



DENSO

Crafting the Core

DENSO “Lean & Clean” Factory toward CO₂ Neutrality

Agenda

- 1.Outline of DENSO
- 2.CO₂ Neutrality Effect & DENSO Challenge
 - DENSO “Lean & Clean” Factory-
- 3.Lean Manufacturing & Lean Automation
- 4.Lean Energy
- 5.Clean Energy
- 6.Summary

8th June 2023

Dr.Theerawat Limpibunternng

Siam DENSO Manufacturing Co.,Ltd.

DENSO Group: Group Profile & Key Figures

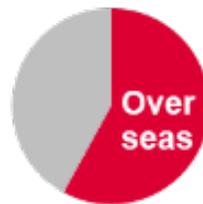
DENSO is known as 'World Leading Automotive Parts Supplier' for more than 70 years, continuously focuses on R&D for its best.

Established

Dec. 1949

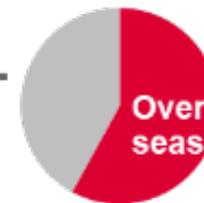
Consolidated Rev.

5.5 Trillion Yen



Employees

170,000



Global Network



Overseas Revenue Ratio

57%

Patents hold Globally

41,500

Medals Won

at World Skills Competitions

69

DENSO Group Overview: Main Products

Powertrain



Gasoline engine system



Diesel common-rail system



Discharge system



Starter, Alternator



Hybrid system

Information & Safety



Display



Head-up display



Milliwave radar



ETC



Laser radar



Electronic Control



Computer on automobiles (ECU)



Semi-conductor



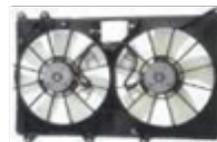
Thermal Management



Car Air-Conditioning



Compressor



Engine cooler



Radiator

Non-automobile



QR scanner



Robot



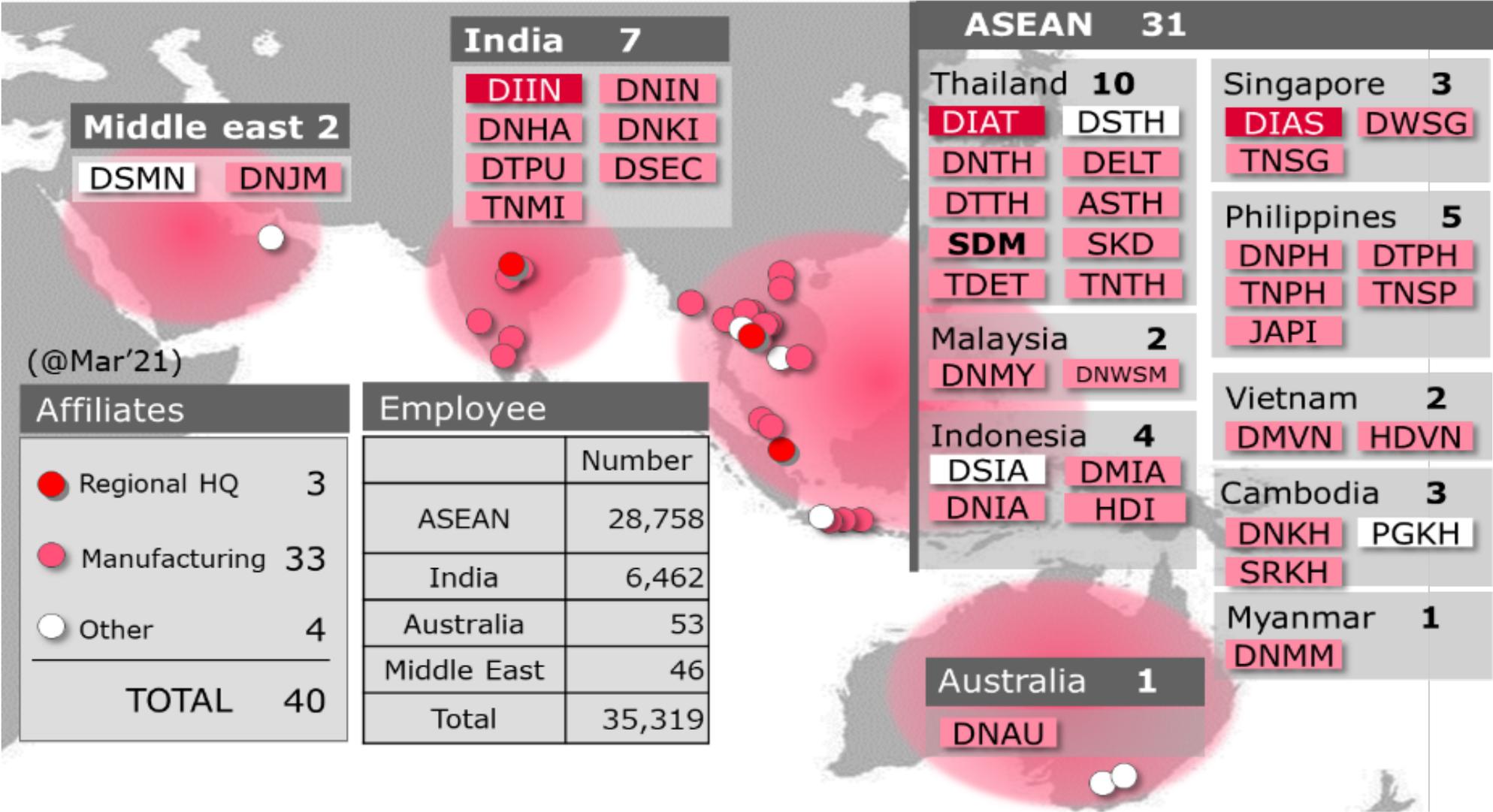
Spot A/C



CO2 Boiler

Strength: Integration of several elements & engineering

DENSO Business in Asia



40 Operations in Asia with HQ & 10 companies in Thailand.

“DENSO will eliminate CO₂ emissions by 2035”



Our goal is to eliminate CO₂ emissions by 2035. We will work on two separate goals: developing products that contribute to decarbonization, and reducing CO₂ emissions from manufacturing at plants.

