

November 11, 2022

# Financial Results – FY 23/03 Q2

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Microwave **Chemical**

**Make Wave,  
Make World.**

世界が知らない世界をつくれ

# Executive Summary

1

Sales grew on y-o-y basis, on path to achieving FY target

- FY 23/03 Q2, **Sales 342 million yen.** Sales grew at a rate of **164.6% y-o-y.**
- 30.2 % progress for FY 23/03 (1,133 million yen).
- **Progress rate on contract basis is 95.4% (1,081 million yen).**
- **Expected to achieve the FY target.**

2

Steady progress made in two KPI

- ① New Contracts
- ② Total Contracts

- Acquired 13 new contracts. FY 23/03 target 25, **52.0% progress.**
- 42 contracts signed. FY23/03 target 52 contracts, **80.8% progress.**

3

Advancement in  
Technology  
Standardization  
&  
Green Market

- Awarded the Osaka Prefecture “Carbon Neutral Technology Development and Demonstration Program” for distributed system. (Partner: Seven-Eleven Japan)
- Succeeded in pilot project to dissolve and refine lithium (Partner: QST)
- Advanced to pilot development project phase for Turquoise Hydrogen production process (Partner: Sumitomo Chemical Corporation)



# Agenda

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1. Company overview
2. Financial Results and KPI Highlights
3. Topics
4. Appendix



**【Mission】**

**Make Wave, Make World**

**【Vision】**

**Innovate the chemical industry, unchanged for more than a century  
revolutionize the world of manufacturing**

**-Making the microwave process a global standard-**



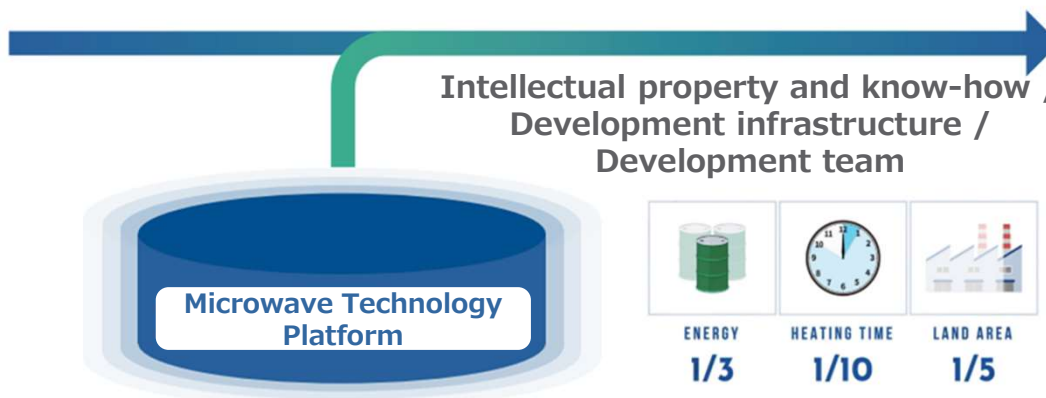
# Company Overview

Industrialized microwave chemical process for the first time in the world. Utilizing the microwave technology platform, we promote joint development and commercialization with various partners in a wide range of fields.



Current manufacturing technology using fossil fuels, etc

Microwave : New energy source



## History



Fatty acid ester  
3,200 t/y



Sugar ester  
1,000 t/y

太陽化学株式会社  
TAYO KAGAKU



Peptide drug  
(GMP, PeptiStar)

PeptiStar



PMMA recycling  
(Mitsubishi Chemical)



ASR·SMC recycling  
(Mitsui Chemicals)

Mitsui Chemicals



Rare metal refining  
(QST)

QST



Hydrogen production  
(Sumitomo chemical)  
SUMITOMO CHEMICAL



Carbon Fiber  
(Mitsui Chemicals)

Mitsui Chemicals

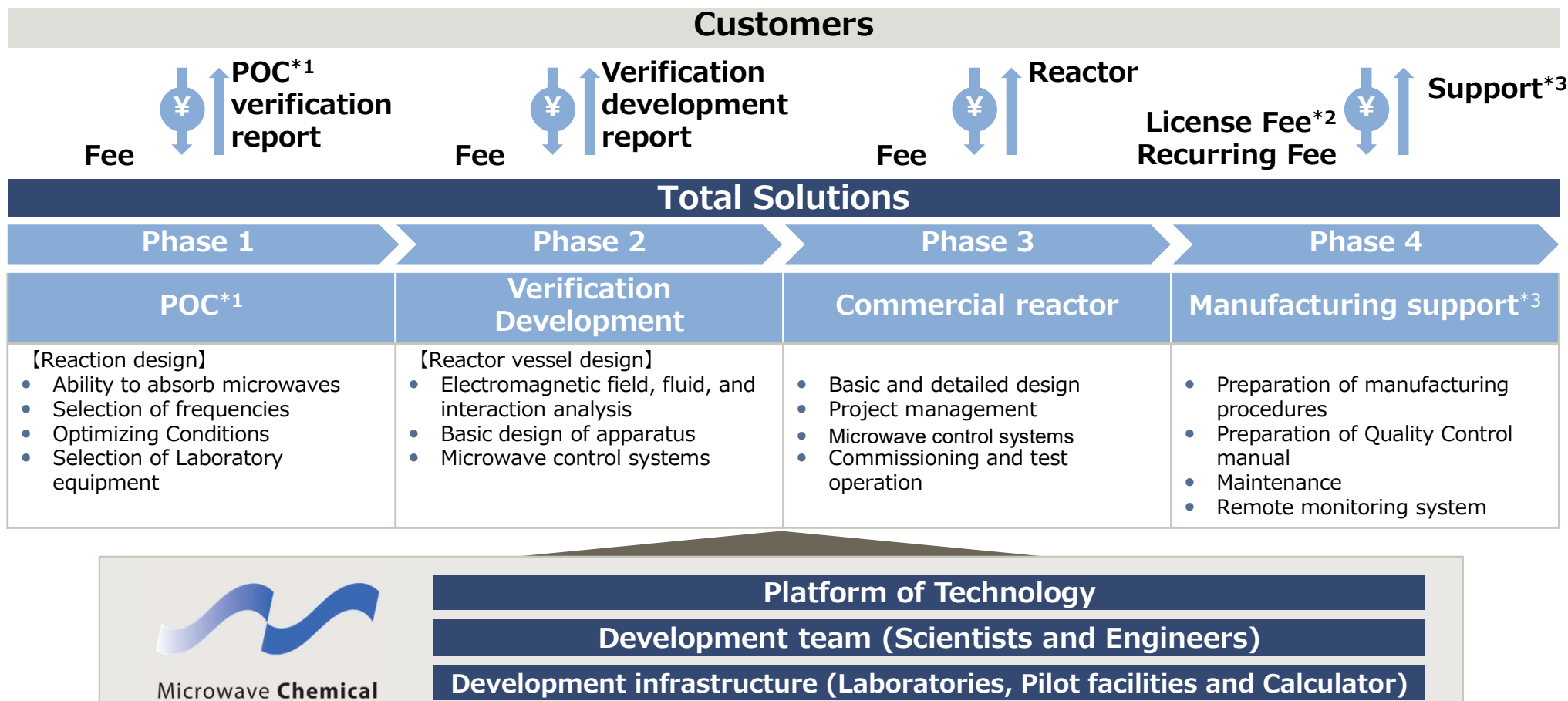
Industrialized

Under Development



# Business Model

- (1) Total solutions from R&D to engineering
- (2) Profit on each phase. License fee when commercialized by client.



\*1: POC: Proof of Concept. The process of testing the feasibility and effectiveness of new concept or idea before actual development

\*2: License: Share the customer value earned by introduction of microwave process as license fees. Specifically, receive as upfront payment and recurring royalties

\*3: Manufacturing support and maintenance: Support customers who have installed microwave reactors in their manufacturing process. In addition, provide maintenance of microwave reactors and other facilities



# Growth Driver

Business Model



Market Focus

Projects

## 1. New Contract Acquisition

Through new and existing customers, strategic alliances, oversea customers.



Unit Price

## 2. A Virtuous Circle Strengthening the Technology Platform

Each project will strengthen our technology platform which in turn increases our ability to provide solutions.



Plants in Commercial Production



Packaged Solution

## 3. Standardization

Scaling business by providing packaged solution to multiple clients.

## 4. Focus on growth areas

Green

Healthcare  
(Includes food)

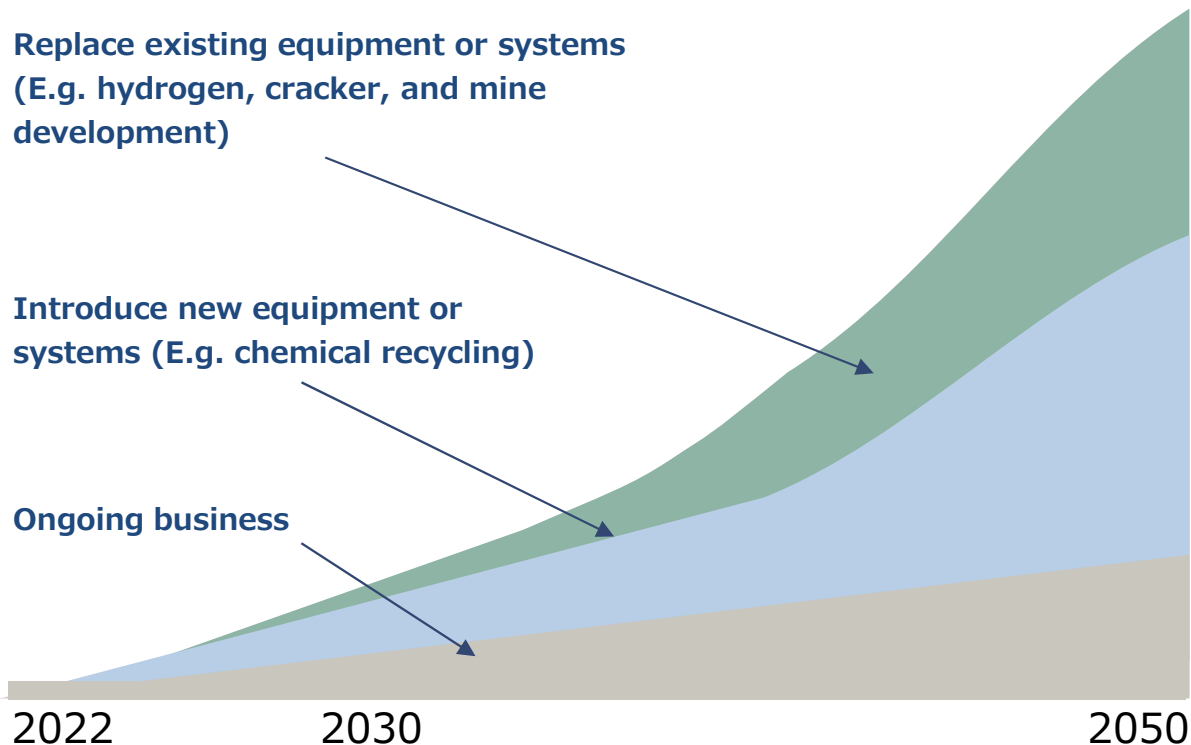
Electronics

# Carbon Neutral – Our vision

We will expand our business long-term by committing to carbon neutrality of various industry.

## MWCC's Growth Image

- ▶ For heavy industry, average lifetimes of emissions-intensive assets is around 40 years, and around 30% of existing assets are expected to require major investment to improve facilities within the next 10 years.\*1
- ▶ In order to achieve carbon neutral, new innovative technologies must be ready for implementation. Generally, it takes about 10 years for new technologies to become commercially viable, so we need to start developing new solutions "now".



## MWCC's Active Solutions for Decarbonization

**C NEUTRAL 2050 design**  
再生による電化・ハイブリッドプロセスは90%のCO2排出削減を可能にします。

- Electrification of the chemical industry
  - Electrification of crackers
  - All other processes
- Contributions to other industries through new processes and materials
  - Energy, steel and petrochemical industries
    - Turquoise hydrogen
    - Ammonia
    - CO2 as a raw material
  - Mobility (automobile, etc.) electronics industries
    - Battery-related material (Cathode materials, etc.)
    - Carbon Fiber
    - Post-consumer recycled materials (chemical recycling)
    - Lithium and rare earth (mine development)



Cathode materials



Lithium

\*1: Net Zero by 2050 A Road Map for the Global Energy Sector IEA May 2021





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# FY23/03 Full-year budget

Planned net sales of 1,133 million yen and operating income of 67 million yen

(Unit : million Yen)

	FY 22/03 Full-year (result)	FY 23/03 Full-year (budget)	Difference	
Net sales	860	1,133	+272	+31.7%
Phase 1	309	686	+377	+121.5%
Phase 2	320	381	+61	+19.0%
Phase 3	30	35	+5	+16.7%
Phase 4	200	–	▲200	△100.0%
Others	–	30	+30	–
Operating profit	▲87	67	+155	–
Ordinary profit	▲98	30	+128	–
Profit	▲110	45	+155	–



# Financial results for FY23/03 Q2

Sales increased by 213 million Yen(+164.6%) YoY due to strong growth in sales from Phase 1~3 onward

(Accumulated, Unit : million Yen)

	FY 22/03 Q2 (result)	FY 23/03 Q2 (result)	Difference	
Net sales	129	342	<b>+213</b>	<b>+164.6%</b>
Phase 1	76	139	+63	+83.0%
Phase 2	53	167	+114	+215.7%
Phase 3	-	35	+35	-
Phase 4	0	-	▲0	▲100.0%
Others	-	0	+0	-
Operating profit	▲252	▲72	+180	-
Ordinary profit	▲259	▲103	+155	-
Profit	▲261	▲105	+156	-

# Seasonal Fluctuations / Revenue Recognition

## <Seasonal Fluctuations>

Our major customers, chemical companies, finalize budgets by March, just before the start of the new fiscal year, so project work with MWCC often begins in the first or second quarter. As a result, the completion of the contract, in which **our company's revenues are recorded, tends to be skewed toward the second half of the year.** There is also an impact from the completion timing of large-scale projects. In addition, since the majority of selling, general and administrative expenses are fixed costs, the proportion of profits also tends to be weighted toward the second half of the year, which may affect investors' decisions.

