V **Appendix**

Appendix 1： List of member companies of 60+Earth Hour 2022

Appendix 2： Presentation materials of 1st Workshop on Net Zero Emissions Business Opportunity under Bangkok Yokohama City to City Program

Appendix 3： Presentation materials of 2nd Workshop on Net Zero Emissions Business Opportunity under Bangkok Yokohama City to City Program

Appendix 1: List of member companies of 60+Earth Hour 2022

	Member companies
1	Pruksa Holding Public Co., Ltd
2	PTT Public Co., Ltd
3	Government Savings Bank
4	Bangkok Expressway and Metro
5	The Thai Bankers Association
6	Metropolitan Electricity Authority
7	Bangchak Corporation Public Co., Ltd
8	Foundation for Environmental Education for Sustainable Development (Thailand)
9	Thai Wacoal Public Co., Ltd
10	Central Group
11	The Emporio Place Condominium Juristic Person
12	Canon Thailand Group
13	Ek-Chai Distribution System Co., Ltd
14	Metropolitan Waterworks Authority
15	Bangkok Mass Transit System Public Co., Ltd
16	The Stock Exchange of Thailand
17	Suan Dusit University
18	CP All Public Co., Ltd
19	True Cooperation Public Co., Ltd
20	Ampol food Processing Co., Ltd
21	Electricity Generating Authority of Thailand*
22	The Mall Group Co., Ltd
23	Royal Thai Armed Forces Headquarters
24	King Mongkut's University of Technology Thonburi
25	Provincial Electricity Authority

The 1st Net Zero Emissions Business Opportunity Seminar

under Bangkok-Yokohama City-to-City Program

29 November 2022
09.00-16.00 (BKK Time) via Zoom

Expected outcomes

- Building business network among Thai and Japanese private sector
- Gaining knowledge and understanding of potential climate solutions and technologies between Japan and Thailand

Agenda

9.00 Welcome remark *by Yokohama and BMA representative*
9.10 Results of COP27 *by UNFCCC Bangkok office/OECC/ONEP/TGO*

9.50-10.50
Workstream A:
Energy transition

11.00 - 12.00
Workstream B:
SMART City & EMS

13.00 - 14.20
Workstream C:
Electric Vehicle

14.30-15.50
Workstream D:
Carbon credit & ESG Finance

Note: TH-EN Interpretator is provided

More detail, Please contact

Register link

Material documents

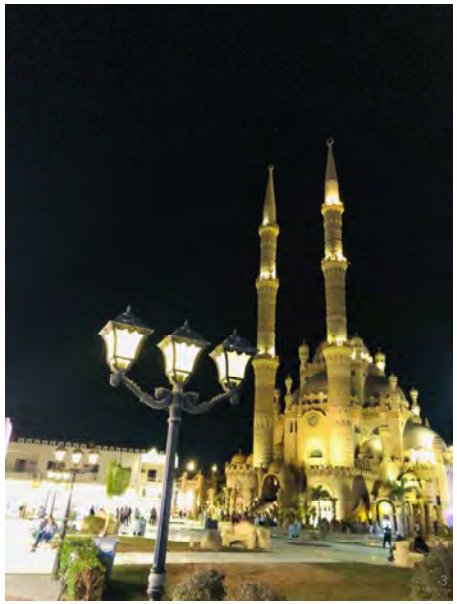
OECC 一般社団法人 海外環境協力センター
Overseas Environmental Cooperation Center, Japan

Key takeaways from COP27 and implications for business

November 29, 2022

Makoto Kato
Member, Board of Directors
Overseas Environmental Cooperation Center, Japan

COP27
SHARM EL-SHEIKH
EGYPT 2022



Source: UNFCCC

Outcome of COP27

- The UNFCCC COP27 was held in Sharm El-Sheikh in Egypt from November 6th to 20th.
- Based on the results of COP26, the meeting was the "**the COP of Implementation**".
- COP27 adopted a decision **"Sharm el-Sheikh Implementation Plan**" and **"Mitigation Work Plan**" to improve mitigation ambition and implementation by 2030 were adopted.

Sharm el-Sheikh Implementation Plan

Mitigation: Emphasized the importance of implementing measures based on the 1.5°C target of the Paris Agreement,

- Called for reexamination and strengthening of NDCs by 2023 consistent with 1.5 target. Called upon accelerating phasing down coal-fired power plant and phasing out subsidies for fossil fuels.

Climate finance:

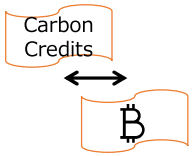
- Article 2.1(c) of the Paris Agreement, which aims to align financial flows with climate action.
- Decided to launch **the "Sharm El-Sheikh Dialogue**" to promote understanding of financial flow with regard to Art. 2.1.
- Decided to prepare a report on the doubling the Adaptation Fund

In addition, integrated responses to biodiversity and climate change, the role of cities, just transition, etc. were highlighted.

Thematic Topics

Mitigation:

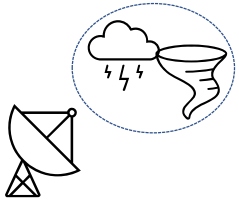
- Agreed on a **"mitigation work plan**" to improve ambition and implementation by 2030.



Article 6 (Market Mechanism):

- Agreed on registration format for reporting international trade in emission reductions, procedures for expert review, details of regulations for Article 6 implementation.
- Decision on the implementation of market mechanisms managed by the United Nations.

Thematic Topics



Adaptation:

- Confirmed the progress of the two-year Glasgow-Sham El Sheikh Work Program on adaptation on global adaptation goal.

Loss and Damage:

- Decided full Operation of the **"Santiago Network" to promote technical assistance** for loss and damage.

Thematic Topics

Global Stocktake (GST)

- Decided to consider the GST deliverables to be implemented at COP28, including new consultations and workshops.

Climate finance

- Decided to **establish a Loss & Damage Fund** as a new financial steps to support loss and damage to particularly vulnerable countries, with a view to recommendation for operationalize in COP28.
- Decided to produce biennial progress reports on the **$100 billion mobilization target**; and decided to prepare a report on the doubling of adaptation finance.

Statement by H.E. Varawut Silpa-archa, Minister of Natural Resources and Environment, Thailand

https://youtu.be/F4urjx-mzxk

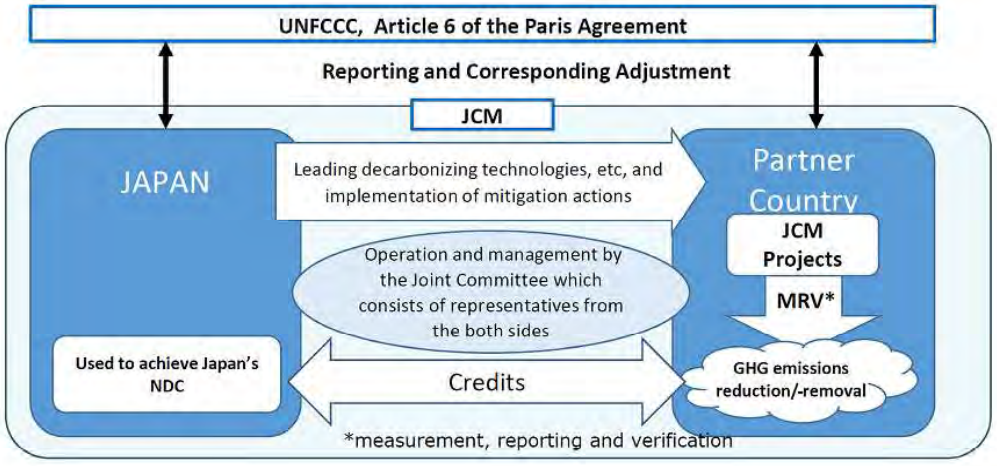
- Raising mitigation ambition up to 40% including with support, by 2030
- National Adaptation Plan with sufficiency economy principle
- BCG economy principle
- Sectoral efforts (RE, cement, cooling, forestry etc.)
- Carbon Credits through ITMO under Article 6

Updated Thailand Mitigation Ambition

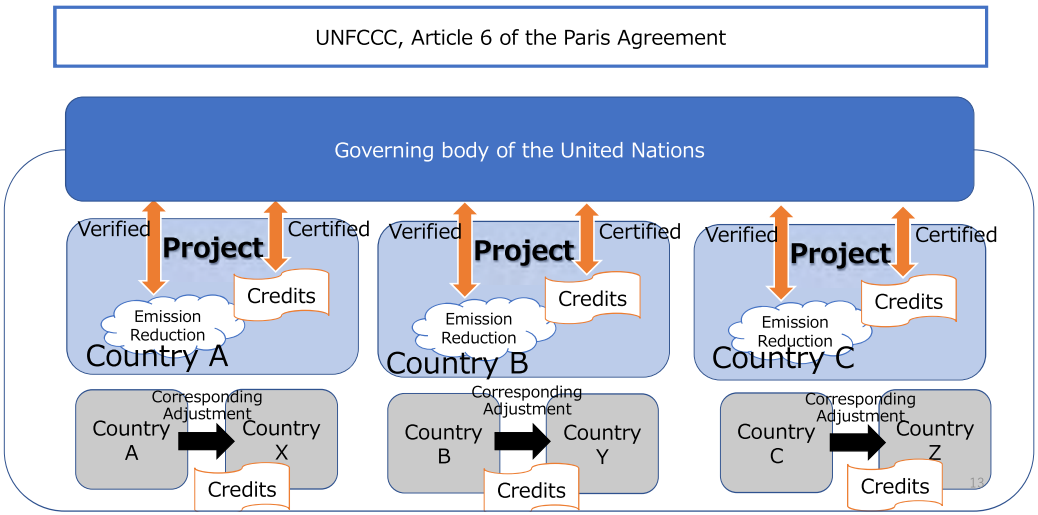
- Revisions made on the Long-Term Low GHG Emissions Development Strategy (LT-LEDS) include:
  - Revise the deadline for greenhouse gas reduction (by 20-25%) from 2030 to 2025 (5 years earlier)
  - Revise the deadline for reaching carbon neutrality from 2065 to 2050 (15 years earlier)
  - Revise the deadline for net zero gas emission from 2100 to 2065 (35 years earlier)
  - Reiterate agendas that Thailand needs assistance and support, especially advanced technology transfer and climate change adaptation and mitigation
- The 2nd Updated Nationally Determined Contributions (NDC) saw the revision of short-term goal to be in line with LT-LEDS, which includes reduction of greenhouse gas emissions by 30-40% from the projected business-as-usual (BAU) level by 2030, among others.

Source: Government of Thailand

Typical case of Article 6.2 (JCM)



Article 6.4 (systems to be developed)



Progress of negotiations of Article 6

Article 6.2: Cooperative Approach

Countries cooperate bilaterally/multilaterally to promote mitigation and achieve NDC through internationally trading carbon credits (ITMOs).

Internationally Transferred Mitigation Outcomes **ITMOs**

Article 6.4 Mechanism

Centrally governed carbon crediting mechanism which can be used for achieving NDC (Successor of the CDM of Kyoto Protocol)

Article 6.4 Emission Reduction **A6.4ER**

	Paris Agreement COP21 [2015]	Rulebook of Art.6 COP26 [2021]	Details of rule COP27 [2022]	Continue
6.2	■ PA 6.2 Avoiding double counting, promoting sustainable development	■ 6.2 Guidance Participation criteria, method of corresponding adjustment, reporting, and review	■ 6.2 details Guidance of recording, tracking, and review	**Bilateral cooperations on going (Japan, Switzerland, etc.)**
6.4	■ PA 6.4 overall mitigation in global emissions, establishing Supervisory Body (SB)	■ 6.4 Rules, modalities, procedures Activity cycle of the mechanism. Structure of SB, CDM transition ■ Establishment of SB	■ 6.4 details Guidance of authorization and reporting of A6.4ER, guidance of CDM transition	**Expected to start from 2024 or later**

Decisions on Article 6 at COP27 (CMA4)

6.2

【Rules and guidance on implementation】

- ✓ Registry and international registry for recording & tracking ITMOs, central accounting and reporting platform (CARP) , Article 6 database
- ✓ Guidelines on technical expert review
- ✓ Guidance on Initial report and regular report

Attention!◎Confidentiality

Countries may designate confidential information and should explain the basis for to do so.

→Leading to untransparent trading /transfer?

【Further negotiation】

- ✓ Inclusion of Emission avoidance (Can REDD-plus credits be included in Art 6.2?)
- ✓ Detailed rules of ITMO authorization (Can ITMO authorization be changed/revoked?)

6.4

【Rules and guidance on implementation】

- ✓ Procedures of CDM & CER transition
- ✓ Rules of Supervisory Body
- ✓ Procedures of Share of Proceeds(SOP) and Overall Mitigation Global Emission (OMGE)
- ✓ Rules of reporting by host country
- ✓ Rules of Mechanism registry

Attention!◎Non-authorized credits

Mechanism registry shall track non-authorized A6.4 credits (“Mitigation Contribution A6.4ER”).

→Affecting way of using credits by companies?

【Further negotiation】

- ✓ Inclusion of carbon removal (Type of removal? Permanence? Safeguard?)
- ✓ Grievance process (How to ensure rights of Local Community & Indigenous People？)

Outreach by the Bangkok Metropolitan Administration in COP27

Side Event: Toward Net Zero Emission in Bangkok

Toward Net Zero Emission in Bangkok

Organizers:

- Bangkok Metropolitan Administration (BMA), JICA、MNRE/DEQP, and OECC
- Venue: November 9, 2022, at Thailand Pavilion

Overview: The Side Event introduced efforts to achieve net zero emissions in Bangkok and Thailand, including

- Public awareness raising
- BMA's climate action under governor's initiative(Livable City for All)
- Yokohama City-Bangkok collaboration
- Importance of leadership and peer review in city action on climate change

JICA's climate change measures to achieve Paris Agreement goals

JICA's climate change measures to achieve Paris Agreement goals

Organizer
- JICA
- Venue: November 9, 2022, at Japan Pavilion

Overview: The Side Event introduced JICA's cooperation approach to promote co-benefits of climate action to achieve Paris Agreement goals in developing countries.
- Case of Bangkok (BMA)
- Case of Indonesia (Bappenas)
- Case of Kenya (JICA)

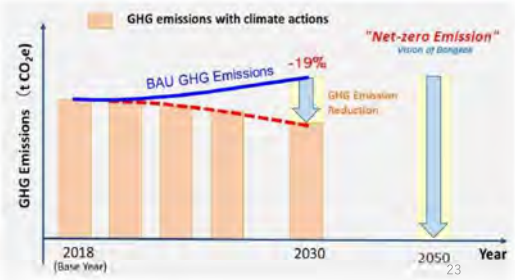
The National and BMA's Climate Policy

National level

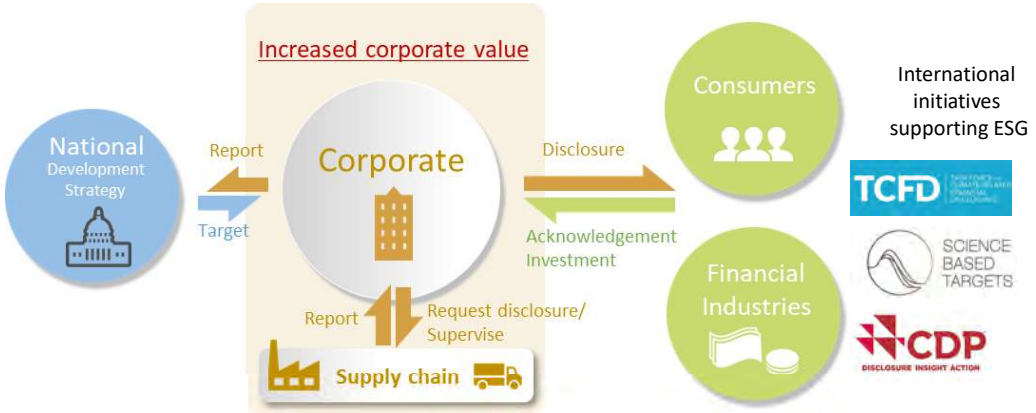
In Bangkok area

Carbon Neutrality by 2050
Net Zero Emissions by 2065

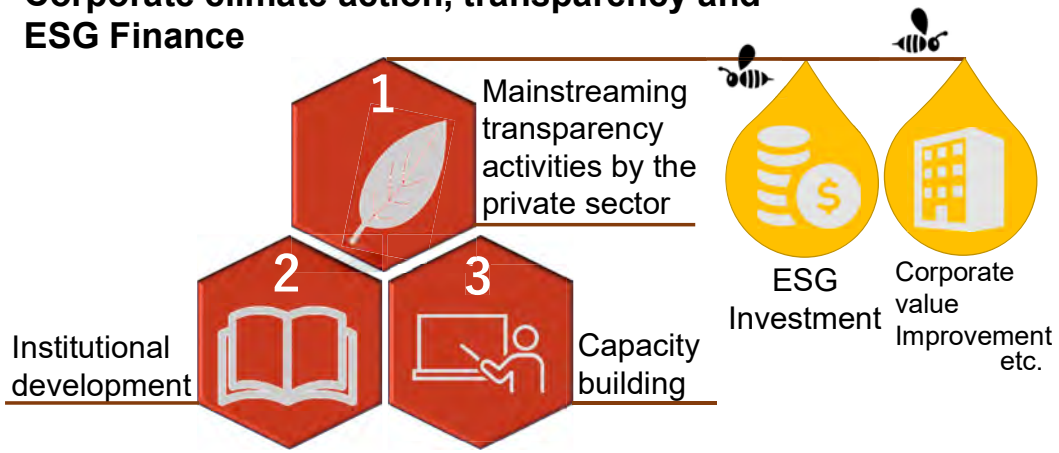
30-40% Reduction by 2030 against BAU



Importance of GHG emission measurement, reporting and verification (MRV)

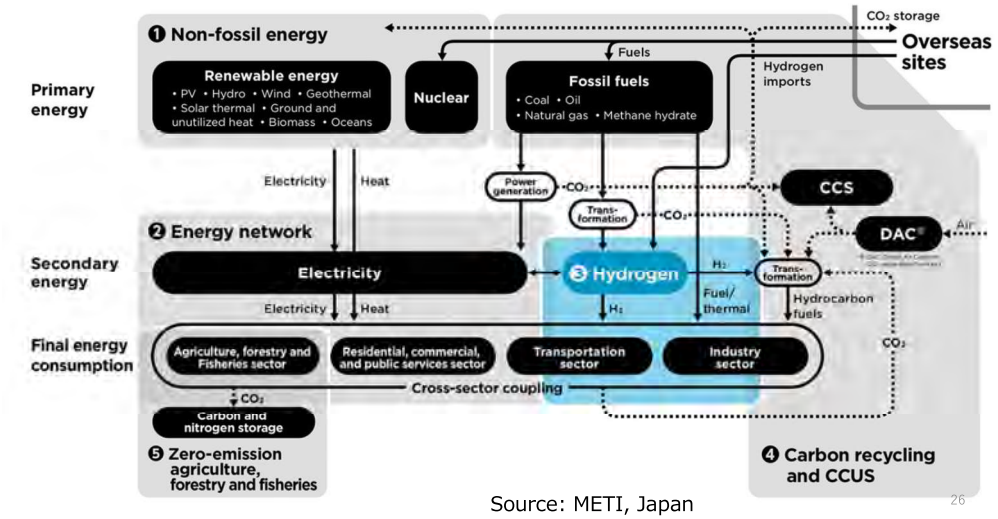


Corporate climate action, transparency and ESG Finance



We promotes transparency of the private sectors which leads to ESG investments and increasing the competitiveness of companies in the global market.

