



BUILDING YOUR TOMORROW TODAY

Investor Relations 2019





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We trust your decisions will be based on your own independent judgement.

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Investor Relations 2019

DOOSAN CORPORATION

Chapter 1. Spin-off Background

Chapter 2. Growth Strategies of Doosan Corp

Chapter 3. Doosan Corp's Dividend Policy



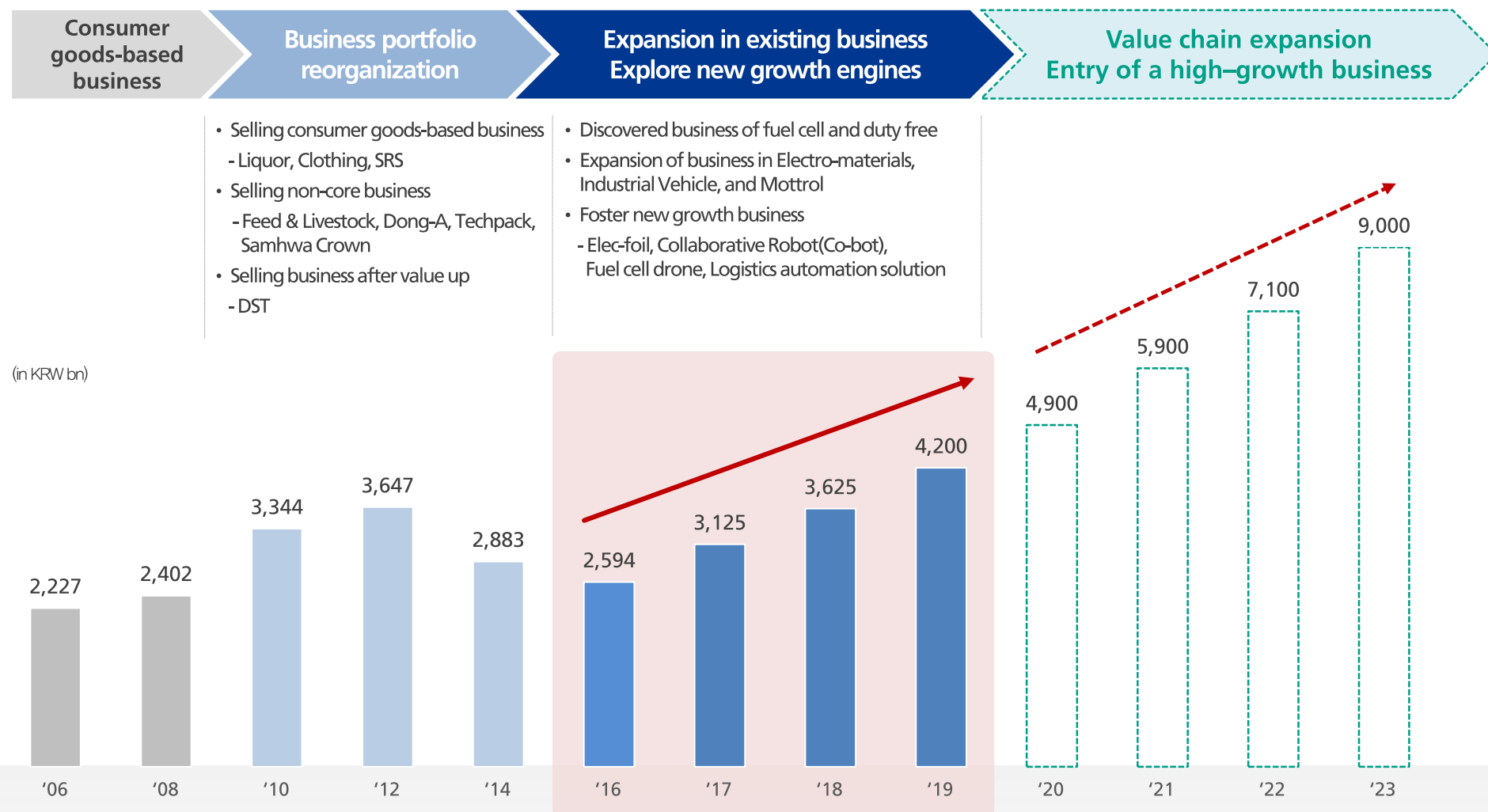


Chapter 1.

Spin-off Background

01. Doosan Corp's Changes in Business : Yearly Sales
02. Growth Direction of Doosan Corp's In-house Business : New and Expanded Portfolio
03. Types of New Business in Doosan
04. Expected Effects after Spin-off
05. Discovery and Growth of Business in Fuel cell/Elec-foil

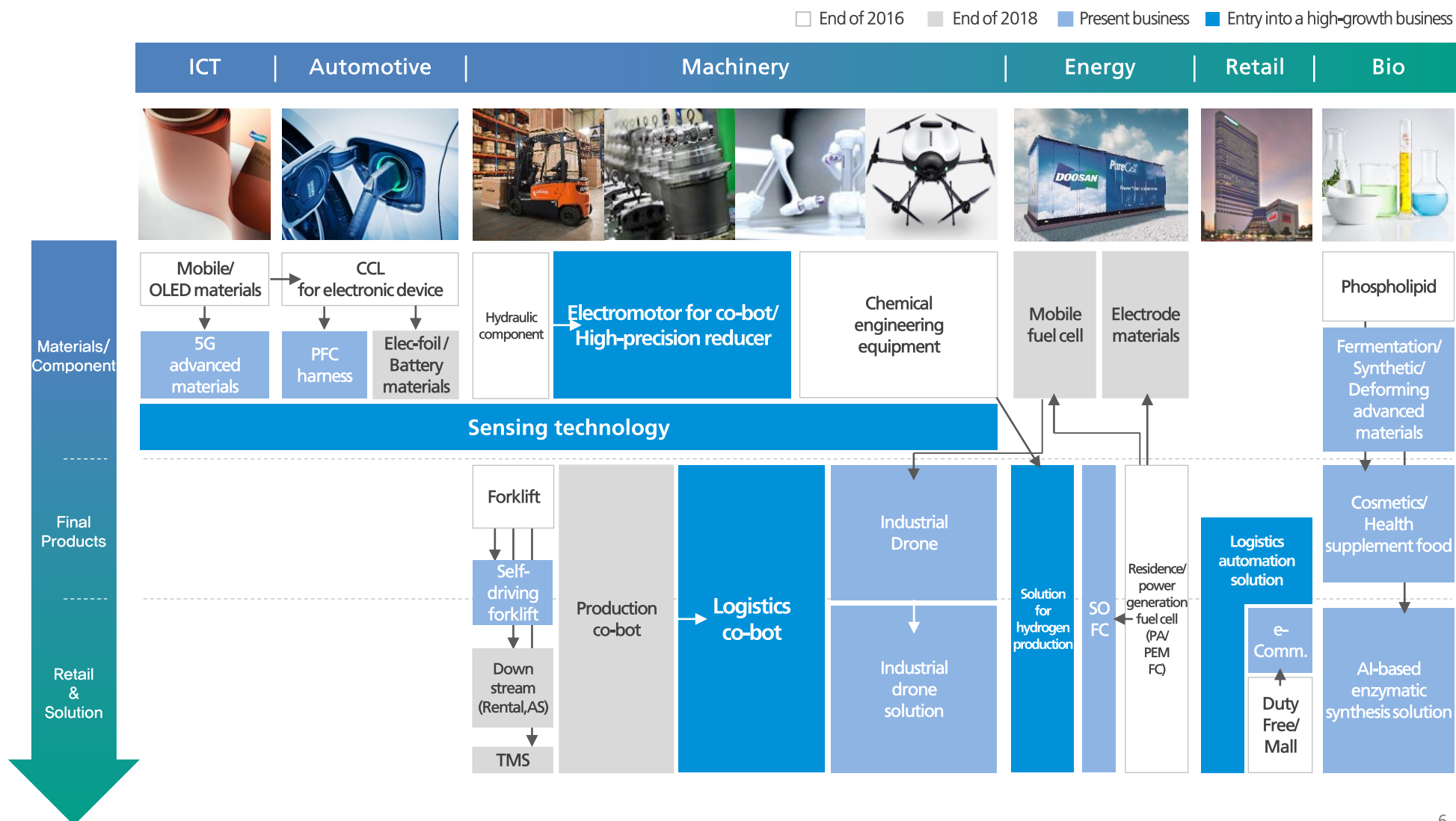
01. Doosan Corp's Changes in Business : Yearly Sales¹⁾



1) Management consolidated basis : Doosan Corp's BG/BU consolidation + 100% Investment company

02. Growth Direction of Doosan Corp's In-house Business : New and Expanded Portfolio

Scale-up(↓) through expansion of value chain, Entry into high-growth business(↔)



03. Types of New Business in Doosan

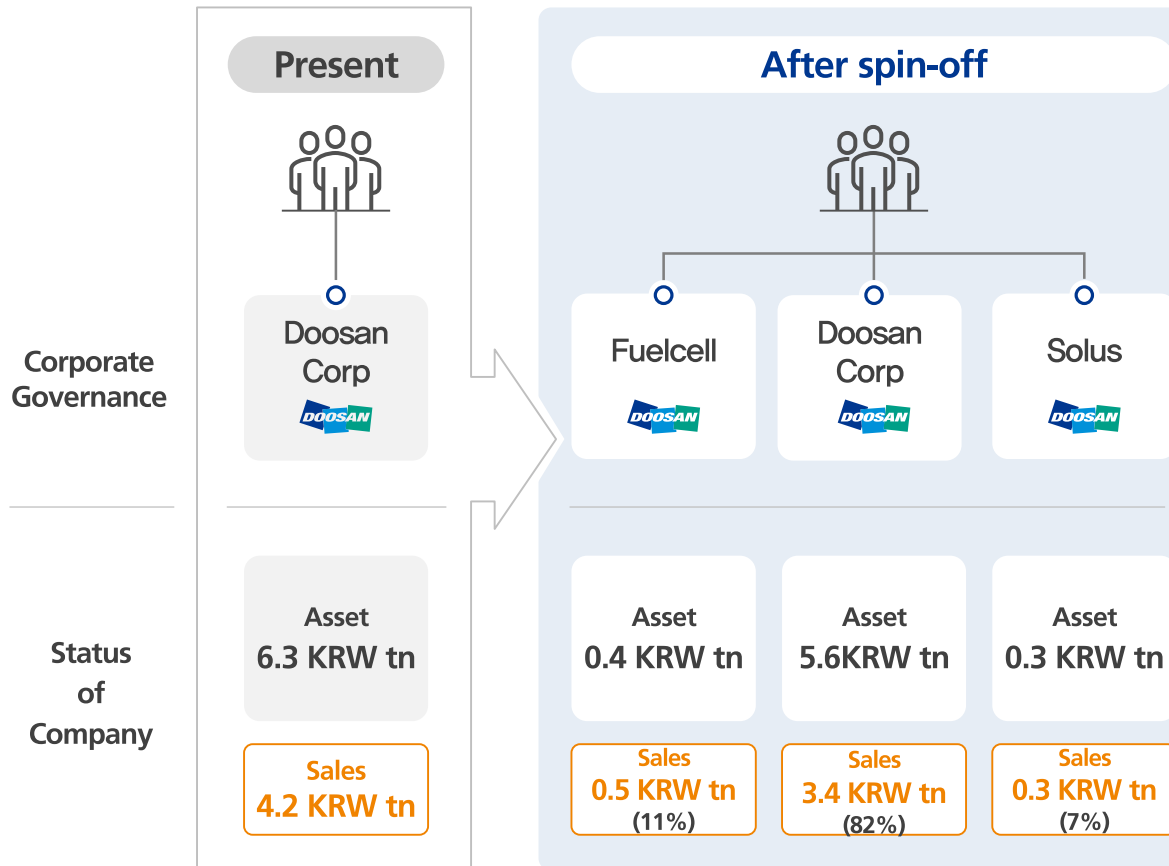
	Operate as Doosan Corp's In-house business					Operate as subsidiary			Review and development in progress	
	Elec-foil	Fuel cell for power generation	Residence/ Building fuel cell	OLED Materials	Bio Materials	Co-bot	Fuel cell drone	Logistics automation solution	5G Materials	SOFC
Rapidly growing market	✓	✓	✓	✓	✓	✓	×	✓	✓	✓
Stabilized business	✓	✓	×	✓	✓	×	×	×	×	×
Large-scale investment necessary	✓	✓	×	✓	✓	✓	✓	×	×	×

Business of Elec-foil / OLED / Bio materials / Fuel cell for power generation is

- 1) rapidly growing and 2) being stabilized so in order to dominate the market in advance,
- 3) large-scale of early investment is required

04. Expected Effects after Spin-off

[As of Oct 2, 2019, management consolidated basis]