FY22/03 Net sales for each quarterly accounting period(Thousand Yen)

Q1	Q2	Q3	Q4	Total
68,053	61,451	548,149	182,855	860,510

## <Revenue Recognition>

The following is a description of the main performance obligations in the Company's main business related to revenues arising from contracts with customers and the usual time at which such performance obligations are met. Payment is made generally within one month after obligation is fulfilled and does not include financial component.

### ① Joint development agreement(JDA)

The Company submits reports, samples, etc. stipulated in the JDA and receives payment. Under such agreements, **revenue is booked upon acceptance of the report, samples, etc. by the customer.**

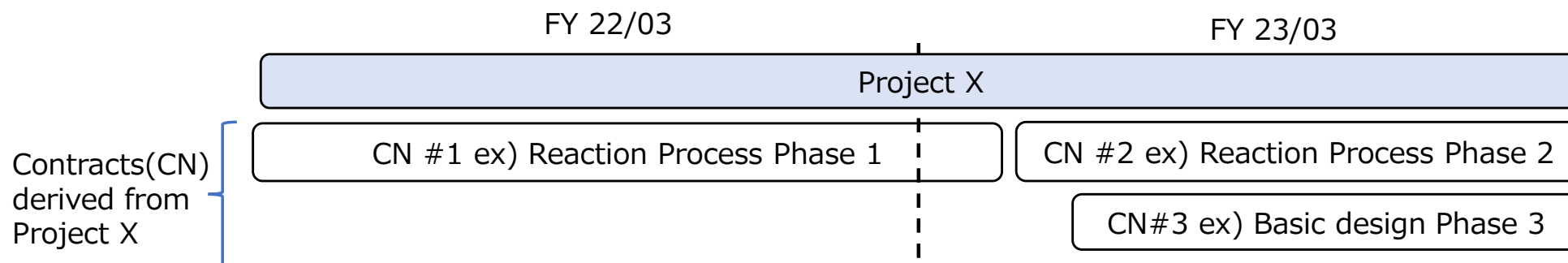
### ② License agreement

Under license agreements, the Company licenses its intellectual property to customers and receives upfront payments and running royalties as compensation. The upfront payment is booked as revenue at the time the intellectual property is licensed. Running royalties are based on the sales revenue of the licensee company, and revenue is recognized when the product is sold by the licensee company.



# KPI(Key Performance Indicator)

1. **Important KPI** for our business are ①**Total Number of newly acquired Contracts** and ②**Total Number of Contracts**.
2. Contracts are signed with clients based on solutions we provide which will defer per phase and service we provide. Multiple contracts could be signed with one project as indicated below.
3. Contracts is basis of our revenue. We disclose only the Contracts that is expected to complete and book sales within this FY as KPI.



## 【Related information】

- Sales per Phase** : To understand the progress of the contract by sales per each phase(1~4).
- Total Number of Projects** ※ : Project consist of a team with task to provide “total solution” to clients. It is also referred as a pipeline and categorized in two types.
  - Revenue generating project: Solution Providing Project to a client
  - Non-revenue generating project : R&D Project which we invest our own resources.

※ In the FY23 Q1 Financial Results, we categorized "Funded Project" independently, but there are cases in which it overlaps with Solution Providing Projects and/or R&D Projects, hence decided to exclude it to avoid confusion.

# FY23/03 Q2 KPI Highlights

## 1 New Contracts - total number of newly acquired contracts

- Acquired 13 contracts out of 25 annual projection

## 2 Total Contracts - total number of contracts

- 42 Contracts already signed, 20 delivered. FY 23/03 target 52 contracts.

## 3 Sales per Phase Projects

- 1,081mil yen (95.4%) achieved on contract basis. FY23/03 target 1,133mil yen.
- Phase 2 sales plus vs Q2 target.

## 4 Projects – total number of projects

- 35 Solution Providing Projects, 4 R&D Projects.
- Net increase of 7 Solution Providing Projects from 23/03 Q1.

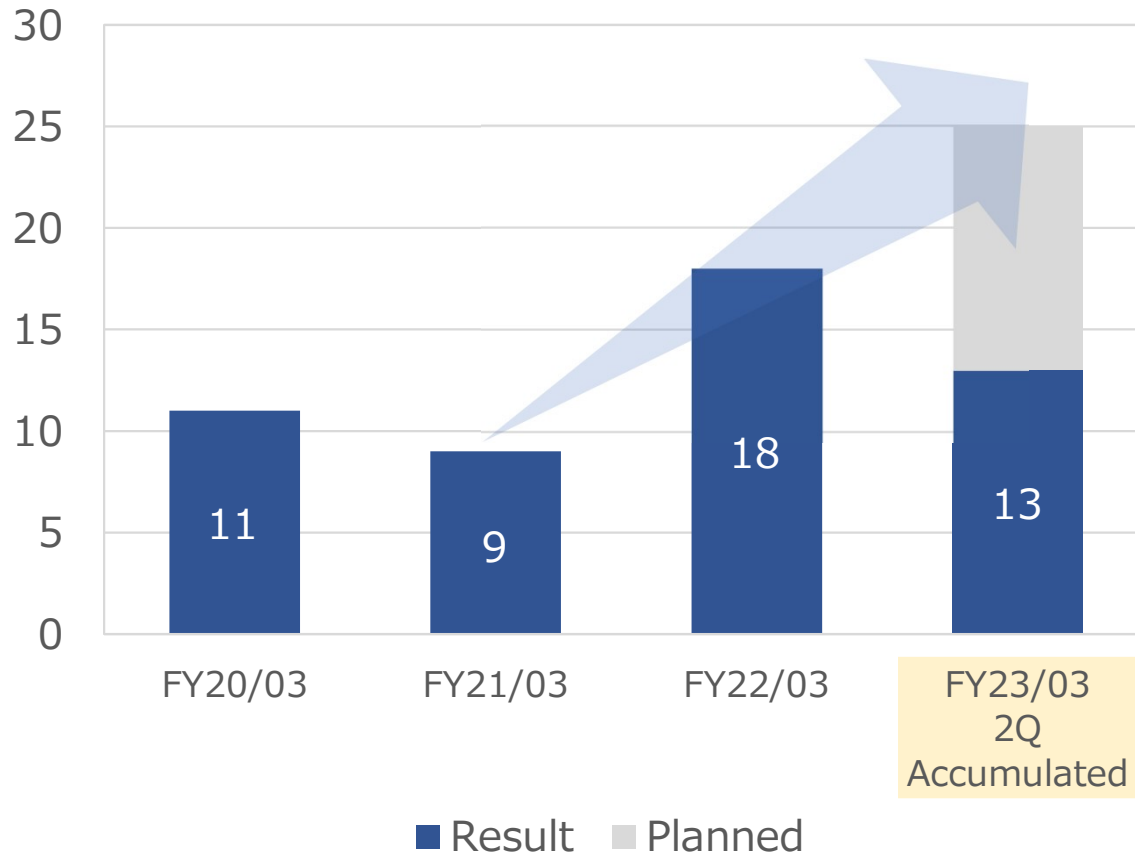


# KPI① Total number of newly acquired contracts

Acquired 13 new contracts in Q2. FY23/03 target 25 contracts.

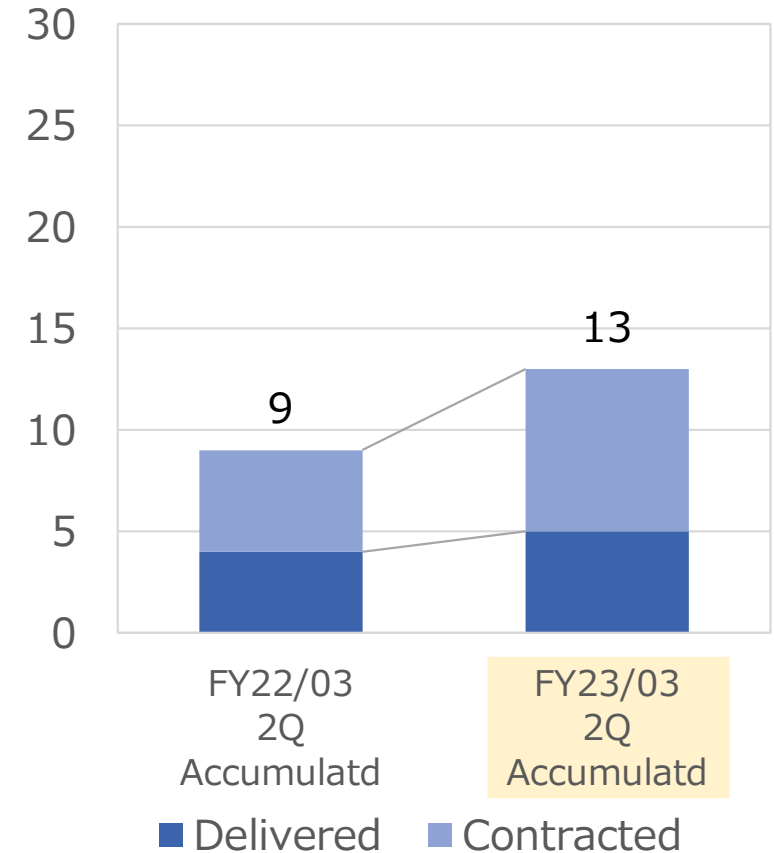
## Newly acquired contracts : Trend

(Unit : # of Contracts)



## YoY comparison

(Unit : # of Contracts)