Innovative technology development and application



Source: METI, Japan

What's next for the Private Sector & Enterprises ?

Roles

- Driving force and implementer of NDC and LTS
- Bringing co-Innovation by R&D and social experiment
- Mobilizing market force and private finance for mitigation and adaptation

Opportunities & Risks

- Decarbonization/resilient corporate management paves the way for stronger competitiveness – companies to be chosen by the market.
- Integration and mainstreaming of business opportunity & risks are the key.

Thank you

kato@oecc.or.jp

OECC COP27 Website

Cooling Sector YouTube

Japan's Decarbonization Technology Website JPRSI

Carbon Market Express YouTube

GHG Transparency and ESG Finance YouTube (PaSTI)

DISCUSSION PURPOSE ONLY

November,2022

To achieve our Carbon neutral society

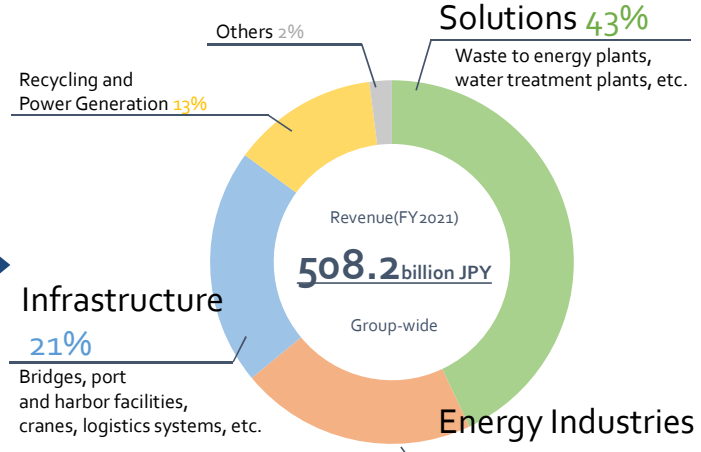
JFE Engineering Corporation

JFE at COP27, Sharm El-Sheikh

COP27 SHARM EL-SHEIKH EGYPT 2022

JFE for sustainable cities and communities

- JFE Holdings
  - JFE Steel
  - JFE Engineering
  - JFE Shoji
    *Trading
  - Japan Marine United



Environmental Solutions 43%
Waste to energy plants, water treatment plants, etc.

Others 2%

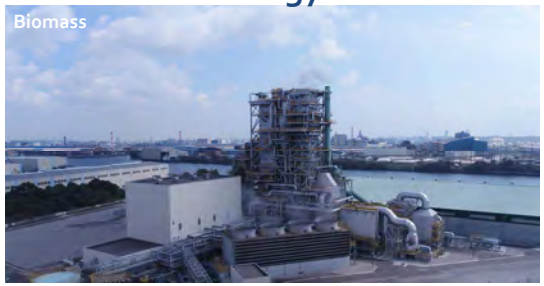
Recycling and Power Generation 13%

Infrastructure 21%
Bridges, port and harbor facilities, cranes, logistics systems, etc.

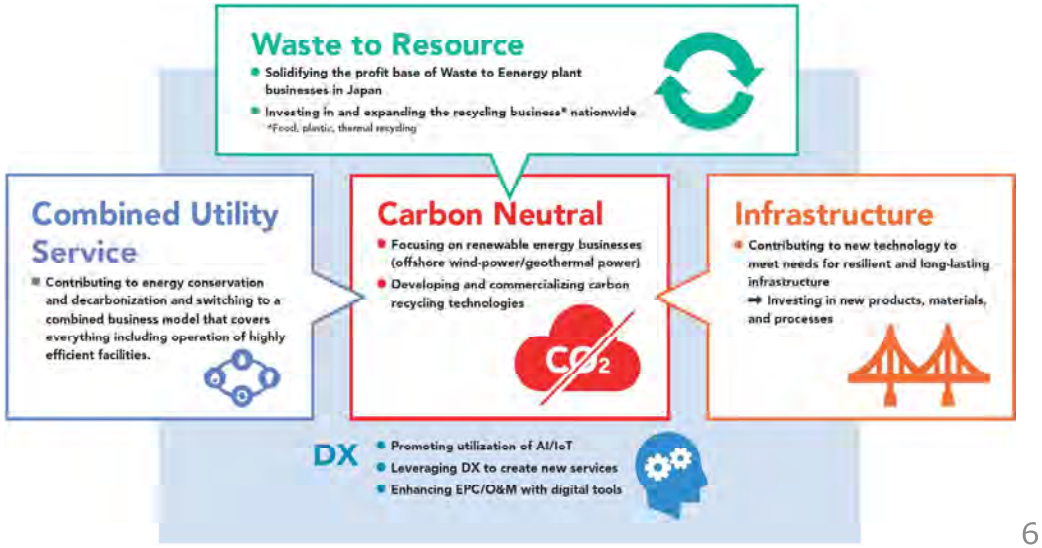
Energy Industries 21%
LNG bases, pipelines, renewable energy, etc.

Environment solutions

Renewable energy

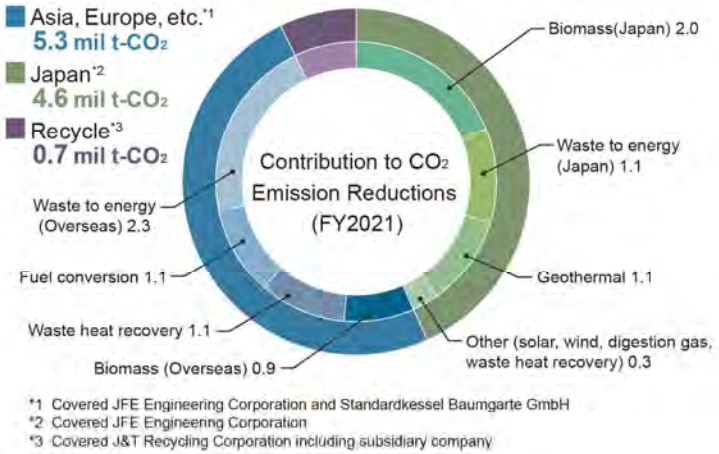


Five Initiatives for 2030 - Focusing on the Circular Economy



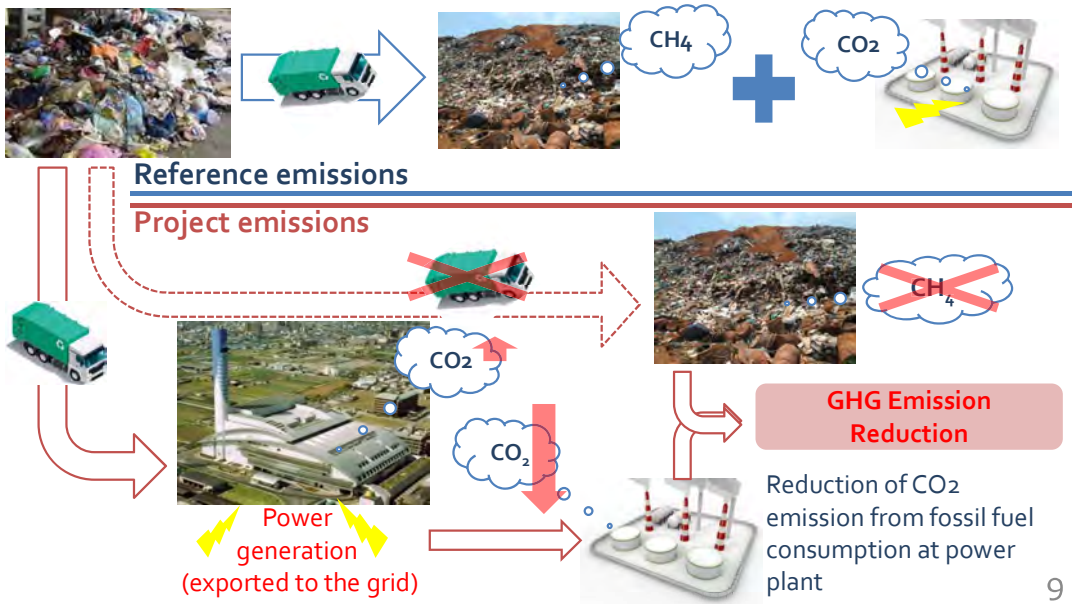
Our Contribution of GHG Emission Reduction

10,560,000 t-CO2/y



*1 Covered JFE Engineering Corporation and Standardkessel Baumgarte GmbH
*2 Covered JFE Engineering Corporation
*3 Covered J&T Recycling Corporation including subsidiary company

Photo : Takahashi


CH4
CO2
Reference emissions
Project emissions
CH4
CO2
CO2
GHG Emission Reduction
Reduction of CO2 emission from fossil fuel consumption at power plant
Power generation (exported to the grid)

9


Chonburi Clean Energy
Stoker furnace for Industrial solid waste
[Location] Bo Win, Si Racha District, Chon Buri
[Capacity] 360 ton/day (ISW), 8.6 MW
WHA
Gow
suez
SPV
PEA
CHONBURI
ESBEC etc.
PPA
Waste supply
Marubeni
JFE

10

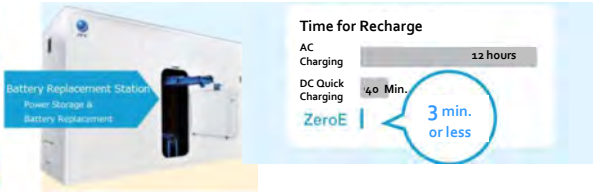

JCM THE JOINT CREDITING MECHANISM
[Expected GHG Emission Reductions]
4,067 tCO2/year (average)
Waste to Energy Plant in Yangon City
[Location] Shwe Pyi Thar Township, Yangon City
[Project participant (Myanmar)] Yangon City Development Committee
[Project participant (Japan)] JFE Engineering Corporation
YANGON WASTE TO ENERGY PLANT
Photo : Takahashi

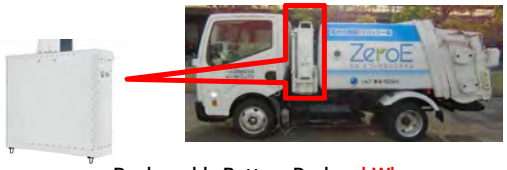
11


JCM THE JOINT CREDITING MECHANISM
[Expected GHG Emission Reductions]
41,805 tCO2/year (average)
Waste to Energy project in Bac Ninh Province
[Location] Bac Ninh province, Vietnam
[Project participant (Vietnam)] T&J Green Energy Company Limited
[Project participant (Japan)] JFE Engineering Corporation
[Capacity] 500 ton/day (MSW+ISW), 11.6 MW
Image

12

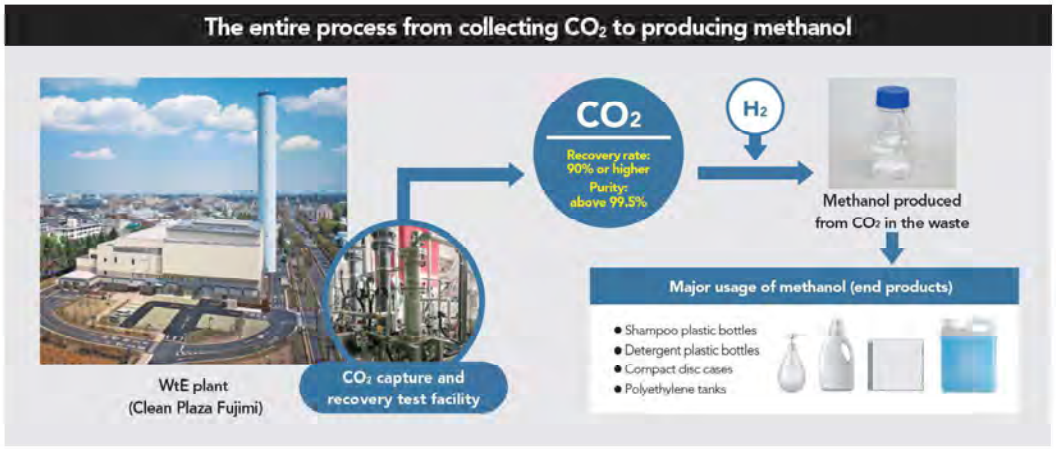
Waste collection by replaceable battery EV



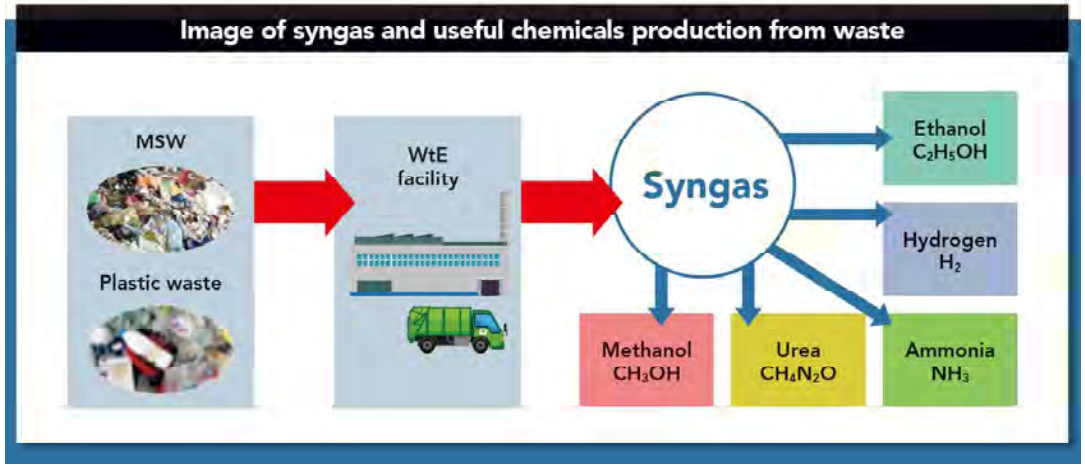


Replaceable Battery Pack:40kWh

"CCU-Ready" Waste-to-Energy



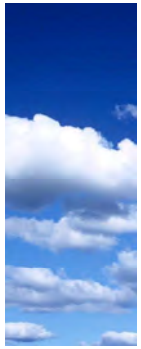
Waste-to-Chemical



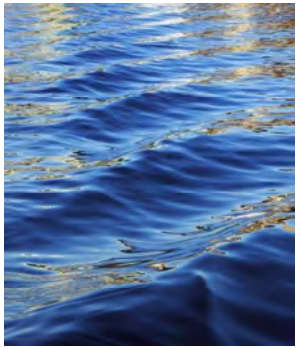
https://www.jfe-eng.co.jp/en/360_jfe_engineering/

JFE

Just For the Earth



Overview of Hydrogen and Ammonia market for energy transition



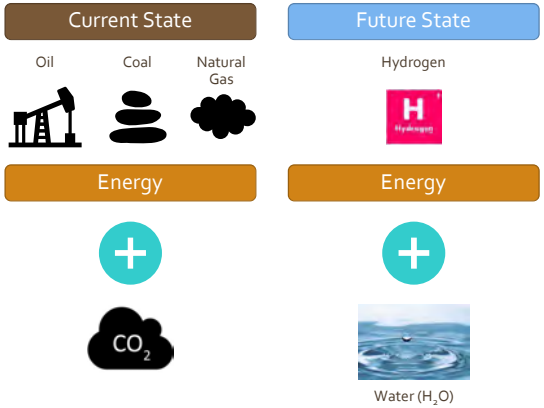
Visarn Lilavivat, Ph.D.

The 1st Net Zero Emissions Business Opportunity Seminar under Bangkok-Yokohama City-to-City Program
29 November 2022

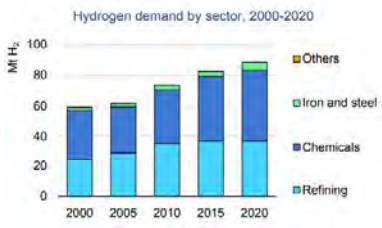
COP27

- Carbon neutrality in 2050 and Net zero green house gas emission in 2065
- Stop using coal
- Use more renewable energy
- BCG Economy

Why Hydrogen



Hydrogen demand has grown strongly

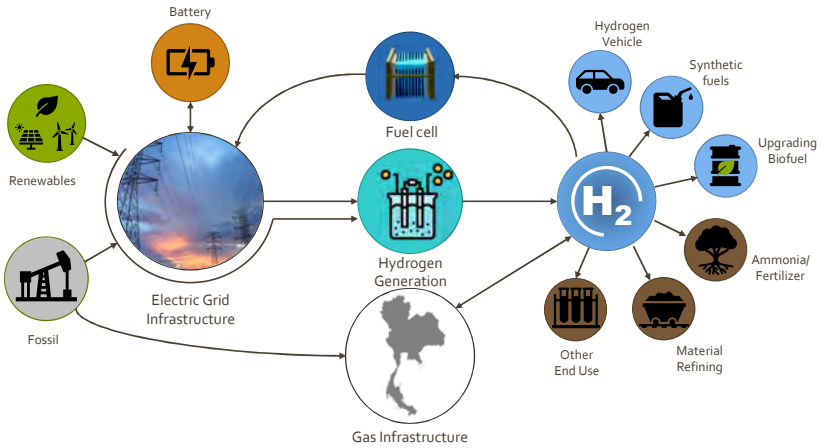


Source: IEA

Hydrogen

- Hydrogen is **the simplest element** on earth—it consists of only one proton and one electron
- Hydrogen can store and deliver usable energy, but it doesn't typically exist by itself in nature and **must be produced** from compounds that contain it.
- Hydrogen is an **energy carrier**, not an energy source.

