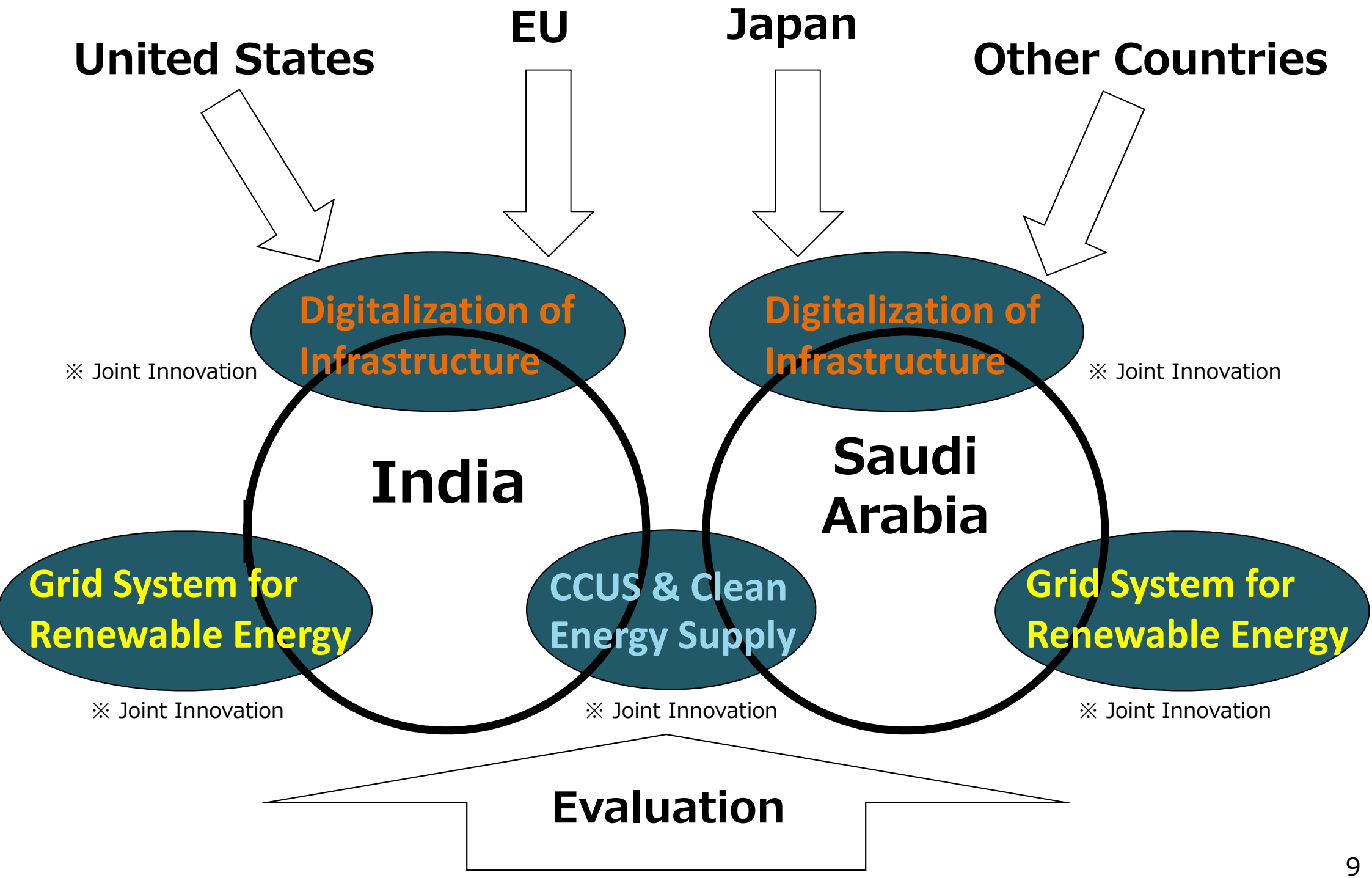


Japan-Saudi Arabia Summit Meeting (March 13)