(excerpt from Nikkei Online *One of the biggest media in Japan)

Key issue for Asia
Firstly focus on
Scope 1 & 2

We will focus on three fields.

(1) Manufacturing

The focus is how to reduce CO₂ emissions from plants in the product manufacturing process.



(2) Mobility products

We will develop broad technologies, from increasing the fuel efficiency of internal combustion engines to EVs, HVs, and FCVs. We will carefully allocate our resources.



(3) Energy use

We will develop systems for collecting and reusing CO₂ in the atmosphere and CO₂ emissions from plants and offices.

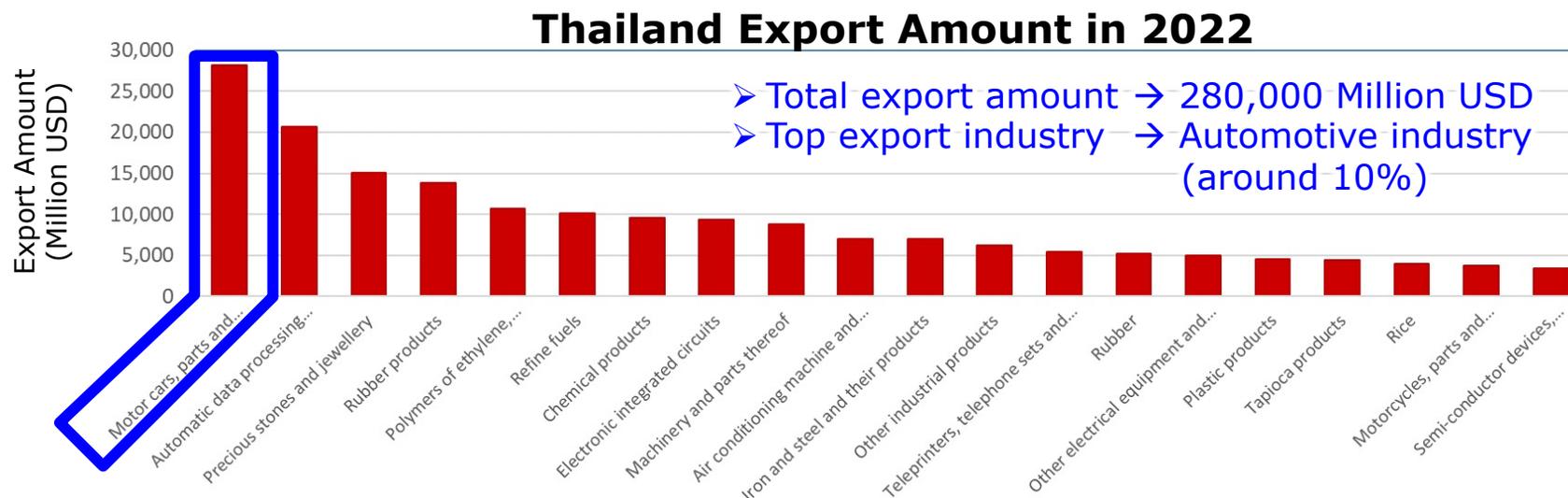


**Our
Target**

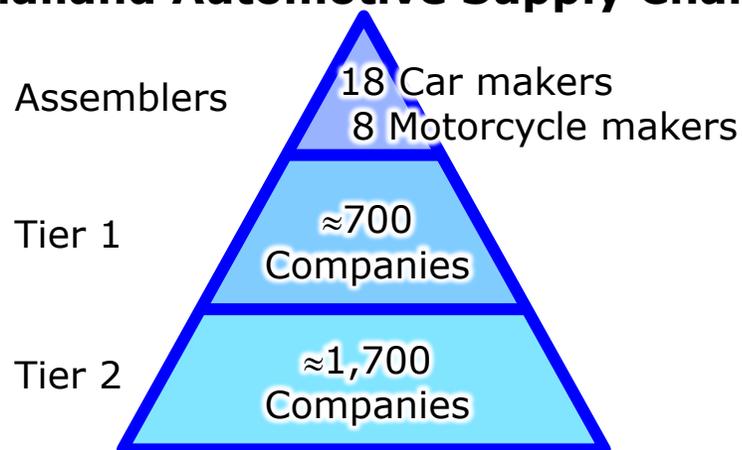
2025 : Achieve CO₂ neutrality for electricity

2035 : Achieve CO₂ neutrality for electricity & gas

Importance of CO₂ Neutrality in Asia (Ex. Thailand Industry)