Hydrogen Economy



H_2: Enabling affordable, reliable, clean, and secure energy across sectors

Hydrogen Production

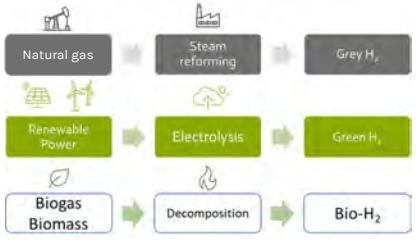
Terminology	Technology	Feedstock	GHG footprint
White	By-product	Mixed	N/A
Green	Electrolysis	Renewable energy	Minimal
Pink	Electrolysis	Nuclear	Minimal
Yellow	Electrolysis	Mixed grid energy	Medium
Blue	Gasification + CCUS	Natural gas	Low
Turquoise	Pyrolysis	Natural gas	Solid carbon
Grey	Gasification	Natural gas	Medium-high
Brown	Gasification	Brown coal (lignite)	High
Black	Gasification	Black coal	High

Hydrogen Production Pathway

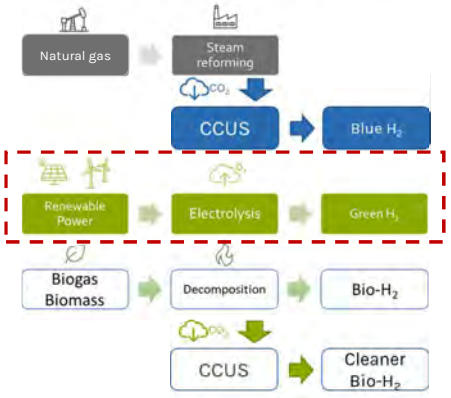
Source: U.S.DOE

Hydrogen Production in Thailand

Current



Future



Key opportunity

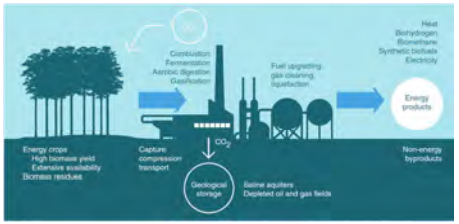
Hydrogen Production	Key opportunity	Growth prospects
Fossil fuel without CCUS	**Hydrogen by SMR is the most common and lowest cost.** This is an important technology pathway for near-term hydrogen production	Grey hydrogen may be **replaced by lower carbon hydrogen** in the long run with decarbonization goal.
Fossil fuel with CCUS	**Blue hydrogen is a crucial bridge** between grey and green hydrogen.	**The strong regulations** are pushing CCUS developments despite costly CCS processes.
Renewable	Green hydrogen, promising option for carbon-free hydrogen, **it is a leading pathway to achieve decarbonization goal.**	**Reducing the cost of renewable energy and increasing performance of clean hydrogen production** would allow green hydrogen to be economically viable
Biogas Biomass	**Growing biomass removes carbon dioxide from the atmosphere,** the net carbon emissions of this method can be low, especially if coupled with CCUS in the long term.	**R&D still needed to lower the costs** to tap into the abundant biomass resource

H_2 from Natural Gas Reforming

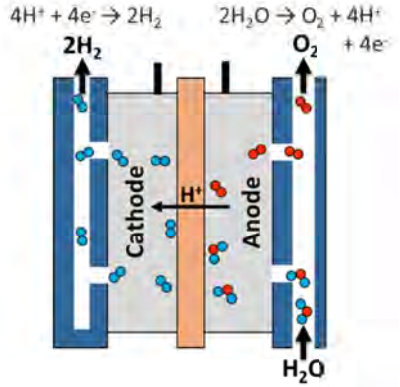
Grey Hydrogen

Steam-methane reforming reaction
$CH_4 + H_2O$ (+ heat) $\rightarrow CO + 3H_2$
Water-gas shift reaction
$CO + H_2O \rightarrow CO_2 + H_2$ (+ small amount of heat)

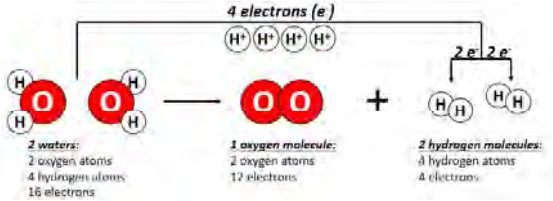
- Large-scale production
- Low-cost
- Emissions are lower than for gasoline-powered internal combustion engine
- Need CCUS



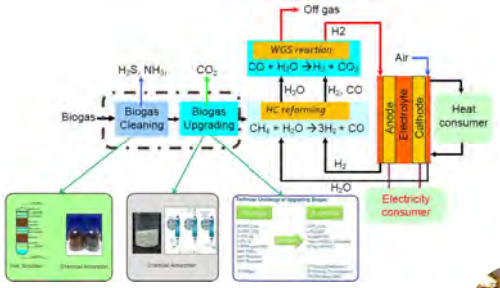
H_2 from Electrolysis



- Hydrogen produced via electrolysis **can result in zero greenhouse gas emissions** (depending on the source of the electricity)
- Potential for **synergy with renewable energy** power generation

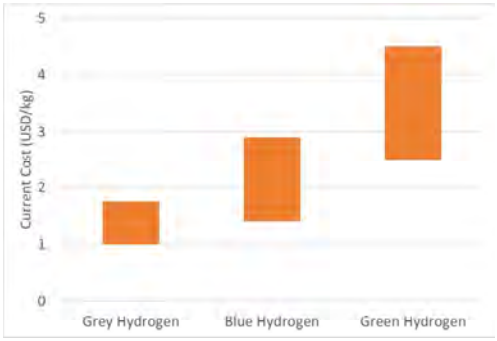


H_2 from Biomass/Biogass



- Biomass is an **abundant domestic resource**
- Biomass/Biogas **"recycles" carbon dioxide**
- Waste to energy
- Can coupled with CCUS in the long term.

Cost of Hydrogen by Process



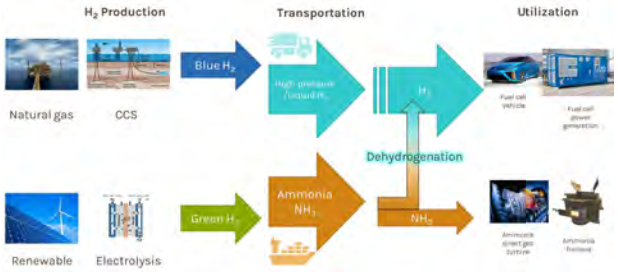
Production pathway	Carbon intensity ($kgCO_2/kgH_2$)	Current cost 2019 (USD/kgH_2)	Projected cost 2050 (USD/kgH_2)
Natural gas SMR (grey)	8	1.00-1.75	1.00-1.75
Natural gas SMR with CCUS (blue)	0.4-2	1.4-2.9	1.3-2.8
Electrolysis (green)	≥0	2.5-4.5	0.7-1.6

Green Hydrogen Could Price Gas Out of Power Markets by 2050 - Bloomberg

Ammonia utilization technology

Ammonia as a Hydrogen Carrier

- Maximum Volumetric Hydrogen Density
  - about 45% higher than that of liquid hydrogen
- Easy to Liquefy
  - 9.2 bar at 25°C/-33°C at 1 atm
- Direct use
  - Fuel, Chemical

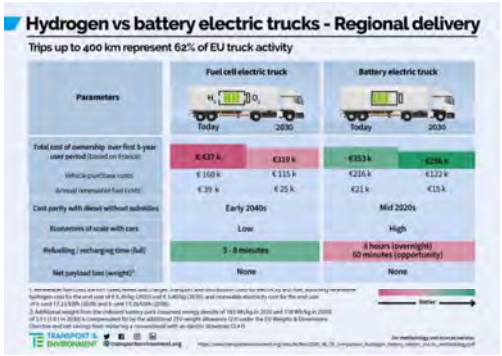


Power Generation

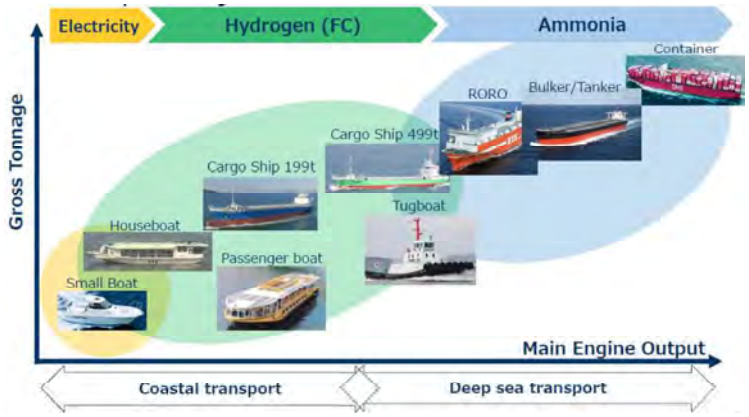
- Hydrogen gas turbine
- Ammonia gas turbine

- Hydrogen fuel cell generator

Battery & Hydrogen Vehicles



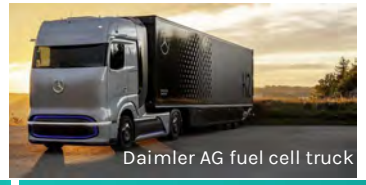
Alternative Fuels for ships

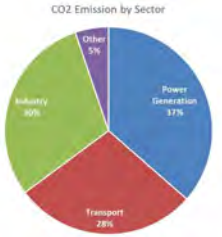


Opportunities for Hydrogen

Hydrogen fuel cell promise in many sectors

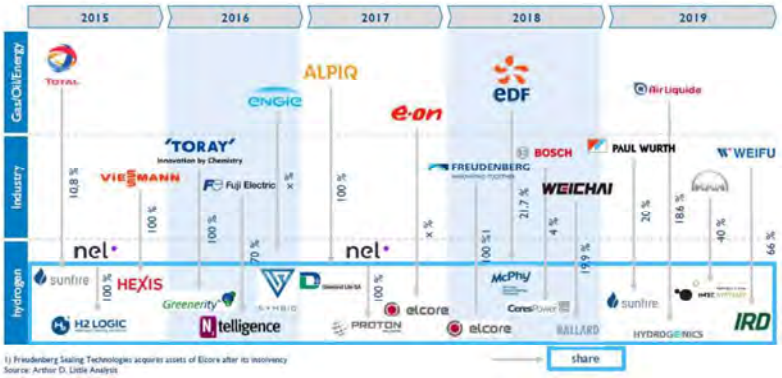
- **Vehicle**
  - Fuel cell electric vehicle
- **Shipping and aviation**
  - Hydrogen-based liquid fuels
- **Buildings**
  - blending hydrogen into existing natural gas networks
- **Industry**
  - Heating and raw material
- **Power generation**
  - Hydrogen fuel cell and hydrogen-based fuels


Daimler AG fuel cell truck



Source: EPPO 2021

Player related with Hydrogen



1) Freudenberg Sealing Technologies acquires assets of Elcore after its insolvency
Source: Arthur D. Little Analysis

Conclusions

- **Low-cost clean hydrogen** is the key for decarbonization.
- **Research on green hydrogen and ammonia** is the key for low-cost hydrogen.
- **R&D on CCUS is a crucial bridge** between grey and green hydrogen. It could couple with Biomass/Biogas in the long term.
- **Ammonia** potential medium as a **Hydrogen Carrier**
- Fuel cell system appropriate for **commercial and heavy transportation.**
- **Cost performace and durability** are the main challenges.

Thank you

"Hydrogen is Not the Future, This is Real. "

Contact

Visarn Lilavivat, Ph.D.

Renewable Energy and Energy Efficiency Research Team

Low Carbon Energy Research Group

National Energy Technology Center (ENTEC)

114 Thailand Science Park (TSP), Phahonyothin Road,

Khlong Nueng, Khlong Luang, Pathum Thani 12120, Thailand

Tel: +66 2564 6500 ext 4744

Email: visarn.lil@entec.or.th

Energy Transition in City of Yokohama

November 29, 2022
Climate Change Policy Headquarters
City of Yokohama

Role of hydrogen in Yokohama City

▸▸▸ Hydrogen is an important element in policies such as "Yokohama City Climate Change Policy Plan" under "Zero Carbon Yokohama" by 2050.

「Zero Carbon Yokohama」

Realizing net zero (decarbonization) by 2050

Announced decarbonization ahead of other cities (Oct. 2018)

Draft Yokohama City Action Plan for Global Warming (under revision)

GHG reduction target by 2030
30% (revised in2018) →raise to 50%
(Base year: 2013)

Key measures
Creating decarbonizing innovation for Yokohama waterfront area
Promoting decarbonizing innovation such as Hydrogen, Ammonia and Synthetic Methane through collaborating with various entities

Hydrogen utilization in Yokohama

▸▸▸ Promoting various hydrogen utilization measures including hydrogen station development and introduction of fuel cell vehicles.

Hydrogen station

写真：ENEOS株式会社提供

- 5 fix-type and 2 mobile-type
- 7 stations in total
- One station produce and sell CO2-free hydrogen using solar power generation and water electrolyzer
- Subsidizing hydrogen station development for its promotion

Fuel Cell Vehicle (FCV)

- Approx. 280 FCV (As of FY 2021)
- Procured 22 FCV as official car (Planning to add 1 FCV in FY 2022)
- Providing subsidies for citizens and businesses

Fuel Cell Bus (FC Bus)

- 1 FC Bus has been introduced for municipal bus
- Planning to add 2 FC Bus in FY 2022

Fuel Cell

家庭用燃料電池（エネファーム）
（出典：東京ガス株式会社）

自立型水素燃料電池システム

- Approx. 25,000 home-use fuel cell units (As of FY 2021)
- Providing subsidies
- Installed business-use fuel cell at city hall (200kW)
- Installed stand-alone hydrogen fuel cell system (H2One) at Yokohama Port Distribution Center

Decarbonization potential at Yokohama waterfront area

▸▸▸ Especially, Yokohama waterfront area is an ideal location to promote decarbonization initiative in terms of logistics, energy, and innovation.

Hub of logistics

- As one of the world's leading integrated logistics ports, it can be a base for importing next-generation energy such as hydrogen.

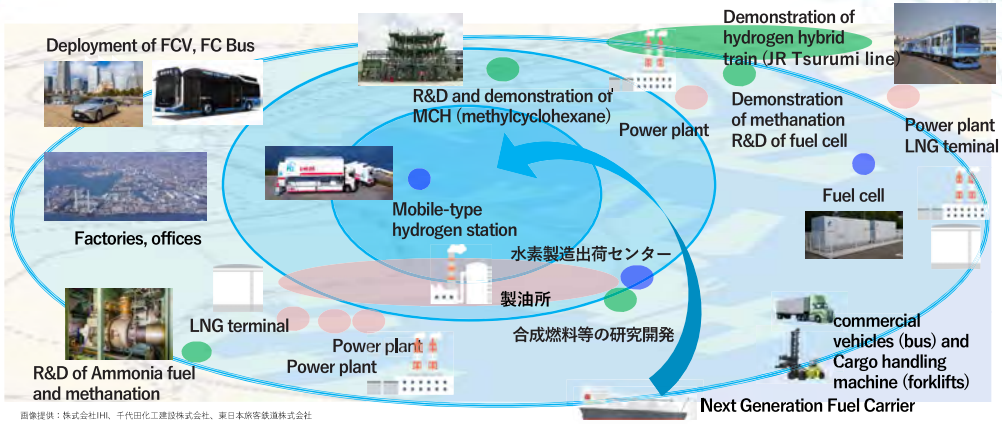
Energy supply center/Huge consumption area

- Extensive energy supply infrastructure including refineries, LNG terminals, and power plants.
- Potential to be a base for supplying next-generation energy to the region and location to accept pioneer consumers

Area to drive decarboning innovations

- Many offices and laboratories engaged in advanced and broad R&D and business development for decarbonization
- Potential to be industrial cluster area to drive decarbonizing innovation in Japan

Overview of Energy Transition in the Yokohama Waterfront Area



画像提供：株式会社IHI、千代田化工建設株式会社、東日本旅客鉄道株式会社

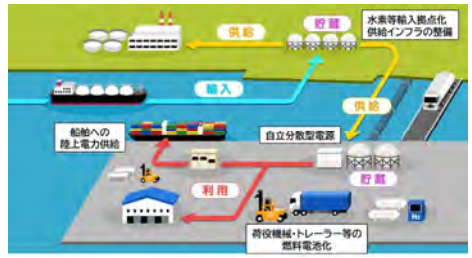
Expanding supply and utilization of next-generation energy including hydrogen

Key projects

Yokohama city is deepening collaboration with entities and foreign ports and surveying potential of hydrogen utilization toward realizing Carbon Neutral Port (CNP)

Concrete efforts toward the formation of CNP and future vision

Aiming to achieve zero GHG emission for the entire port by importing large quantities of hydrogen and storage /supply as well as realizing upgrade of port functions at port area centered on the Port of Yokohama where many industries are located through activities such as “Waterfront Business Council on Yokohama Carbon Neutral Port” and “NEDO study project” and collaborations with foreign ports including Japan-US CNP Workshop and QUAD Shipping Taskforce



Key projects

Yokohama city is also promoting development of hydrogen supply chain and demonstration of methanation through collaboration with private entities.

Overview of hydrogen supply chain development

- Yokohama city concluded cooperation agreement with ENEOS to develop hydrogen supply chain in Nov. 2021.
- Promoting studies for developing hydrogen supply infrastructure including wide-area pipelines.

※水素インフラ網の将来構想イメージ図であり、インフラ網や工場等の正確な位置を示したものではありません

Overview of methanation demonstration

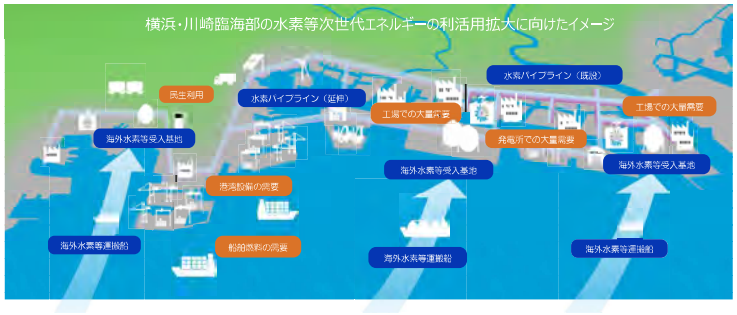
- Yokohama city concluded cooperation agreement with Tokyo Gas regarding methanation demonstration at Yokohama Techno Station in Jan. 2021.
- The adjacent Yokohama City Sewerage Center and Waste Incineration Plant will supply biomass-derived resources (e.g., CO2) to support technological development.

Methanation: Technology to produce methane, the main component of city gas, through the reaction of CO2 and H2

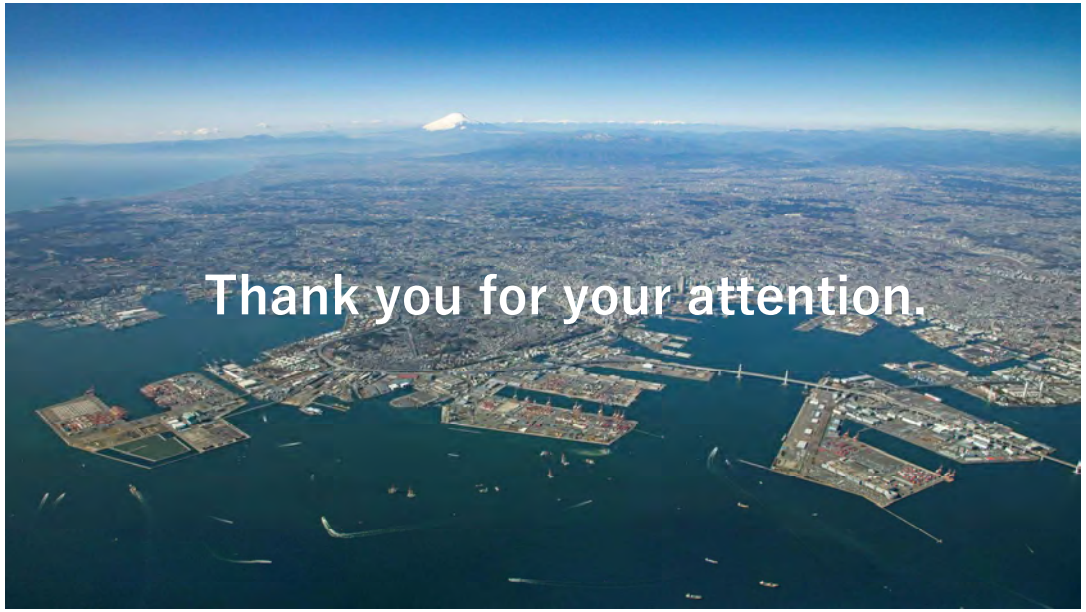
Movements for decarbonization in Yokohama waterfront area

Concluded a cooperation agreement with Kawasaki City to expand the use next-generation including hydrogen.

Yokohama City and Kawasaki City signed a cooperation agreement to expand the use of next-generation energy including hydrogen in the waterfront area, the core of the regional economy, in order to maintain and strengthen industrial competitiveness while realizing carbon neutral (July 26, 2022).



【Key contents of the agreement】
（1） Development of hydrogen supply
（2） Expansion of hydrogen demand
（3） Study and demonstration regarding (1) and (2) above.