Expected effects

Growth of business through selection and concertation strategy



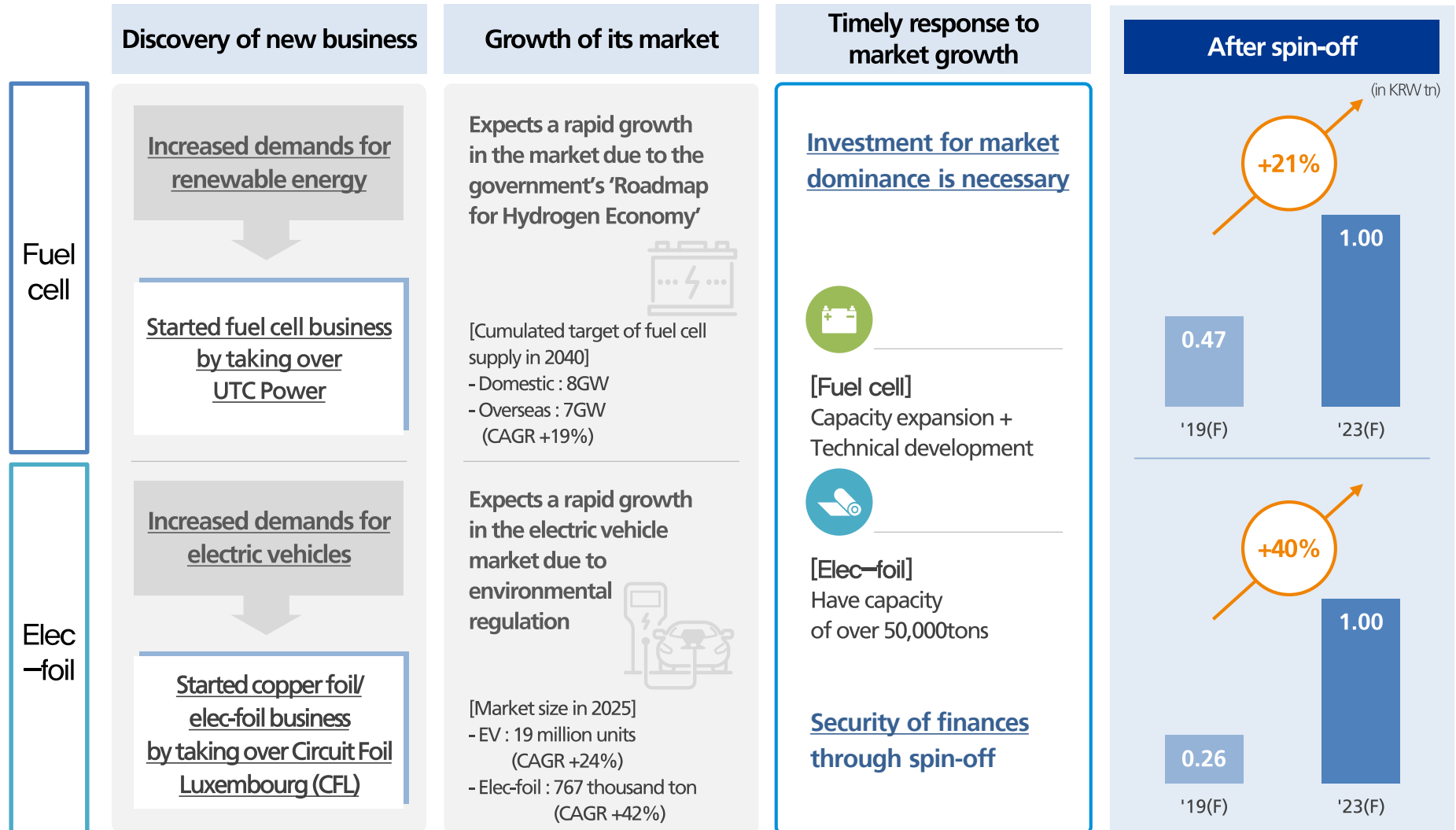
◦ New Entity

- Dominance of high-growth market in advance by securing timely investment
- Sustainable development of future core technologies

◦ Surviving Entity

- Focus on core business, such as electro-materials and industrial vehicle
- Increasing value of logistics solution, co-bot, and fuel cell drone through growth and stabilization
- Explore and foster new growth engines

05. Discovery and Growth of Business in Fuel cell/Elec-foil





Chapter 2.

Strategies of Doosan Corporation

Strategies of Doosan Corporation

Advanced Material & Energy

- 1 Expanding Business of Electro-materials/Energy
- 2 Growth of Residence/Building Fuel Cell Business

Advanced Material & Energy
- Mid/Long-Term Sales Target

Machinery

- 1 Expansion of industrial vehicle downstream business
- 2 Expanding M/S of Mottrol and diversifying products other than excavators
- 3 Mecatec discovery of hydrogen production equipment business

Machinery
- Mid/Long-Term Sales Target

Vision of Doosan Corporation

Logistics Solution Provider

- 1 Logistics Automation Solution
- 2 Co-bot
- 3 Fuel cell drone
- 4 Expansion of the electric logistics equipment business

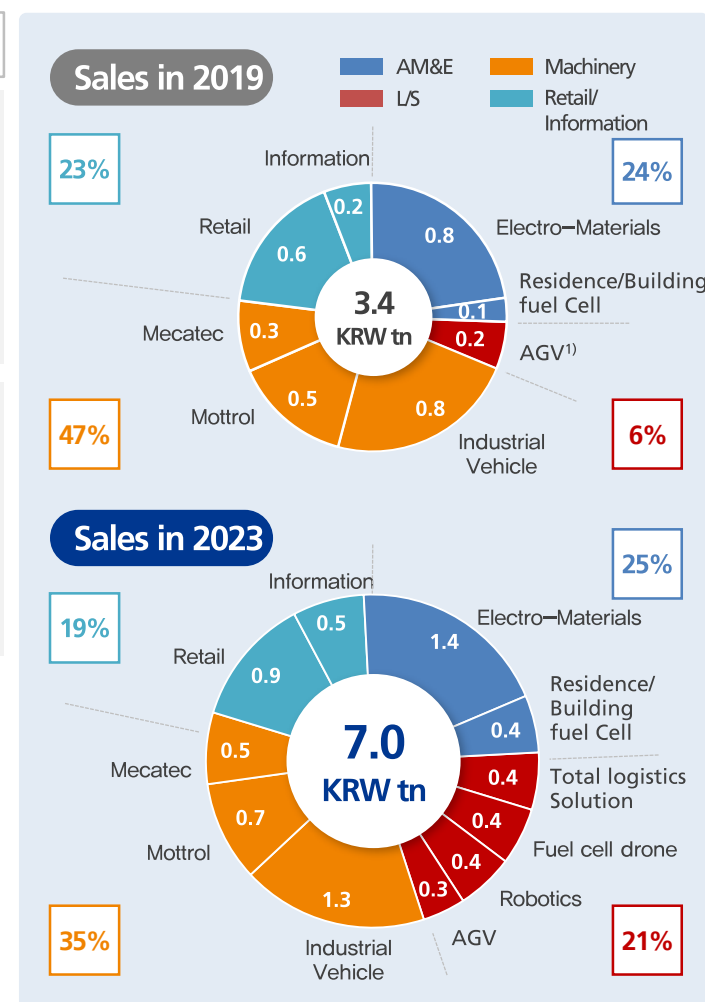
Logistics Solution Provider
- Mid/Long-Term Sales Target

Strategies of Doosan Corporation

Stabilize Machinery business and explore/foster new growth engines on the basis of following two business :

①Advanced Material & Energy and ②Logistics Solution Provider

	Market Trend	Major Business Areas
Advanced Material & Energy	<ul style="list-style-type: none"> 5G, Autonomous/Electronic Vehicles, AI, IoT, AR/VR Eco-friendly energy <p>→ Increases in demand for high-end and eco-friendly materials</p>	<ul style="list-style-type: none"> Network board Materials for semiconductor Materials for electric device and fuel cell Residence/Building fuel cell
Logistics Solution Provider	<ul style="list-style-type: none"> e-Commerce based Complex/Automated logistics <p>→ Increases in demand for logistics automation system</p>	<ul style="list-style-type: none"> Total logistics automation solution Elec-type forklift co-bot, fuel cell drone
Machinery	<ul style="list-style-type: none"> Stable growth based on aftermarket services Increased demand in emerging markets 	<ul style="list-style-type: none"> Engine-type forklift, Forklift downstream business Hydraulic and electronic drive Chemical engineering equipment, Hydrogen Equipment
Retail/ Information	<ul style="list-style-type: none"> Online based Importance of Big Data 	<ul style="list-style-type: none"> Retail (Duty free, Mall) IT



1) AGV : Automatic Guided Vehicles

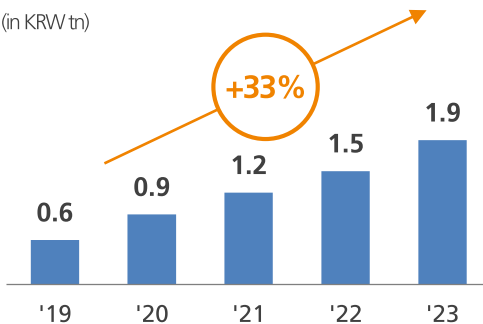
1 Expanding business of Electro-materials/Energy

Expand business of 5G / Semiconductor / Electronic Device / Energy based on core technologies acquired

Changes and Growth in the Market

Rapid growth of 5G materials/components markets with entry into the 5G era

[5G base station material market]¹⁾
(in KRW trn)



Expansion of electronic device markets due to autonomous/electric vehicles

Growth of non-memory semiconductor market
(Government and Samsung Electronics' strategic development)

Growth of related business according to the government's 'Roadmap for Hydrogen Economy'

Market Position & Growth Strategies

Global Position in CCL business

- Global only company with a wide portfolio of high-end materials

[Global M/S in main products]

	1st	2nd	3rd
PKG			HITACHI
NWB	Panasonic		tuc
FPCB			TRIFLEX

Acquired technology meeting the needs of the market

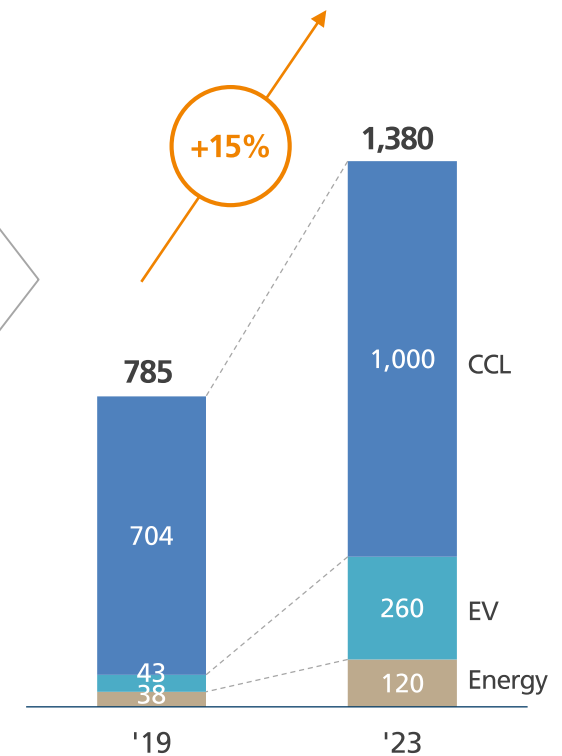
- High-end and eco-friendly material technology acquired

- Low loss/dielectric technology acquired
- Ability to correspond refining circuit and high specification
- Key fuel cell materials acquired

Mid/Long-Term Sales Target

Develop as an electro/electronic device/energy materials company from an electro-materials company

(in KRW/bn)



1) Source : Prismark

2 Growth of Residence/Building Fuel Cell Business

Capture market opportunities in accordance with 'Roadmap for Hydrogen Economy' through competitiveness in technology and product differentiation

Changes and Growth in the Market

Rapid growth of fuel cell markets according to 'Roadmap for Hydrogen Economy'

[Roadmap for Hydrogen Economy]

[Accumulated Units]

Hydrogen
Vehicle/Station



	2018	2022	2040
HV	18,000	81,000	6.2million
HS	14	310	1,200

Fuel cell for plant



	2018	2022	2040
	307MW	1.5GW (1GW)	15GW (8GW)

Residence/Building fuel cell



Households
Building

	7MW	50MW	2.1GW
Households	2,000	4,000	300,000
Building	500	4,500	180,000

Market Position and Growth Strategies

1st M/S in residence fuel cell

Share the fuel cell market with 'S' company

SOFC technology acquired

Secure technology through agreements with Ceres Power in UK

- ✓ Joint development of SOFC products for building
- ✓ Competitiveness in cost/durability

Product differentiation

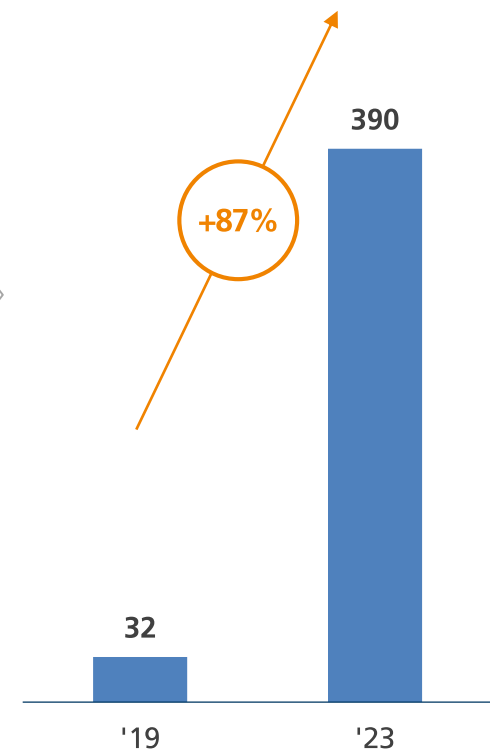
Different market approach depending on each type of technology (PEMFC, SOFC)

- ✓ PEMFC : Residence, Mobile (Drone)
- ✓ SOFC : Residence/Building that needs only electricity