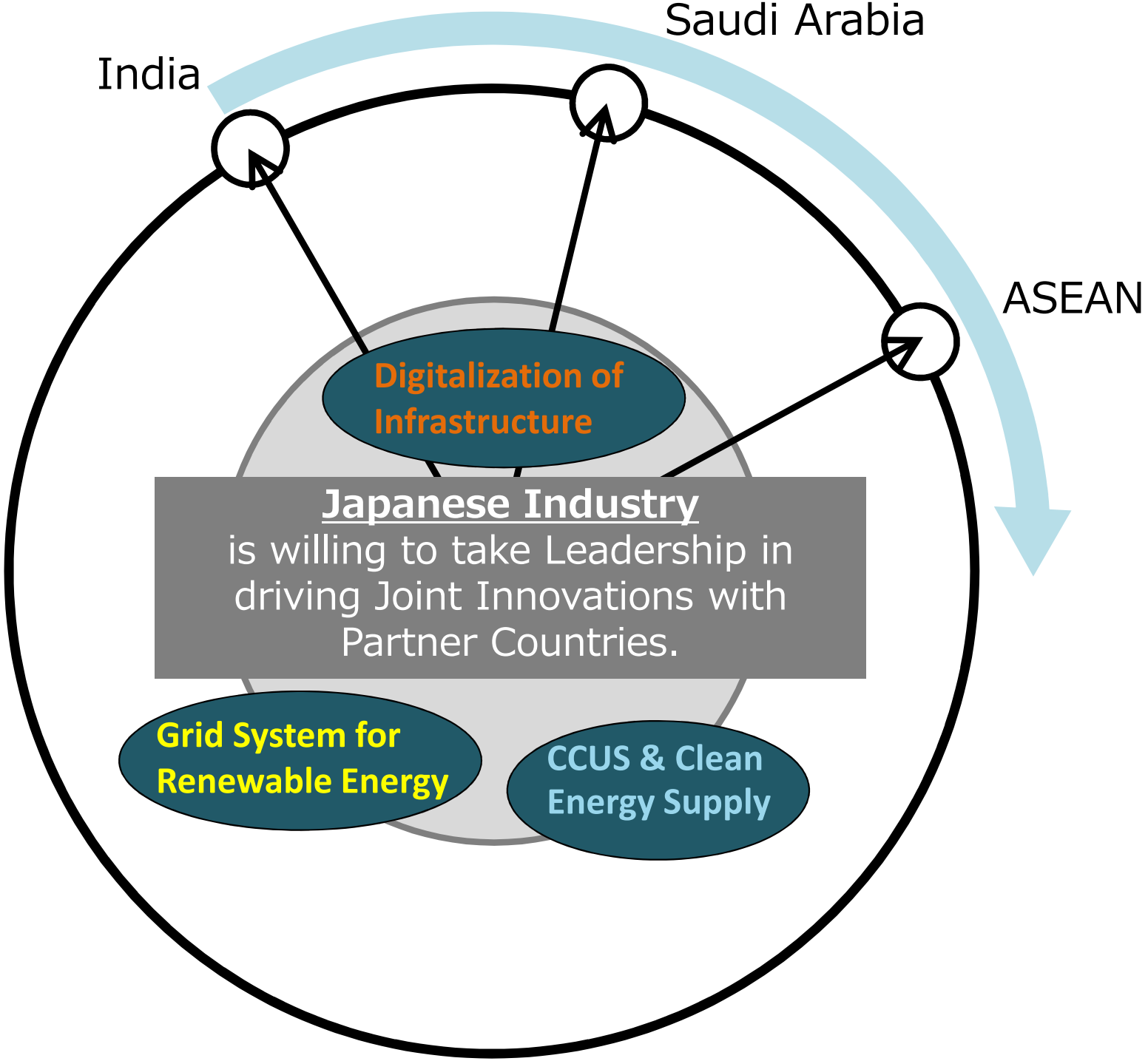
Signed agreement on implementation of joint studies on technologies toward low carbon energy systems such as CCS and hydrogen.

At a summit meeting on March 13, “Saudi-Japan Vision 2030” was agreed between Prime Minister Abe and Custodian of the Two Holy Mosques King Salman Bin Abdulaziz Al-Saud, King of the Kingdom of Saudi Arabia.