Thailand Automotive Supply Chain



Do-or-Die Issue for Thailand Industry

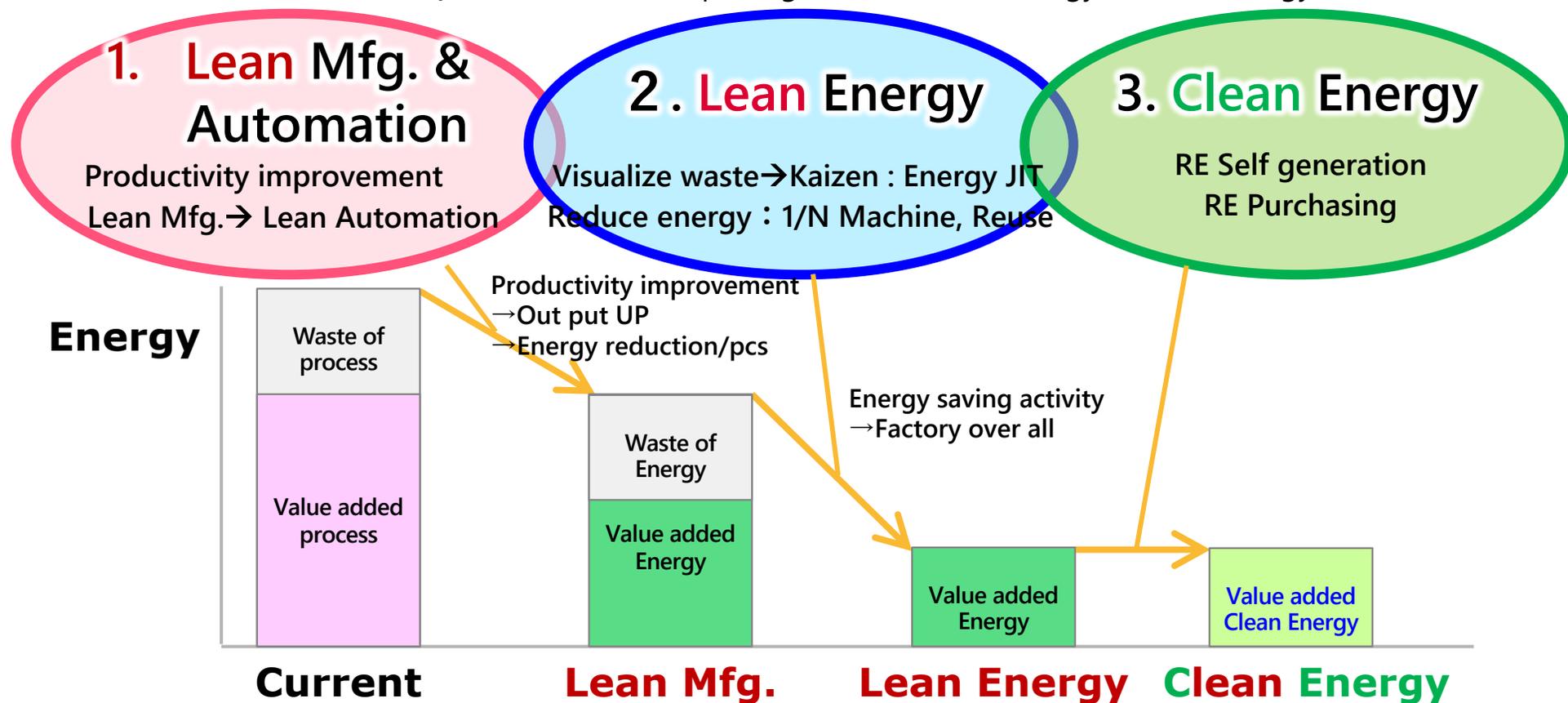
- × Disqualified from business competition
- × Loss in competitiveness (ex. Additional cost from CO₂ tax)
- × Withdraw of investment, Refusing from society
- ◎ **Chance to build on current strengths and attract more/new business**

Must achieve CO₂ Neutrality with Cost competitiveness

DENSO's Factory Direction in Asia

Lean & Clean

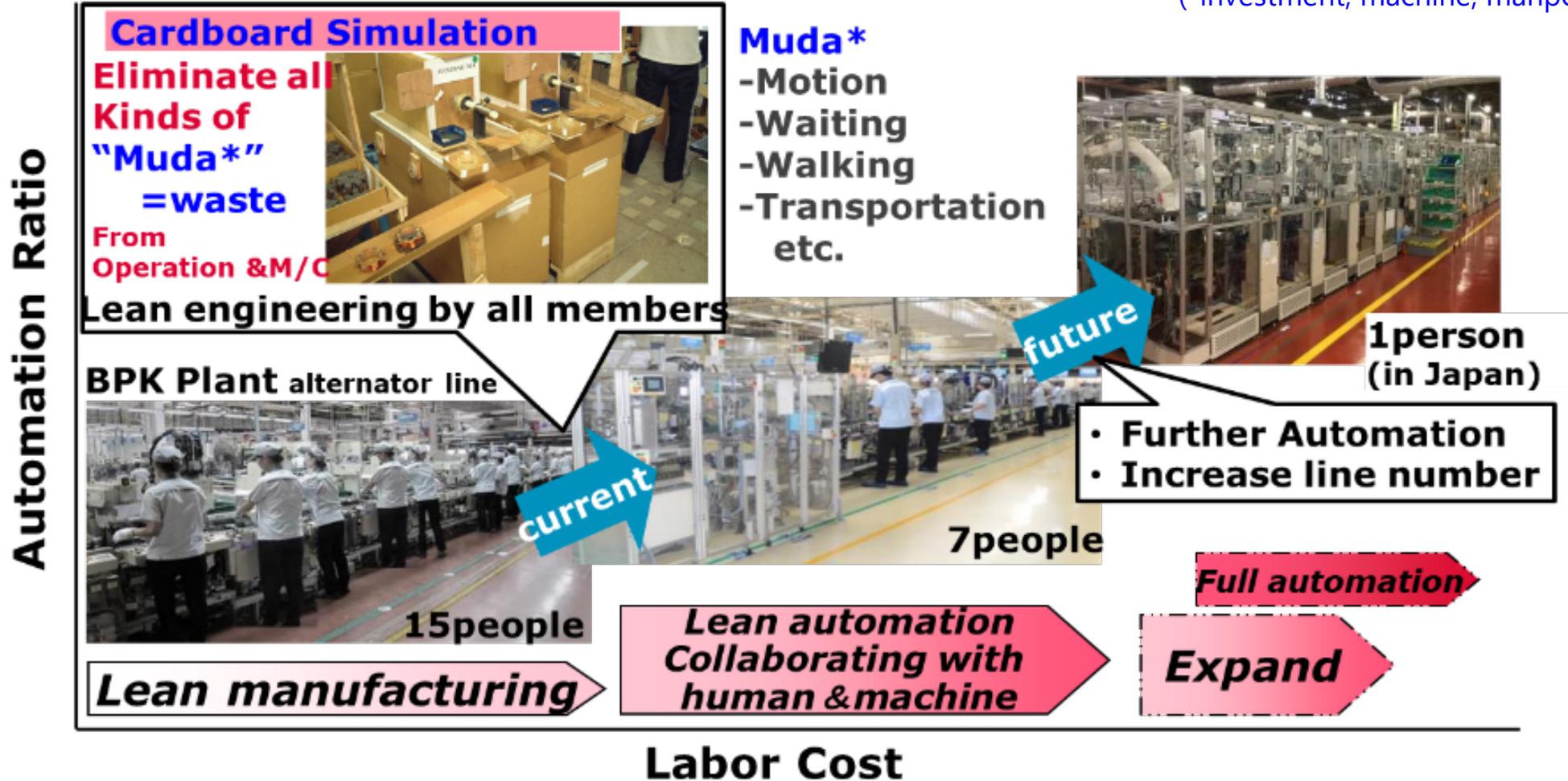
Realize CO2 free factory by improving productivity to reduce energy consumption with continuous kaizen (waste elimination) in factory over all before replacing the minimized energy to clean energy