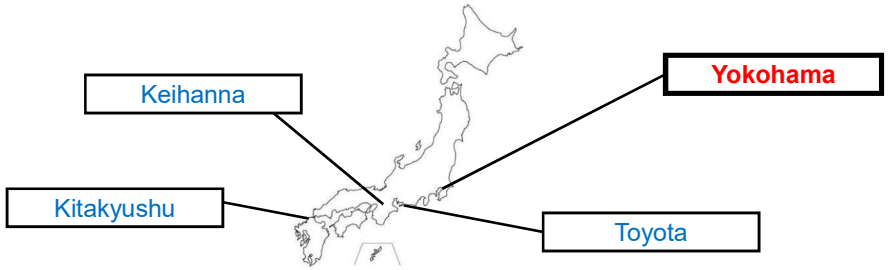

Thank you for your attention.

What is YSCP?

(Yokohama Smart City Project)

History of Yokohama Smart City Project Selection

We were selected by the Japanese government as a "Next-Generation Energy and social system demonstration area."



The Main Theme of activities in four areas

Renewable energy should use existing power networks.

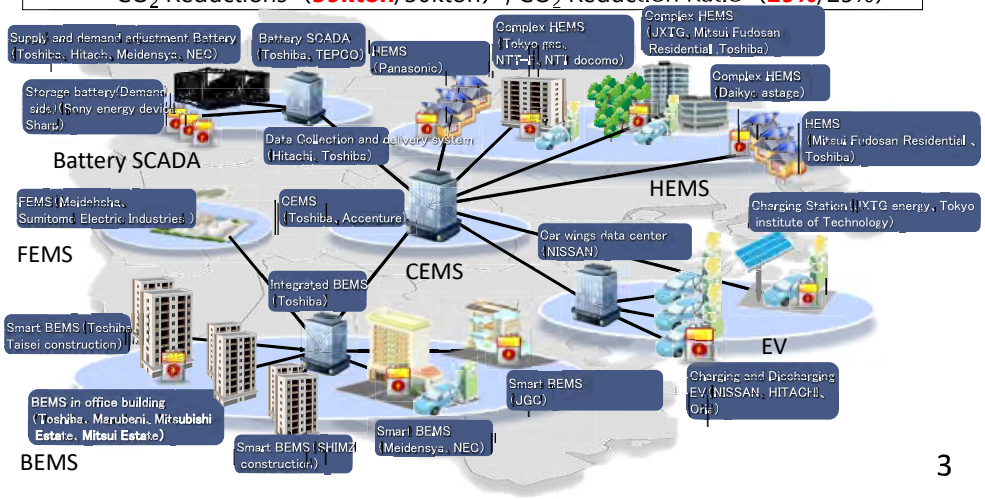
+

Peak shifting and peak saving should also be part of the objective.

Yokohama Smart City Project (YSCP)

Demonstration Project of Development/Introduction of a Regional Energy Management System in large-scale existing urban area

■ **Performance/Target** FY **2010～2014**
HEMS（**4,200site**/4,000site), PV（**37MW**/27MW), EV（**2,300**/2,000）
CO_2 Reductions（**39kton**/30kton）, CO_2 Reduction Ratio（**29%**/25%）



From Demonstration of YSCP to Implementation

4

Actual Implementation Based on Public-Private Partnership

Yokohama Smart Business Association

<8 secretary members>

TEPCO, TOKYO GAS, TOSHIBA Leading Innovation, TAISEI, DHC, みなとみらい21熱供給株式会社, MEIDEN, azbil, OPEN YOKOHAMA

<16 general members>

IHI, SHMZ, MI, ORIX, Panasonic, NISSAN, PACIFICO, TGES, TTS Co.ltd, NTT, 三井不動産, 三菱地所, e MOBILITY POWER

Achievement of an "Energy - recycling City"

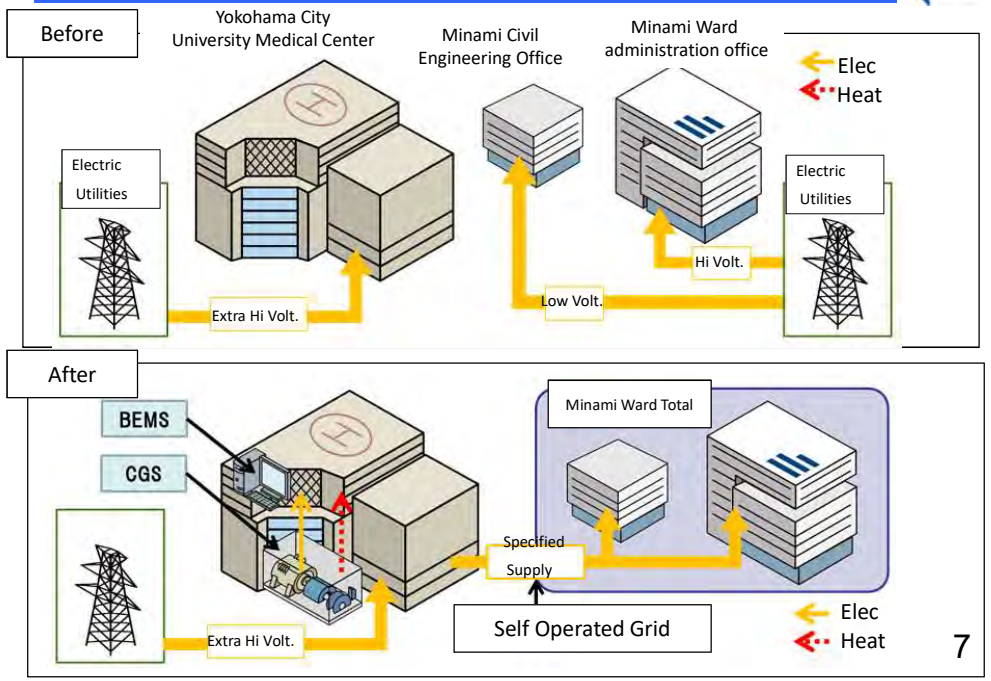
- Promote local energy production for local consumption
- Use BEMS to verify public facility demand response

5

Implementation example (Power supply to Minami Ward office)

6

Energy Management based on specified supply



7

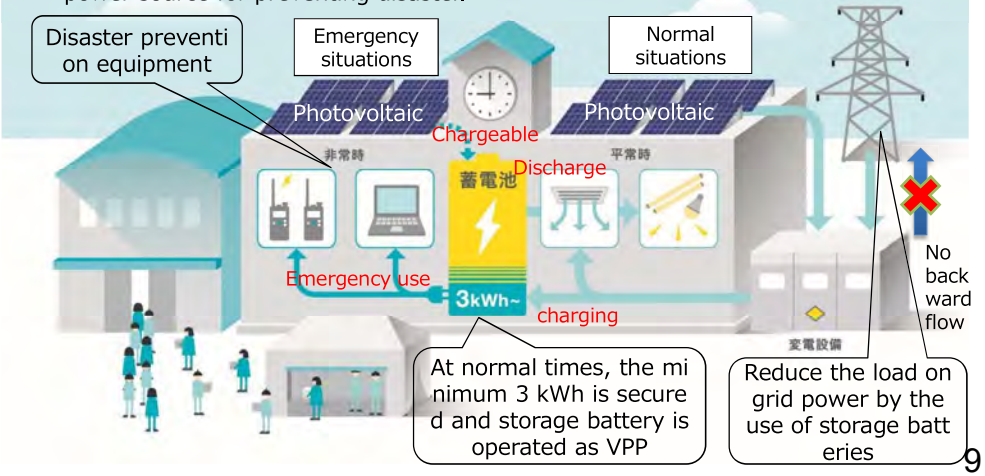
Implementation example

（ Virtual Power Plant abbreviation : VPP ）

Energy Saving -Virtual Power Plant-

Yokohama type virtual power plant

- In normal situations, we contribute to a society that uses electricity smartly, which is aimed at by the government, with the effects of VPP.
- In emergency situations, including power outage, we contribute to the improvement of anti-disaster property of local community, by using VPP as “a power source for preventing disaster.”



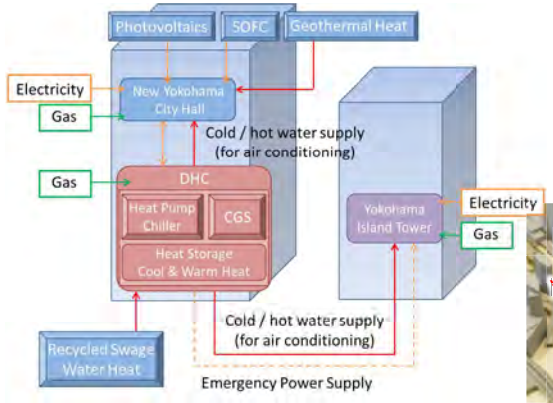
Implementation example

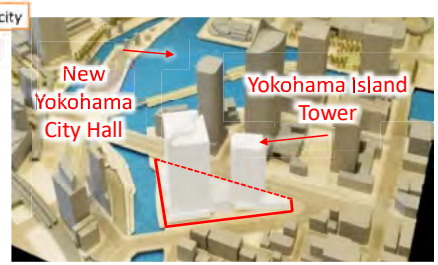
（ Energy Saving of New City Hall ）

Energy Saving -New City Hall-

- Area Energy Network with neighboring building, Yokohama Island Tower
- Installing CGS, Photovoltaics, SOFC, Geothermal Heat ,... etc.

Improving environment, disaster prevention and economy by installing equipment





Various Initiatives by YSBA Member Companies

Extended use of energy by Technology Center, Taisei Corporation

- Extended use of energy with the use of the next-generation large fuel cell
- Energy optimization between multiple facilities with the use of AEMS
- Total energy management through the self-consignment of power, including remote facilities

Promotion to grow the low-carbon society through the introduction of large fuel cells and greater energy management

CGS introduction in PACIFICO Yokohama

- Initiatives on the extended use of energy in the Minatomirai area
- Installation of CGS 1,000 kW ● 2 units and Genelink 195 RT ● 2 units
- Extended use of heat and electricity in conference centers, exhibition halls, and hotels

Improvement of environmental friendliness, disaster risk reduction capacity, and economic efficiency through introduction to facilities

Establishment of an energy center in the Tsunashima SST

- Tokyo Gas Engineering Solutions Corporation established an energy center in the Tsunashima SST and introduced 2 units of gas cogeneration 370 kW, a Genelink 700 RT, and a turbo refrigerator 400 RT.
- Electric power, hot water, and cold water are supplied from the energy center to research institutes, commercial facilities, multiple dormitories, and hydrogen stations inside the SST.
- With the use of high-performance CGS, a further reduction of fossil fuel consumption and CO_2 emissions were achieved.
- Improvement of disaster risk reduction capacity and contributions to regional revitalization are also expected.

CGS introduction into the heat supply in Minatomirai 21

- Initiatives on the extended use of energy in the Minatomirai area
- Through installing CGS 2,000 kW to secure power inside plants and supply steam and cold water to communities via existing piping, we aim to achieve peak power measures and increased high performance.
- In addition, improve BCP by installing a 1,600 kW generator for disaster countermeasures.

New Yokohama City Hall DHC

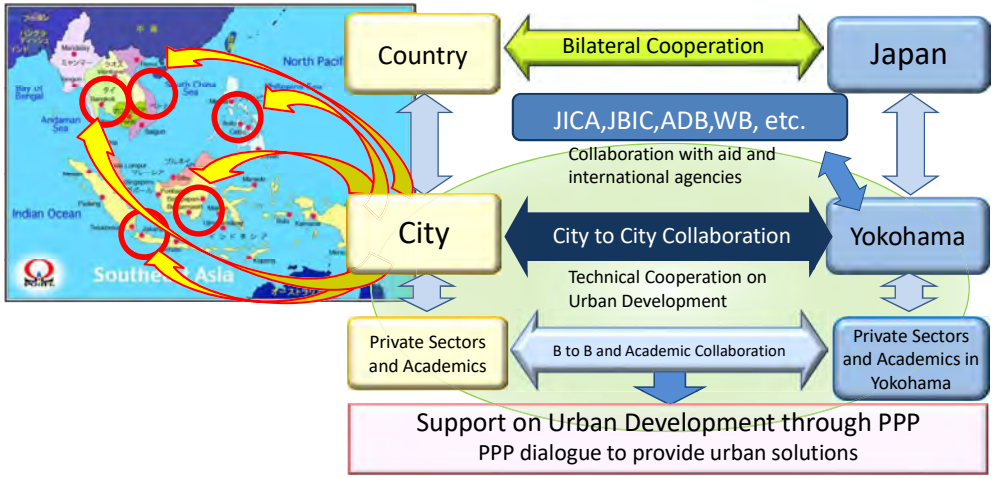
- Initiatives on the extended use of energy in the new city hall
- Extended use of heat with the adjacent Yokohama Island Tower
- Installation of CGS and Genelink

Improvement of environmental friendliness, disaster risk reduction capacity, and economic efficiency through introduction to facilities

Disseminate the Initiatives of Yokohama to the World

Towards a Sustainable City Management in Asia

Yokohama's experience can bring a new perspective for city governors and urban planners around the world



Thank you for your attention.


Chinatown


Minato Mirai


Yokohama Port Opening Memorial Hall


Yamate Diplomat's House


Sankeien Garden


Zoorasia Yokohama

MACNICA

Macnica's Zero Carbon Initiatives

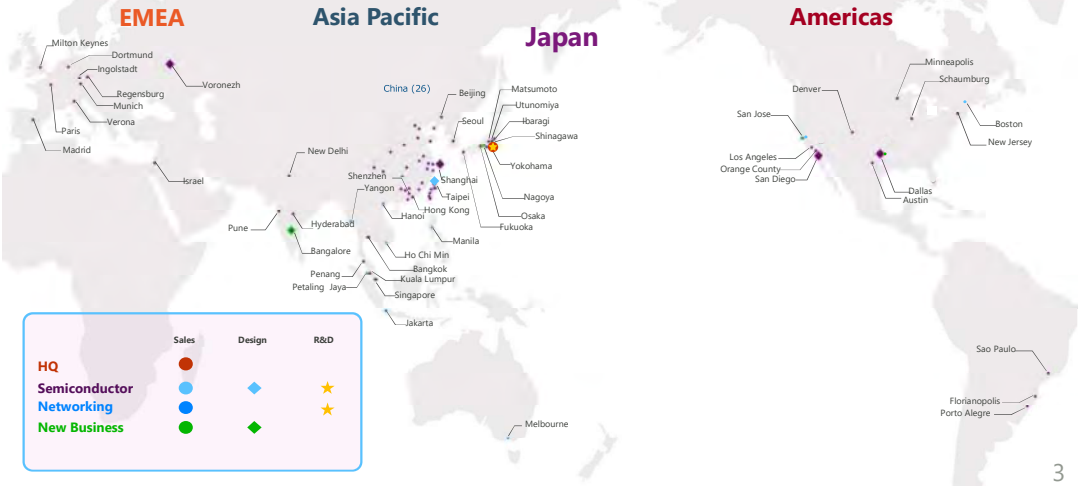
Macnica At a Glance

FY21 Sales **US$7.6B**

Of All Employees **1 in 3 are Engineers**

Locations **24 countries** **80 locations**

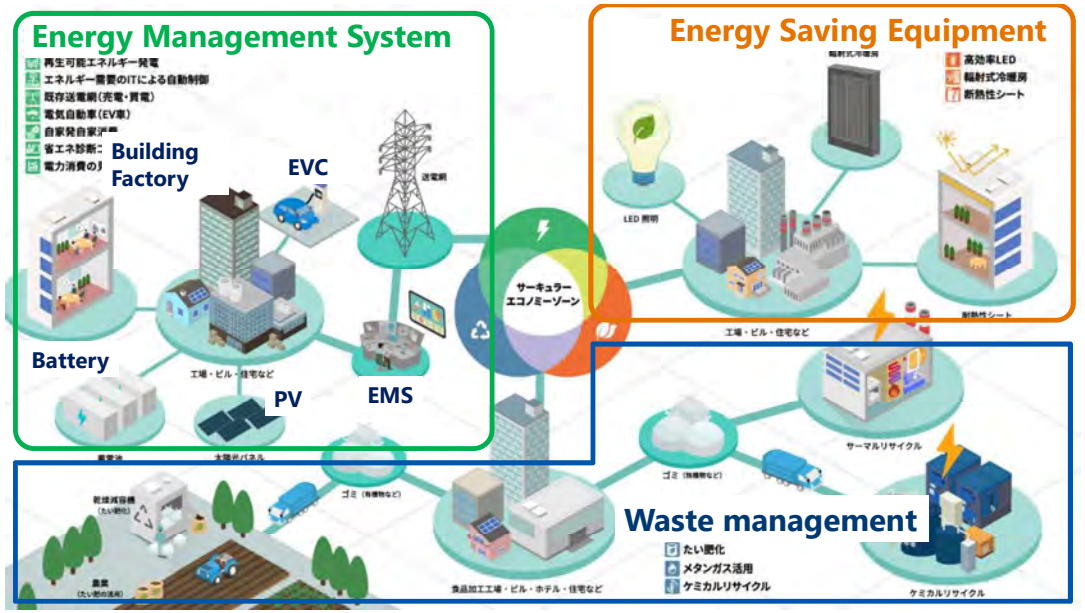
Global Coverage



New Business Development

AI Research & Innovation Hub

ARIH



Case study

Promoting a green industrial collaboration area within the region by realizing a circular economy zone

Regional universities, housing complexes, commercial facilities, hospitals, and public facilities will work together to promote a circular economy within the region. Promote local carbonization of local waste to reduce disposal costs and carbon emissions. At regional facilities, we will combine silicon power generation using sunlight with perovskite solar cell demonstration projects to generate renewable energy and promote local production and consumption of electricity. Local energy is used as power for disaster prevention and evacuation facilities during emergencies, and as a local community mobility power source during normal times. Realize the visualization of the region by linking water, electricity, gas, roads, and various facilities, and provide it as a regional energy saving program and a regional commercial information dissemination medium.

(1) Local treatment of wasteMedical and food waste generated in the region is dried within the region and reused as compost for vegetable gardens, while greatly reducing disposal costs.

② Electric power local production for local consumption
A storage battery (stationary/mobile type) has been introduced in this area. Equalize power consumption and promote self-consumption of power within the area.Power Generation Incorporates Bending Power Perovskite Demonstration **to Pioneer Renewable Power Generation in Cities**

(3) Visualization of regions

Monitoring the operation and status of infrastructure facilities for roads, schools, public facilities, and buildings → realization of demand forecasts, facility inspections, and transmission and reception of information within the region

◎災害時の避難所（地域交流センター）ライフライン対策
災害時の避難所となる学校での非常時電源確保

On August 2021, Cleanwatts inaugurated the 1st REC (Renewable Energy Community) in Portugal


NEWSBREAK

Home
Coronavirus
Original
Headlines
MY CHANNELS
Add location

Cleanwatts paves the way for the deployment of energy communities

Miranda do Douro, a municipality in northern Portugal with a population of just under 10,000 people, is the first in a pipeline of more than 100 communities that Cleanwatts plans to launch across Portugal over the coming months. Every renewable energy community developed by Cleanwatts begins with an anchor client and in this case, the Miranda do Douro chapter of Santa Casa da Misericórdia expressed interest in playing this critical role.