Mid/Long-Term Sales Target

Develop as a leading residence/building fuel cell company

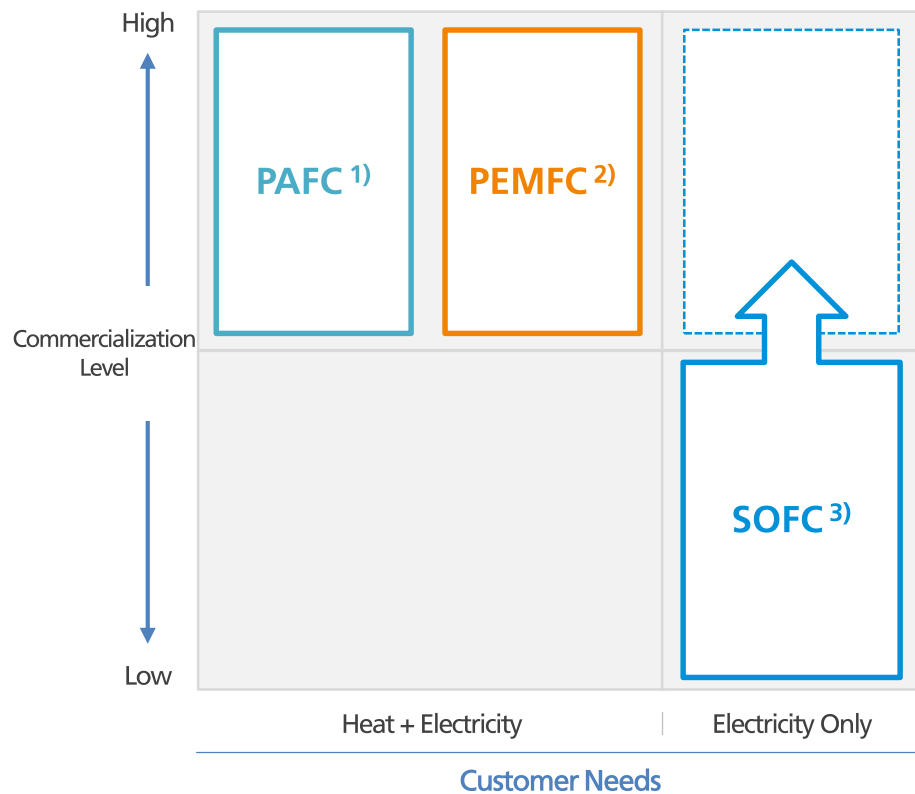
(in KRW/bn)



Appendix] Securing SOFC technology

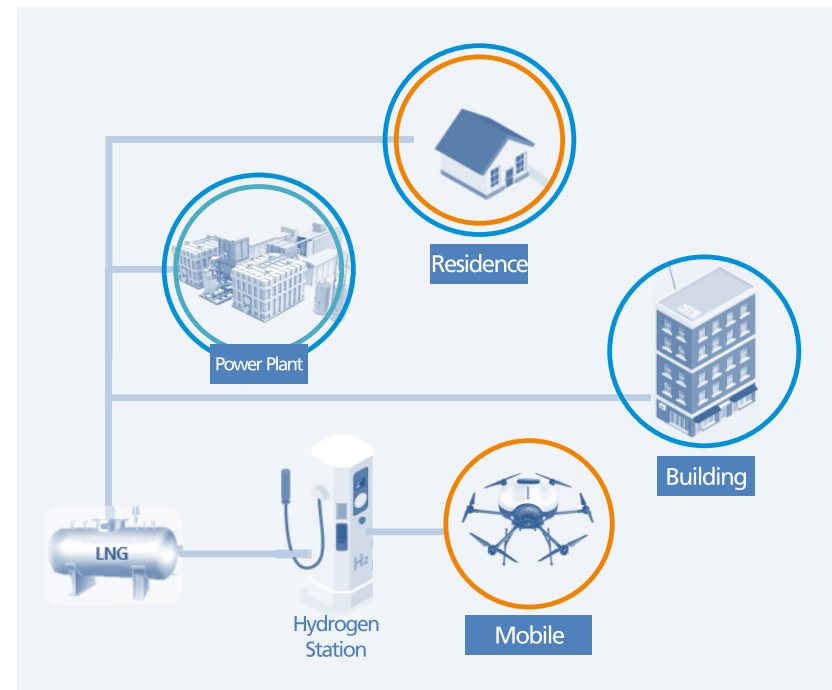
Secure SOFC technology in advance in response to market growth driven by the government and diversification of demand

Expansion of fuel cell technology portfolio
Secure SOFC technology in advance in response to customer who prefers power efficiency

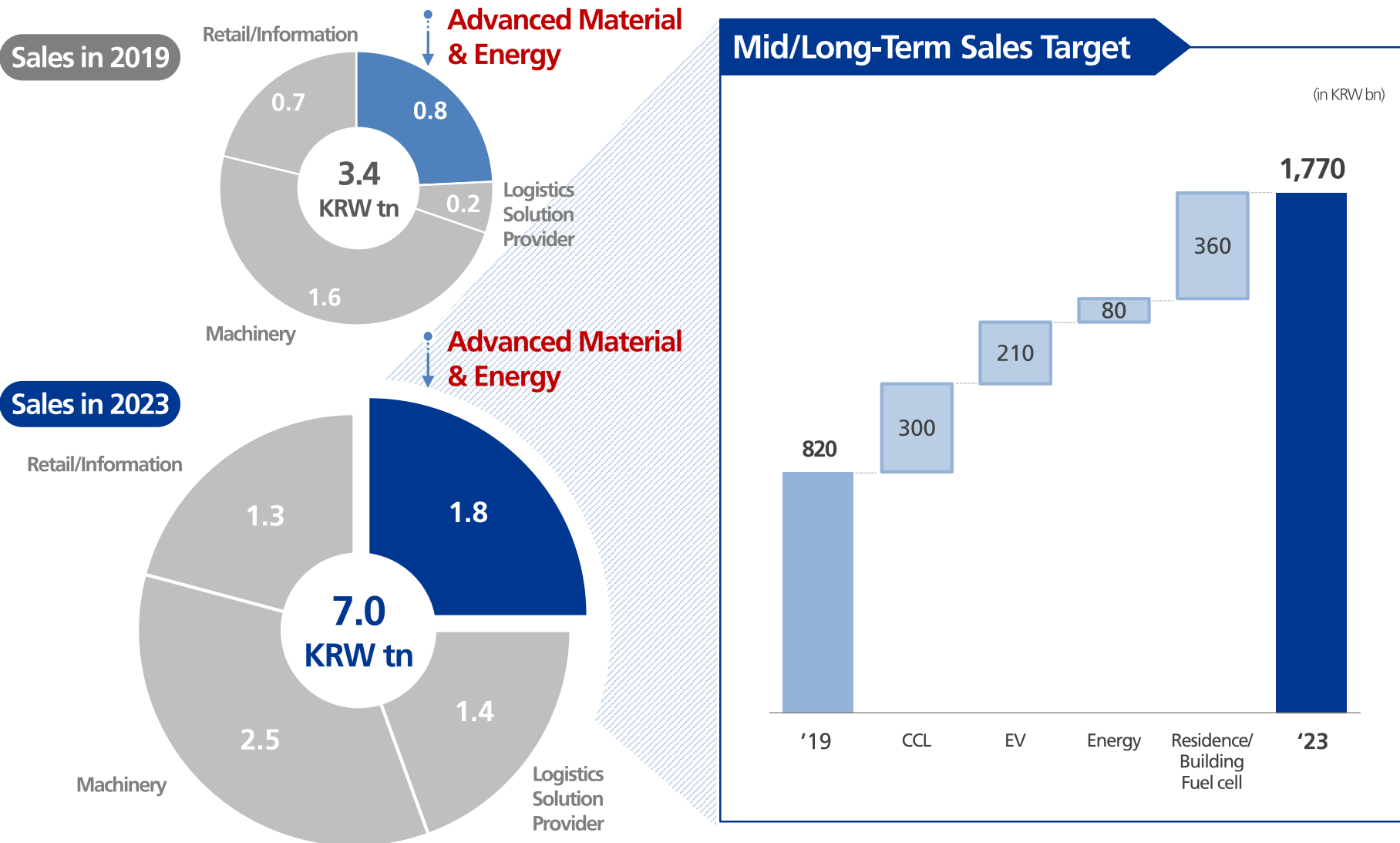


- 1) PAFC : Phosphoric Acid Fuel Cell
- 2) PEMFC : Proton Exchange Membrane Fuel Cell
- 3) SOFC : Solid Oxide Fuel Cell
- 4) CHP : Combined Heat and Power

Expansion of fuel cell application
Possess different fuel cell technologies applicable to various applications



Mid/Long-Term Target of Advanced Material & Energy Business

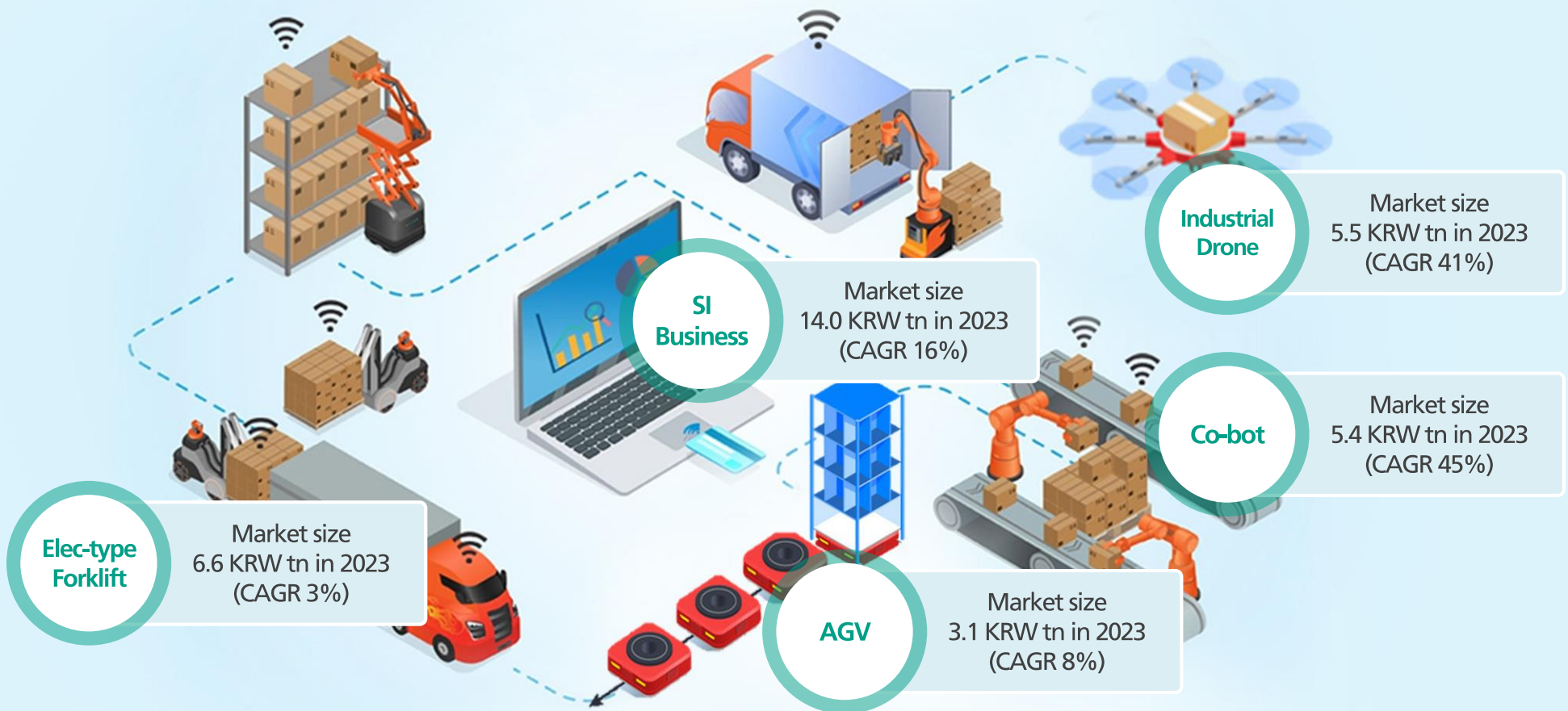


Logistics Solution Provider

Expand business of AGV, elec-type forklift, co-bot, and fuel cell drone based on logistics automation solution

Logistics Solution Provider

Integrated design, construction, and operation management of H/W (facility, transportation equipment) and S/W (WMS, WES, WCS)¹⁾ across the entire logistics warehouse



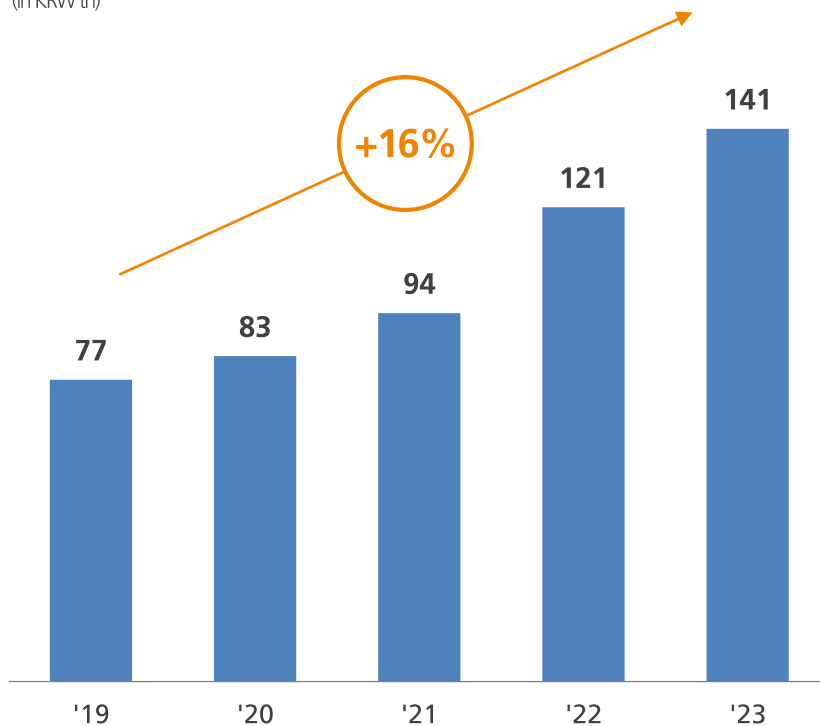
1) Warehouse Management / Execution / Control System

1 Logistics Automation Solution

Rapid growth of global logistics automation industry due to technology evolution fused with robotics and AI based on e-Commerce demand

[Global logistics automation market]