Aim to achieve CO2 Neutrality with Cost competitiveness

① Lean Manufacturing & Automation: Asia Activity

Promote Lean Mfg. & Lean Automation to maximize productivity & minimize all wastes & resources*
 (*investment, machine, manpower, energy)



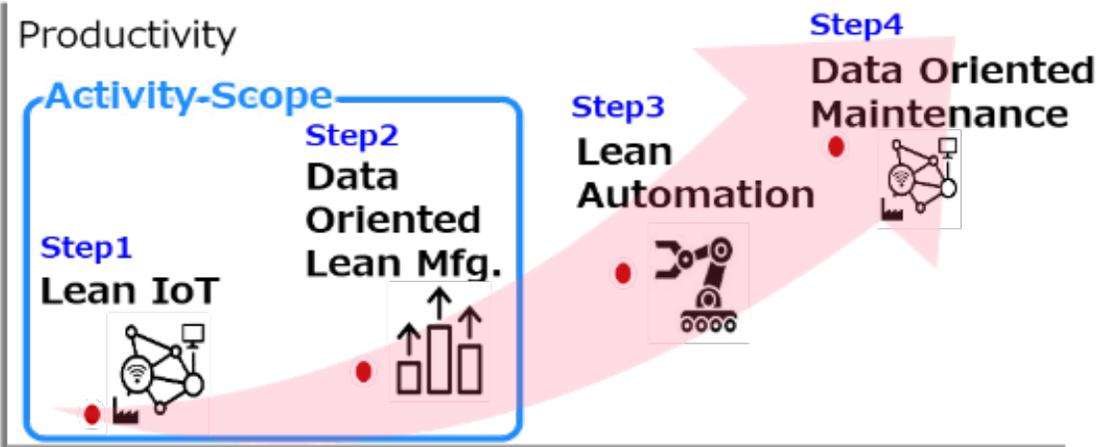
Productivity: >Double, ROI: <1Year

① Lean Manufacturing & Automation: Asia-Style IoT Utilization

Ex. Cutting line



DENSO Lean Automation Kaizen Process



Activity Detail

【Step1】IoT visualization

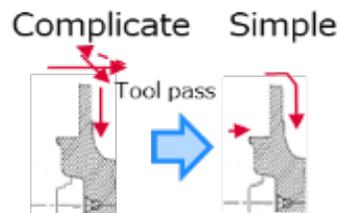


Find **real bottle-neck** from data & prioritize Kaizen

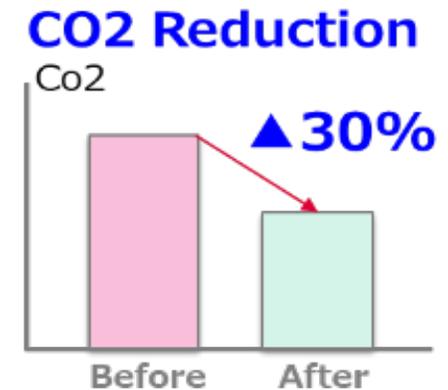
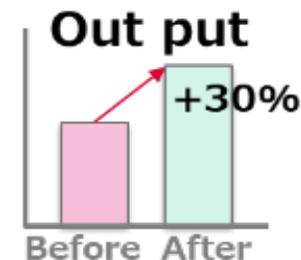
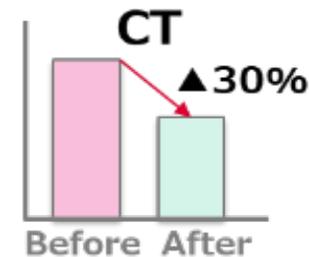
【Step2】Data Oriented Kaizen