Evaluation of Achieved Emission Reduction through Joint Innovations

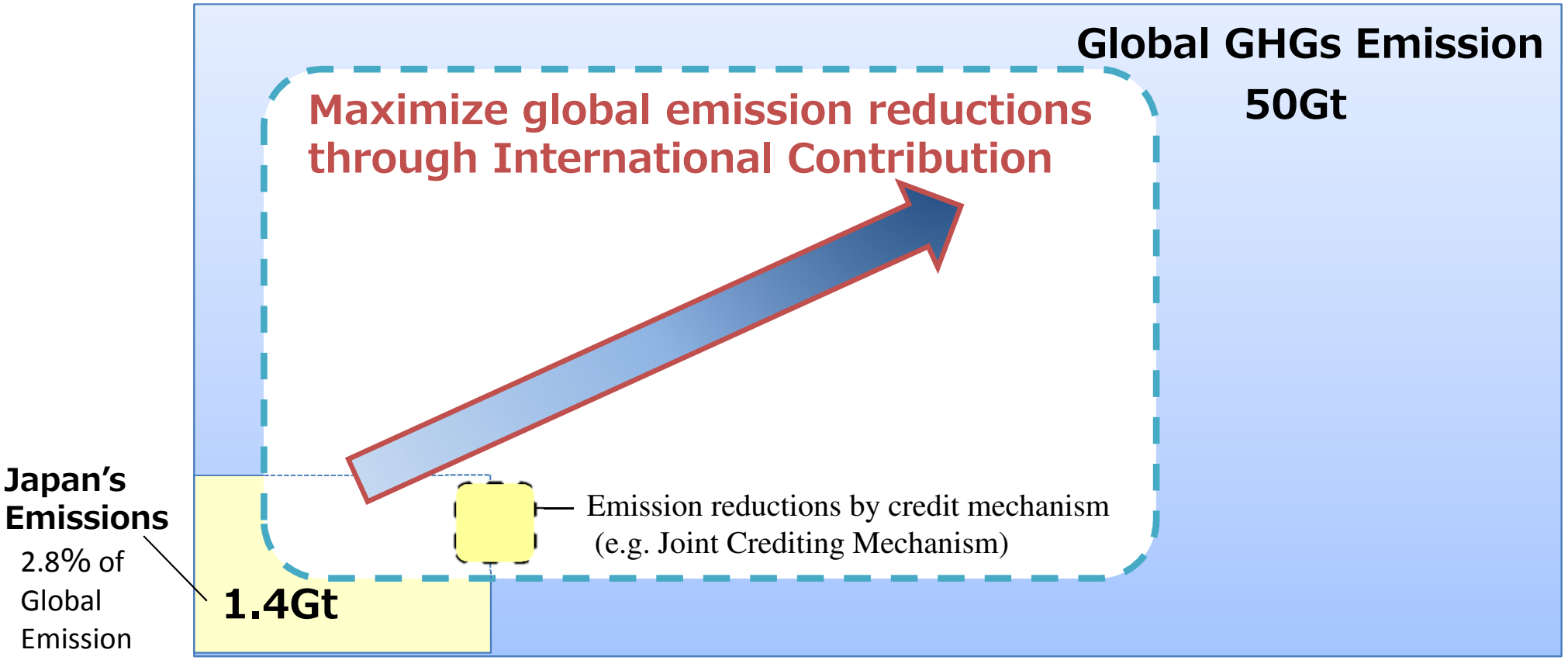


Industry's Leadership



Toward Carbon Neutral through International Contribution

- ✓ Japan can contribute to the Paris Agreement by maximizing global carbon reductions (both domestically and internationally).
- ✓ Joint Innovation Projects will play a key role for Japan in pursuing sustainable economic growth with partner countries.
- ✓ Through international contributions, Japan may be able to achieve more than 100% emission reduction (Carbon Neutral).



Summary of the Long-term Climate Change Policy Platform

April 7th, 2017
"Long-term Global Climate Change Policy Platform", METI"

◆ **Sustainable development** is the major objective of climate change policy. Reducing **GHGs on a global scale** is an absolute necessity.
◆ Although measures taken by Japan to date have been effective to a degree, **a country's own efforts can have only limited effect**.
◆ Therefore, the platform has set the **"three arrows" game changers** as its core strategy.

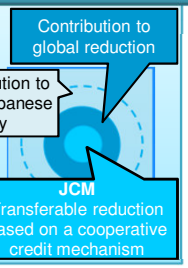
[1] The Three Arrows

(1) Toward Carbon Neutral through International Contribution

(1) As is: Japan contributes to global reductions with its excellent low-carbon technology based on ODA, JBIC and other public finance schemes as well as JCM. However, **only JCM has been visible as Japan's contribution.**

(2) To be: **We should maximize global reductions with all countries, including Japan, through a healthy competition of the amounts of visualized emission reduction contributions.**

(3) Potential Scale of Emission Reductions : **Around 2.9B tCO2 in 2030 and 9.7B tCO2 in 2050 (based on 10 developing countries in Asia, South America and Middle East** incl. JCM partners)



(2) Toward Carbon Neutral through Global Value Chain

(1) As is : **Japan's rich eco-system of industries** (materials, machinery, electronics, automobiles, infrastructure, etc.) has been creating innovative, high-performance products and technologies.

(2) To be : In product lifecycles, **emissions are greatest at the utilization stage**. As such, it is important to **broaden the view from reduction in factories to reduction throughout product lifecycles (value chains)**.