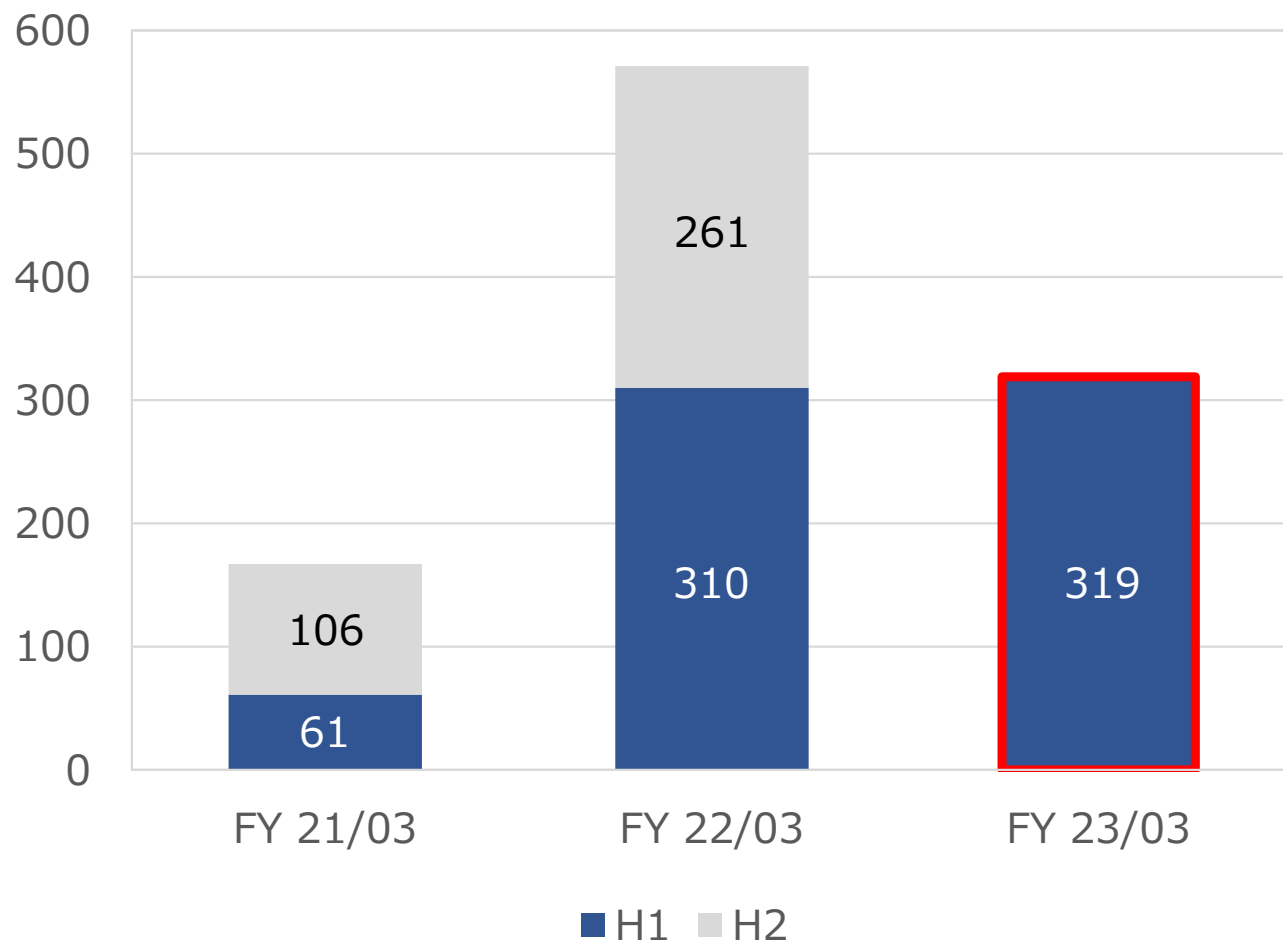


# Ref: Status of Inquiry

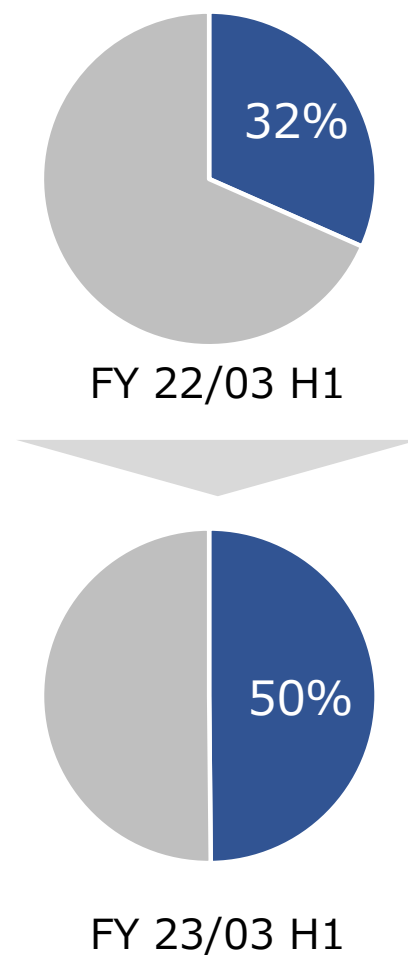
Inquiry increased driven by carbon neutral (CN)-related projects. Achieved record number of inquiry for FH FY23/03.

## Status of Inquiry

(Unit : # )



## Percentage of CN related Inquiry



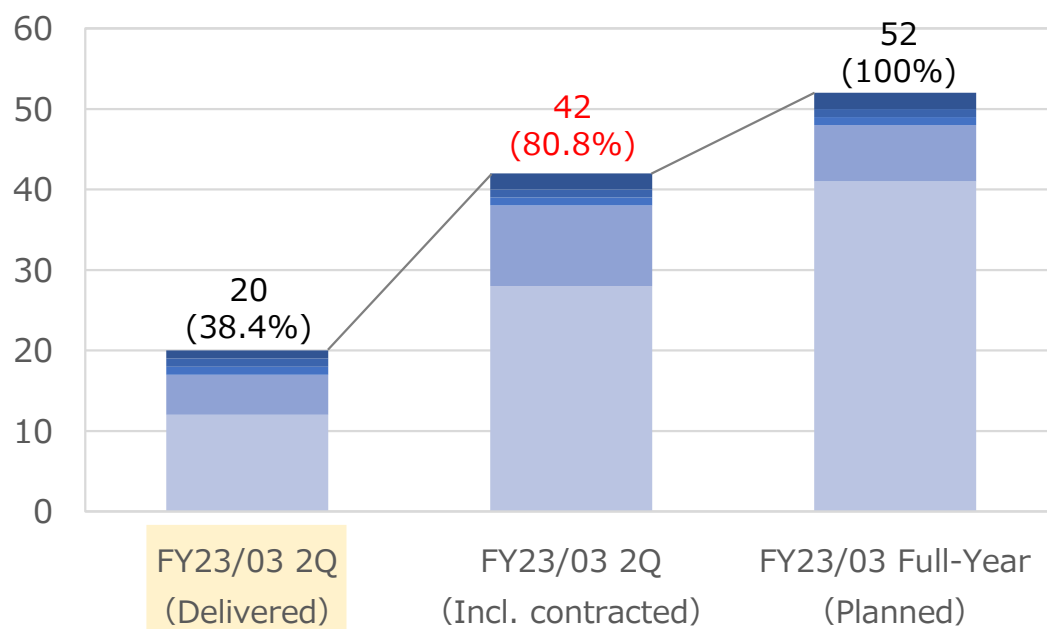


# KPI② Total number of contracts

80.8 % progress compared to FY23/03 target. 20 contracts delivered and booked revenue.

## Progress vs. full-year plan

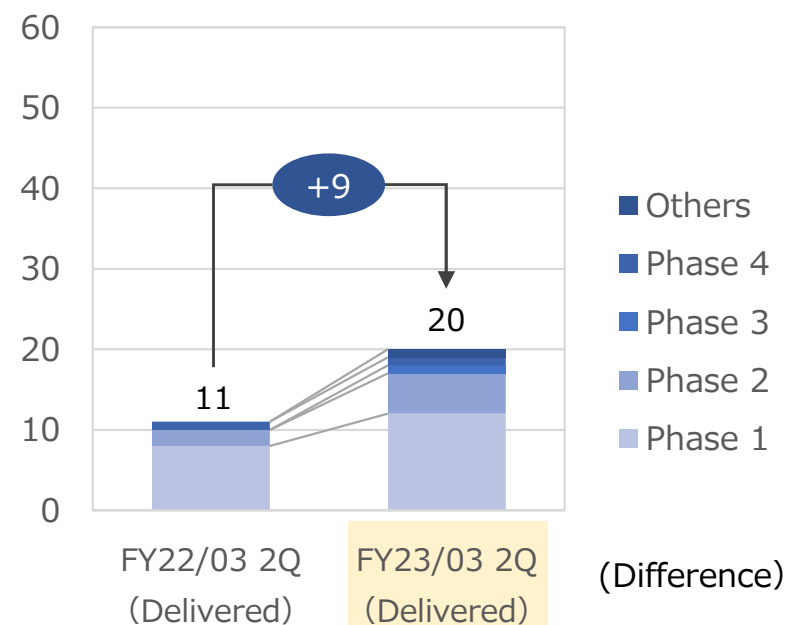
(Accumulated, Unit : # of Contracts)



Phase 1	12	28	41
Phase 2	5	10	7
Phase 3	1	1	1
Phase 4	1	1	1
Others	1	2	2
<b>Total</b>	<b>20</b>	<b>42</b>	<b>52</b>

## YoY comparison

(Accumulated, Unit : # of Contracts)

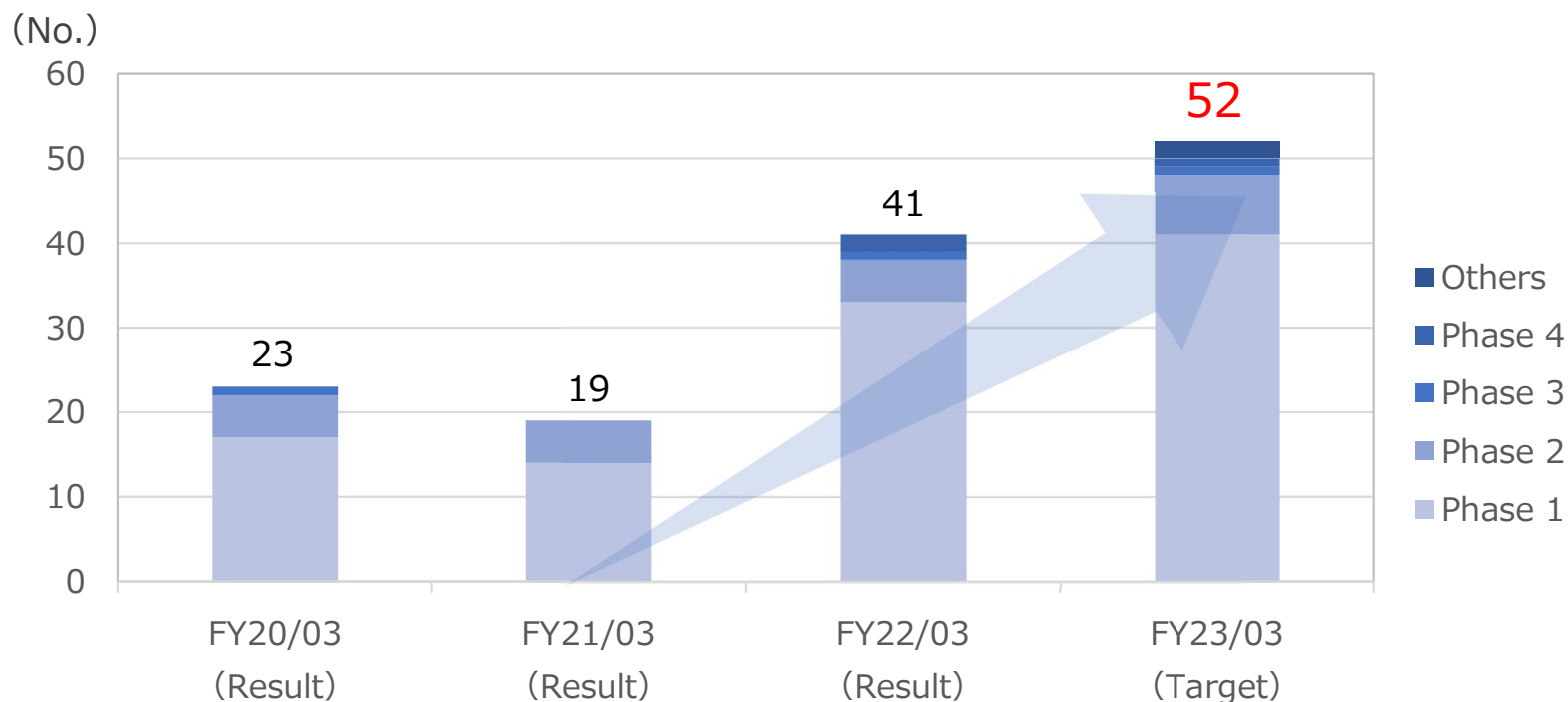


Phase 1	8	12	+4
Phase 2	2	5	+3
Phase 3	0	1	+1
Phase 4	1	1	0
Others	0	1	+1
<b>Total</b>	<b>11</b>	<b>20</b>	<b>+9</b>



# Ref: Total number of contracts, Results & FY23/03 Forecast

Growth achieved with acquisition of new projects and stage-up of existing projects



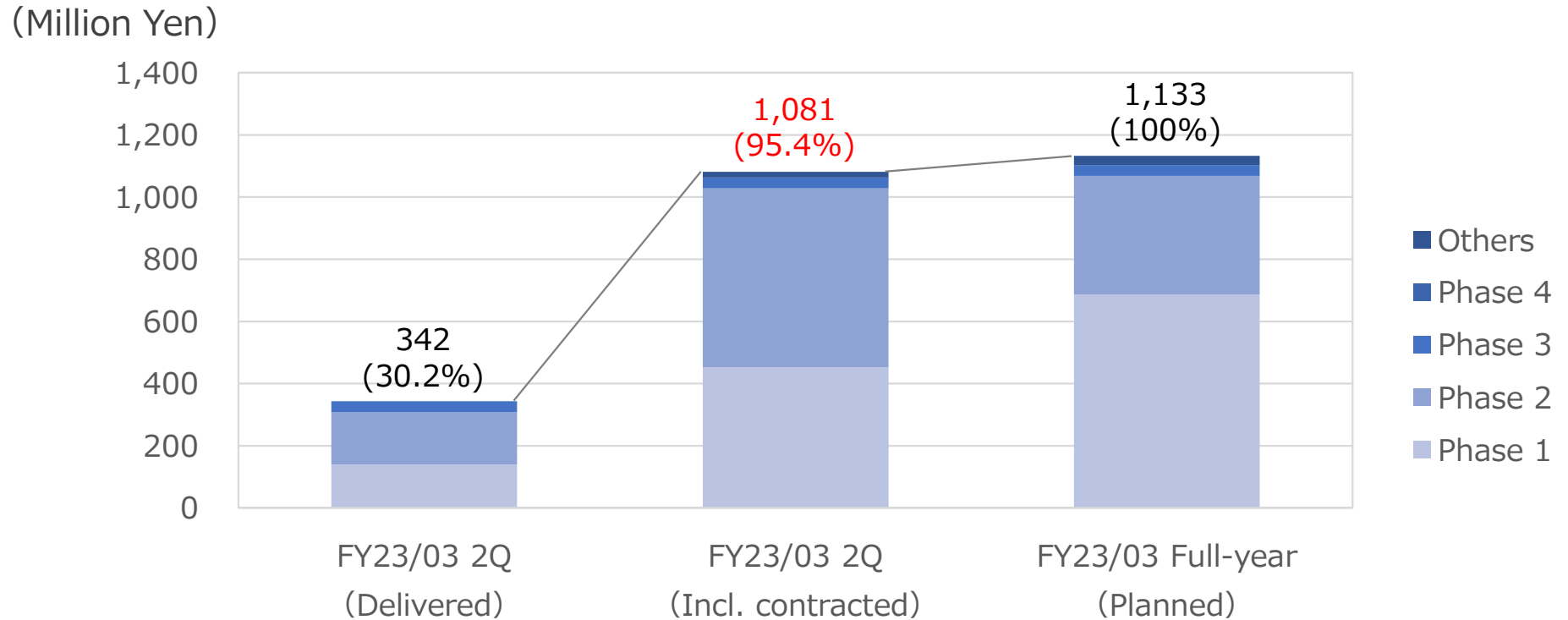
Phase 1	17	14	33	41
Phase 2	5	5	5	7
Phase 3	1	—	1	1
Phase 4 <sup>*1</sup>	—	—	2	1
Others	—	—	—	2
<b>Total</b>	<b>23</b>	<b>19</b>	<b>41</b>	<b>52</b>

\*1 One of the Phase 4 projects in FY22/03 and FY23/03, respectively, does not provide a technology platform as a solution, but is related to a project with TMT Corporation, a joint venture established by Microwave Chemical and TAIYO CHEMICAL for the production of sucrose esters. Microwave Chemical and TMT have entered into a patent and know-how license agreement, but the Company does not expect to recognize any revenue based on this agreement in FY23/03. One of the Phase 4 projects recorded in FY22/03 is revenue related to spot maintenance work, but since there is no ongoing contractual relationship with the company for this project, no ongoing revenue is expected in FY23/03.