Data + DENSO know-how
→ Propose effective idea

- Cutting tool integration
- Tool life improvement
- Tool pass reduction



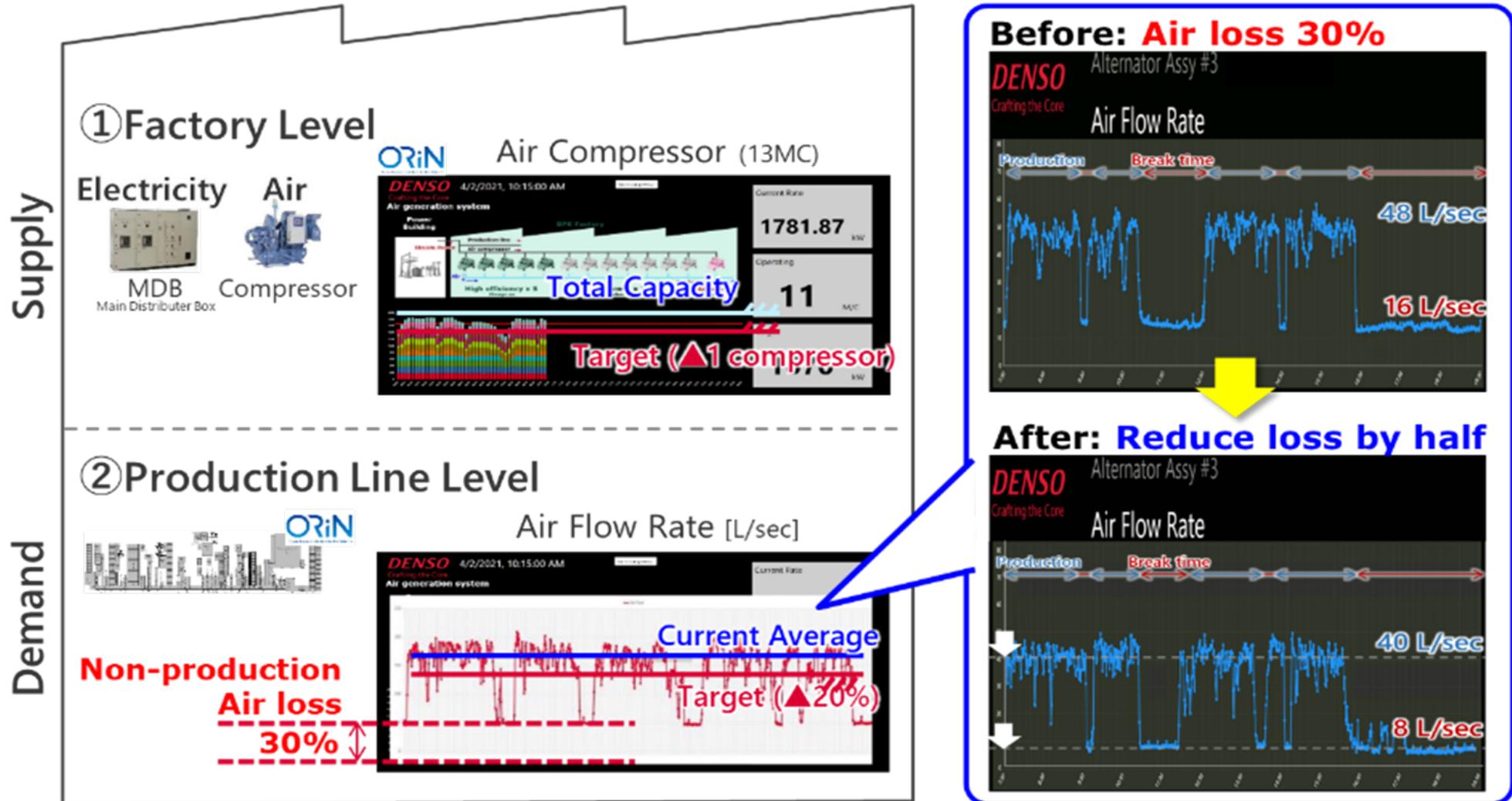
Result



-Loss, Over time reduction
-Out put improvement
→ **Electricity/Air reduction**

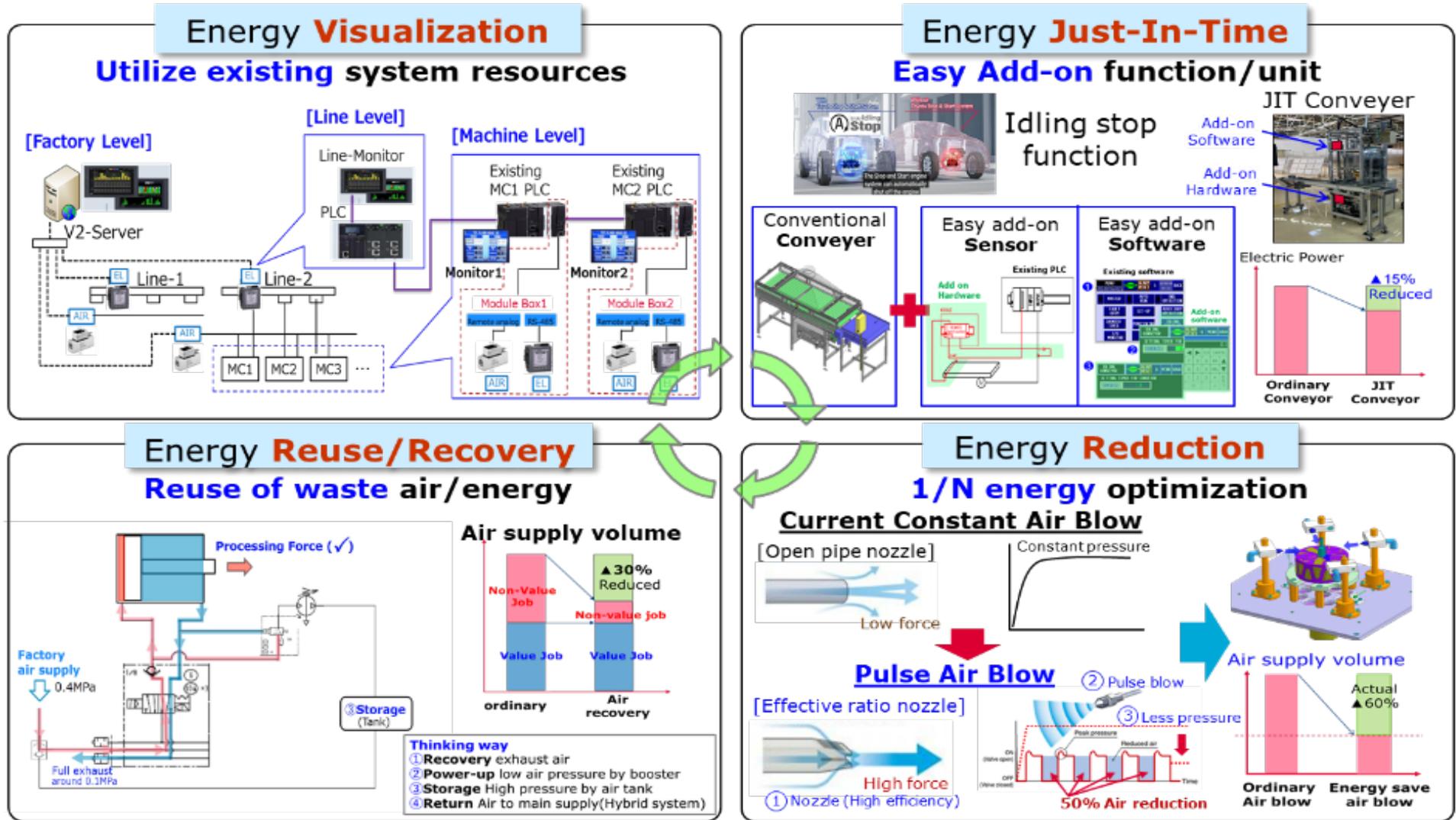
② Lean Energy: IoT Visualization for Energy JIT

[Thinking Way] Visualize invisible loss → Increase awareness → Quick idea & action