(3) Potential Scale of Reducing Emissions : Greater than equal to **1.0B tCO2 in 2020 and 1.6B tCO2 in 2030** globally (based on 7 industries' "The Commitment to a Low Carbon Society")

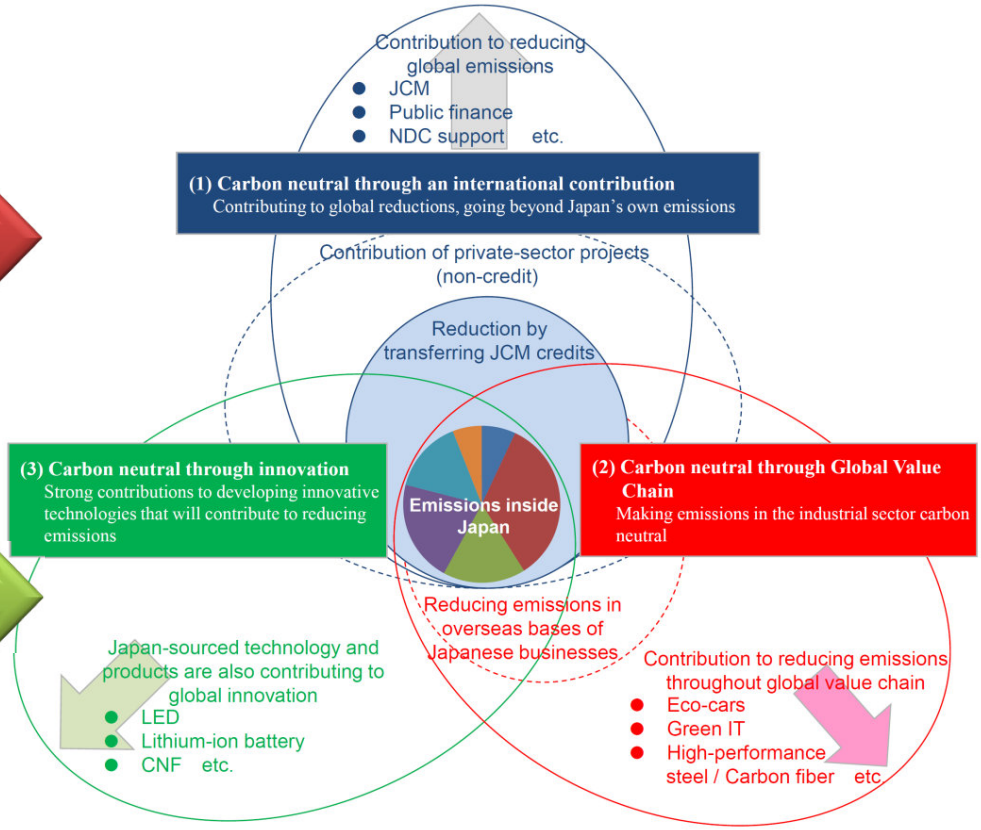
(1) As is : **The key to acting against climate change without sacrificing economic growth is the development of innovative technologies.**

(2) To be : **Japan formulated "National Energy and Environment Strategy for Technological Innovation towards 2050" (NESTI 2050) , identifying technological fields with potential to make huge impacts on emission reduction**. Japan will provide roadmaps for 10 of the identified fields, and also establish a platform on which the bottlenecks are to be identified under industry-academia-government collaboration.

(3) Potential Scale of Reducing Emissions: **Between several billion and 10 billion tCO_2** globally (based on target fields of NESTI 2050)

"Climate change policy over the entire globe"

– Making all players (countries, companies, individuals) carbon neutral –



[2] Issues and Facts Concerning the Three Game Changers

Strategy to co-exist with uncertainty

*Science, society, international circumstance

- **Major objective**: "Sustainable development"
- **Resilience**: "Implementation of non-regret action", "Seeking for strategic options"
- **Flexibility**: "Milestone", "The best course of action in a continuous PDCA cycle"

Finance & investment

- Greater interest shown by financial community (engagement, green finance, etc.)
- Necessary to consider measures for positive cycle between investors and investees through disclosure and engagement, that are consistent with Japanese circumstance.

Carbon pricing

- Japan already has $40/t-CO2 energy tax in place.
- Necessary to consider international equilibrium, industrial competitiveness and consistency with existing domestic measures such as FIT.

Support for international contribution

- **Strengthen competitiveness of Japanese low-carbon technology:** Seamless support in global market(pilot projects (IoT related etc.), business environment).
- **Private-public cooperation:** Bilateral cooperation on CCS, NDCs implementation support.