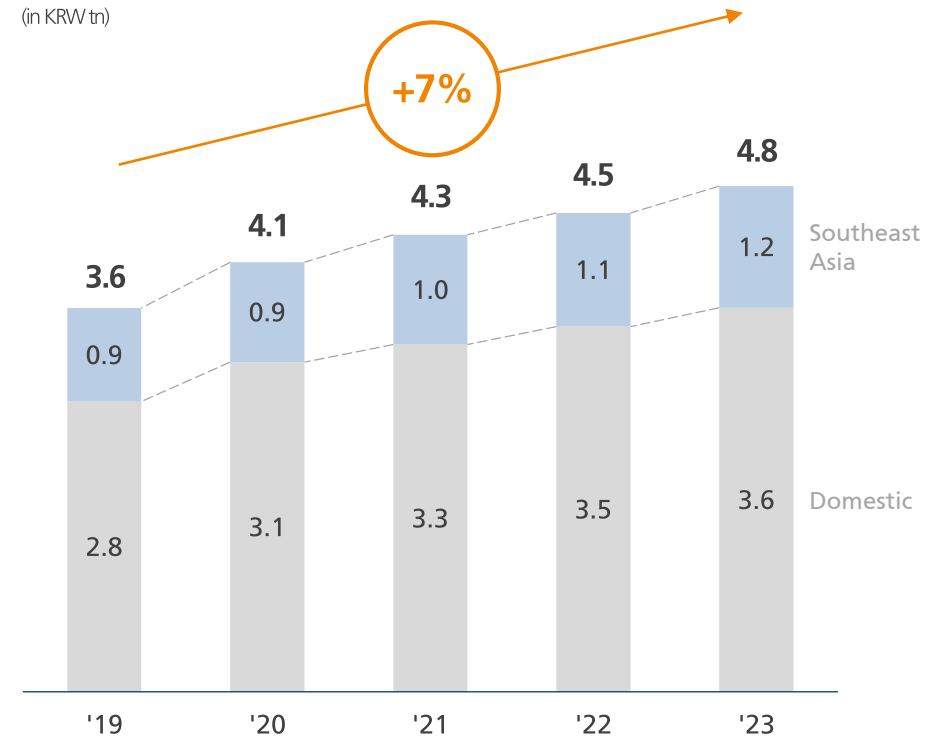
(in KRW tn)



Rapid growth of logistics automation market in Korea/Southeast Asia led by multi-channel distribution due to increased mobile/online transactions

[Domestic + Southeast Asia¹⁾ logistics automation market]

(in KRW tn)



Source : QY Research, Grand view Research, BCG Analysis

1) Thailand, Vietnam, Malaysia, Singapore, Hong Kong, Indonesia, Philippine excluding China
Source : e-Marketer, Statista, Korea shipping Gadget, Logistics Magazine

1 Logistics Automation Solution

Grow as a logistics SI company by securing additional capabilities, such as technology partnership with advanced companies based on secured SW technology

Mid/Long-Term Growth Strategies



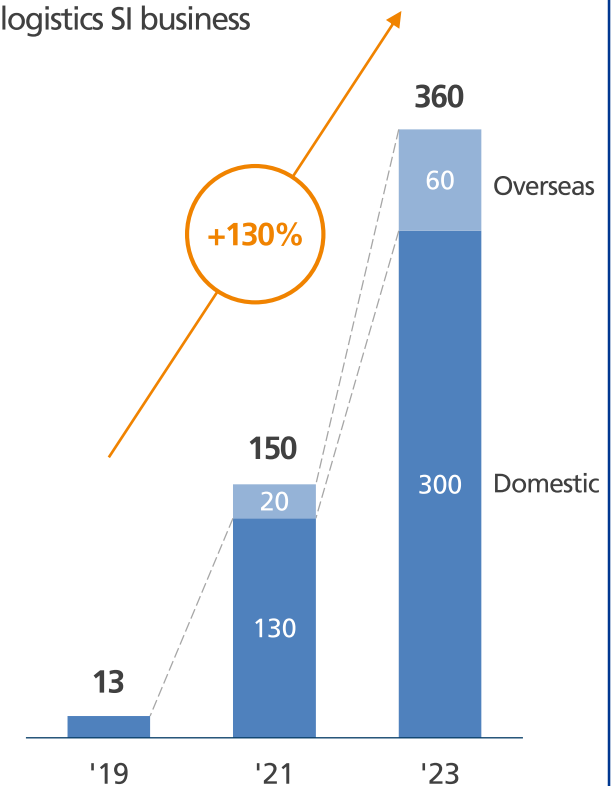
1) Level of Logistics Automation Market

- Level 1 : Manual warehouse with forklift/low rack
- Level 2 : Semi-automatic warehouse with conveyor/rack system
- Level 3 : Automatic warehouse with stacker crane AS/RS
- Level 4 : High-automated warehouse with multi-shuttle AS/RS (Automated Storage & Retrieval System)

Mid/Long-Term Sales Target

Achieve 360 KRW bn through expansion of logistics SI business

(in KRW bn)

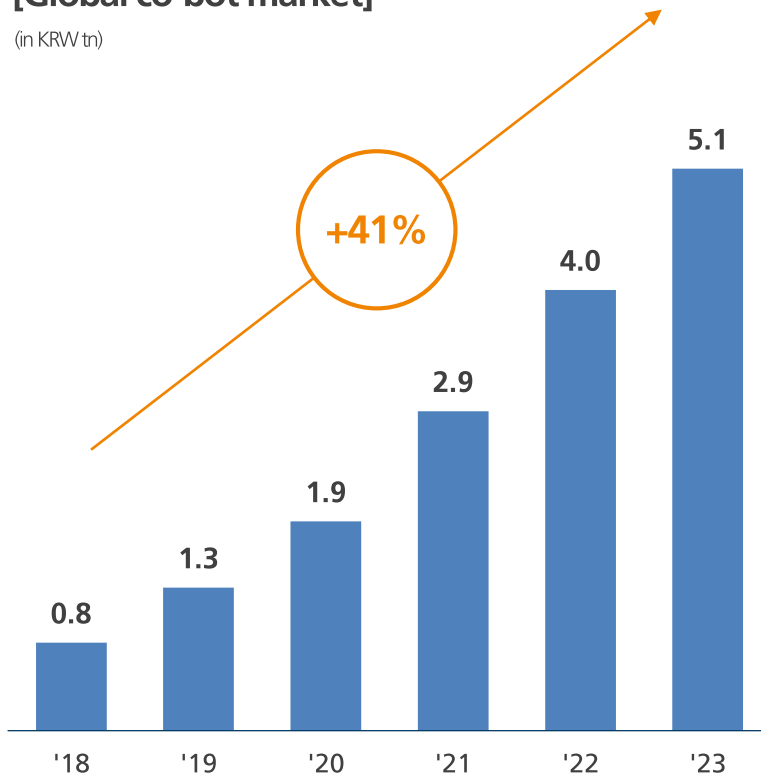


2 Co-bot

The robot market is expected to continue to grow,
especially the co-bot market

[Global co-bot market]

(in KRW tn)



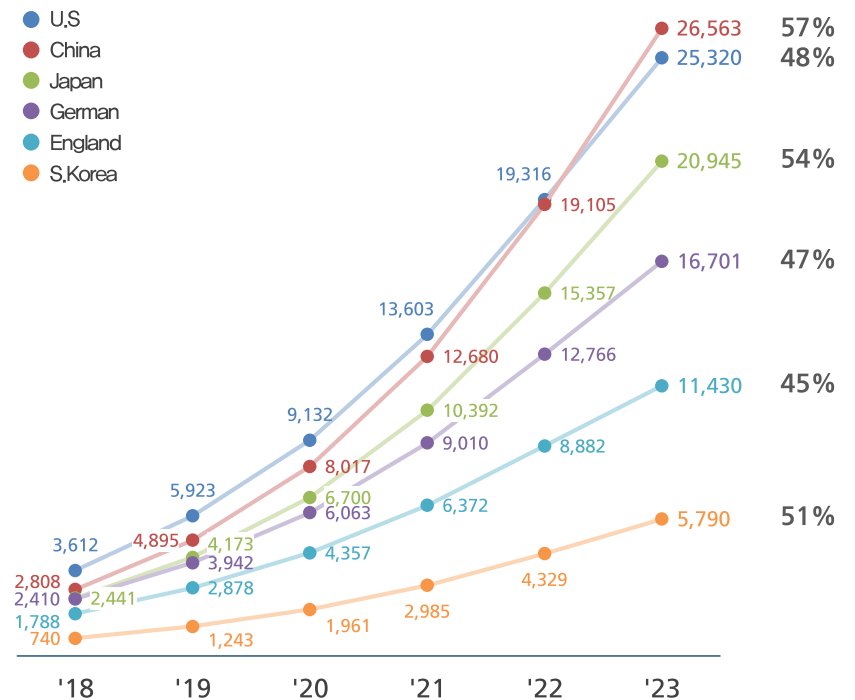
Source : M&M

Demand for co-bot is growing globally,
especially in advanced countries,
due to increased labor costs and fewer workers

[Co-bot market by country]

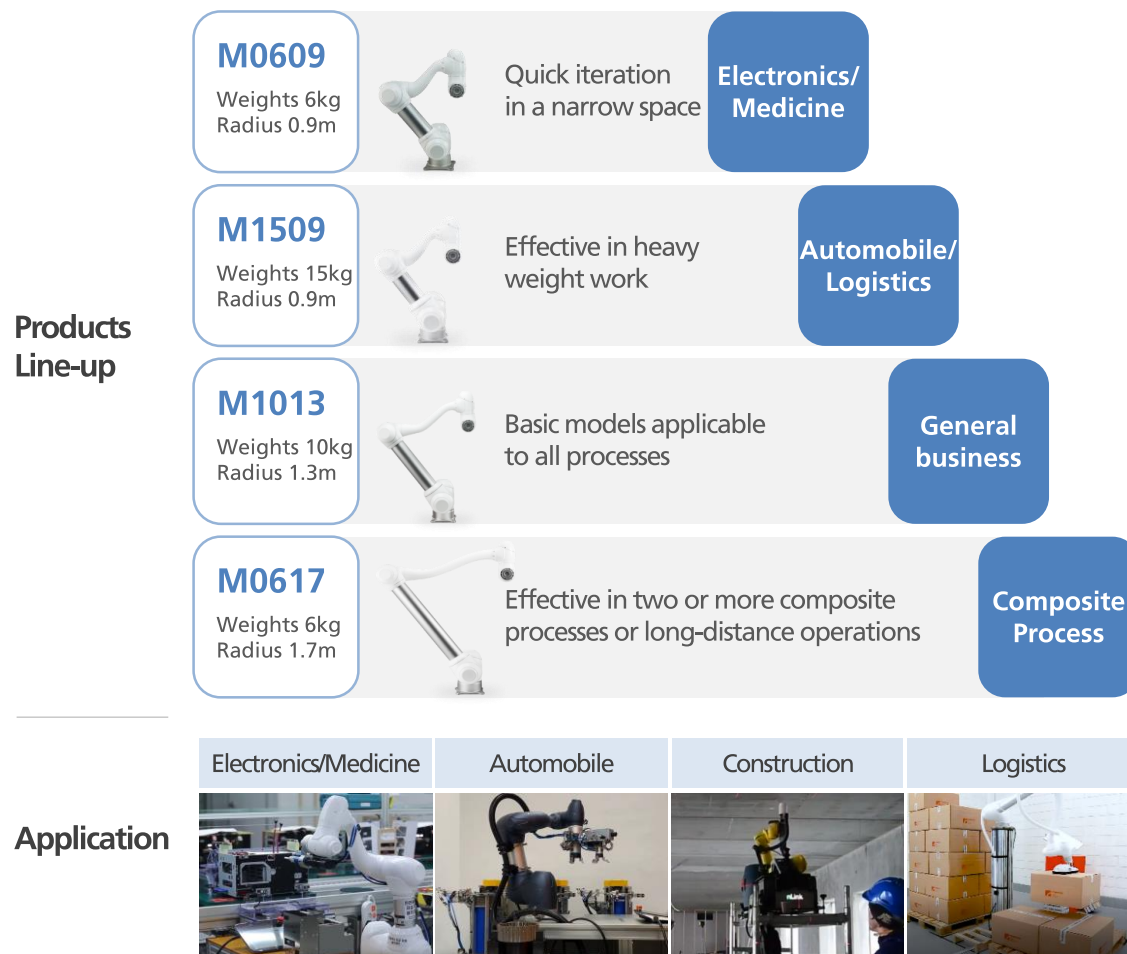
(Units)

CAGR
('18~'23)



2 Co-bot

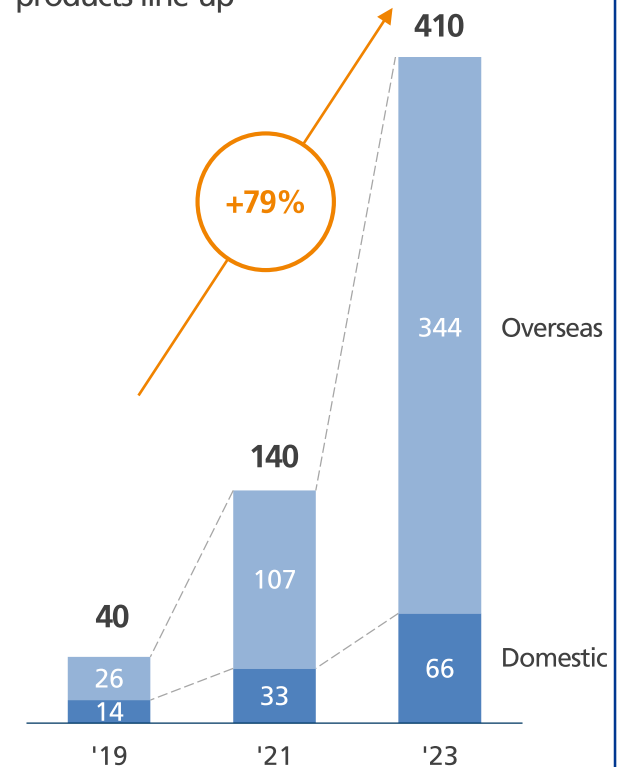
Promote business growth through an expansion of products line-up available for various industries from electronics/automobile/construction to logistics in the future



Mid/Long-Term Sales Target

Achieve 410 KRW bn
through an expansion of
products line-up

(in KRW bn)