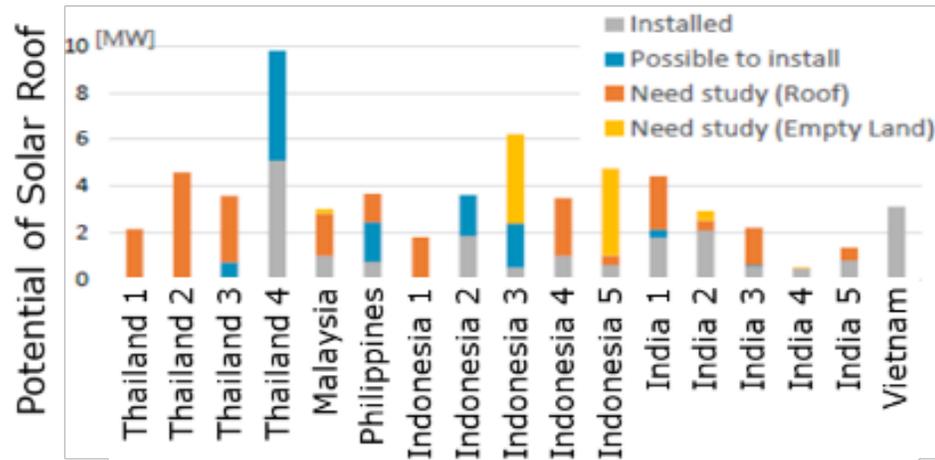
② Lean Energy: Low-Cost Energy Reduction Technology Development

[Concept] Low-cost Add-on module + Applicable to current machine



③ Clean Energy: Renewal Energy (RE) Self-Generation

【Thinking way】 Continuous effort to increase energy generation



- ❑ Proactively promote solar roof installation at all factories by 2025
- ❑ 17 factories in Asia with possibility around 30 MW + potential 15 MW
- ❑ Study various concept to optimize RE for each factory necessity

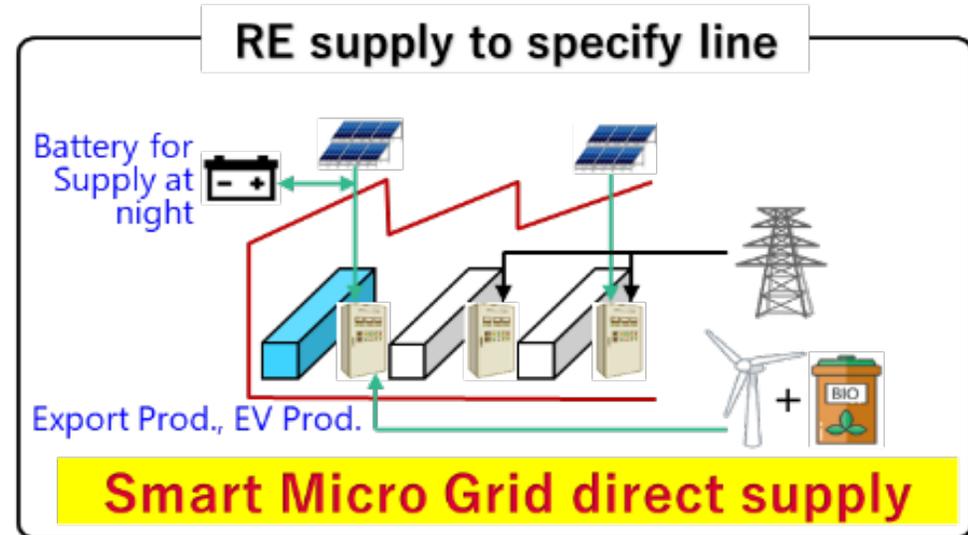
RE supply to whole factory

Ex. Siam DENSO Manufacturing (Thailand)

- Phase 3 (2022 Apr~)
 - > 15,517 m²
 - > 2 MW
- Phase 2 (2020)
 - > 16,355 m²
 - > 2 MW
- Phase 1 (2018)
 - > 8,235 m²
 - > 1 MW

Currently 6MW Self generation

Total 30% of overall energy



Only internal RE generation is not enough. RE purchasing is key issue for competitive CO₂ Neutrality.

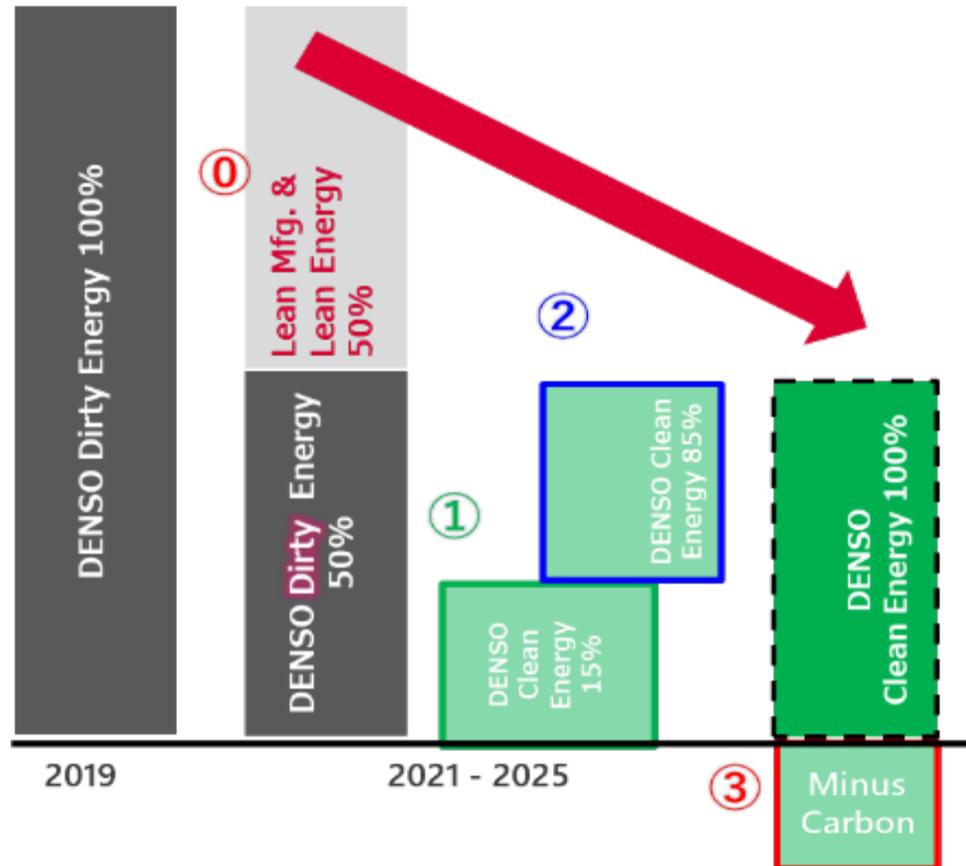
③ Clean Energy: RE Purchasing Regulation Promotion