# a. Sales per phase

On a contract basis, each phase is progressing vs. the full-year plan.

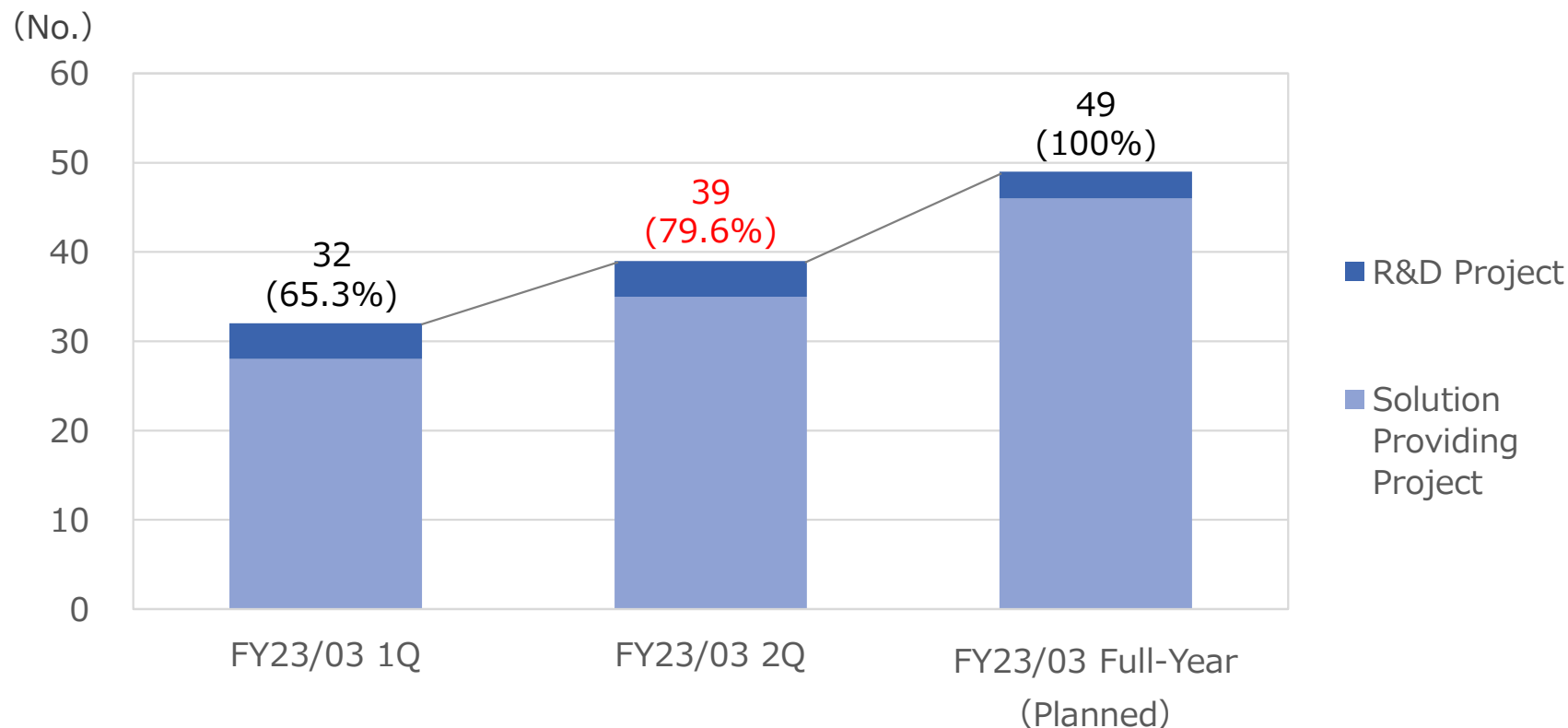


Phase 1	139	452	686
Phase 2	167	575	381
Phase 3	35	35	35
Phase 4	-	-	-
Others	0	18	30
<b>Total</b>	<b>342</b>	<b>1,081</b>	<b>1,133</b>



## b. Total number of projects

79.6% progress vs. the full-year plan. Expect to achieve this year's plan by acquiring new projects.



R&D Project	4	4	3
Solution Providing Project	28	35	46
Total	32	39	49

※※ In the FY23 Q1 Financial Results, we categorized "Funded Project" independently, but there are cases in which it overlaps with Solution Providing Projects and/or R&D Projects, hence decided to exclude it to avoid confusion.



# Grant Information

Developing technologies funded by following Government Grants.

Institution	Project	Theme
Osaka Pref.	Carbon Neutral Technology Development and Demonstration Program	Development and demonstration of distributed chemical recycling system utilizing microwave heating technology
NEDO	Strategic Innovation Program for Energy Conservation Technologies / Pilot Phase	Development of new chemical recycling method for plastics using microwave process
NEDO	Carbon recycling technologies based on biobased process	Development of bio-foundry technology for production processes
AMED	Project Focused on Developing Key Technology for Discovering and Manufacturing Drugs for Next-Generation Treatment and Diagnosis	Development of basic manufacturing technology for raw materials and drug substances in the development of basic technology for manufacturing, purification, and analysis of nucleic acid medicines
JST	Program on Open Innovation Platform with Enterprises, Research Institute and Academia ( <b>OPERA</b> )	Creation of Innovative Oxidation Reaction Activation Control Technology Using Safe Oxidants

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# Topics

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## ■ Scaling through Standardization

- Announced partnership with **Seven-Eleven Japan** for chemical recycling. This is our fourth partner other than, Mitsubishi Chemical, Mitsui Chemical and Showa Denko.

## ■ Progress in Green Market

- In addition to development in the Chemical Recycling Domain, we made following announcements:-
  - Succeeded in pilot project with **QST** to dissolve and refine lithium.
  - Advanced to pilot development project phase with **Sumitomo Chemical** for turquoise hydrogen production process.

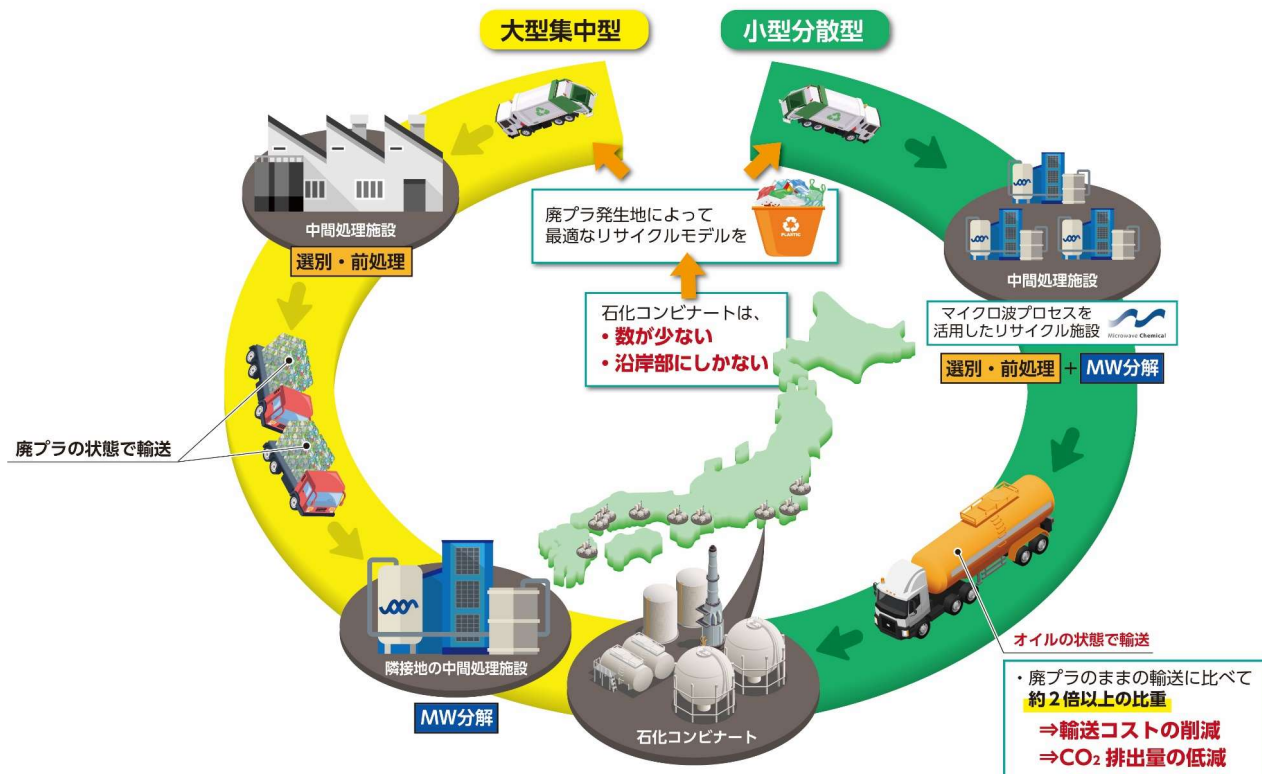
# Chemical Recycling with Seven-Eleven Japan

Awarded the Osaka Prefecture "Carbon Neutral Technology Development and Demonstration Program" together with Seven-Eleven Japan for distributed recycling system.

- ✓ Most of the chemical recycling project is "large-scale centralized system" with capacity of thousands to tens of thousands of tons per year.
- ✓ This project focuses on "distributed system".
- ✓ Project focuses on building highly efficient eco-system.