Joao Galamba • 2nd
Secretário de Estado Adjunto e da Energia/ Deputy Minister and Secretary of State...
1w •

Primeira comunidade de energia nasce em Miranda do Douro. Governo quer mais, para ajudar a baixar fatura da luz

eco.sapo.pt • 5 min read

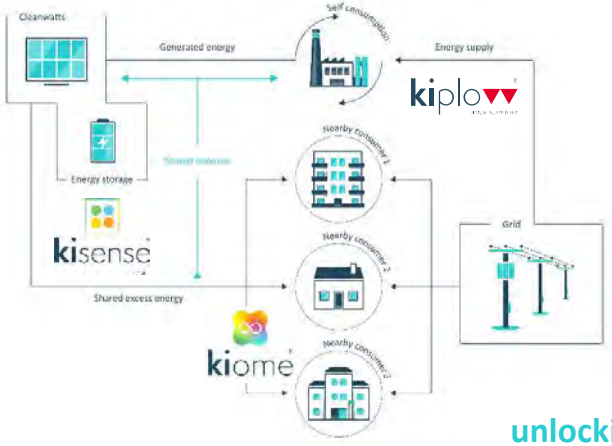
Cleanwatts paves the way for the deployment of energy communities

Cleanwatts launches Portugal's first energy community under the country's new legal framework recently transposed from the EU's Renewable Energy Directive (RED II).

AUGUST 16, 2021 CLEANWATTS

MACNICA

Cleanwatts makes it easy to build and manage clean energy communities that deliver measurable positive impact locally.



- ✓ Possibility of zero investment for local generation + storage + sourcing (Cleanwatts supports all costs)
- ✓ Savings on energy costs
- ✓ Technology deployable anywhere
- ✓ Load management + forecasting
- ✓ Advanced reporting

Simplifying complexity, unlocking value for our clients.

MACNICA

® Buildings use case: Argatintas

Challenge

Argatintas had the goal of maximizing usage of their rooftop space, obtain savings on their electricity bill, increase their self-consumption at lower costs and monetize their surplus production, especially in periods of low activity such holidays and Sundays.

Solution

Cleanwatts installed 254 kWp on the rooftops of the anchor client's facilities, covering 100% of the investment and taking care of all licensing and compliance with regulations.

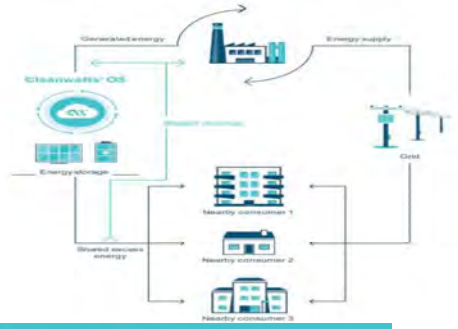
Using Kisense® Buildings, we optimized their energy consumption and generation, providing access to detailed reports and analysis, and alarms to detect abnormal consumption.

Results

Argatintas received a risk-free PV solution allowing a reduction of over 30% in energy costs and 1125 tons of CO2 emissions abated. Our solution also allows them to see high returns on excess electricity sold to the local community.

In addition to this, Kisense® Buildings predictive analytics generate savings of up to 20% on maintenance costs and our billing module allows the consolidation, analysis and optimization of external services billing, generating additional savings.

Partnering with Cleanwatts shows that your company is socially responsible and focused on accelerating energy decarbonization.



Kisense® Buildings

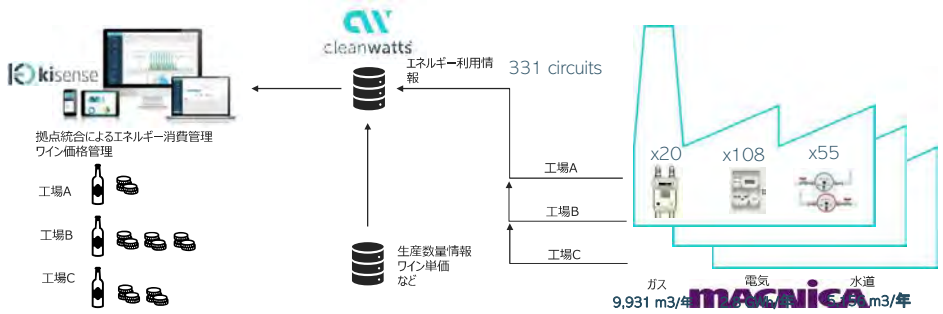
- ✓ Reduce your carbon footprint
- ✓ Obtain savings on your energy bill
- ✓ Manage energy consumption, production & storage
- ✓ Detect abnormal consumption patterns
- ✓ Control your equipment remotely
- ✓ Smart efficiency & optimization

SYMINGTON

Symington own and manage three distribution companies dedicated to the sale and marketing of Port wines and other wines owned and produced by the family: Portfolio in Portugal, Fells in the United Kingdom, and Premium Port Wines in the USA

- ✓ Monitoring points: 331 circuits (20 gas meters, 108 electrical meters, 24 water meters)
- ✓ Annual consumption of electricity: 2.8 GWh
- ✓ Annual consumption of water: 5 156m³
- ✓ Annual consumption of gas: 9 931m³

Kisense® used to aggregate consumption data from all production sites and integrate data (units of wine) from another platform (via API)



MACNICA

next generation technology

MACNICA

perovskite solar cell ペロブスカイト太陽電池

https://www.youtube.com/watch?v=ADzXL-fpj28
CBC broadcast on perovskite

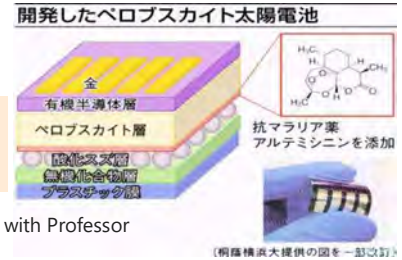
https://sauletech.com/
Company in Poland

http://www.dazhengtop.com/en/
Company in China

Inventor of perovskite Professor Miyasaka, the inventor

2022年
寿命は15年
変換効率15%

宮坂ブランド製品
で実装実証開始！



2022
15 years life15%
conversion efficiency

Implementation demonstration started with Professor Miyasaka brand products!

MACNICA

Mass production of perovskite, starting from August 2022

Factory of perovskite

- https://drive.google.com/file/d/1s8miCL4_KLnzyMeSA2xElQ-Ta5eDETam/view?usp=sharing_eil_se_dm&ts=63046179

- https://drive.google.com/file/d/1HHKD5EaeZWcdXTjpHtH3sPVZc2OdOX8h/view?usp=sharing_eil_m&ts=63046ab8

Manufacturer： 大正微納科技有限公司 http://www.dazhengtop.com/en/
Address：江苏镇江高新区戴家门路298号1号楼4楼
（Professor Miyasaka serve as advisor）

- Product

Module of perovskite solar cell of flexible plastic film-type. current module is, thickness: 1mm, size: 40X40cm、weight: 0.4kg, output voltage: DC 30V, output current: 0.2-0.3A

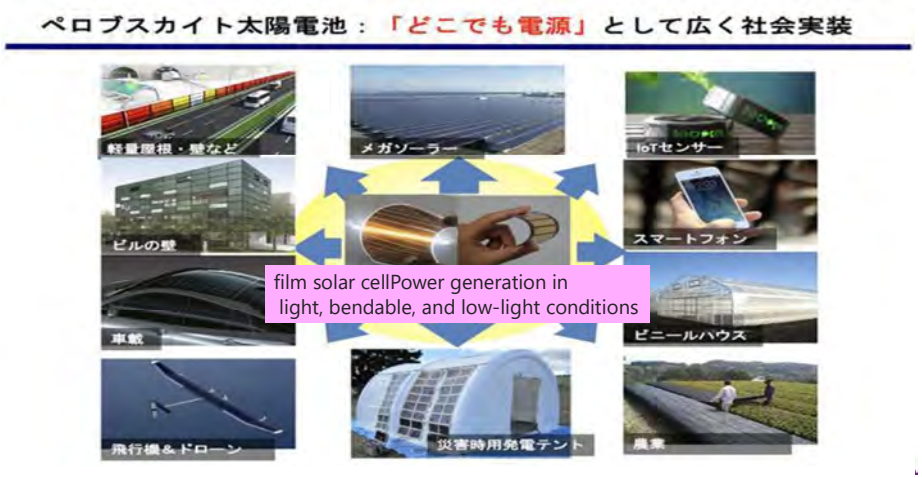
- Feature

Perovskite solar cell can generate electricity under any weather condition (sunny, cloudy, rainy) and under indoor lighting. It's light and flexible to be installed on curved surface.

MACNICA

Realize solar power generation in various places

Where perovskites were not possible in siliconenable power generation.



DAIKIN

Perfecting the Air

Solutions for smart city and smart building

To Achieve Carbon Neutrality in Thailand

29th November, 2022

Atsushi Kakimoto
Senior Manager/Group Leader
Solution Business Development Grp
Global Operations Division

Agenda

1) About Daikin

Daikin is Comprehensive Air Conditioning Manufacturer

Company name	Daikin Industries, Ltd.
Founded Established	October 25, 1924 (Founder : Akira Yamada) February 11. 1934
Chairman President	Noriyuki Inoue Masanori Togawa (President and CEO)
Capital	85 billion Yen (FY2021)
Employees	88,698
Annual Sales	3 trillion Yen (FY2021, Overall sales)
Group Companies	322 Consolidated Subsidiaries (30 in Japan, 292 overseas)
Head Office	Osaka, Japan

PICHONKUN

Founded in **1924**
98 Years of History

People-Centered Management

100+
Production Bases
In the World

¥3 trillion
Overall Sales

Business Development in
170+
Countries

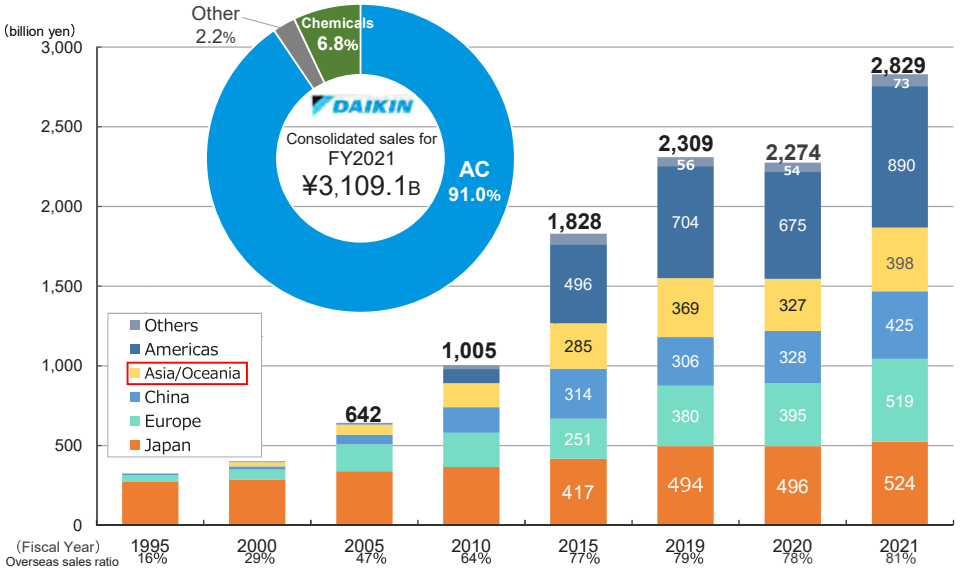
79%
of Daikin Sales are from outside Japan

Comprehensive AC Manufacturer
handling both AC equipment and refrigerants

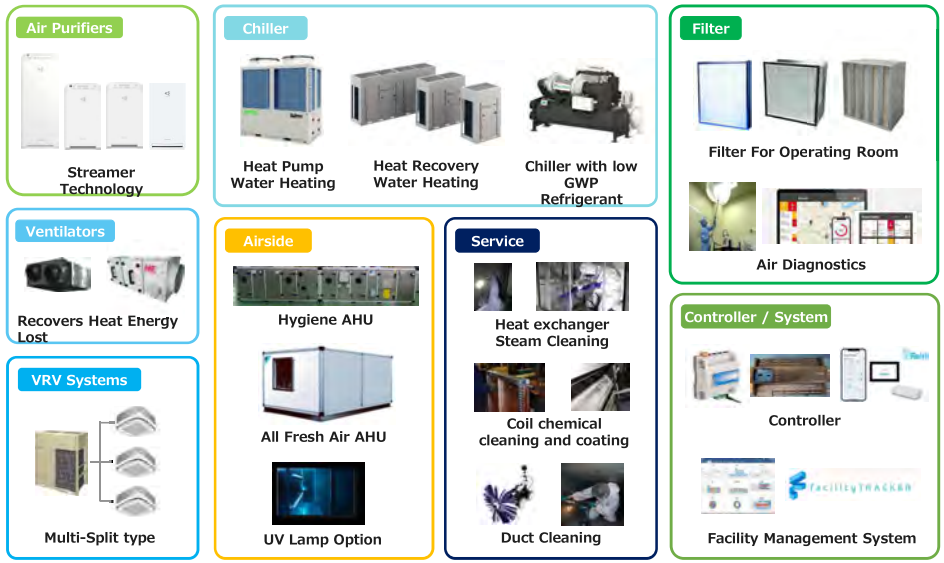
88,000+
Employees

1) About Daikin

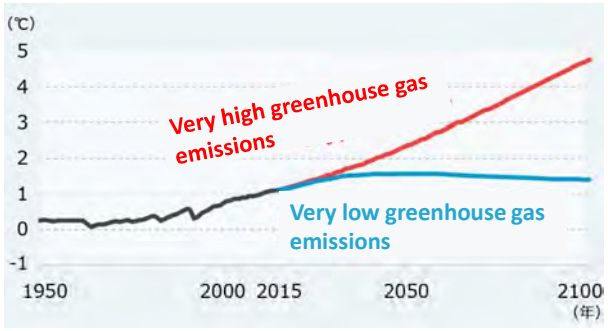
Daikin Group sales and AC Business Sales Trends by Region



Extensive Lineup that meets the diverse needs.



Change in global average temperature with reference to 1850-1900



IPCC, "Sixth Assessment Report, Working Group I Report, Climate Change 2021: The Natural Science Basis. Prepared from "Summary for Policymakers (SPM) Provisional Translation (May 12, 2022 version) SPM.8(a)

Risks posed by rising global temperatures

Flood disaster

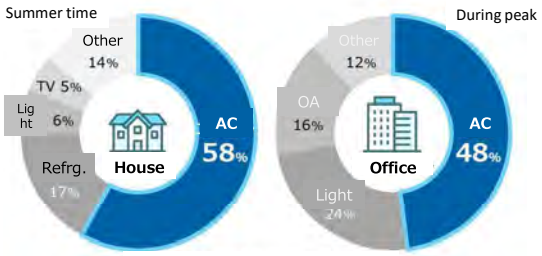
Decreased crop yields

Sea level rise

Spread of diseases

How does air conditioning affect the environment?

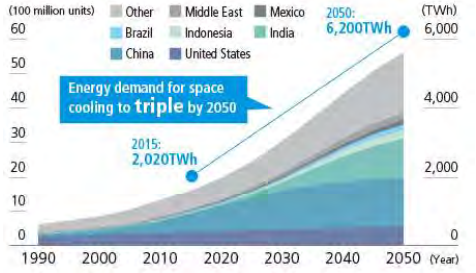
Percentage of air conditioners (A/C) during peak power consumption hours in summer



Ministry of Economy statics

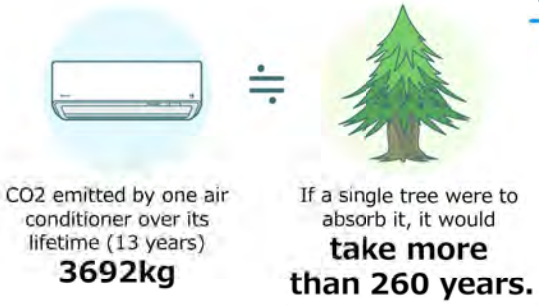
Prepared by Ministry of Economy, Trade and Industry from "Summer Power Saving Menu (For Households / For Businesses)" (2015)

Worldwide Air Conditioner Stock (Number of Units) and Electricity Demand

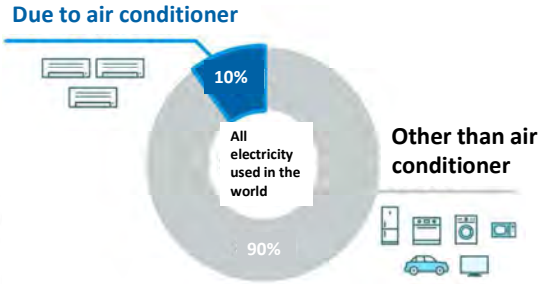


Prepared from International Energy Agency (IEA), "The Future of Cooling" (2018)

How many years does it take for one tree to absorb the CO2 emitted by an air conditioner?



Air conditioners consume 10% of all electricity in the world and Daikin air conditioners are among them.



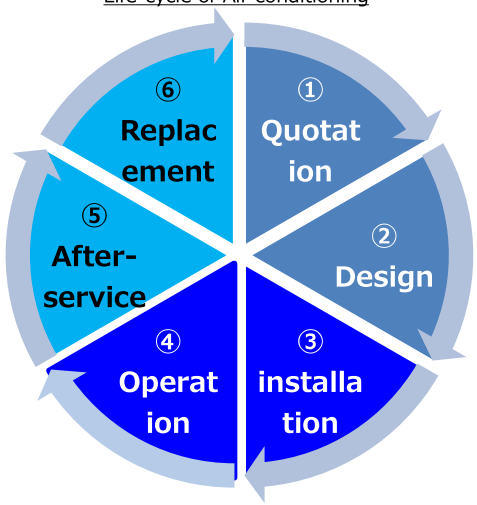
*Daikin calculations based on IEA/UNEP "Cooling Emissions and Policy Synthesis Report

Environmental Vision 2050

4) Solutions toward carbon neutrality

Reducing CO2 emissions throughout the air conditioning life cycle is required to commit carbon neutrality.

Life-cycle of Air conditioning



Proposal 1

Temperature/Humidity Controlled Ventilation & Air Conditioning system

Proposal 2

Efficient Chiller & iPlant Manager(Controller)

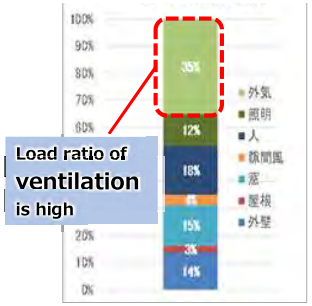
Proposal 1 ：Background

❒ Air conditioning in ASEAN offices is often set at low temperatures, **resulting in excessive cooling.** The power consumption of air conditioners is increasing due to the increased ventilation by Covid-19. **Electricity bills are also rising** due to problems in Ukraine.

Wearing the jacket because of excessive cooling (Thailand)

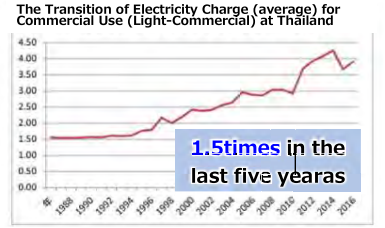
Load Ratio for Cooling

Load at the peak (Cooling)



Load ratio of **ventilation** is high

Transition of electricity charge (Thailand)



2016
·Residential : ¥10
·Commercial : ¥11

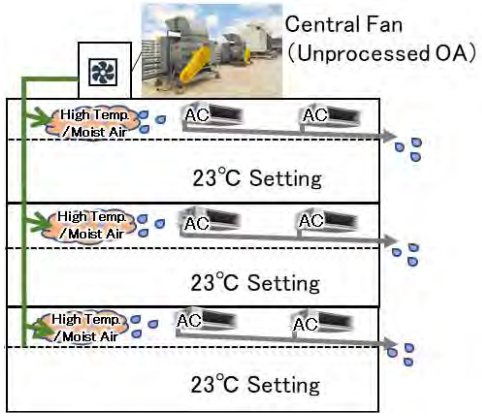
2021
·Residential : ¥15
·Commercial : ¥17

(Unit : /kWh)

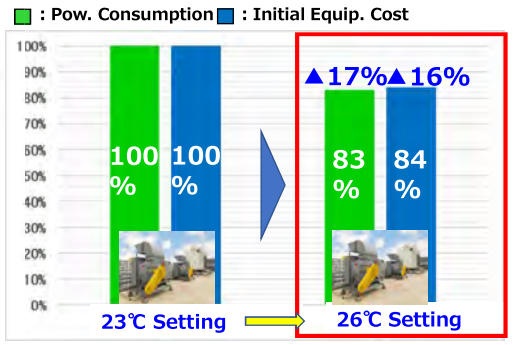
Proposal 1 ：Typical AC Systems in ASEAN Countries (Current System)

❒ In office buildings of ASEAN countries, a combination of large central fan and a AC with low temperature setting for dehumidification can be seen. This system has some disadvantages.