Thai DENSO Case Study



Collaborate with “Federation of Thai Industries” to realize “**Lean & Clean Factory**” model and expand to other industries to contribute as “**Minus Carbon**”

- DENSO group contributes strong points of Lean manufacturing & Lean Energy
- FTI supports for promoting RE purchasing realization



① Reduce Energy 50%

- 0.1 Lean Mfg. & Lean Automation
- 0.2 Lean energy

② Self Generation

- 1.1 Storage excess energy
- 1.2 Sell at noon use at night



② RE Purchasing

- 2.1 Purchase RE from outside (Virtual power plant)
- 2.2 RE transfer in DN group



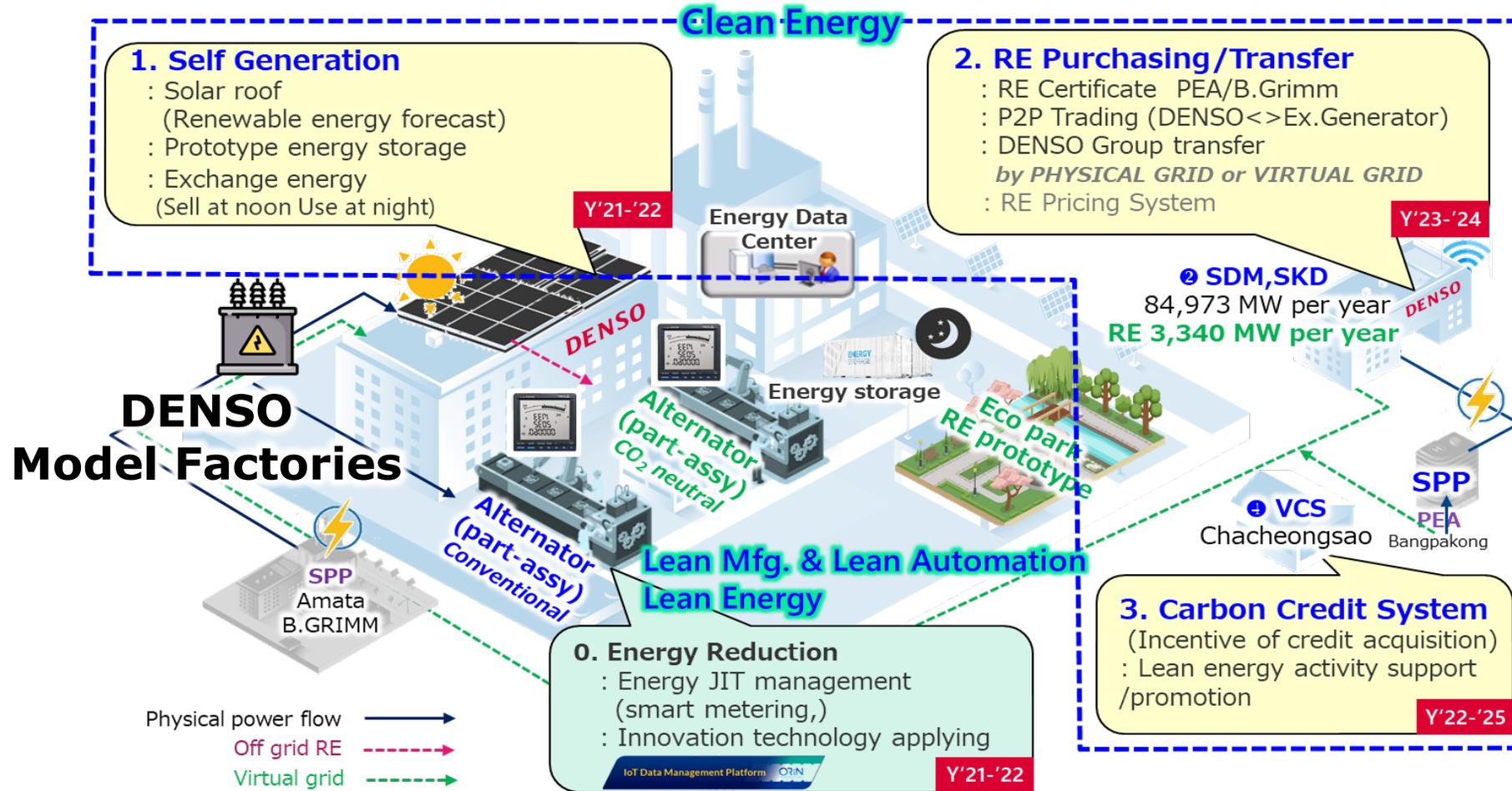
③ Energy Saving Expansion

- 3.1 Sharing know-how of energy-saving
- 3.2 Transfer of Carbon credit from energy-saving support



③ Clean Energy: RE Purchasing Sandbox Project

Apply **Government Sandbox** to test RE purchasing platform that suitable for Thai Industry