Image produced by MWCC,  
does not represent actual business

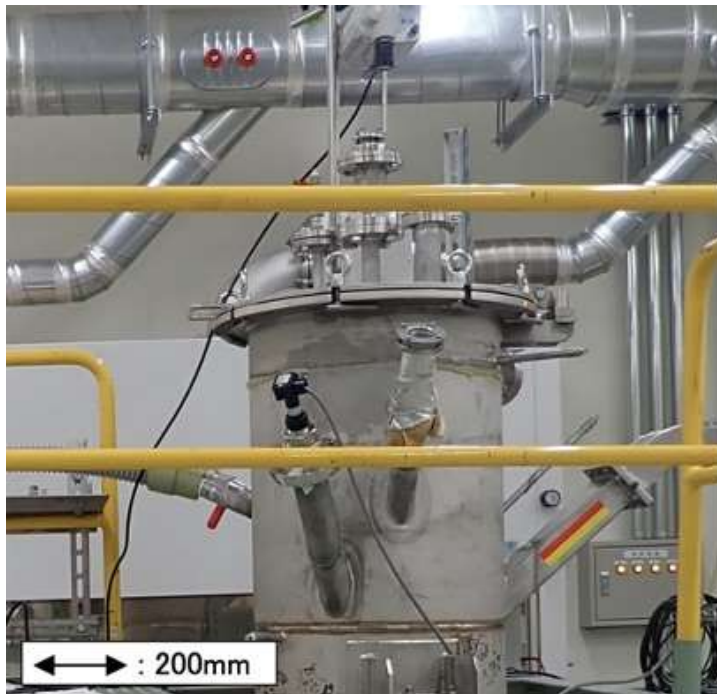




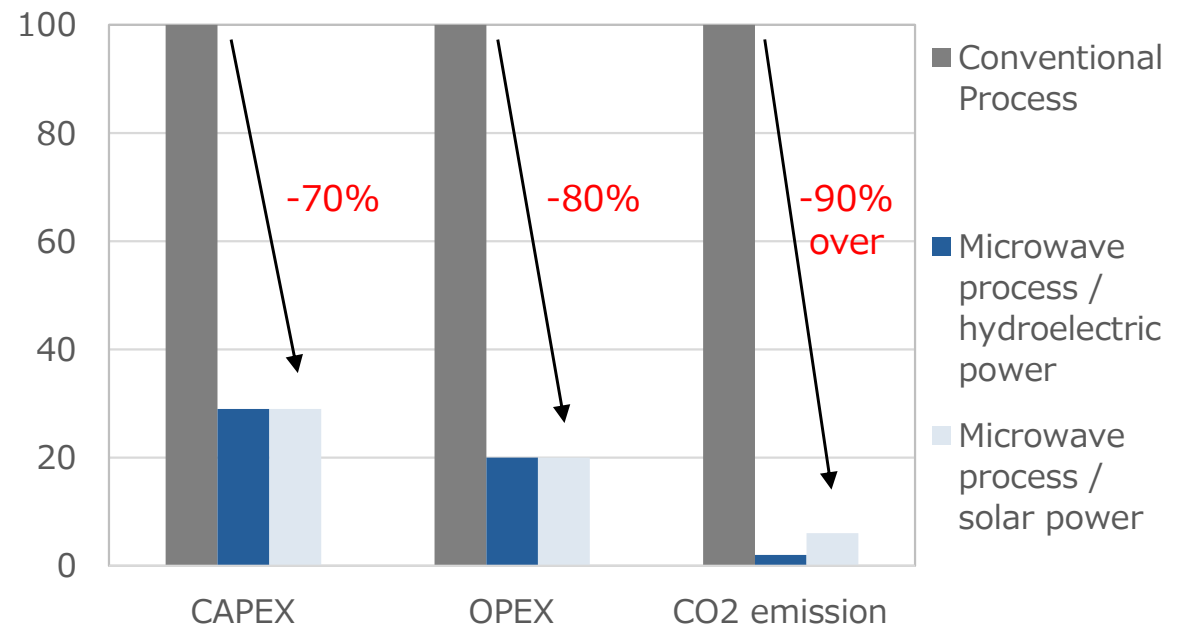
# Succeeded in pilot project with **QST** to refine lithium

Melted actual ore with bench plant with 100 X scale-up from lab scale.

- ✓ QST and MWCC entered into a joint R&D/demonstration agreement to **refine rare metals including lithium** by combining chemical treatment and microwave heating in Dec 2021.
- ✓ Succeeded in dissolving 100g lithium ore. Lowered temperature from 1,000°C to 300°C utilizing bench scale reactor.
- ✓ Expected to lower **CAPEX and OPEX by 70%, CO2 emission by 90%.**



Microwave Bench Scale Reactor  
used for the development



Comparison of CAPEX/OPEX/CO2 emission

# Pilot Development with **Sumitomo Chemical** for Turquoise Hydrogen Prod.

Entered into Joint Pilot Development Agreement(JDA) to produce hydrogen from methane using microwave.

- ✓ Jan 22: Lab scale JDA for energy-saving, efficient turquoise hydrogen process.
- ✓ Aug 22; Entered into JDA for **pilot development** after successful lab experiment.
- ✓ **Commission pilot facility @MWCC Osaka within FY2023**, target to establish process by 2026.



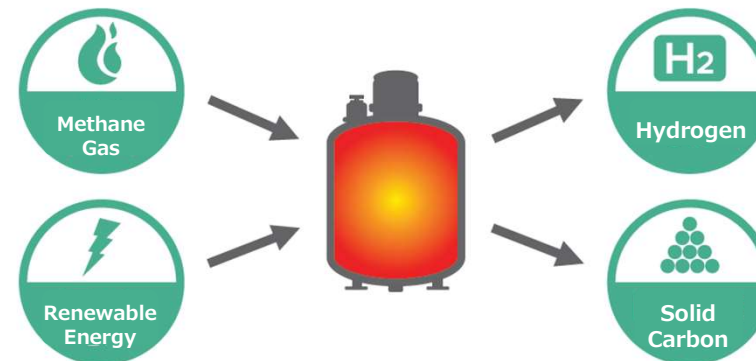
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does not represent actual business

## Turquoise Hydrogen

CH<sub>4</sub> gas

Prod.

Hydrogen



SUMITOMO CHEMICAL

Source: Sumitomo Chemical  
ESG Meeting in Dec., 2021

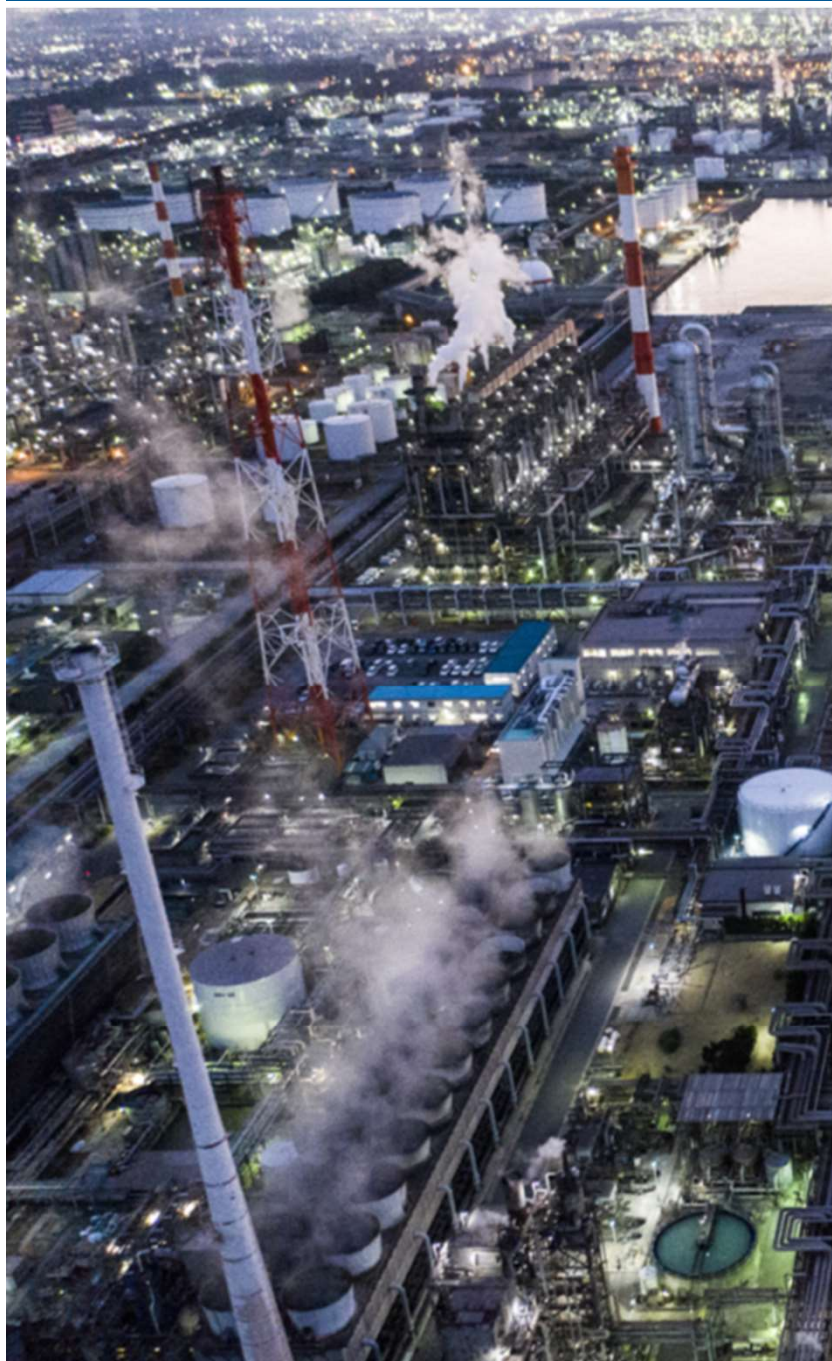
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# Company Overview



## Name

Microwave Chemical Co., Ltd.

## Founded

August 15, 2007

## Representative

CEO Iwao Yoshino

## No. of employees

60 (including 16 Ph.Ds)

## Head office

Photonics Center 5F, 2-1 Yamadaoka, Suita,  
565-0871 Osaka

## Major businesses

Provide solutions for from R&D to engineering processes, making the most use of our microwave technology platform

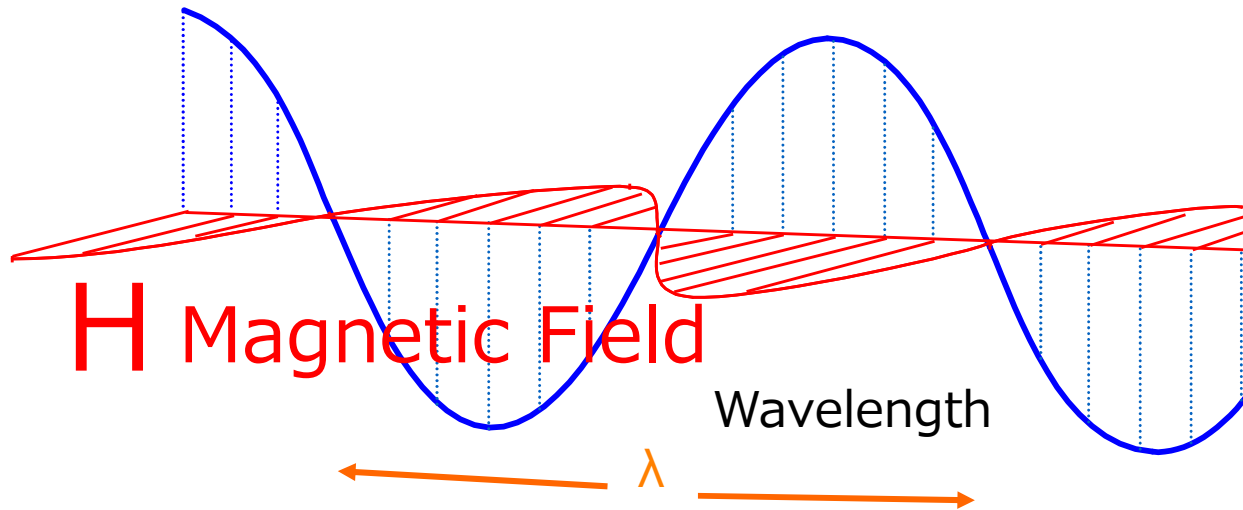
Note: Number of employees as of the end of March 2022



# What is Microwave ?

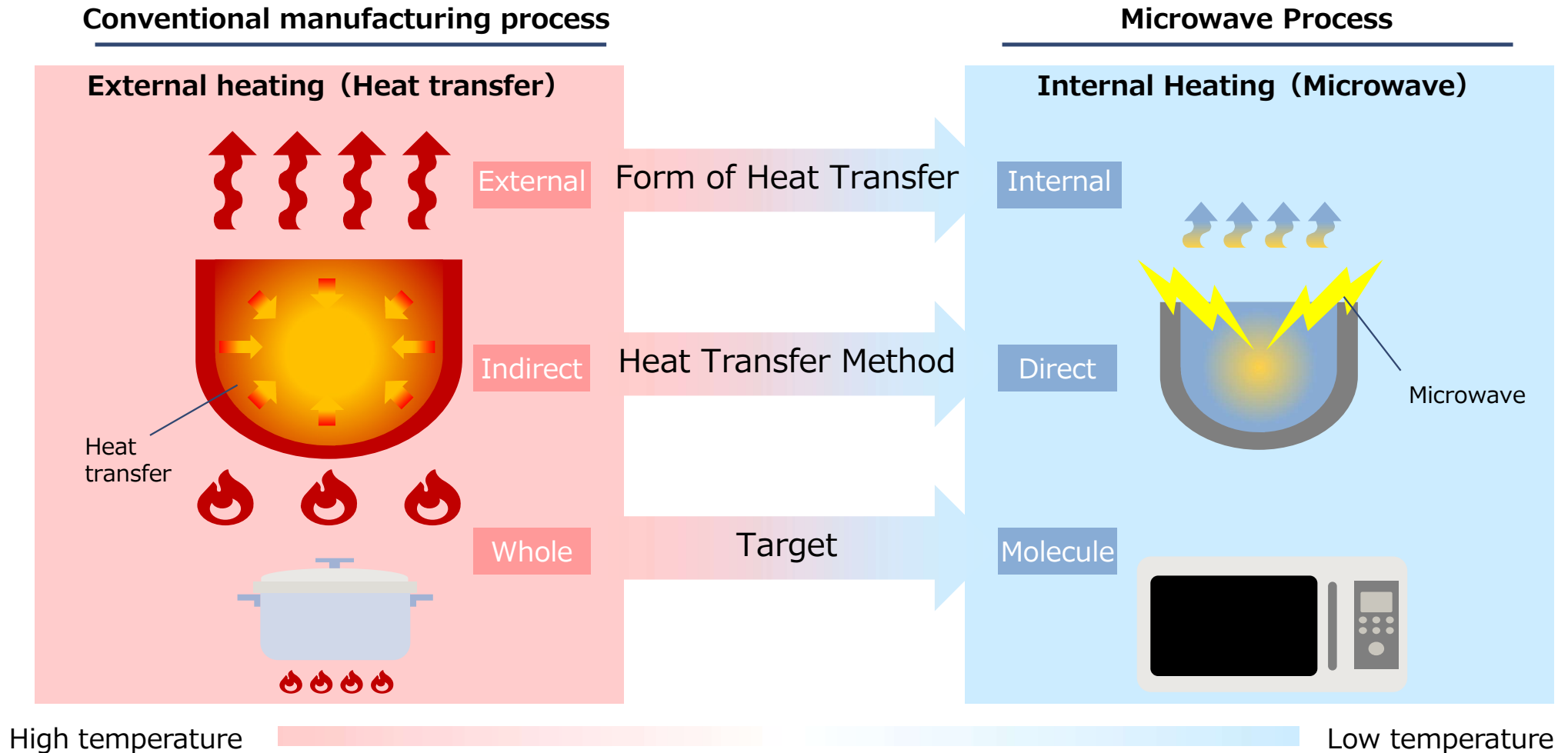
Microwave is an electromagnetic wave used in applications such as wireless base stations, radar-communication systems, and microwave ovens.