Image of Current AC System



Comparison: Power Consumption & Initial Equip. Cost



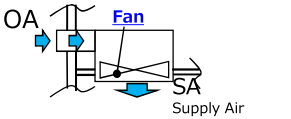
A. [AC] (18HP System) RXYP500FC×1, FXYMP90EB×6
[Ventilation] VFDS1300B (Box Fan)
B. [AC] (16HP System) RXYP400FC×1, FXYMP90EB×5
[Ventilation] VFDS1300B (Box Fan)

Proposal 1 ：Newly Proposed AC Systems (Counter Measures)

❒ To solve the issues of the current system, we propose the following AC systems. We aim to create an AC system that can save energy and maintain comfort level.

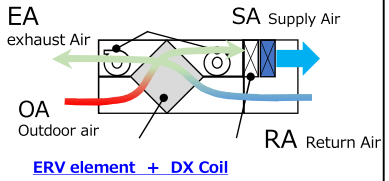
Current System

AC+natural ventilation
(23℃ Setting)



Newly Propose System

AC+ERV with DX Coil
(Positive Pressure)
+CO2 Control
+Interlock control with AC
(26℃ Setting)



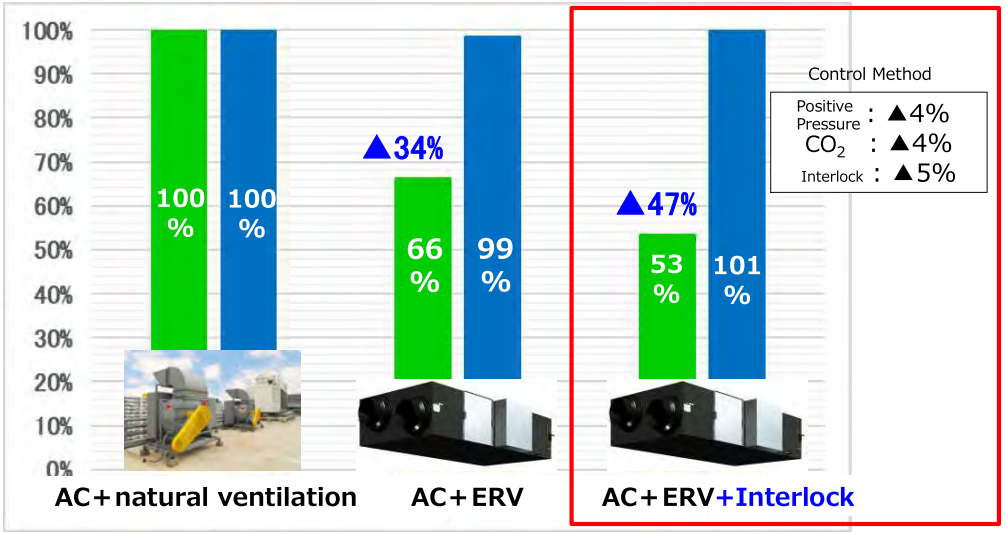
ERV element + DX Coil

Proposal 1 ：Conclusion of Calculation Results

❒By setting ERV at positive pressure (SA +20%), air infiltration can be lowered, and **approx. 4% of energy can be saved. CO2 control can further cut energy by 4%, and interlock with AC can cut it by approx. 5%.** Adding control is cheap, and energy can be saved at nearly equal cost as current system.

Comparison: Power Consumption & Initial Equip. Cost

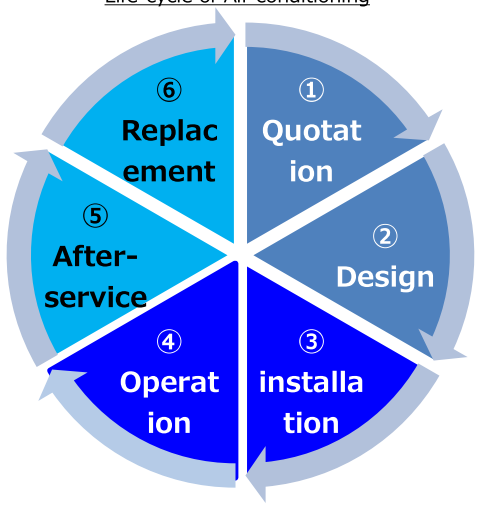
■ : Energy Consumption ■ : Initial Equip. Cost



4) Solutions toward carbon neutrality

Reducing CO2 emissions throughout the air conditioning life cycle is required to commit carbon neutrality.

Life-cycle of Air conditioning



Proposal 1

Temperature/Humidity Controlled Ventilation & Air Conditioning system

Proposal 2

Efficient Chiller & iPlant Manager(Controller)

Proposal 2 ：iPlantManager (Background)

What is Applied Product?

Product Lineup

Building Type	Air Conditioning Products
Large Comm. > 10k m2	Chiller, Air Handlers, Fan Coils
Mid Comm. < 10k m2	VRVs, Chiller, Rooftops, Fan Coils
Small Comm. > 2k m2	VRVs, Room ACs, Rooftops, Fan Coils
Residential	

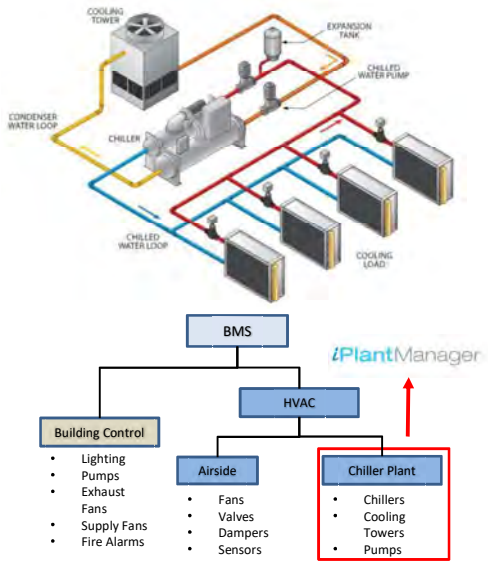
Use case of Applied product

KHALIFA STADIUM（Qatar Doha）
◆**Usage :** 2022 FIFA World Cup
◆**Equipment :** Turbo Chiller 3,000ton×18units

Proposal 2 ：iPlantManager overview

What is iPlantManager?

How Applied product works



iPlantManager product & service

Hardware

Dashboard

Monthly Reports

How iPlantManager?

Machine learning and Optimization algorithms have been implemented with below 2 key strategy's:

1) **Smart sequencing** focuses on combining the optimal chiller configuration.
2) **Smart Variable Flow** optimize the balance between chiller input power and pump power

iPlantManager uses state-of-the-art technology

AI - Machine Learning Backed Data Models

AI - Automatically Generated Control Algorithms

Automated Alerts if Operations Deviate from Target Efficiency Level

DAIKIN

Perfecting the Air

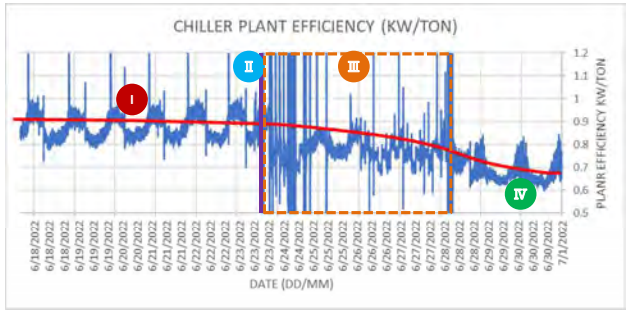
iPM Outcomes: Case Study in Singapore Hotel

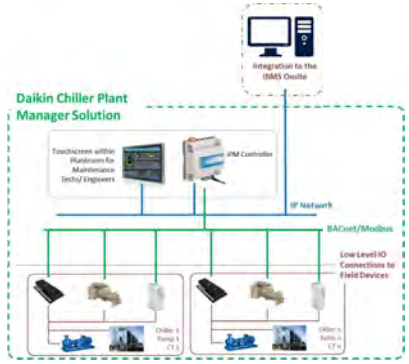
I Plant efficiency ~0.9kW/RT

II Installation of iPM

III iPM identified System Flow Issues through the inbuilt FDD which has now improve comfort and operation for the field FCUs

IV Plant efficiency jumped to ~0.62kW/RT, with optimized sequencing of chillers and overnight operation for 24/7 plant operation





Once iPM was installed 1 week of operation, **Plant efficiency jumped ~0.62kW/RT**, with improved comfort and operation

Development on Public Transport Electrification in Thailand

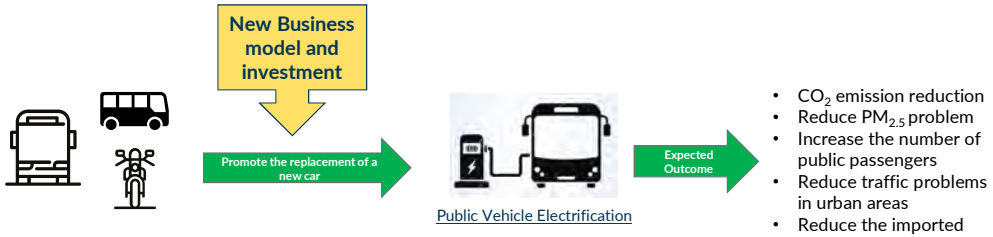
Wasintara Khuaikhoen
wasintara@thecreagy.com

29 Nov 2022

Outline

- Background & Study objective
- Integrated Assessment of Public Bus Electrification
- Integrated Assessment of Motorcycle Taxi Electrification
- Roadmap for Development on Public Transport Electrification


Background

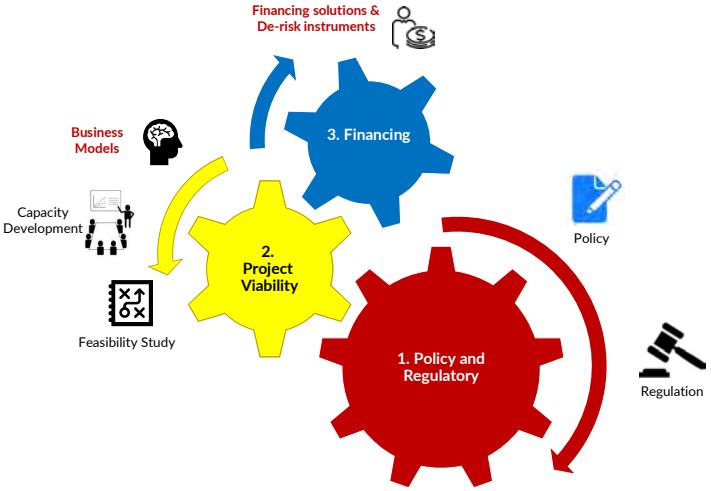


Study Objective

Key Objective:
To support Thailand to develop Country-driven effective **Financing and Business model solutions** for upscaling public & private investment on **public transport electrification.**

Focused Modes:

Bus Van Motorcycle Taxi

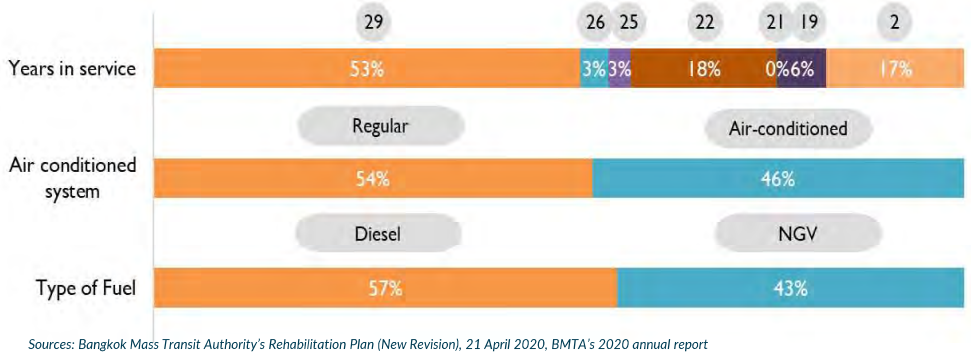


I. Integrated Assessment of Public Bus Electrification

- Status of public bus in Bangkok
- Total cost of ownership (Diesel, NGV, and electric buses)
- Financial and technical challenges for public bus electrification
- Proposed business models for public bus electrification

Status of public bus in Bangkok

- In 2021, there are 3,786 public buses in service
- Around 50% of buses are non-airconditioned diesel buses and have been operated for more than 29 years



Sources: Bangkok Mass Transit Authority's Rehabilitation Plan (New Revision), 21 April 2020, BMTA's 2020 annual report

Route & Fare

- As of April 2022, there are 239 service routes of public buses.
- 3 large operators operate in 225 routes, the rest of them (14 routes) are operated by SME.

Operators	Number of routes
BMTA	108
Thai Smile Bus	80
E Transport Holdings	37
Others	14
Total (excluding new routes)	**239**
New routes	30
Total	**269**

Sources: Bangkok Mass Transit Authority's Rehabilitation Plan (New Revision), 21 April 2020, https://classic.set.or.th/dat/news/202204/22041019.pdf, https://thaismilebus.com/about-us/, https://classic.set.or.th/dat/news/202203/22035439.pdf

- As of 21st January 2019, the Central Land Transport Control Board resolved to increase the fare. (Effective on 22nd April 2019)
- For non-airconditioned bus, the fare was increased by 1.50 THB.

Types of bus	Fare (Baht)		
	Ceiling price (Central Land Transport Control Board)	BMTA	Private operators
Non-airconditioned bus	10 (0.50 - 10)	8 (0.40 - 8)	10 (0.50 - 10)
Airconditioned bus (Old model)	13 – 21 (1.05 - 13)	12 - 20 (1.05 - 12)	13 - 21 (1.05 - 13)
Airconditioned bus (EURO)	14 – 26 (1.30 - 14)	13 - 25 (1.25 - 13)	14 - 26 (1.30 - 14)
Airconditioned bus (New model)	15, 20, 25 (1.25 - 15)	15, 20, 25 (1.25 - 15)	15, 20, 25 (1.25 - 15)

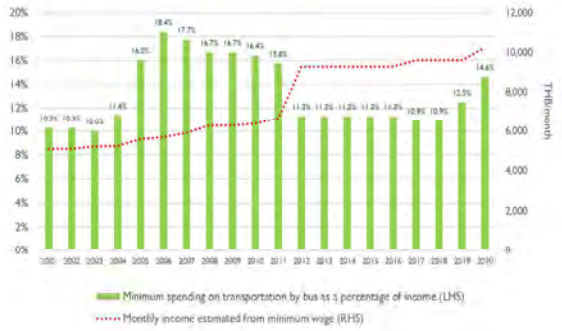
Remark: Numbers in () are the average fares per km of distance assuming that the longest distance is 20 km.
Source: https://mgronline.com/business/detail/9620000039833

Bus Fares

- Since 2003, a total of 6 fare increase were made, with an average increase of 5.68%

https://mgronline.com/business/detail/9620000039833,
http://www.eppo.go.th/index.php/th/energy-information

- Public buses fares account as 10.0%-18.4% of minimum income of people in Bangkok.



Note: Affordability level (Affordability) according to the Sustainable Urban Transport Index is 3.5% - 35%.
http://social.nesdc.go.th/SocialStat/StatReport_Final.aspx?reportid=3817&template=2R1C&yeartype=M&subcatid=11

Upgrading the public bus service to become everyone's choice is needed!

Replacement of new fleet

- Reduce cost of maintenance.
- Provide better service with reliable schedule due to the availability of fleet.
- Increase operators' revenues due to escalating number of passengers
- Reduce air pollution.

Improvement of service standard

- Reform service routes & networks.
- Promote safety of public transportation.
- Connect all mode of transportation
- Reduce traffic congestion and pollution

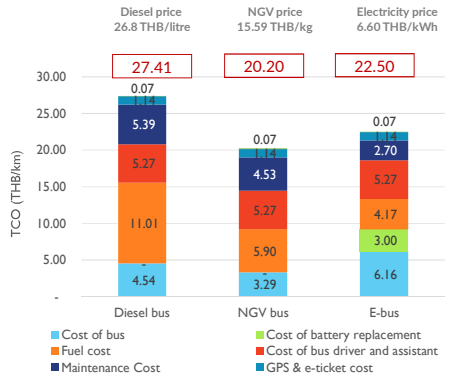
Fair adjustment of bus fare

- Allow reasonable adjustment of bus fare to encourage the development of service quality.
- Support from the government can be provided to specific groups, e.g., low-income groups, students, elderly.

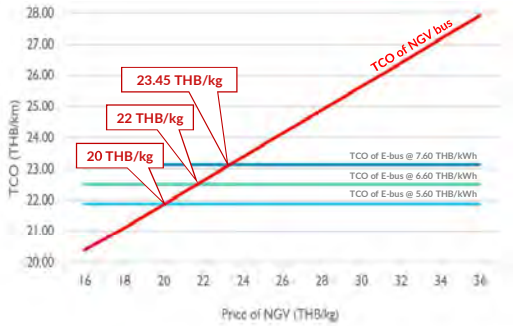
Which vehicles type that operator should be investing?

Total cost of ownership (TCO): Diesel, NGV, Electric Buses

- TCO of diesel bus is almost 5 THB/km higher than that of e-bus while TCO of NGV bus is about 2.30 THB/km lower than that of e-bus.

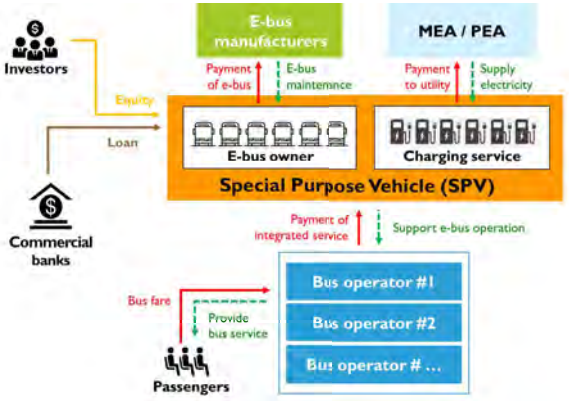


- If the NGV price increases to 22 THB/kg., the TCO of the NGV bus will be equivalent to that of the electric bus with an electricity price of 6.60 THB/kWh.