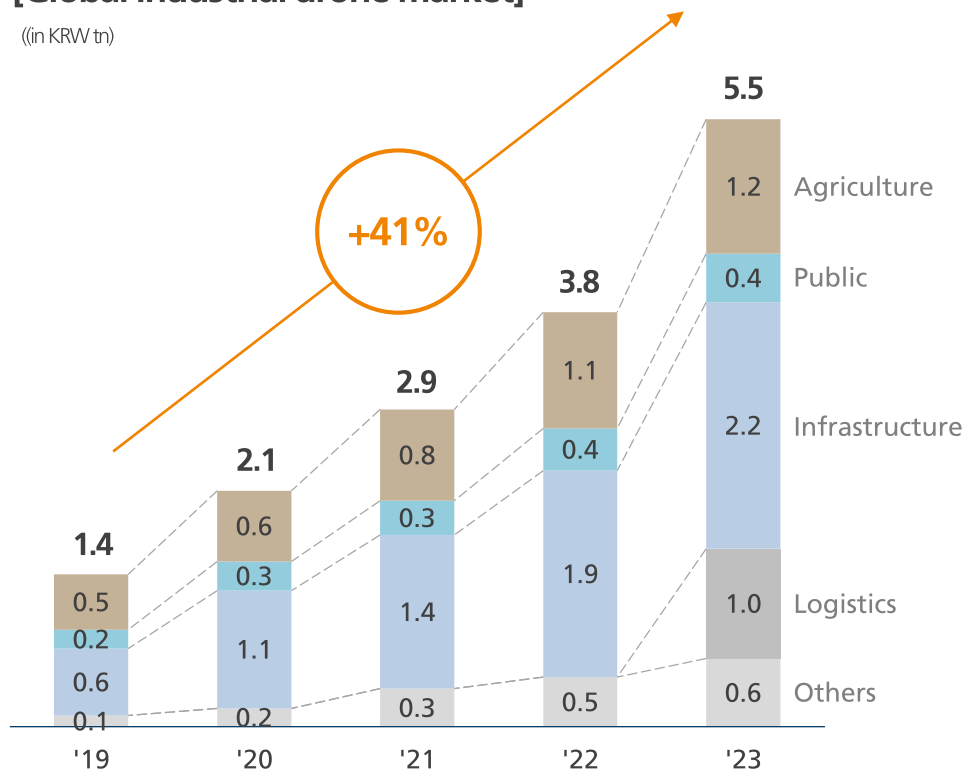


3 Fuel cell drone

Significant growth in industrial drone market due to expansion of drone utilization and its service business

[Global industrial drone market]

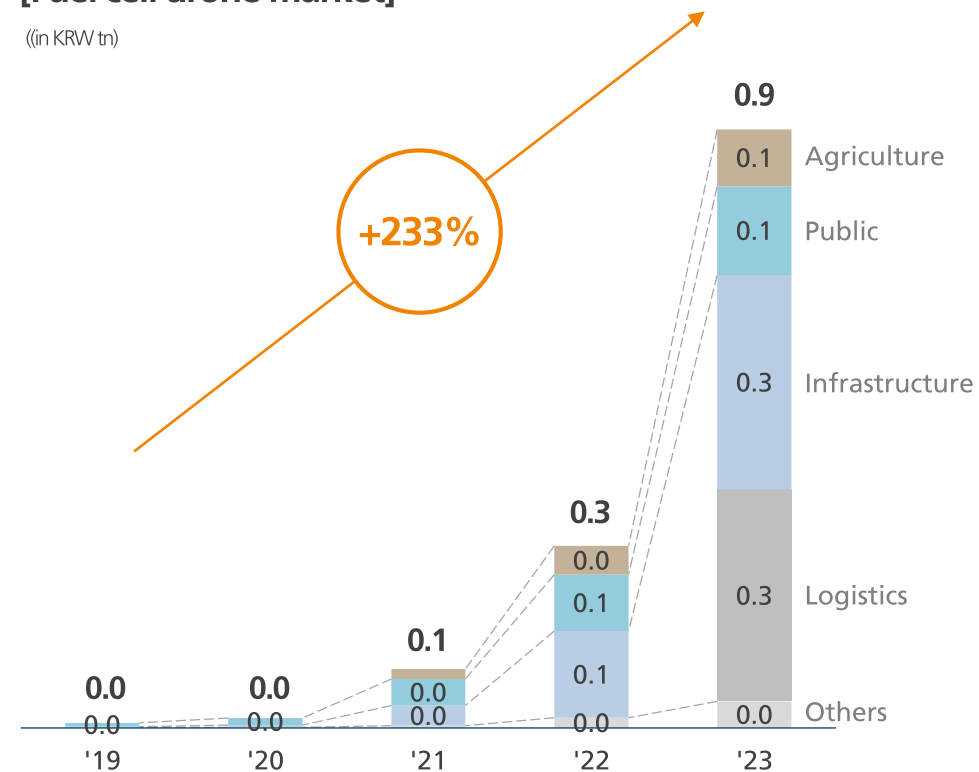
((in KRW tn))



The market of fuel cell drone with high reliability/long-distance flight is expected to grow

[Fuel cell drone market]

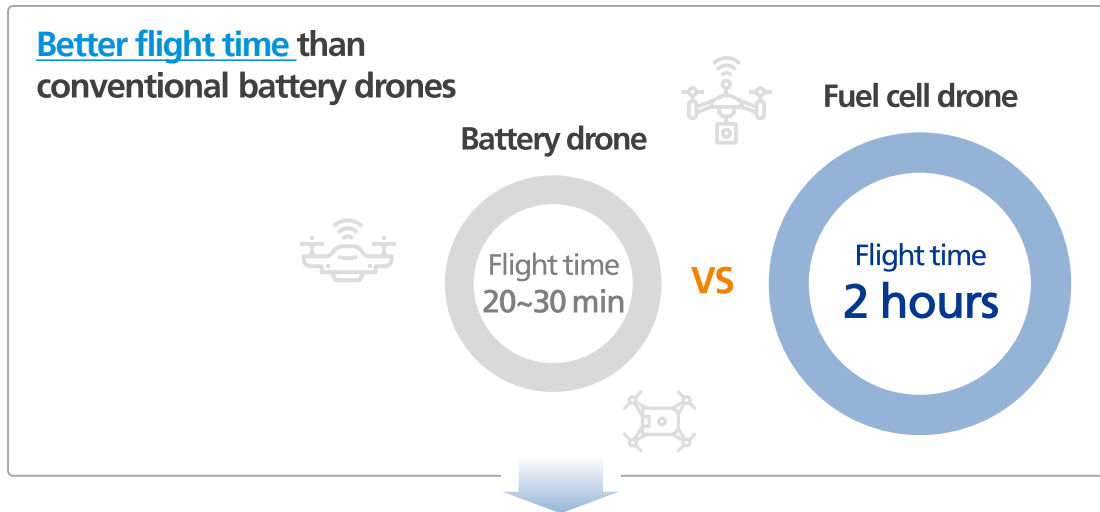
((in KRW tn))



Source : TEAL Group

3 Fuel cell drone

Promote business growth by supplementing payload performance in the future, based on competitiveness in technology with long-haul flight



Various applications are available for long-haul flight



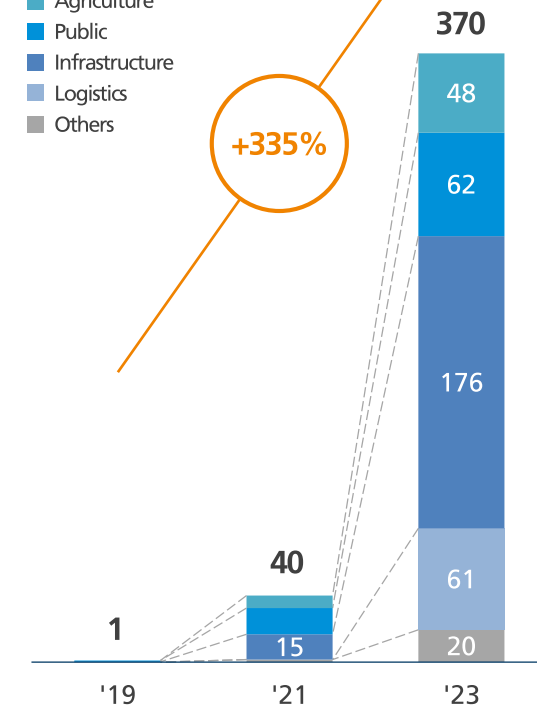
Company providing various solutions for each application besides selling power pack for drone

Mid/Long-Term Sales Target

Achieve 370 KRW bn in 2023 through differentiated technology











(in KRW bn)

- Agriculture
- Public
- Infrastructure
- Logistics
- Others



4 Expansion of the electric logistics equipment business

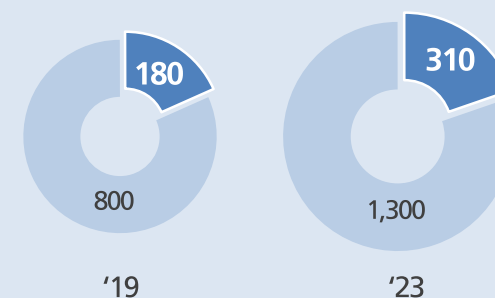
Expand products line-up and secure production base in response to growth of logistics equipment market

			'17	'19	'21
Electric Vehicle		Lead battery	○	○	○
		Li-ion battery		○	○
Warehouse Vehicle		Reach Truck	Domestic-type ○	US-type ○	Europe-type ○
		High Level Order Picker			○
		Stand-up Rider		○	○
		AGV		○ Expansion of products line-up	○
Warehouse Equipment		Stacker Truck (Walkie / Rider Type)		○	○
		Rider Pallet Truck		○	○
		Pallet Truck (Walkie / Rider Type)		○	○
		Low Level Order picker			○

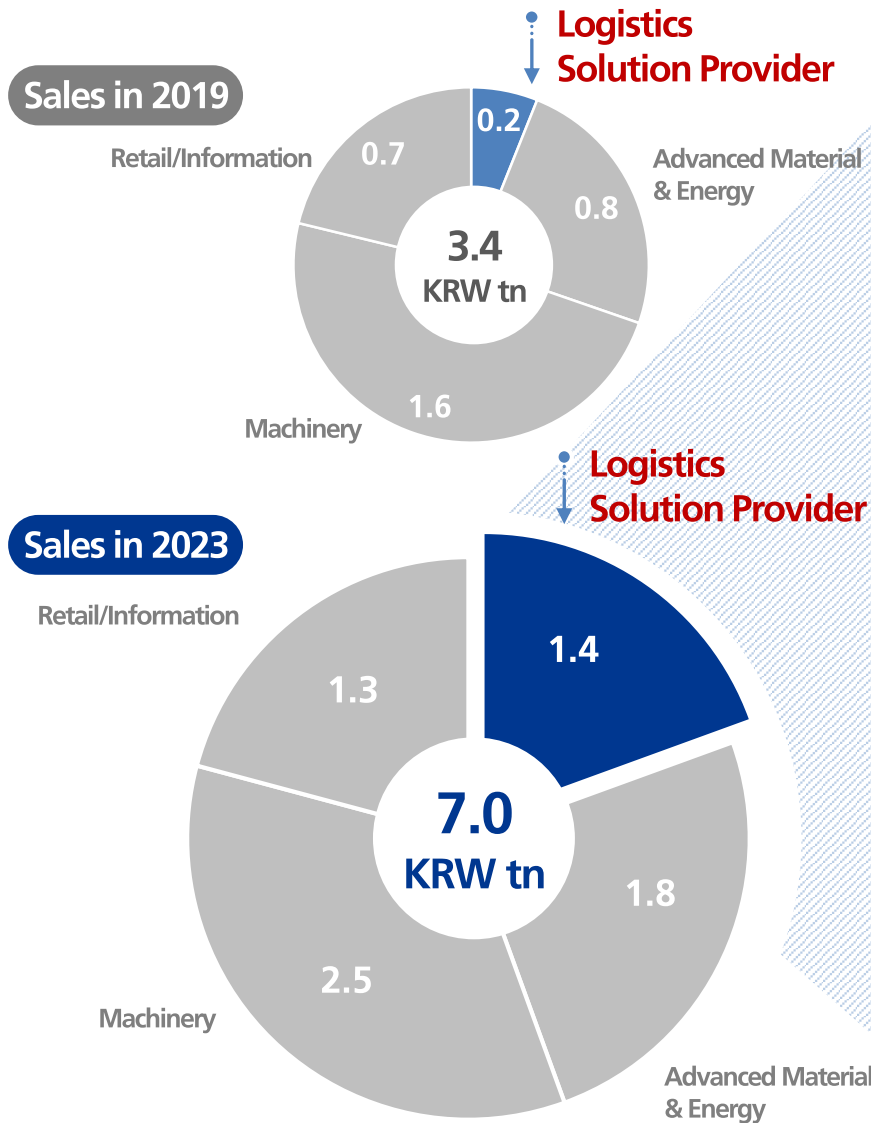
Mid/Long-term Growth Strategies

- Promote growth of warehouse vehicle/equipment business through expansion of products line-up
 - Secure next-generation technology products
 - Expand products line-up of warehouse vehicle/equipment
 - Develop additional products line-up of warehouse equipment
- Development of regional specialization model: Reach Truck
- Expand products line-up through overseas production