**E** Electric Field



# Feature of Microwave Process

We will dramatically change the manufacturing process utilizing microwave technology.



\*In the Conventional heat transfer process, energy is transferred to the whole object indirectly through external material. On the other hand, microwaves process transfers energy to the target molecule directly from inside. **Totally opposite approach.**

# Benefit of Microwave Process (1/2)

## Legacy System



Source : BASF Corporate History  
1900



Current

## Innovation



## Benefits

Process



Reduce Energy consumption by 1/3\*<sup>1</sup>

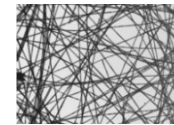


Highly efficient and reduces cycle time by 1/10\*<sup>1</sup>

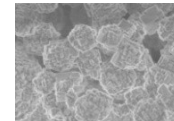


Small Footprint 1/5\*<sup>1</sup>

Product



Development of new materials and high-quality materials



Decarbonation

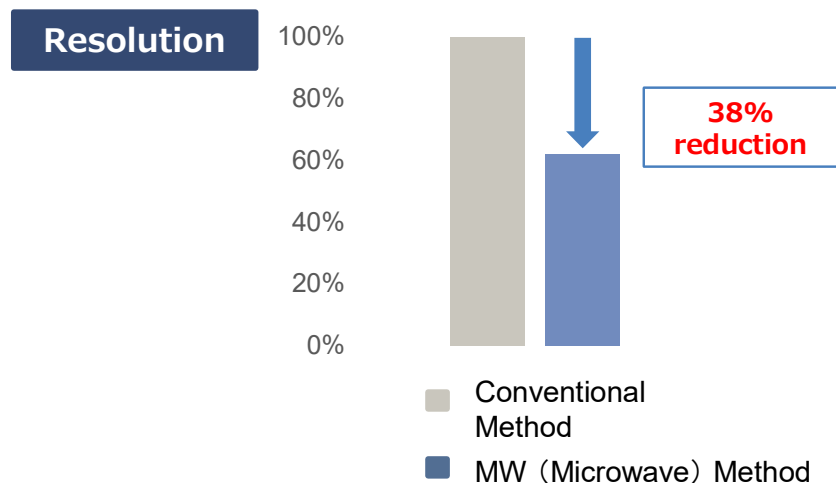
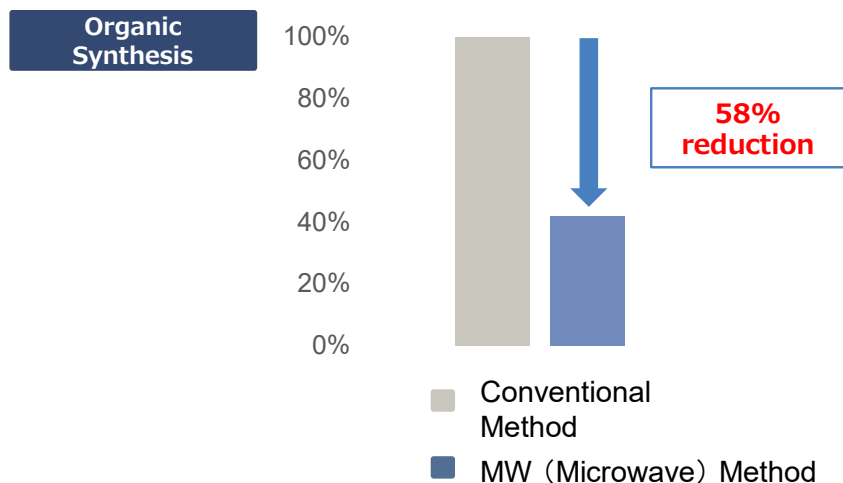


90%\*<sup>1</sup> reduction of CO<sub>2</sub> emissions with electrification using renewable energy

\*1 : The figures are estimated from our plant of fatty acid esters operated in Osaka

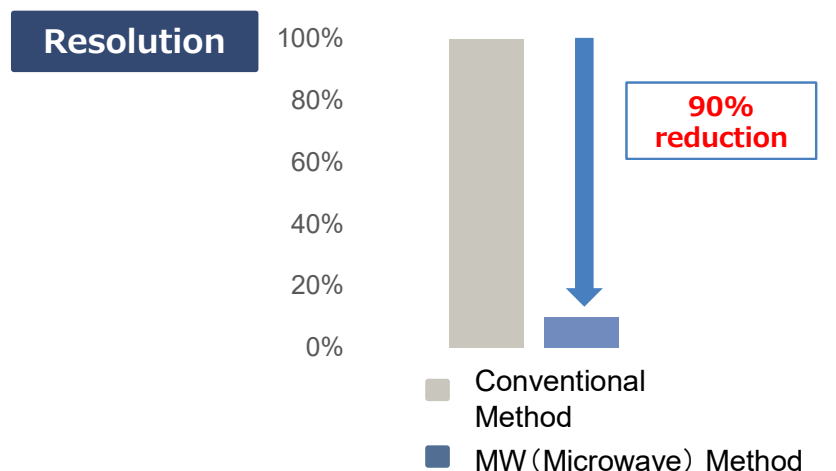
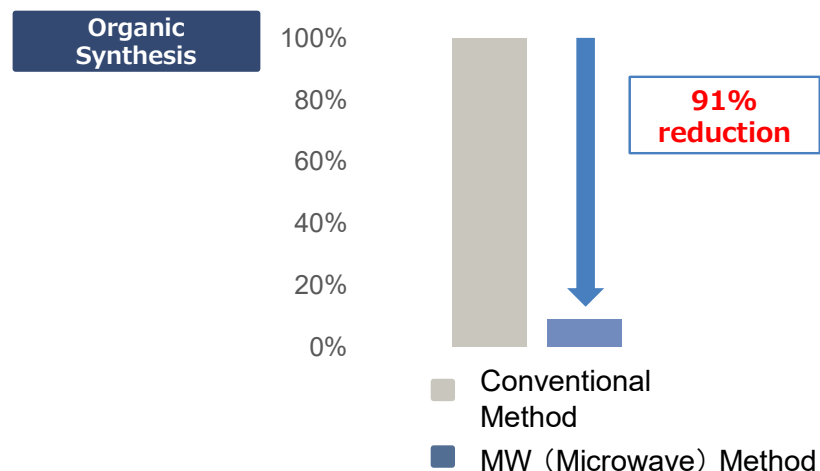
# Benefit of Microwave Process (2/2)

## Energy consumption: 1. Energy saving with microwave systems



## CO<sub>2</sub> emissions:

### 1. CO<sub>2</sub> emission cuts = 1. Microwave-assisted energy efficiency × 2. CO<sub>2</sub> emission intensity by energy source



CO<sub>2</sub> emission cuts are calculated by multiplying 1. energy consumption by 2. energy sources used. Use of microwaves reduces energy consumption in many chemical reaction processes. There is a trend that chemical manufactures across the world are laying out their roadmaps, assuming that they significantly reduce the use of conventional fossil fuels to shift to natural energies, which will diminish the intensity of CO<sub>2</sub> emission from energy sources.

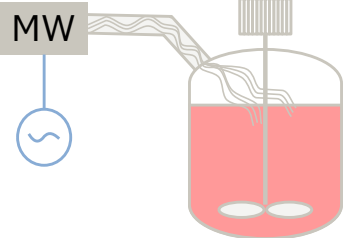
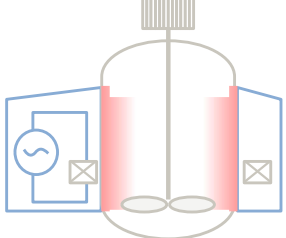
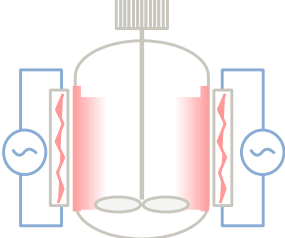




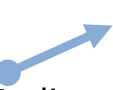
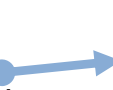
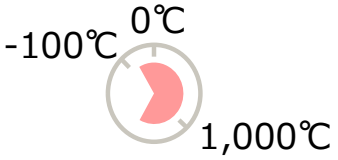
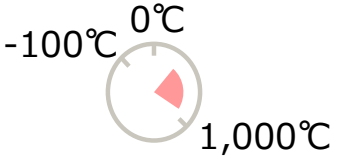
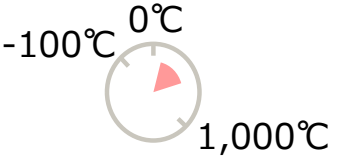
\* MW Method assumes the use of photovoltaic electricity, CO<sub>2</sub> emission reductions and energy equivalent reductions are our estimates. Conventional method data is our trial calculation, and MW method data is based on our demonstration machine at commercial level





# Comparison – Electrification technology

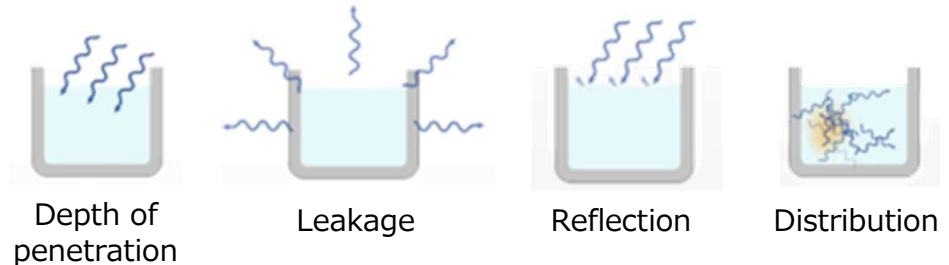
Microwave process is the only process that transfers energy directly, which provides advantage, such as scaling up, energy efficiency, and temperature range.

	Microwave Heating	Induction Heating	Electric heater Heating
			
Energy Transfer	Direct	Indirect	Indirect
Scaling Up	 Easy	 Restricted	 Restricted
Energy Efficiency	 High	 Medium	 Low
Temperature Range			

# Success in Scaling Microwave Process to Industrial Level

## Challenges for Industrial Applications of Microwaves

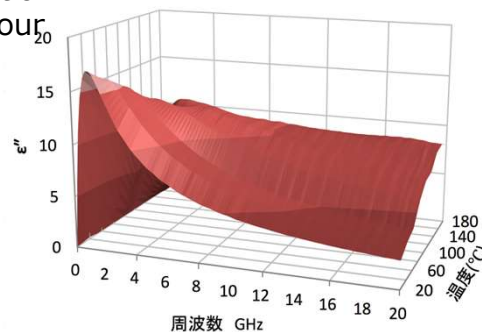
In the chemical industry, many useful experimental results using microwaves have been reported in papers since the 1980s. However, because microwaves are "waves," it is extremely difficult to control. Therefore, industry norm was that the microwave technology cannot be used in industrial setting and only in the lab.



## Solved by Our Unique Approach

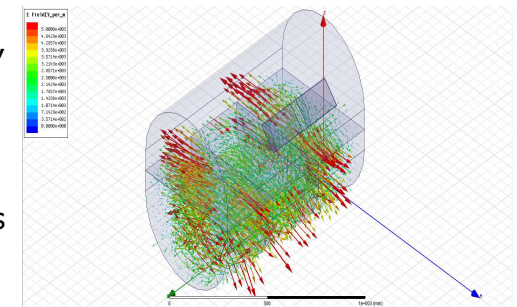
### 【Reaction System Design】

Developed data base of absorption rate of each molecule through our proprietary measurement technology. Design reaction utilizing the database by recognizing the pattern.