Note: If price of gas is 400-450 Baht/million BTU, the retail price of NGV will be around 20-22 Baht/kg., as of April 2022 with a pool gas price at 449.52 Baht/million BTU

Proposed option: Integrated End-to-End Financing Model



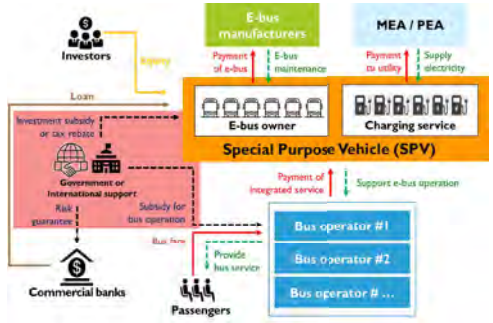
- This model aims to bundle all services/products required for public bus electrification (mainly vehicle, battery, charging infrastructure) to provide integrated solution.
- Key players include:
  - **Integrated end-to-end service SPV:** owning all assets required for public bus electrification through a long-term contract with e-bus manufacturers as well as charging infrastructure suppliers and providing integrated end-to-end service to the bus operators under long-term contracts with bus operators
  - **Bus operator:** running buses for public service under the long-term contract on provision of integrated service between integrated SPV and bus operators. An operator will be charged for integrated service monthly at the rate per km (operating distance) while the revenue comes from the collection of fares.

Financial assessment of integrated end-to-end financing model

Concept: Find a charging rate for end-to-end service (THB/km) that allows an attractive investment return to integrated service SPV. (IRR > 10%)

NPV of the bus operator is negative; therefore, additional financial support is needed.

Items	Unit	Number of buses in the fleet		
		30 buses	100 buses	500 buses
Total charge for end-to-end service	THB/km/bus	30.00	28.75	27.75
Revenue from bus fares	THB/bus/year	2,280,000		
Annual ridership	Passenger-trip	152,000		
Bus fare	THB/passenger-trip	15.00		
Return on investment				
1) Integrated service SPV				
• NPV	MB	33.11	99.19	727.83
• IRR	%	10.15%	10.06%	11.15%
• ROE	%	13.54%	13.36%	15.60%
• Payback Period	years	12.75	12.84	11.90
2) Bus operator				
· NPV	MB	(144.10)	(394.97)	(1,974.85)



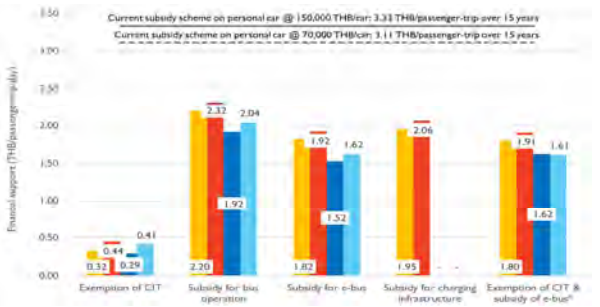
Scenario analysis on support needed for integrated end-to-end financing model

Items	Scenario I	Scenario II	Scenario III	Scenario IV
Number of buses to invest	500 vehicles			
Total charge for end-to-end service (THB/km/bus)	26.75	27.75	22.95	22.95
Options for financial support from government only				
- Exemption of corporate income tax (years)	5 years			5 years
- Subsidy for bus operation (THB/km)		4.80		
Options for financial support from government or international agencies				
- Investment subsidy for e-bus (%)			26%	23%
- Investment subsidy for charging infrastructure				
- Risk guarantee	Fee @ 3%			
Size of fund needed (MB)				
- Subsidy for bus operation (NPV over 15 years)		1,638.91		
- Investment subsidy for e-bus & charging infra.			1,302.87	1,152.54
- Decrease of govt revenues due to tax exemption	244.66	-	-	137.85
Sub-total	244.66	1,638.91	1,302.87	1,290.39
- Risk guarantee	105.23	105.23	86.36	88.54
Total	349.89	1,744.14	1,389.23	1,378.93
Return on investment				
1) End-to-end service SPV				
· NPV (MB)	417.09	434.94	320.06	324.04
· IRR (%)	10.05%	10.06%	10.04%	10.04%
· ROE (%)	13.63%	13.37%	13.73%	13.89%
· Payback Period (years)	12.81	12.84	12.86	12.84
2) Bus operator				
· NPV (MB)	(1,196.27)	4.07	4.07	4.52

Supports needed for public bus electrification VS existing subsidy scheme for electric personal cars

Scenario	Financial options	Operating lease		Integrated end-to-end service	
		w/o risk guarantee	with risk guarantee	w/o risk guarantee	with risk guarantee
I	Exemption of CIT	274	379	245	350
II	Subsidy for bus operation	1,878	1,983	1,639	1,744
III	Subsidy for e-bus*	1,558	1,641	1,303	1,389
IV	Subsidy for charging infrastructure	1,666	1,764	-	-
V	Exemption of CIT & subsidy of e-bus*	1,543	1,629	1,389	1,379

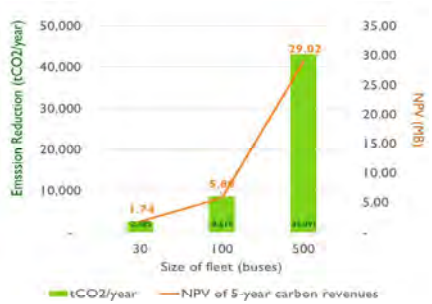
*Remark: *Subsidy is provided for the investment cost of both e-buses and charging infrastructure in the integrated end-to-end service model.*



- ✓ Sizes of fund required for the operating lease model for all scenarios are slightly higher than that required for the integrated end-to-end service.
- ✓ The subsidy for bus operation (Scenario 2) requires the largest fund.
- ✓ **Rate of support per passenger-trip over the 15-year lifetime**
  - Personal cars: 3.11 - 3.55 THB/passenger trip
  - E-bus: highest at 2.32 THB/passenger trip
- ✓ **Beneficiaries over 15-year lifetime**
  - 18,600 – 28,300 electric personal cars: **510 - 776 million passenger-trip**
  - 500 buses: 1,140 million passenger-trips

500-electric-buses fleet can reduce about 43,091 tCO2/year.

- Replacement of e-bus for existing diesel bus fleet reduces 86 tCO_2/bus/year.
- 500-buses fleet can reduce about 43,091 tCO2/year and generate revenues of about 29.02 MB for a 5-year crediting period. (@ 5 USD/tCO_2)



GHG abatement cost of the support needs for promoting 500-public-bus electrification (Unit: USD/tCO_2)

Scenario	Financial options	Operating lease		Integrated end-to-end service	
		w/o risk guarantee	with risk guarantee	w/o risk guarantee	with risk guarantee
I	Exemption of CIT	22.26	30.49	19.67	28.12
II	Subsidy for bus operation	150.95	159.42	131.74	140.19
III	Subsidy for e-bus*	125.22	131.92	104.73	111.67
IV	Subsidy for charging infrastructure	133.95	141.80	-	-
V	Exemption of CIT & subsidy of e-bus*	124.00	130.96	103.74	110.86

Remarks:
1. The exemption of CIT only (Scenario I) cannot make the project feasible.
2. Subsidy is provided for the investment cost of both e-buses and charging infrastructure in the integrated end-to-end service model.
3. The discounted amount of tCO_2 over 15-year lifetime is 368,836 tCO_2.
4. Exchange rate: 1 USD = 33.73 THB (Data from BOT during Jan – Jun 2022)

The proposed business model can remove key financial barriers

However, the remaining barriers need further actions taken by the government.

Uncertain demand of e-bus	• Clear target setting of public bus electrification
Bus fare, the main source of revenue of bus operators, is regulated and keeps low.	• New model for bus operators (e.g., bus contracting model in Singapore -- fixed fee provided for the delivery of high standard services)
Timely and complicated permission process	• Improved permission process for charging service providers
Availability of land or space for charging infrastructure	• Allocation of land and improvement of grid infrastructure to promote the investment on charging services.

Modernized Public Bus Service:
- ✓ **safe,**
- ✓ **comfortable**
- ✓ **punctual,**
- ✓ **with high standard of service, and**
- ✓ **environmentally-friendly**

2. Integrated Assessment of Motorcycle Taxi Electrification

- Status of motorcycle taxi in Bangkok
- Total cost of ownership (Gasoline & electric motorcycle)
- Financial and technical challenges for motorcycle taxi electrification
- Proposed business models for motorcycle taxi electrification

Market for Motorcycle Taxi
Key Figures and Information

Service Demand Size, 2020 (ridership)

300 million passenger-trip/year (for BKK & metro)

Service Supply Size, 2020

5,564 motorcycle taxi stands
84,889 motorcycle taxi riders

Vehicle Supply Size, 2020

87,960 motorcycle taxis
Honda, **Yamaha**, **Suzuki** are the most popular vehicle brands

Key stakeholders

- Regulators: The 11th Military District, DLT, Metropolitan Police Bureau and BMA
- Associations: The motorcycle taxi association
- Large operators: Chatuchak, Rajthevi

Licensing & Routing

- Fare is partly regulated, but also subject to negotiation between drivers and clients

Existing motorcycle fleet profile

Number of total fleet (national and/or BKK), categorised by fuel type, emission standards or any other criterion that is available

E-motorcycle manufacturers or operators or Pilot projects

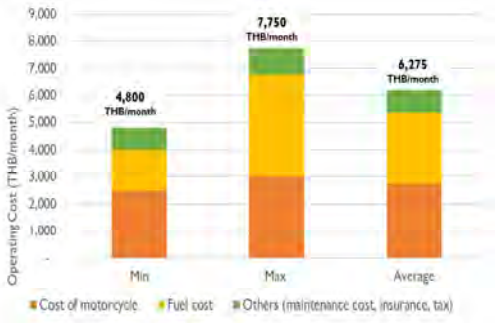
Example: Edison, Elon, Tatung, Winnonie

Status of motorcycle taxi operators in Bangkok

According to the field survey, the status of riders is as follows:

- **Most of them are individual operators. They own vehicles and provide taxi service. Their income is unstable, with an average of around 620 Baht/day, varying from around 300-1,000 Baht/day.**
- **Their expenses are approximately 4,800 – 7,750 baht/month, divided into**
  (1) Loan repayment for vehicle: 2,500 - 3,000 THB/month
  (2) Fuel cost: 1,500 – 3,750 THB/month
  (3) Others: about 800 - 1,000 THB/month.

- **Operating cost of public motorcycle taxi (excluding income of rider)**

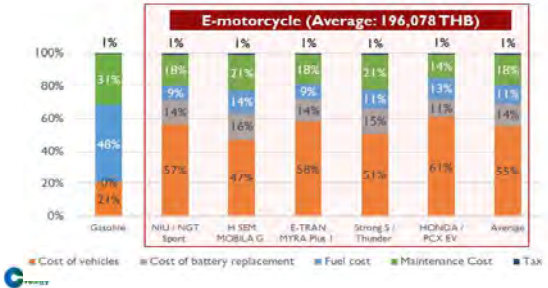


Which vehicles type that operator should be investing?

Total cost of ownership (TCO): Gasoline and Electric Motorcycle Taxi

CAPEX & OPEX over 6 years (lifetime)

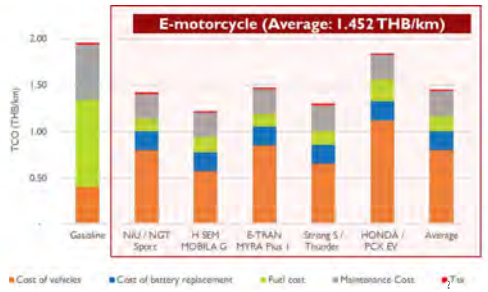
Cost \ Model	Gasoline motorcycle	Electric motorcycle: NIU / NGT Sport	H SEM MOBILA G	E-TRAN MYRA Plus I	Strong S / Thunder	HONDA / PCX EV	Average
CAPEX (THB)	54,500	136,181	105,181	142,741	116,181	178,692	135,795
OPEX (THB)	209,546	55,553	60,394	56,195	59,284	69,991	60,283
Total (THB)	264,046	191,733	165,575	198,935	175,465	248,684	196,078



TCO : THB/km.

Cost \ Model	Gasoline motorcycle	Electric motorcycle model: NIU / NGT Sport	H SEM MOBILA G	E-TRAN MYRA Plus I	Strong S / Thunder	HONDA / PCX EV	Average
TCO (THB/km)	1.956	1.420	1.226	1.474	1.300	1.842	1.452

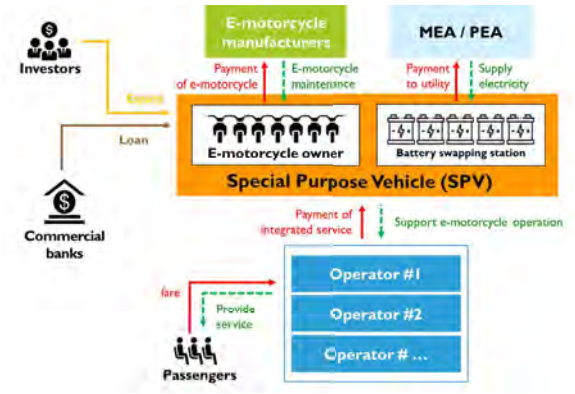
Remark: From the field survey, the total distance in service of a motorcycle taxi is about 75 km/day or 135,000 km over its 6-year lifetime.



Financial and technical challenges for motorcycle taxi electrification

	Technical	Financial
E- Motorcycle and battery manufacturer	• Uncertain demand of electric motorcycles • Need for electric motorcycle model of which the battery capacity is sufficient for 100 – 160 km/day • Existing models of e-motorcycle in the market (small size& low speed) do not match with the needs of motorcycle taxi drivers. • Timely process for local certification of new e-motorcycle model by the manufacturers • Lack of operators' awareness on safety of electric motorcycles	• Limited access to financing and lack of confidence from financial institutions on EV manufacturers • Higher production cost of local manufacturers compared to import cost (especially exemption of import tax) • No reference for residual value of EV, especially public EV that commercial banks can apply for assessing project financing
Motorcycle operator	• No universal batteries for all models • Timely and complicated process for DLT's registration of e-motorcycles • Limited technical capacity to maintain and repair of e-motorcycles • Lack of confidence on the capacity of batteries and the limited availability of charging stations or battery swapping stations	• Relatively high investment cost of e-motorcycle acquisition • Limited credits of operators to access financing • Lack of confidence from financial institutions and insurance sector • Lack of confidence on sufficient charging stations and unstable electricity price
Battery swapping station	• Relatively high investment cost of battery swapping stations • Unstable electricity price	• Uncertain demand due to small number of e-motorcycle • No clear standard and in-charge public sector on battery swapping stations in Thailand leading to difficulties for battery swapping businesses in accessing financial support from the government • Timely and complicated permission process

Proposed Model: Integrated End-to-end Financing Model



- This model aims to bundle all services/products required for motorcycle taxi electrification (mainly vehicle, battery, and charging infrastructure) to provide an integrated solution.
- Key players include:
  - **Integrated end-to-end service SPV:** owning all assets required for motorcycle taxi electrification through a long-term contract with e-motorcycle manufacturers as well as charging infrastructure suppliers and providing an integrated end-to-end service to the motorcycle taxi operators under monthly or yearly contracts.
  - **Motorcycle taxi operators (riders):** providing service to passengers. Operators can rent electric motorcycles together with maintenance and charging services through the SPV. Operators will be charged for integrated service on a monthly basis while the revenue comes from the fare collection.

Financial assessment of integrated end-to-end financing model

Concept: Find a charging rate for end-to-end service (THB/year) that allows an attractive investment return to integrated service SPV. (IRR > 10%)

Items	Unit	Scenario I	Scenario II	Scenario III
Targets of e-motorcycle in 2030	units	10,000	85,000	650,000
Total batteries in 2030	pieces	15,000	127,500	975,000
Total modules of batteries in 2030	modules	750	6,375	48,750
Operating cost of operators				
Baseline operating cost of operator	THB/year		75,300	
Service fee	THB/year	42,000	40,500	39,500
Net savings for the operators	THB/year	33,300	34,800	35,800
Return on investment: Integrated service SPV				
· NPV	MB	126.52	744.92	5,655.38
· IRR	%	10.50%	10.15%	10.56%
· Payback Period	years	9.55	9.83	9.60

Remarks:
1. The goal of the initial assessment is to find the rate of charge for end-to-end service (THB/year) that allows an attractive return of investment to an integrated service SPV, i.e., the IRR of the investment is not less than 10%).
2. Scenario I: Assumed by consultants at 1,000 e-motorcycle deployed each year
   Scenario II: All motorcycle taxi in Bangkok changes to e-motorcycle
   Scenario III: Targets of national plan (30@30 policy)

- It is feasible for integrated service SPV to invest on both e-motorcycles and BSS. Also, the operator can save monthly operating cost.
- However, it requires high investment cost for BSS in the early years and the SPV is facing risks on uncertain demand.
- The government support is needed for developing BSS infrastructure for electric motorcycle.

Source: https://www.global-imi.com/blog/electric-vehicle-battery-swapping-boom-or-bust

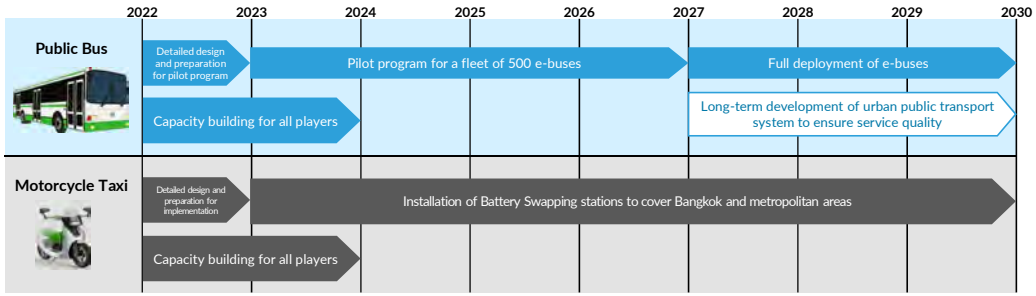
Scenario analysis on support needed integrated end-to-end financing model

Items	Unit	Scenario I	Scenario II	Scenario III
Targets of e-motorcycle in 2030	units	10,000	85,000	650,000
Total batteries in 2030	pieces	15,000	127,500	975,000
Total modules of batteries in 2030	modules	750	6,375	48,750
Operating cost of operators				
Baseline operating cost of operator	THB/year		75,300	
Service fee charged to operators (50% savings)	THB/year		37,650	
Investment subsidy needed				
• Total investment (e-motorcycle + BSS)	MB	1,463	10,353	70,621
• Total investment (BSS only)	MB	960	6,077	44,189
• % of totol investment (BSS only)	%	30%	20%	10%
• NPV of subsidy	MB	288	1,215	4,419
• Subsidy per module	THB	72,500	57,500	32,500
				Return on investment: Integrated service SPV
• NPV	MB	87.29	631.47	4,092.31
• IRR	%	10.03%	10.06%	10.00%
• Payback Period	years	9.6	9.8	9.7
				Abatement cost
• Total CO2 reduction	tCO_2	72,217	507,242	3,561,681
• CO_2 abatement cost	THB/tCO_2	3,989.13	2,396.13	1,240.67
• CO_2 abatement cost	USD/tCO_2	118.27	71.04	36.78

Remarks: Scenario I: Assumed by consultants at 1,000 e-motorcycle deployed each year
Scenario II: All motorcycle taxi in Bangkok changes to e-motorcycle
Scenario III: Targets of national plan (30@30)

Roadmap for Development on Public Transport Electrification in Thailand

Roadmap for Development on Public Transport Electrification



Roadmap of operationalising financial mechanisms for public bus electrification in Thailand

	Preparation (2022 – 2023)	Pilot (2024 – 2026)	Full Deployment (2027 onwards)
Government	• Setting clear target for pilot and long-term phase, • Selection of financial packages, • Acquisition of fund for financial packages or revision of some existing scheme, i.e., BOI, investment subsidy, • Improved permission process for charging service providers • Allocation of land and improvement of grid infrastructure to promote the investment on charging services.	• Provision of financial support to SPVs and bus operators • Provision of technical assessment support for commercial banks • Monitoring and evaluation the result of pilot project to ensure that all barriers are removed	• Long-term development of urban public transport to remove overlapping routes and improve service quality – • New institution arrangement • New models for bus operators
International Support			
Commercial banks	• Capacity building related to guidelines on EV technology and clear policy direction	• Provision of soft loan to SPVs	• Provision of debt financing (no preferential needed)
SPV	• Setting up SPV(s) with specialization on electric vehicles and charging infrastructure • Capacity development for technicians on EV and charging infrastructure	• Procurement of **500 e-buses** • Investment on charging infrastructure	• Providing lease for all e-buses or providing integrated services for all e-buses to bus operators
Bus operators	• Capacity building for bus operators on running e-buses	• Running 500 e-buses for public service	• Running all e-buses for public service

Roadmap to promote battery swapping stations for public electric motorcycle

	Preparation (2022 – 2023)	Implementation (2024 - 2030)
Government	• Setting clear target for e-motorcycles and BSS • Development of universal battery • Considering appropriate level of financial supports • Provision of financial supports • Identification of the clear process of BSS licensing and in-charge government agency • Identification of locations with reliable electricity systems for BSS	• Financial support to SPV, mainly for the expansion of BSS network
International Support		
Commercial banks	• Provide technical assistance in determining loans for BSS investment	• Soft loan for SPV for investing in e-motorcycles and BSS network
SPV	• Setting up integrated end-to-end financing SPV • Capacity development for technicians on e-motorcycle maintenance and repair of charging infrastructure	• Developing BSS networks to cover Bangkok Metropolitan Region • Providing services to motorcycle taxi operators
Operators / Drivers	• Capacity building and technical understanding on how to utilize e-motorcycle	• Providing service to passengers with GPS tracking for quality of service

Thank you for your attention.