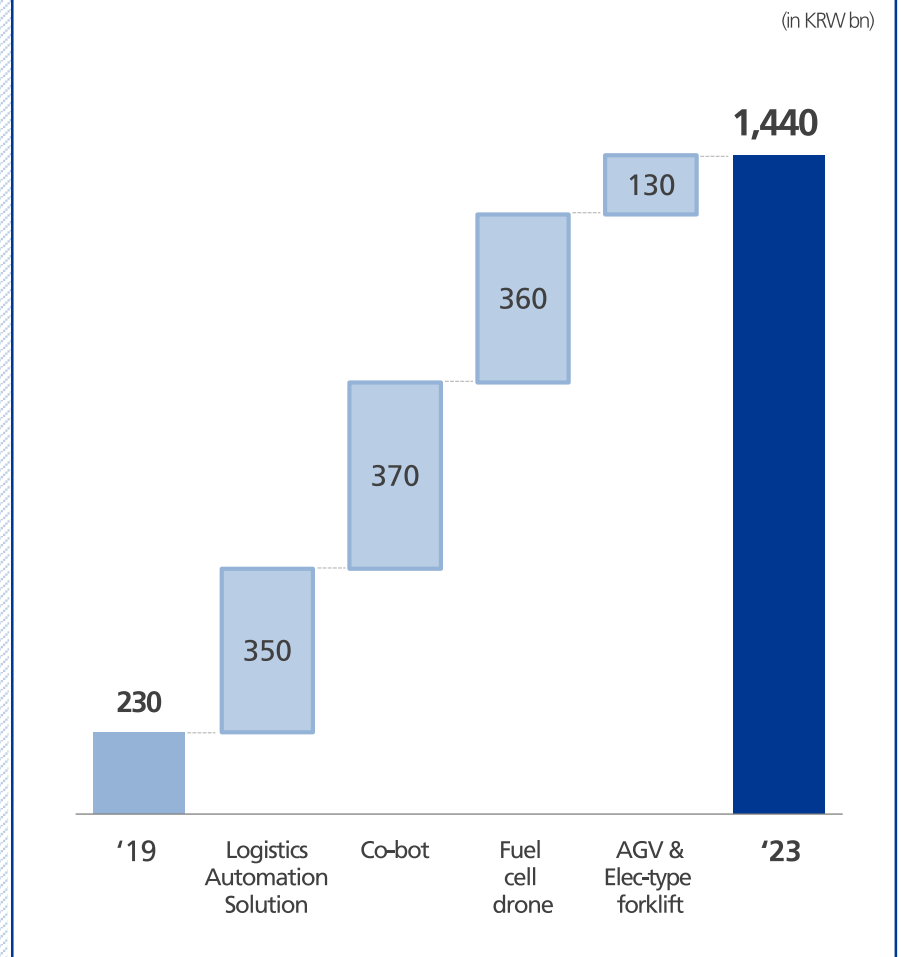
Sales of electric logistics equipment (in KRW bn)



Mid/Long-Term Target of Logistics Solution Provider

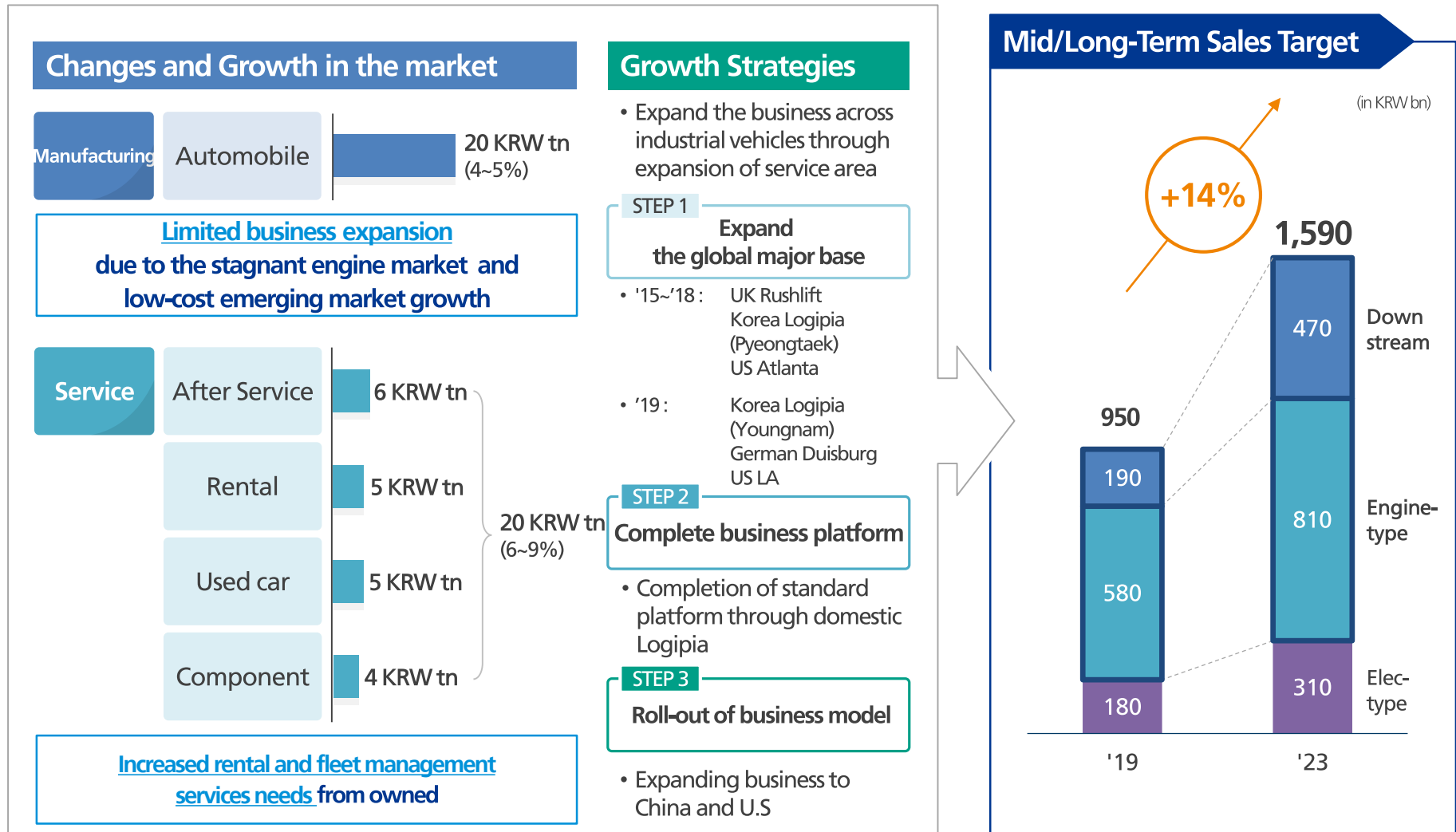


Mid/Long-Term Sales Target



1 Expansion of Industrial Vehicle downstream business

Grow as a Total Service Provider by expanding downstream business from manufacturing/sales-oriented business

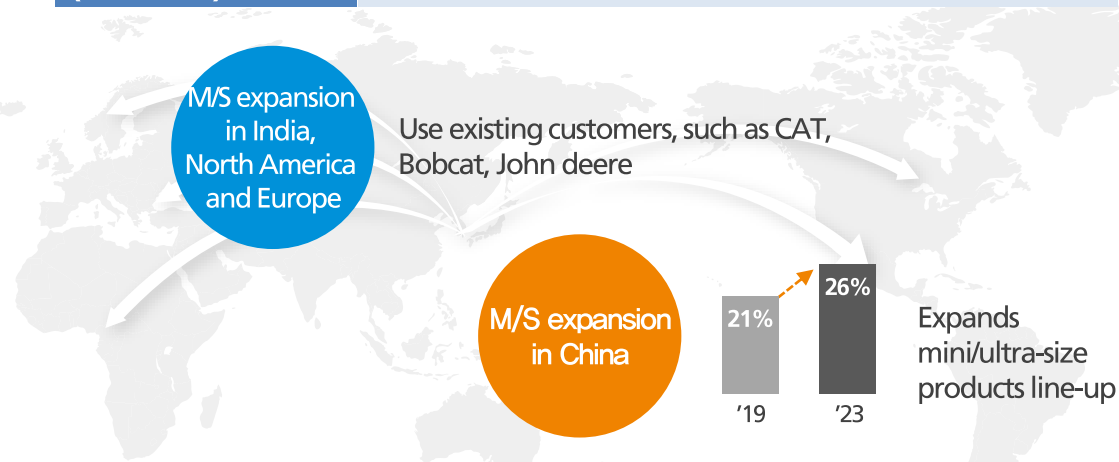


2 Expanding M/S of Mottrol and Diversifying products other than excavators

Promote growth of business by expanding M/S of hydraulic products for excavators and diversifying products other than excavators

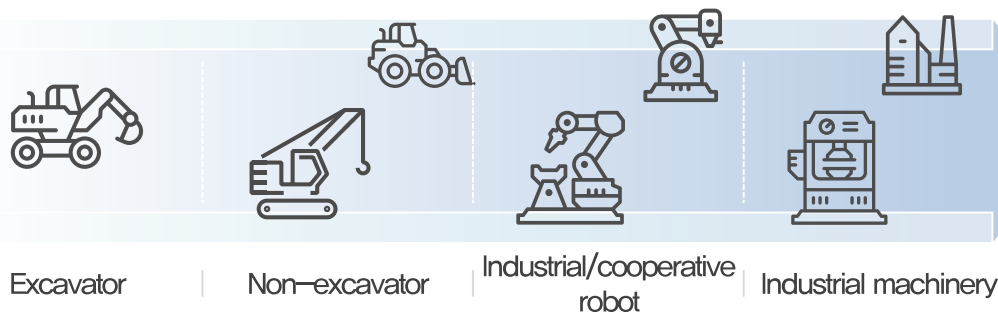
M/S expansion (Excavator)

M/S expansion in China and overseas markets



Business diversification

Expansion of business in construction machinery and industrial/cooperative robot other than excavators



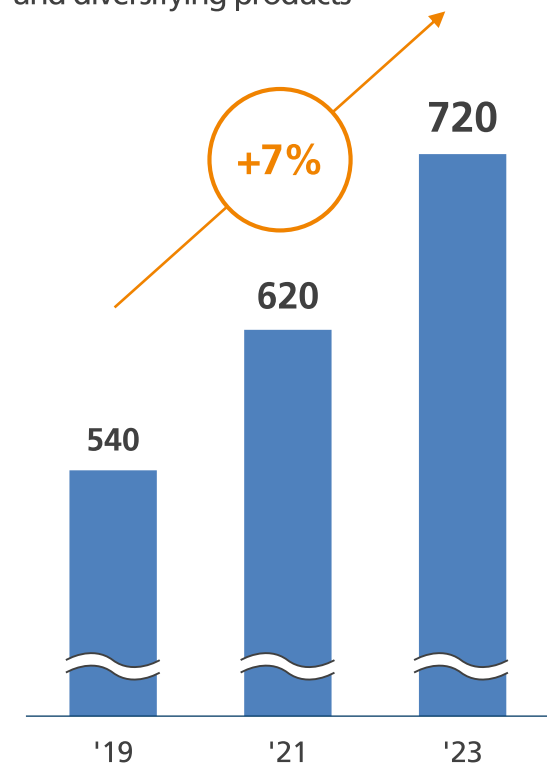
Hydraulic technology – traveling/swing motor, pump, MCV

Electric driving – High-precision reducer, electromotor

Mid/Long-Term Sales Target

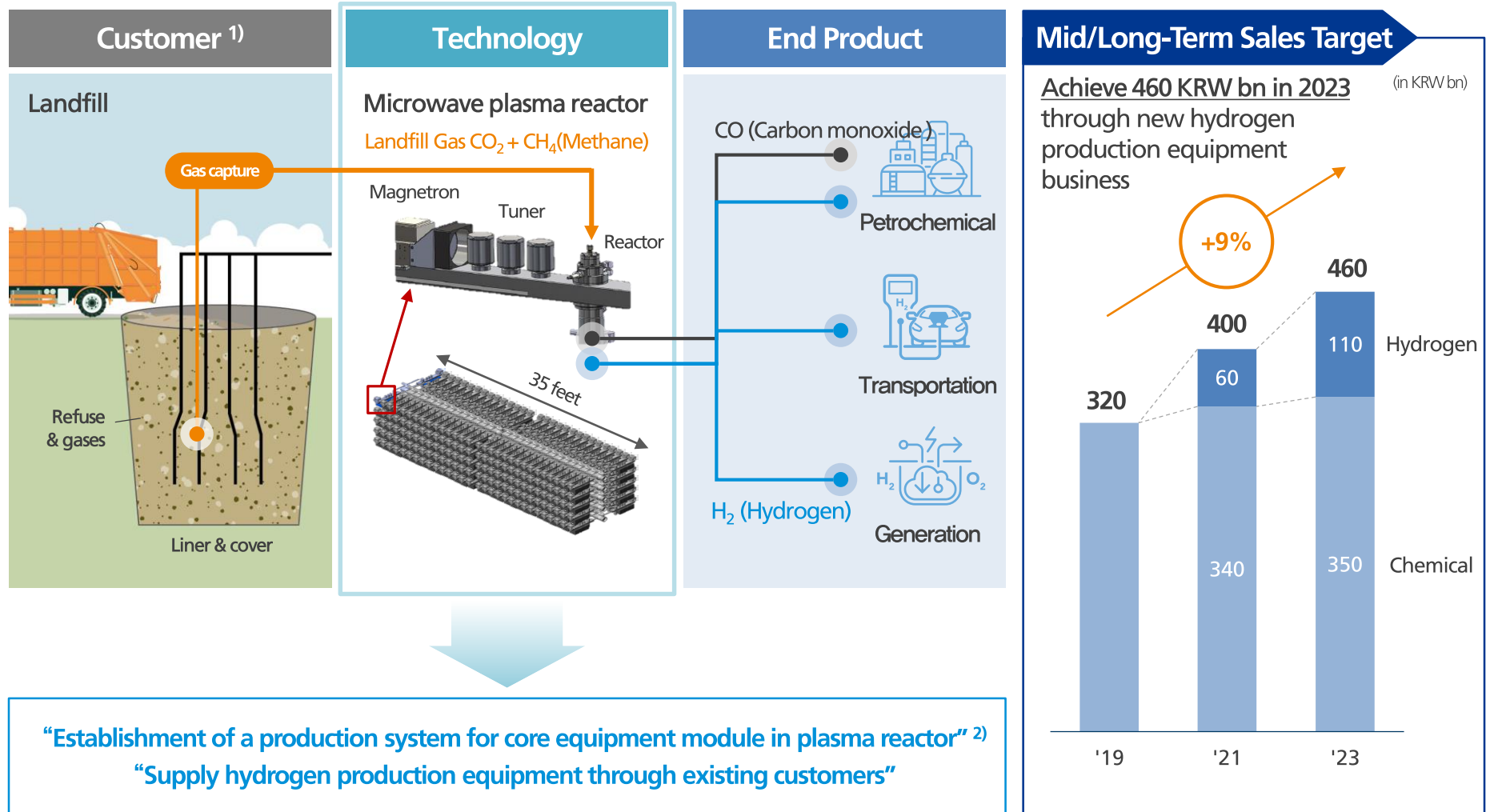
Achieve 720 KRW bn in 2023
through M/S expansion
and diversifying products