### 【Reactor Vessel Design】

Develop simulation technologies, couple electromagnetic field and thermic fluid analyses to increase the granularity in simulating the state, and introduce supercomputers, so as to apply to large-sized and complex reactor vessels



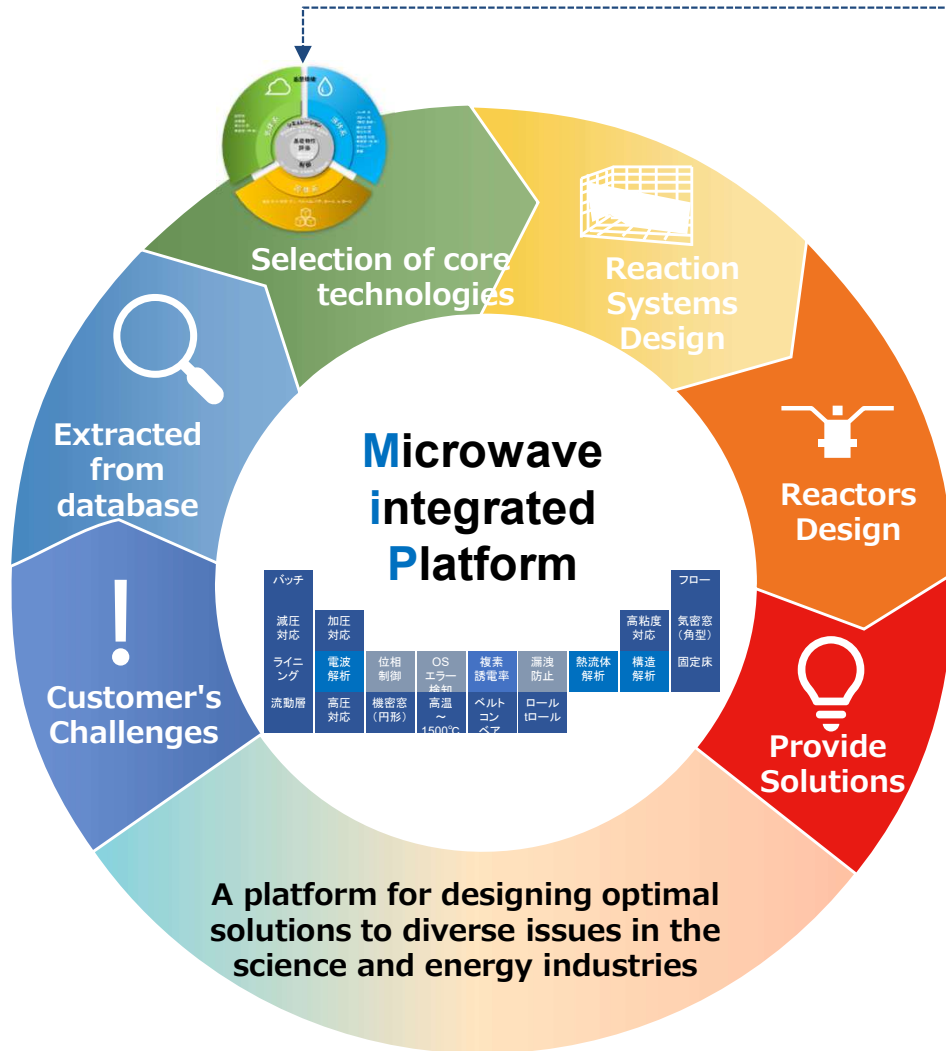
## Realizing Industrial Applications of Microwaves

Completed large-scale chemical plant using microwave chemical process in Osaka in 2014 and started commercial operation complying with various laws and regulations such as the Fire Service Act.

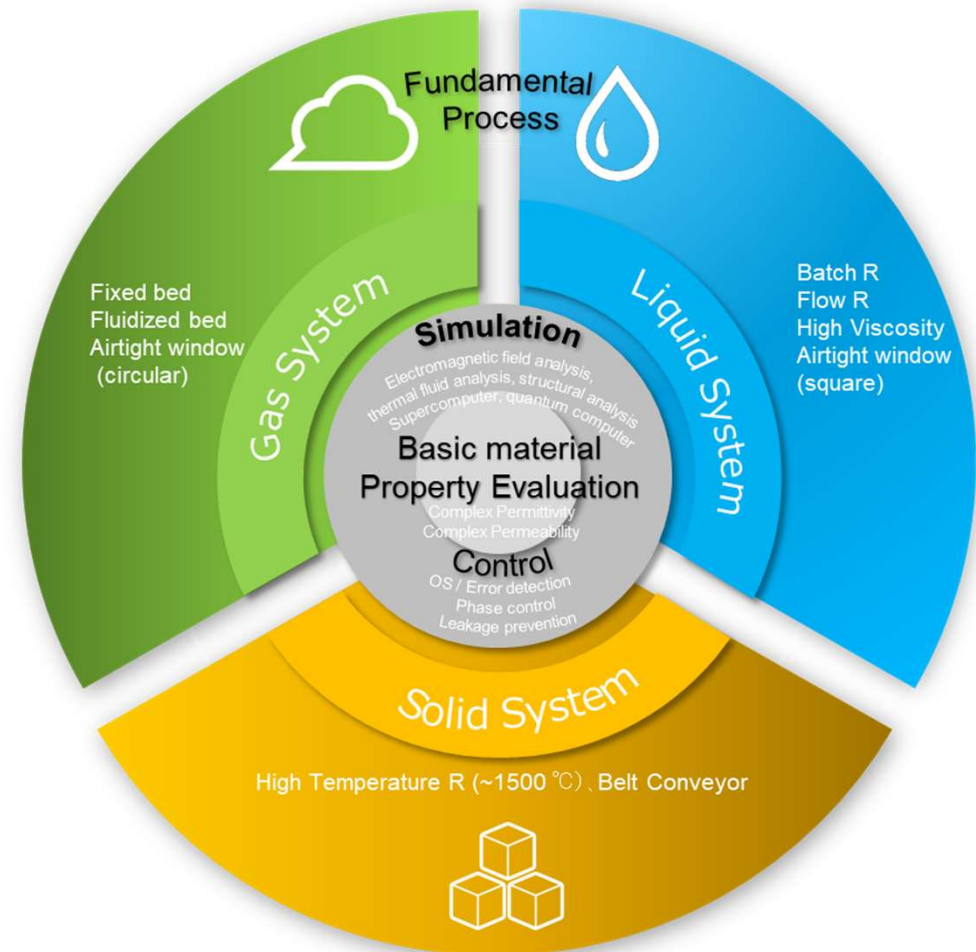


# Technology Platform and Core Technologies

## Our Technology Platform

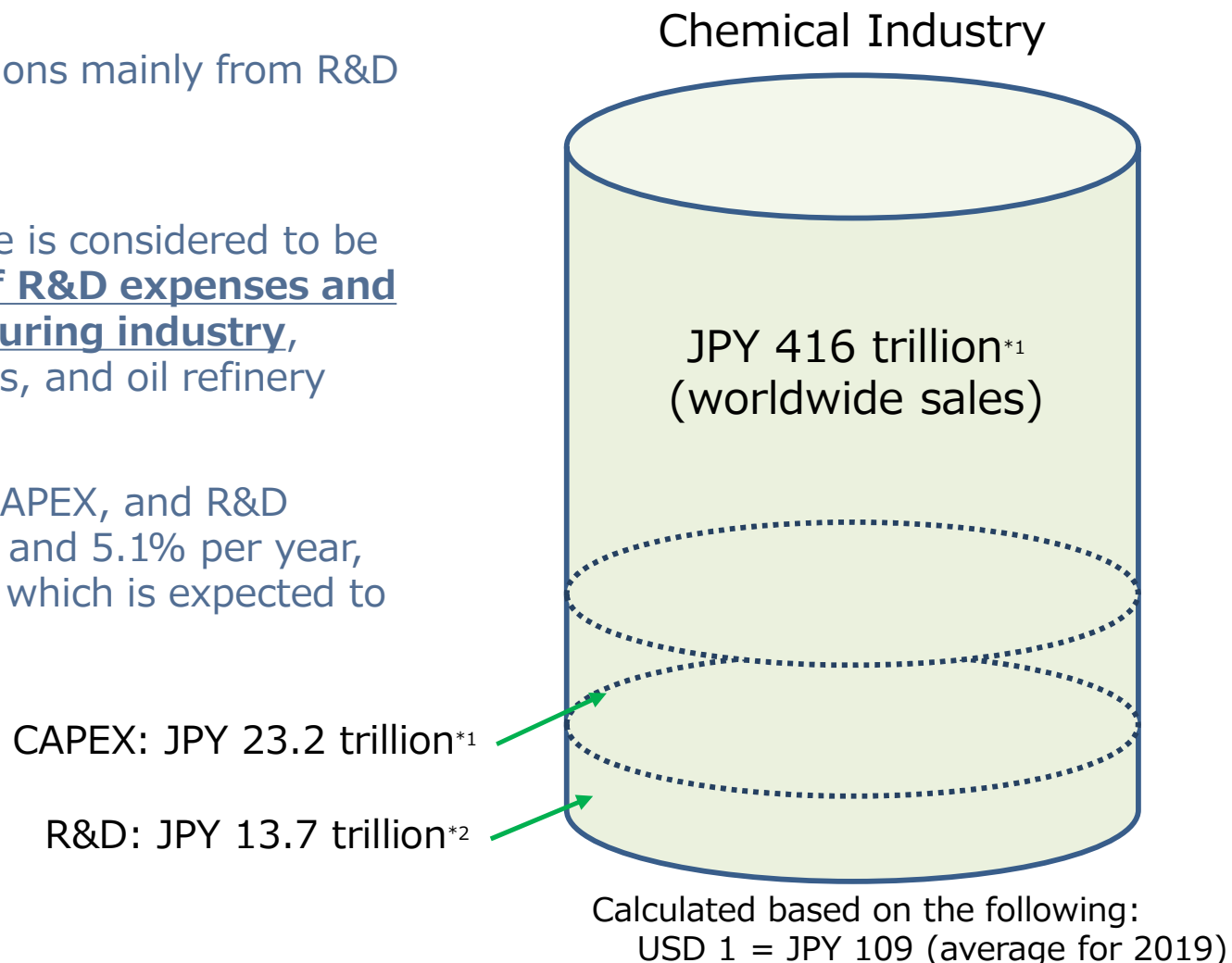


## Our Core Technologies



# Potential Market

- Customers pay fees for our solutions mainly from R&D expenses and CAPEX
- As such, the potential market size is considered to be **the part of the total amount of R&D expenses and CAPEX in the overall manufacturing industry,** including chemical, medical, foods, and oil refinery
- In the chemical industry, sales, CAPEX, and R&D expenses increased 3.9%, 4.6%, and 5.1% per year, respectively, from 2010 to 2020, which is expected to continue



\*1 Guide to the Business of Chemistry 2021 American Chemical Council, August 2021

\*2 Forecast on global annual chemical industry capital expenditures 2019-2023

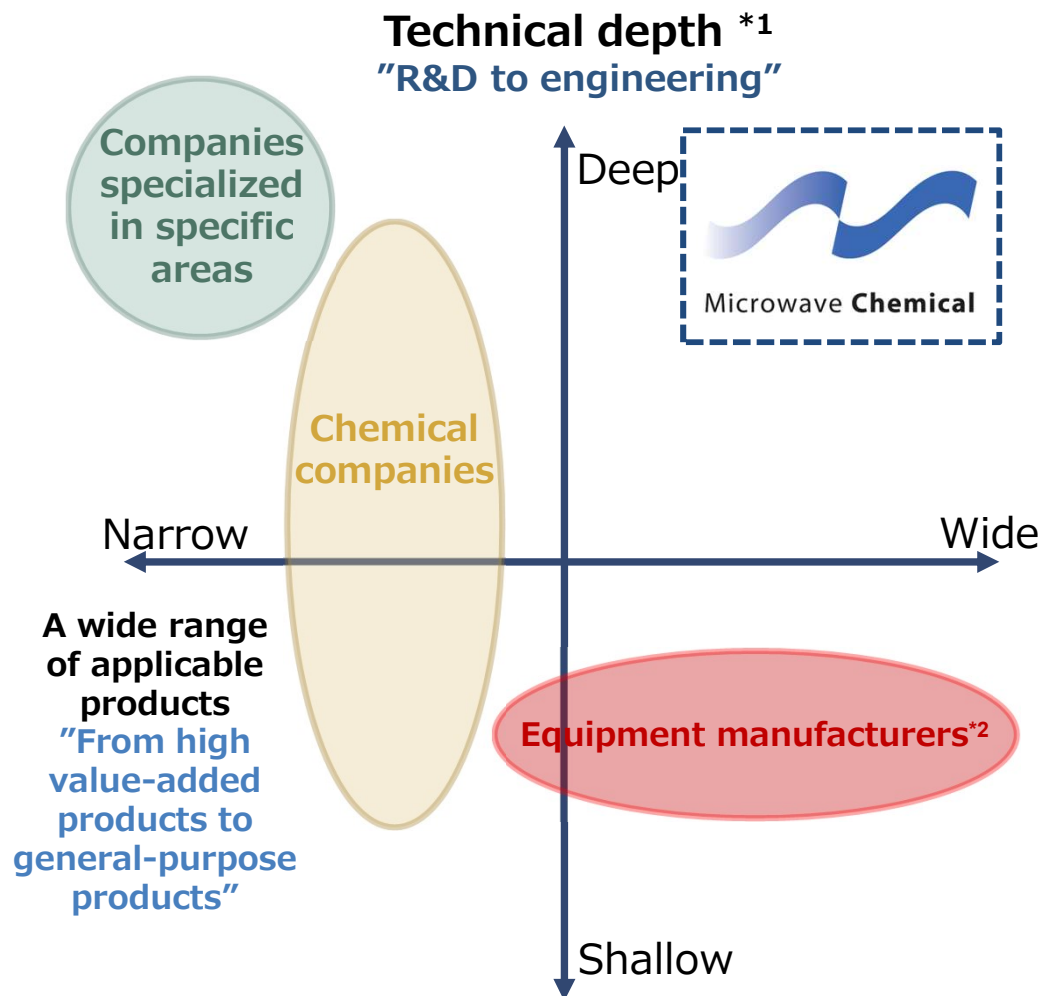
\*3 Research spending continues on an upward trajectory ) <https://cen.acs.org/business/investment/Research-spending-continues-upward-trajectory/97/i23>