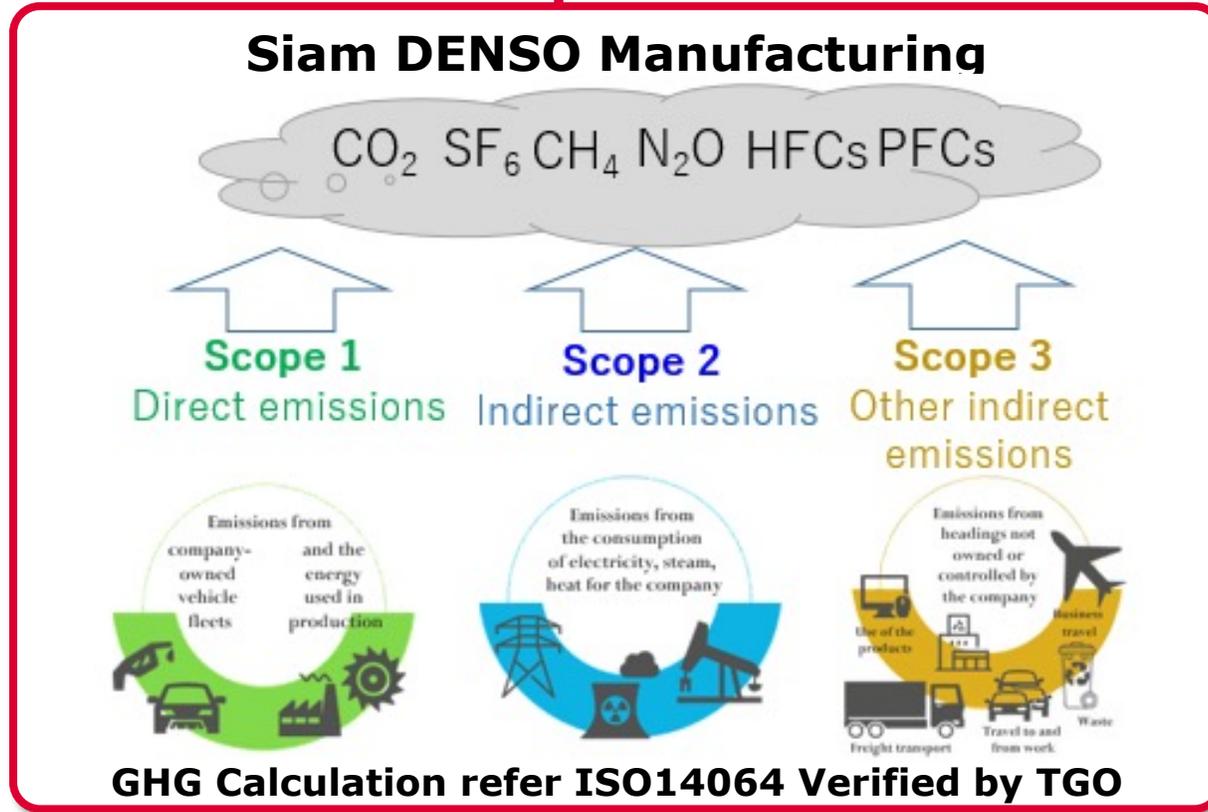


Develop company system for various RE trading scheme to secure stable & competitive RE

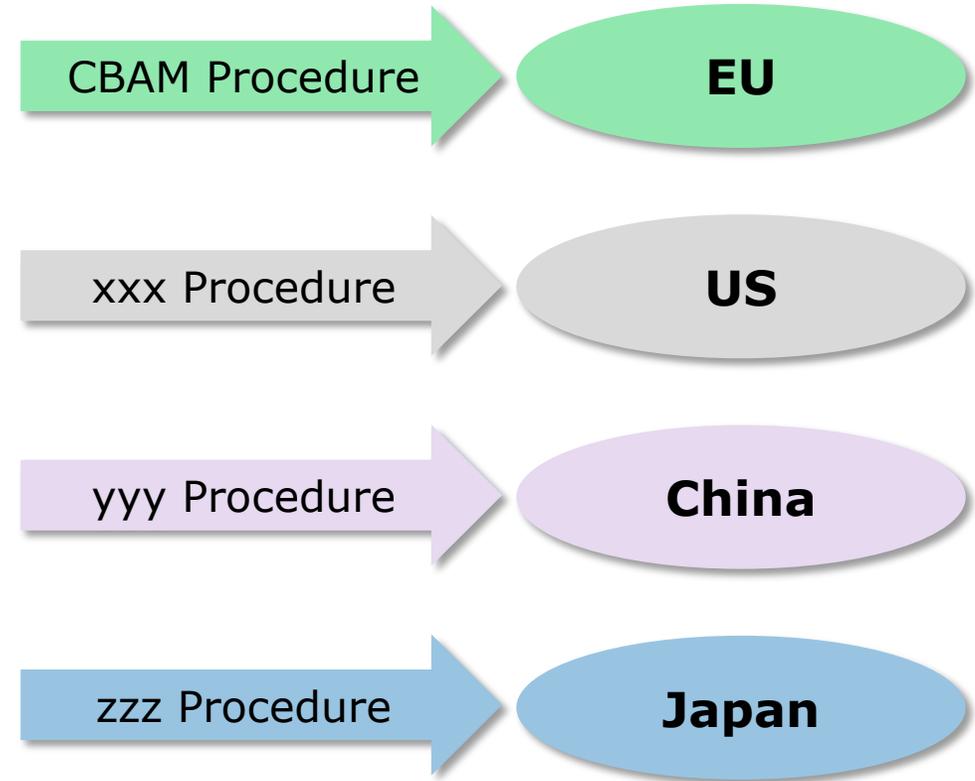
CO₂ Emission Certification

❑ In order to export products, CO₂ emission certification is needed.

Exporter



Destination



Export business need to establish our CO₂ emission structure to be compatible with all export destination rules. (with minimum workload and cost)

Summary of DENSO Preparation

- ❑ Climate change disruption = **Opportunity** to change crisis to be chance for new sustainable competitiveness improvement, and attracting more new business opportunity. We are trying to build on our current advantage of supply chain competitiveness.
- ❑ CO₂ Neutrality must come with productivity improvement to achieve **CO₂ Neutrality & Cost Competitiveness** at the same time.
DENSO uses **"Lean & Clean"** Factory concept.
- ❑ Issue = **Speed**
 - ❑ **Policy/System**: Corporate policy, Rule & Regulation
 - ❑ **Awareness**: Knowledge, Information, Visualization
 - ❑ **Resource**: Expert, Partnership, Financial support
 - ❑ **Technology**: RE, Energy saving (Provider x User)

Partnership & Network



DENSO

Crafting the Core