(in KRW bn)



3 Mecatec discovery of hydrogen production equipment business

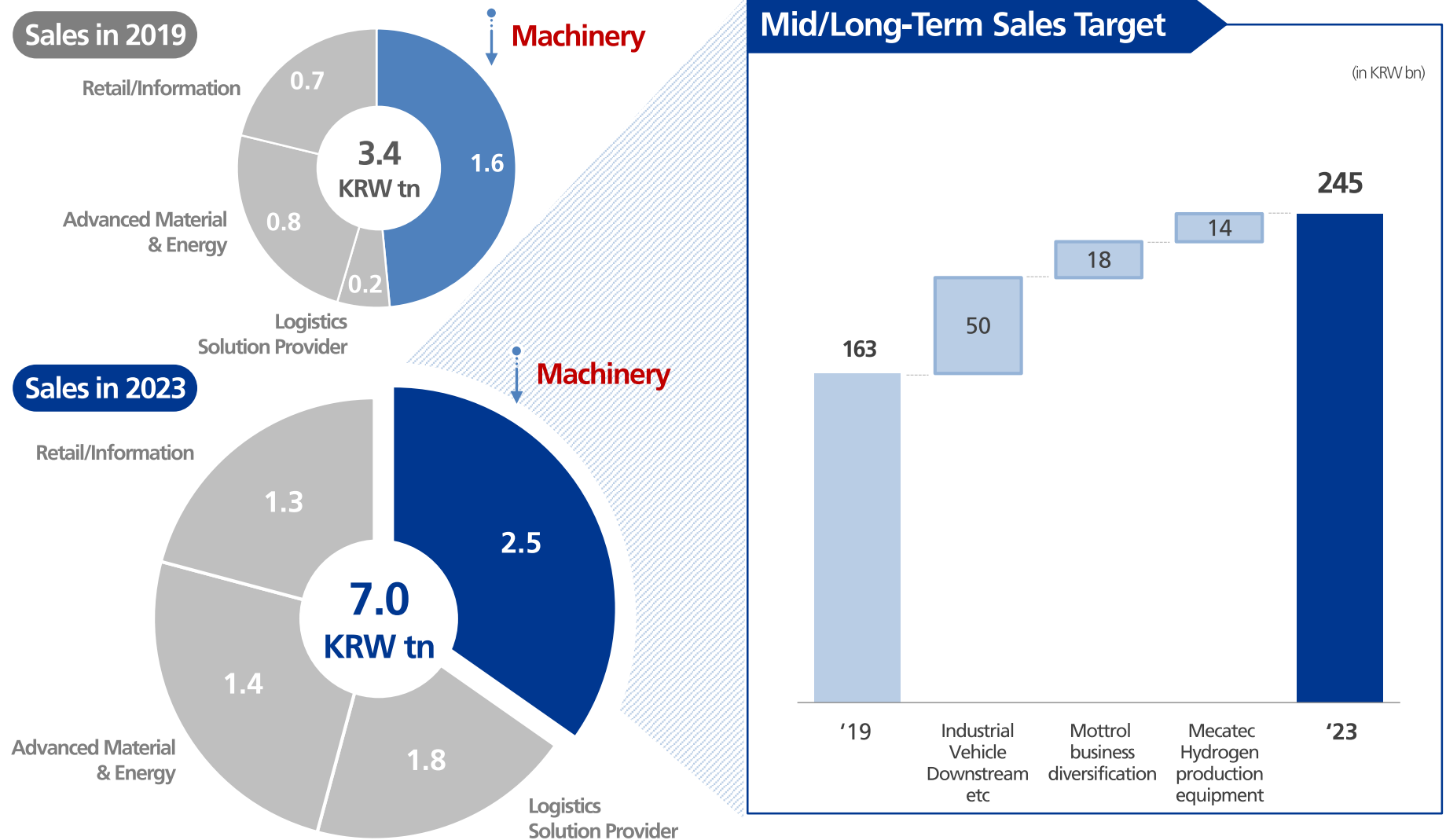
Green business model for converting and reusing greenhouse gases and carbon from landfills into hydrogen



1) Customers who have needs to resource landfill gas among landfill operators

2) Equity investment in progress regarding ReCarbon, Inc. in the U.S (Series B \$7M, 12.7% shares secured)

Mid/Long-Term Target of Machinery Business



Vision of Doosan Corp

WORLD BEST INNOVATION PARTNER

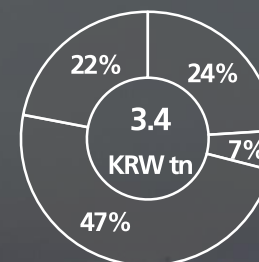
Slogan

Design the future, Spark the growth!

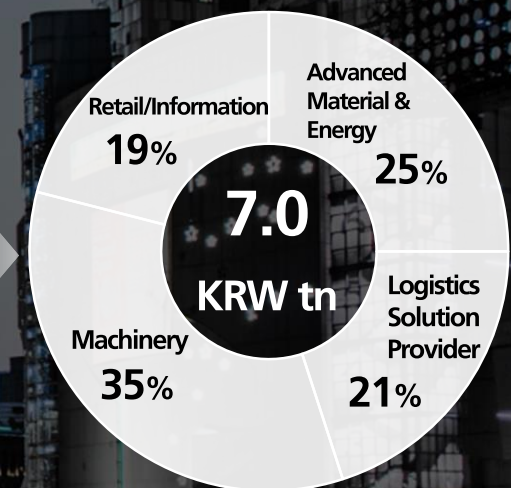
Vision Statement

Doosan leads the future by providing innovative solution and differentiated value to B2B customers and end users and continuous investment and development of future technologies

Aspiration



Sales in 2019



Sales in 2021



Chapter 3.

Doosan Corp's Dividend Policy

Doosan Corp's dividend policy will be continued

Doosan Corp's dividend policy will be continued

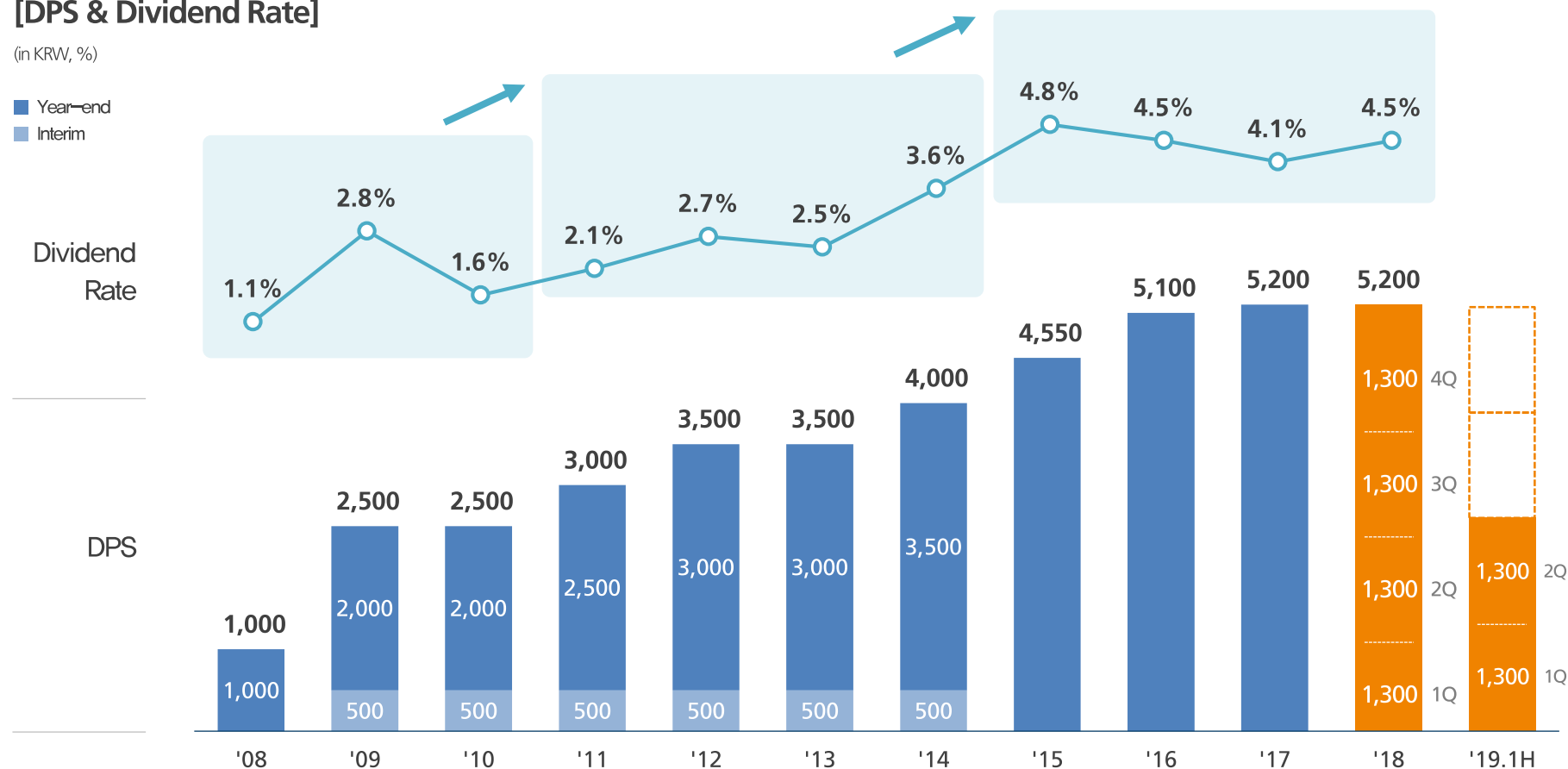
Doosan Corp has continuously increased dividend for shareholders profit by creating business value

It has implemented quarterly dividend of KRW 1,300 per share to strengthen the shareholder return policy since 2018

[DPS & Dividend Rate]

(in KRW, %)

■ Year-end
■ Interim



An aerial night view of a city, likely Dubai, with a network of white lines and dots overlaid on the image, suggesting a digital or technological theme. The city lights are visible in the background, and the network lines connect various points across the scene.

Design the future, Spark the growth!





Investor Relations 2019

DOOSAN SOLUS

Chapter 1. Company Overview
Chapter 2. Doosan Sous Highlights





Chapter 1.

Company Overview

01. Company Overview

02. History & Long-term Outlook

03. Doosan Solus Share Structure

01. Company Overview

Company Profile

<u>Name</u>	Doosan Solus
<u>CEO</u>	Lee, Yun-Seok
<u>Establishment</u>	2019.10.01
<u>Listing</u>	2019.10.18(KOSPI)
<u>Assets</u>	260 KRW bn ¹⁾
<u>Employees</u>	about 600 persons
<u>Head Office</u>	Jeollabuk-do Iksan

1) ' As of 4Q18, Consolidated basis

Business Profile



Battery Foil

Copper foil for EV batteries



Copper Foil

Copper foil for electronic devices (PCB)



Display

OLED and display materials for smartphone, TV, laptop, etc.