2022 Facts And Figures Of The European Chemical Industry) <https://cefic.org/a-pillar-of-the-european-economy/facts-and-figures-of-the-european-chemical-industry/>

# Competitive Landscape

Current Competitive Environment

Multi-layered Entry Barrier



- **Technology platform**

- ✓ Design capabilities and core technology groups for reaction systems and reactors
- ✓ Patents and know-how supporting the platform

- **Development team and infrastructure**

- ✓ Cross-sectorial team, such as physics, chemistry, engineering, and simulation
- ✓ The large microwave-focused labs and demonstration development infrastructure

- **Customer base accumulation**

- ✓ Deeply understanding issues and requests identified through constant relationships including horizontal connection
- ✓ Production technology and compliance with laws and regulations accumulated through experience in the start-up and operation of large-scale commercial plants

\*1 Depth of solutions we provide for customers' R&D and engineering challenges, which are backed by our scientific capabilities. Generally, either only R&D or only equipment is provided

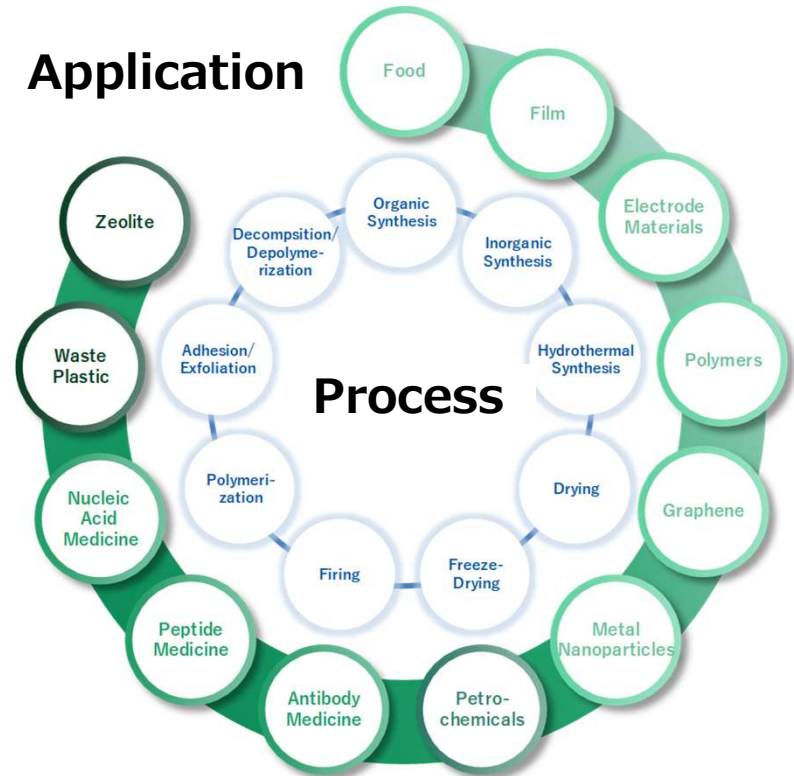
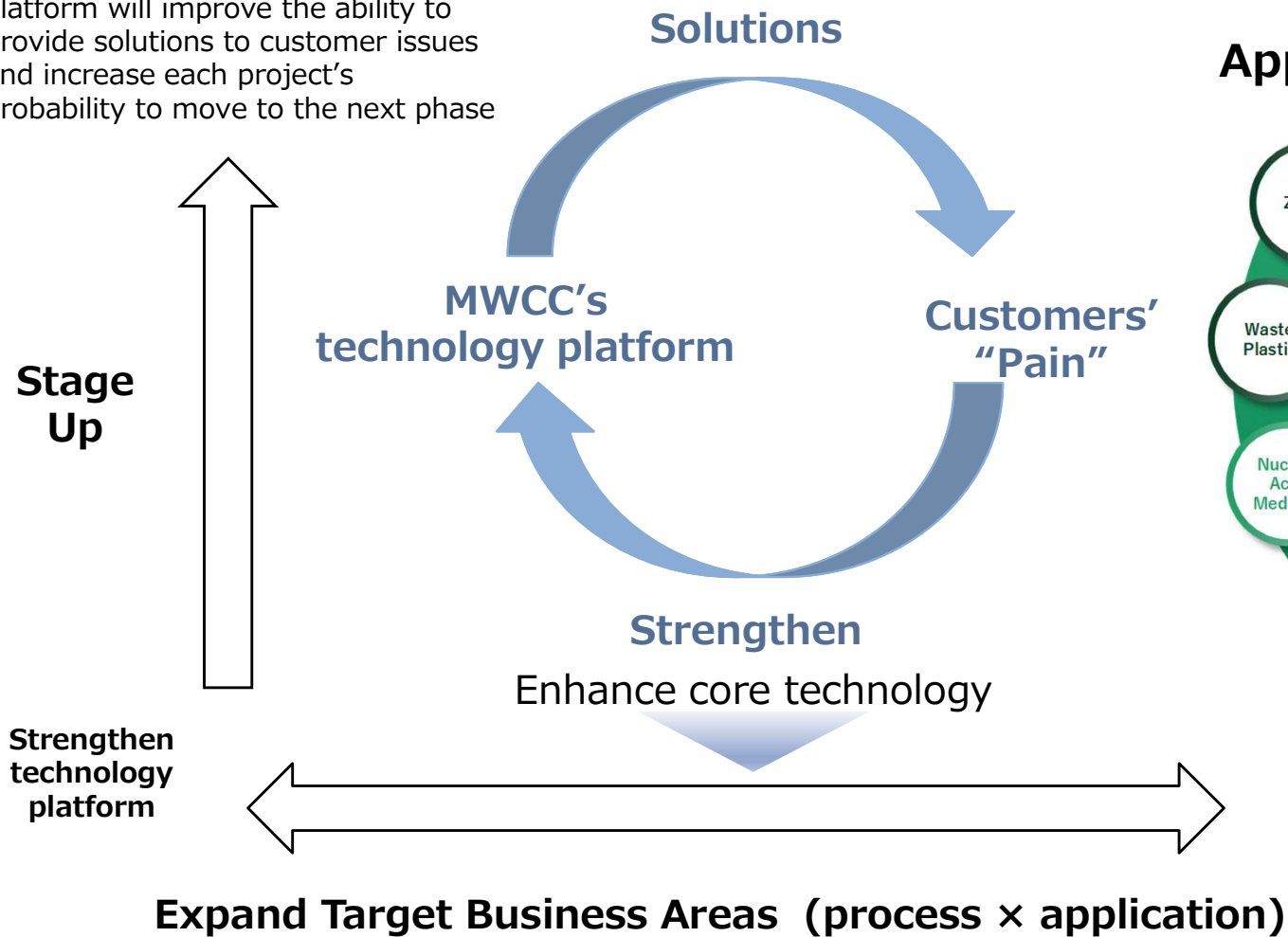
\*2 Mostly machine manufacturers

Note: This graph is an image of our own analysis of the positioning of each company in the industry



# Virtuous Cycle Drives Growth

Strengthening of our technology platform will improve the ability to provide solutions to customer issues and increase each project's probability to move to the next phase



Enhanced core technology will increase the number of processes (manufacturing methods) and applications (products) for which microwave technology platform can be used

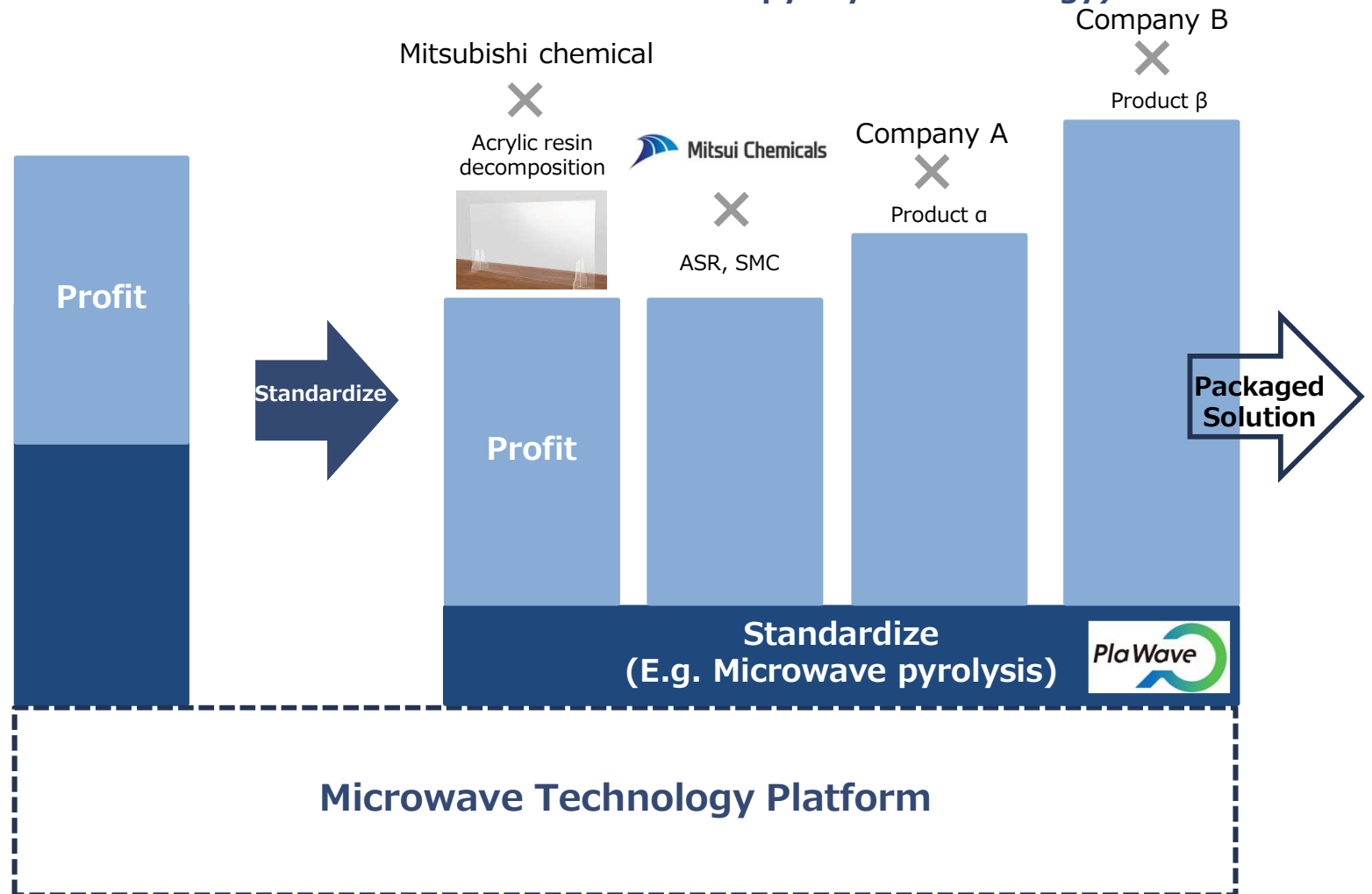
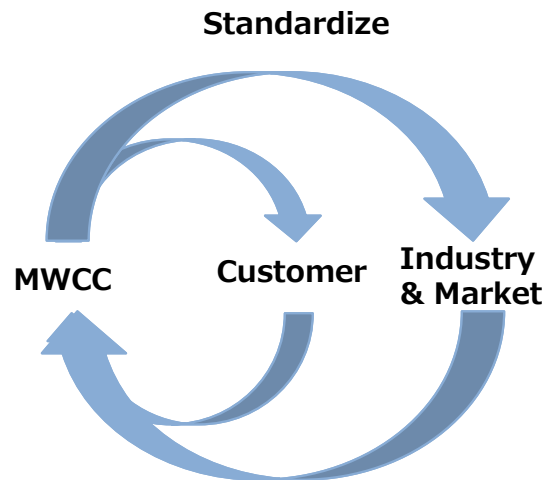
# Standardization Drives Growth

We scale our business by “standardizing” our technology platform and providing solutions to “pains” which is common to industries and markets. For example, we have conducted chemical recycling business using microwave pyrolysis technology, pharmaceutical-related and food-related business using microwave freeze-drying technology.

Solutions for each customer

Standardized solutions for each industry and application (E.g. Chemical recycling business by standardized microwave pyrolysis technology)

Examples: chemical recycling, freeze-dry, etc.



Note: This graph is an illustration of our own analysis of the scale of the business



# End of Document

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Microwave **Chemical**

**Make Wave,  
Make World.**

世界が知らない世界をつくれ