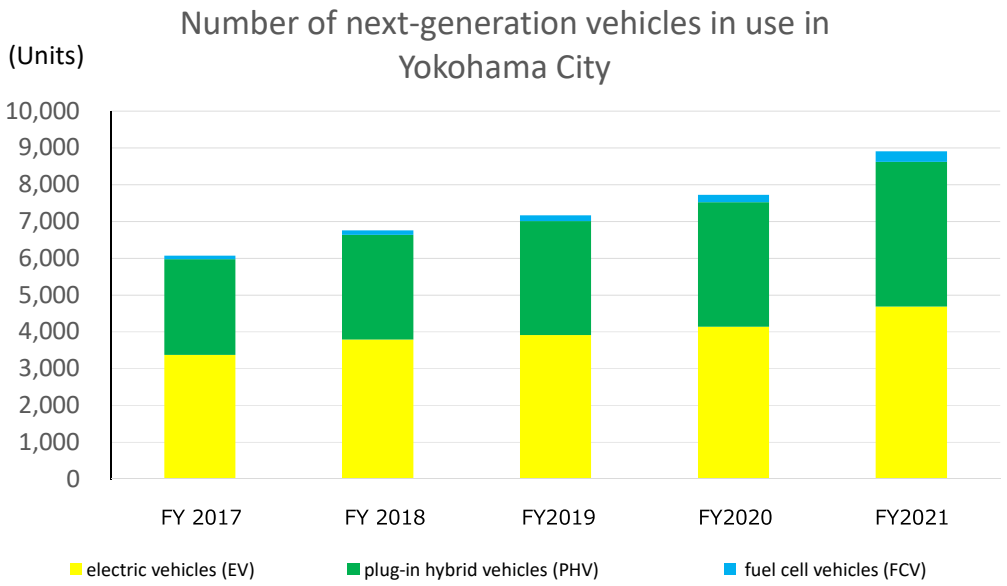
Introduction target (number) of next-generation vehicles

● Yokohama City has set three major introduction plans for next-generation vehicles*1.

*1 Yokohama City defines three types of electric vehicles (EV), plug-in hybrid vehicles (PHV), and fuel cell vehicles (FCV) as "next-generation vehicles".

Name of Plan	Goal indicator	Target Number	Target Year (JFY)
Mid-term four-year plan 2018-2021	Number of next-generation vehicles in the city	10,000 Units	FY 2021
Action Plan for Global Warming Countermeasures (Area Measures Edition)	Number of next-generation vehicles in the city	9,000 Units	FY 2020
Action Plan for Global Warming Countermeasures (City Hall Edition)	Ratio of next-generation vehicles, etc.*2 in official vehicle for general purpose*3 owned by Yokohama City * 2 Next-generation vehicle + hybrid vehicle (HV) * 3 Official vehicles other than official vehicles for special purpose such as buses and fire trucks	100%	FY 2030

*1,288,675 vehicles registered in the city (as of the end of March 2022)



Specific efforts to promote the next-generation vehicles (subsidies)

● Attraction and installation of hydrogen stations, subsidies for construction of hydrogen station, purchasing FCV

In addition to subsidizing purchase costs of FCV and hydrogen station construction, information exchange with business entity related to hydrogen stations is conducted.

Stationary type hydrogen station

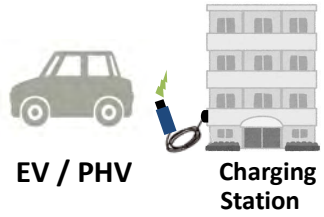
FCV (fuel cell vehicle)

Specific efforts to promote the next-generation vehicles (subsidies)

● Subsidy for installation of charging equipment for collective housing, subsidy for installation of V2H charging/discharging equipment

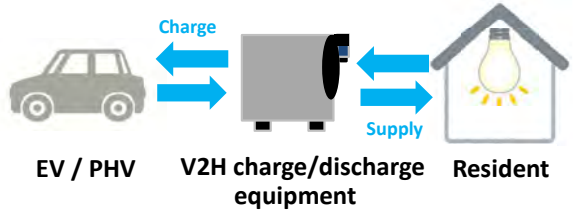
In order to promote the popularization of EVs and their use as power sources in the event of a disaster, etc., subsidies are provided for charging facilities for EVs installed in collective housing (condominiums, etc.) and V2H (Vehicle to Home) systems that allow electricity to be exchanged between houses and automobiles

Charging Station (Charging to EV, etc.)



EV / PHV　Charging Station

V2H charge/discharge equipment
*In addition to charging the vehicle, the vehicle's electricity can be supplied to the house. Therefore, it can be used as an emergency power source in the time of a disaster.



EV / PHV　V2H charge/discharge equipment　Resident

Concrete efforts to promote the next-generation vehicles (proactive introduction to official vehicles)

When updating or newly introducing general official vehicles, next-generation vehicles should be introduced to passenger cars, and next-generation vehicles or hybrid vehicles should be introduced to freight vehicles in principle.

Yokohama city is aiming for introducing 100% next-generation vehicles by 2030 JFY.

		Official vehicle for general purpose		Official car of special purpose
		For riding	Freight	Bus / Fire truck / Ambulance, etc.
		The introduction of EV・PHV・FCV in principle	The introduction of EV / PHV / FCV / HV in principle	Renewal and new introduction of more Low-fuel consumption vehicles
Target	2030JFY	The introduction ratio of EV・PHV・FCV・HV: 100%		—

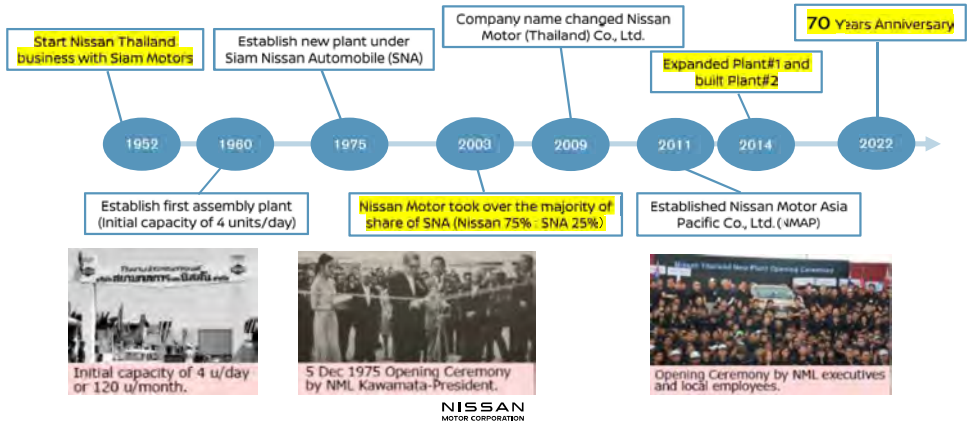
Specific efforts to promote the next-generation vehicles (dissemination and enlightenment, public-private partnership)

○ Partnership agreement with car dealers, etc. regarding the popularization and enlightenment of next-generation vehicles was concluded (November 2022)

A kick-off event was held in front of Sakuragicho Station on November 3rd.

70 years history in Thailand

- Nissan has been present in the ASEAN region for 70 years, employing employees across R&D, manufacturing, logistics and Sales & Marketing operations.
- Nissan's manufacturing operations in Thailand are the brand's regional hub for ASEAN and the R&D center in Thailand providing testing facilities for 90 countries globally.



Nissan Ambition 2030

- Our long-term vision for empowering mobility and beyond
- We aim to become a truly sustainable company, driving towards a cleaner, safer, and more inclusive world
- Nissan Ambition 2030 lays out our plan to deliver superior value by empowering journeys and society through electrified vehicles and technological innovations
- Electrification at the center of our strategy

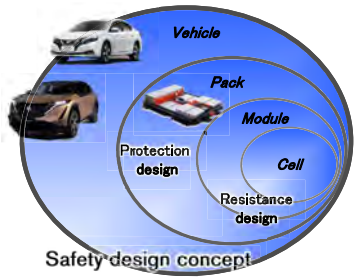
NISSAN AMBITION 2030
Together we empower mobility and beyond

Realize zero emission society through electrification as a pioneer and global leader of EV

EV Ecosystem: moving beyond mobility

Nissan EV battery reliability

- Prioritize safety and durability while increasing energy density.



0 incidents

Nissan LEAF

60K~ units × 192~cells** = >100M cells

* Production base as of Oct, 2022
** battery with 288 cells available in some markets

EV system durability tested in various scenes


Submerging

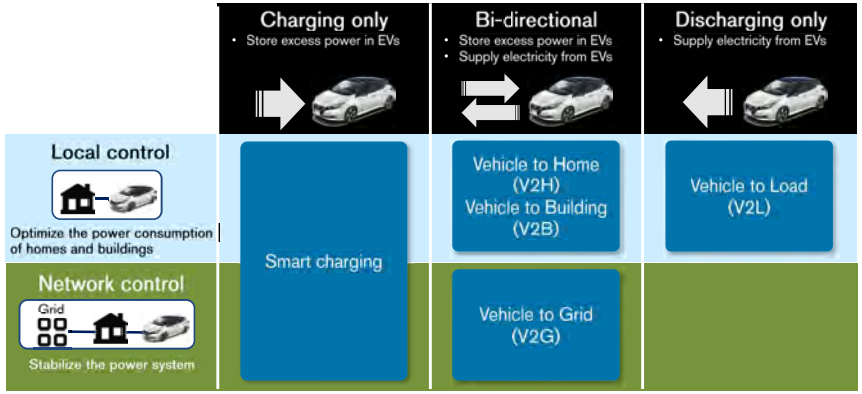

Charging in the rain


Wavelike passage


Thunder

Nissan Energy Share: Technology overview

- Nissan EVs have the capacity to store and supply electricity via EVs.
- The technology that makes effective use of power using this capability is called V2X (V2H, V2B, V2G, V2L).



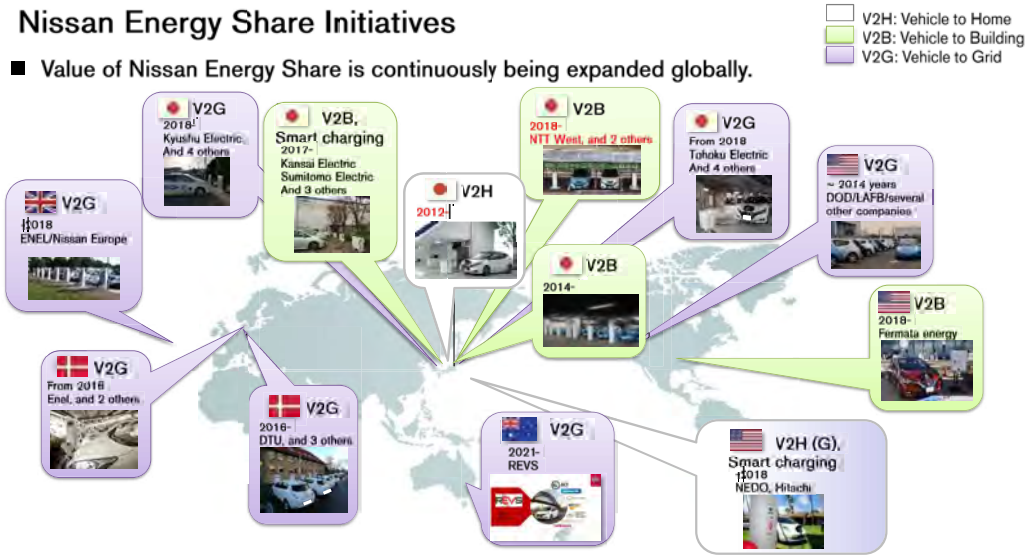
Nissan Energy Share: Value provided

- Enables multipurpose use of electricity stored in Nissan EVs.
- The ability to share electric power with residences and commercial buildings and local communities, providing new value to people's lives.

	Values to customer			Value to society	
	Electricity bill savings	Incentive acquisitions	Back-up energy	Power grid stabilization	Efficient use of Renewable energy
Smart Charging	○	○		○	○
V2H (Home)	○		○		
V2B (Building)	○		○		
V2G (Grid)		○		○	○
V2L (Load)			○		
	Economic		Emergency	Environmental	

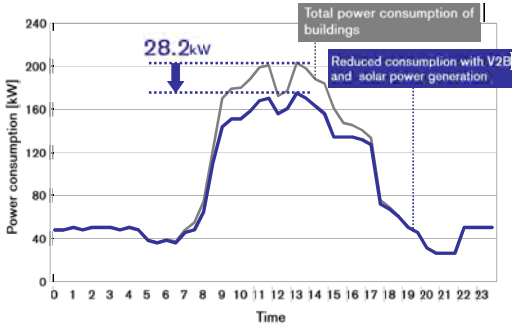
Nissan Energy Share Initiatives

- Value of Nissan Energy Share is continuously being expanded globally.



Project Example : V2B project with NTT West

- NTT West's office building (Yamaguchi Prefecture) achieved a reduction in peak consumption that yielded a savings of approx. 663,000 yen per year in electricity base rates with a combination of V2B and solar panels.
  - Consumption of 28.2 kW was reduced from highest peak (by 3EVs and PV panels)
  - Boosting RE 100 * and EV 100 * * initiatives



- Nissan Leaf (40 kWh) x 3
- Bi-directional charger (5 kW each) x 3
- Solar panels (16.5 kW)

**RE100: Global corporate leadership initiative bringing together influential businesses committed to 100% renewable electricity.
***EV100: Global initiative bringing together forward-looking companies committed to accelerating transition to EVs and making electric transport the new normal

Blue Switch: utilizing electric vehicle as a solution for social challenges

ブルー・スイッチ
BLUE SWITCH

令和3年度
気候変動アクション
環境大臣表彰
Minister of Environment Climate Action Award 2021

- 195 projects around the national, utilizing Nissan EV as a solution for social problems
- About 70% projects were for disaster management which utilizing EVs as the emergency back up power

<Nursing Homes> <Elders Day Cares Center>

Blue Switch HP: https://ev.nissan.co.jp/BLUESWITCH/

"Blue Switch Activity" in ASEAN

Mission

Contribute Thai society through EV promotion to make cleaner, sustainable and smart society
✓Address social concerns, such as CO2 reduction, Energy management, Eco-tourism and Disaster relief with EV as solution to realize a zero-emission society

(*Blue Switch was officially launched May 2016 in Japan to celebrate 100K units LEAF Sales)

Blue Switch declaration in THI (Feb'22)

- Nissan Thailand has opened "*Nissan Electrification Experience Center*" to demonstrate EV solution for the society in Thailand.

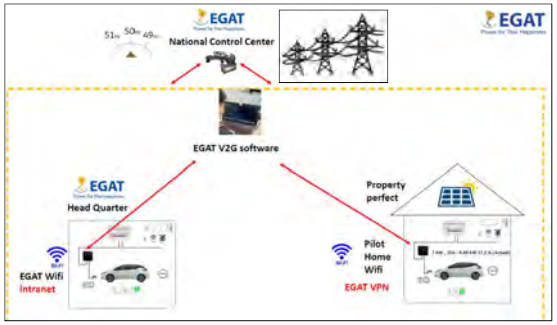
Disaster relief in Typhoon PHI (Dec '21)

- Typhoon Rai hit Philippines in Dec '21, Nissan Philippines assisted communities in Cebu and Tacloban by restoring power using Nissan LEAF and Power Mover (V2L)
- More than 1,000 devices are charged via Nissan LEAF

EGAT & NISSAN V2G pilot project summary

- Partner : Electricity Generating Authority of Thailand (EGAT), State enterprise as Electricity generator/transmitter
- Key concept : First project to demonstrate V2G with actual EV(LEAF) owners in Thailand
- Objective
  - Gather the LEAF owners' real charge/discharge condition data for future analysis.
  - Rule making and business model establishment for V2G technology

Project image



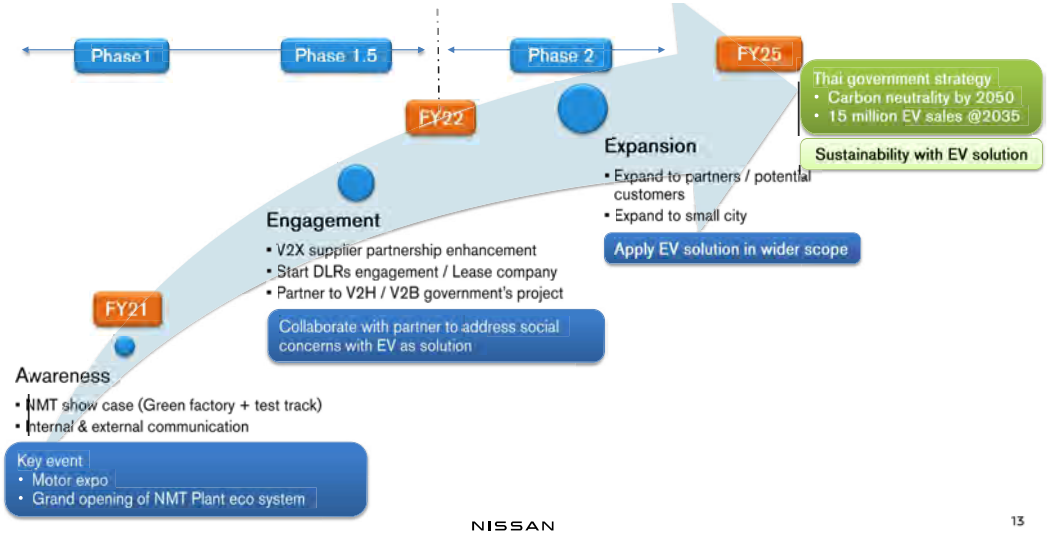
Bi-directional charger
Quasar (Made by Wallbox in Spain)

Vehicle
NISSAN LEAF

V2G control system
Provided and operated by EGAT

Other conditions
- 20 LEAF owners will join this project
- 2 years period

Blue Switch in Thailand: NMT activity road map



Thank you !