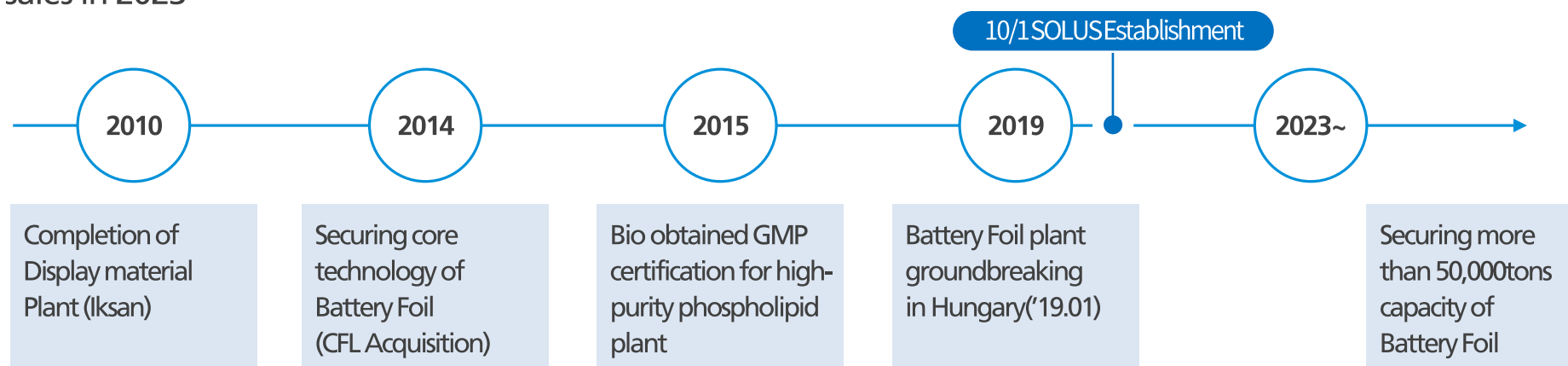
Bio

Natural-based materials for cosmeceutical, pharmaceutical and nutraceutical



02. History & Long-term Outlook

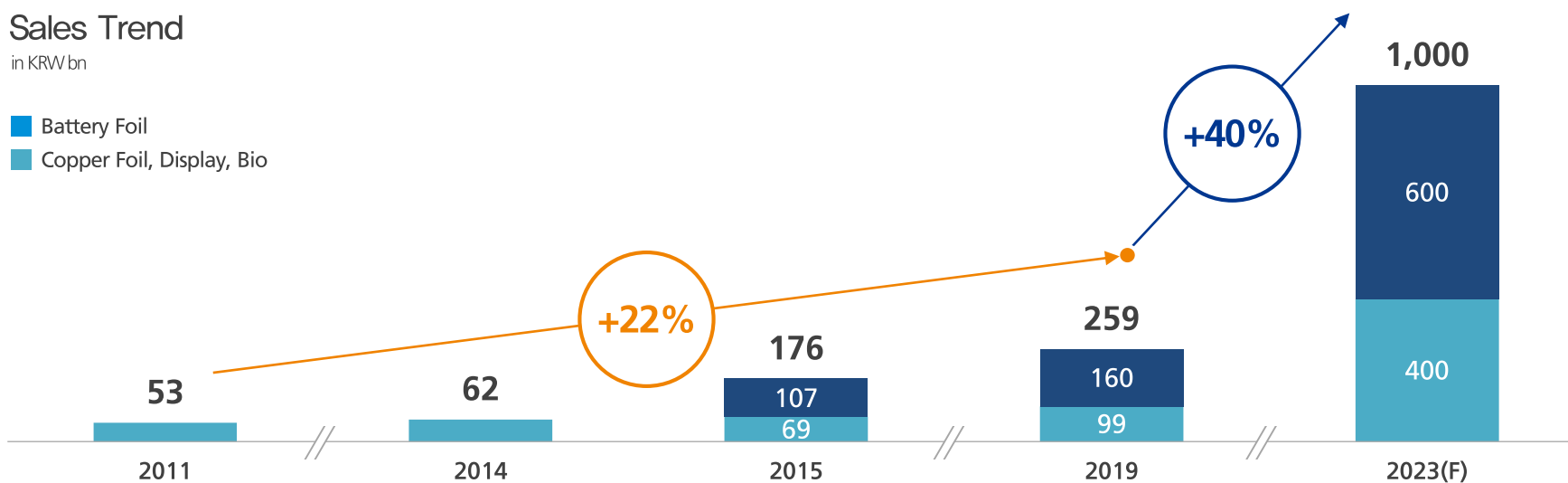
Growing as a global leader in providing differentiated, industry-leading materials, Targeting 1 KRW Tn of sales in 2023



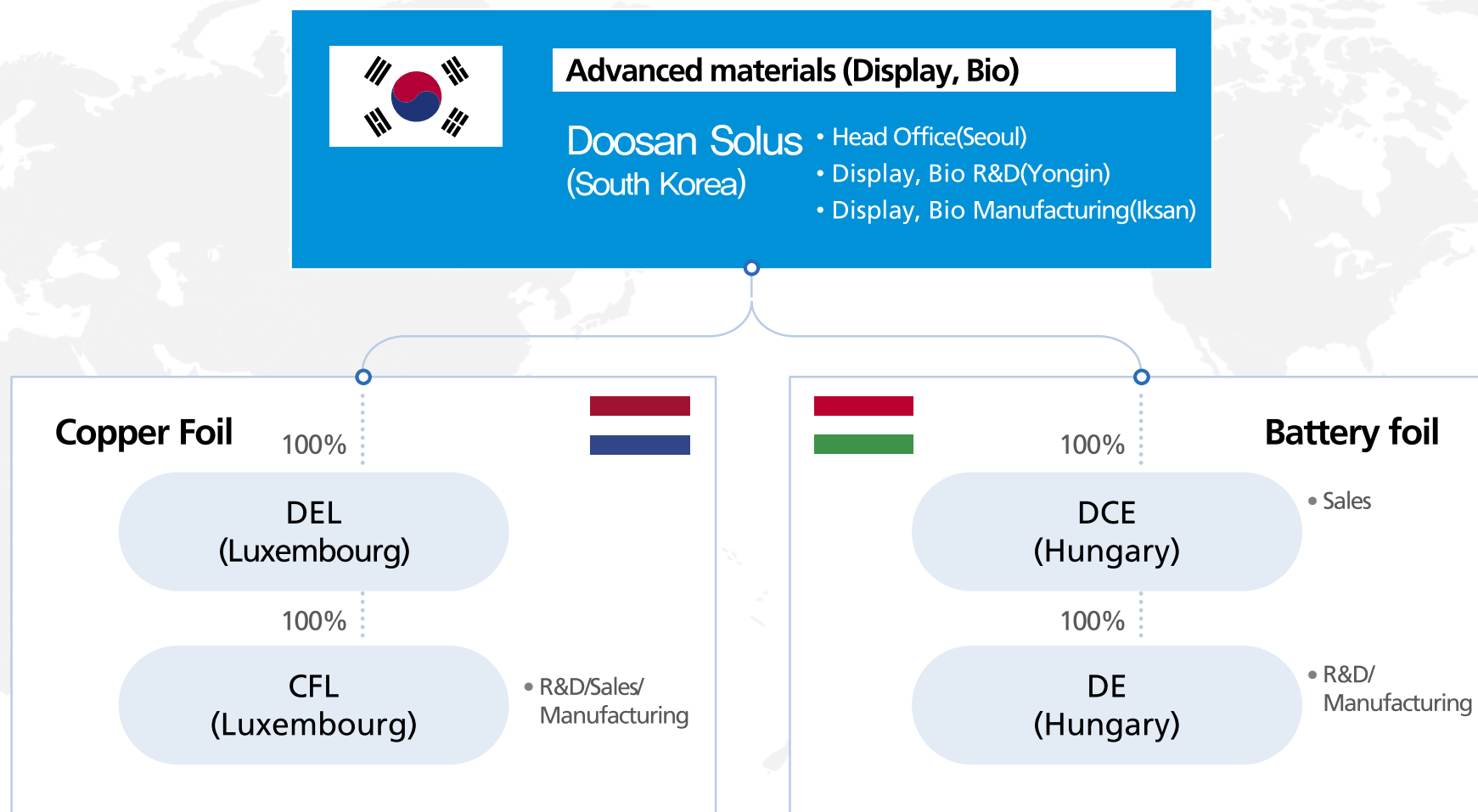
Sales Trend

in KRW/bn

- Battery Foil
- Copper Foil, Display, Bio



03. Doosan Solus Share Structure



[Back-up] Global Networking



Employees

“600 Persons (in 2019)”



1,000 Persons (in 2023)”





Chapter 2.

Doosan Solus Highlights

Doosan Solus Highlights

Battery Foil / Copper Foil / Display / Bio

Future-oriented, High-growth Portfolio

Standing-out position in the market

High-growth in Short-term

Doosan Solus Vision

Doosan Solus Highlights

Future-oriented, High-growth Portfolio

- Based on expansion of EVs, Battery Foil demand in Europe is expected to surge x15('25)
- According to entering the 5G era, High-end Copper Foil demand is expected to increase x1.5('23)
- Based on increasing OLED Display adoption in Mobile & TV, OLED materials market is expected to grow x3('23)
- According to increasing needs for natural materials, Bio target market is expected to grow x2('23)

Standing-out position in the market

- Providing differentiated value to customers by technical superiority, and excellent locational requirements
 - Sole supplier of Battery Foil in Europe
 - High-end Copper Foil, M/S No.1
 - OLED functional material for blue (aETL¹⁾), M/S No.1
 - Natural moisturizing Cosmeceutical materials(Ceramide), Domestic M/S No.1
- References of Top-tier customers
 - Samsung, LG, Cisco etc.

High-growth in Short-term

- Battery Foil : Timely capacity expansion
 - 10,000tons('20) → 50,000tons('25)
(Additional 50,000 tons can be added)
- Copper Foil : Expansion of high-end, High-margin product Portfolio
- Display : Sales expansion of OLED TV & to global display customers
- Bio : Product Portfolio diversification & Value Chain expansion

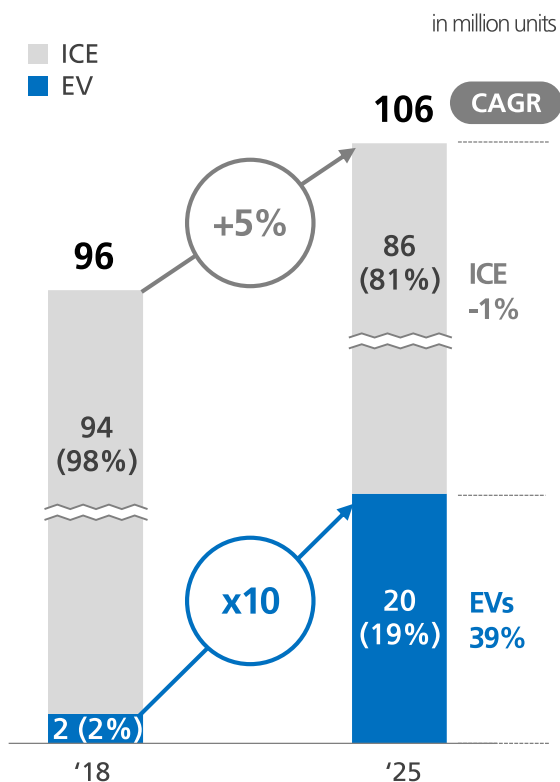
1) Additional Electron Transport Layer(aETL) : Improve the efficiency of Blue layer by 30%

Future-oriented, High-growth Portfolio

Based on EVs expansion, Battery Foil demand in Europe is expected to surge x15

Global Vehicle Market Outlook

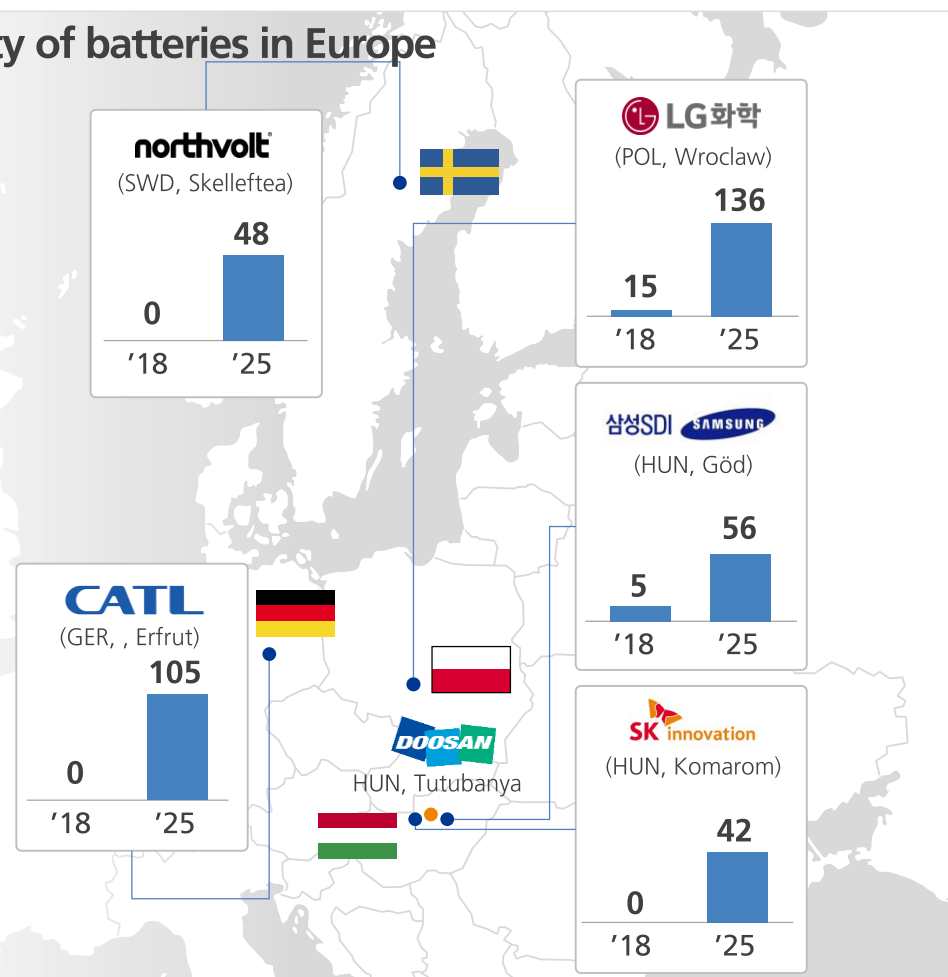
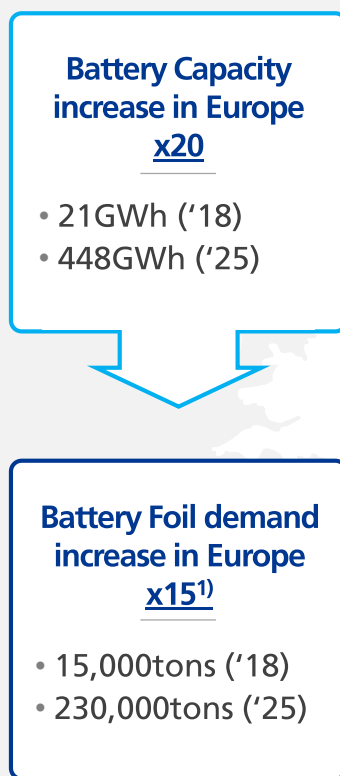
x10 growth in EV Market, while Negative growth in ICE (Internal Combustion Engine) Market



Source : SNE Research

Production Capacity of batteries in Europe

in GWh



1) 1) Usage of Battery Foil : 700tons/GWh(2018) → 500tons/GWh(2023)

Standing-out position in the market

Building an unrivaled position in the market with exclusive supplying Battery Foil in Europe



Sole
Supplier
of
Battery Foil
in Europe

Top-tier
Customers

Competitive edge in lead time

- Shipping to major customers available in one day
- In case of the other competitors, 5~7 weeks are required (product life span 4 months)
 - Potential quality risk, such as oxidization, deformation could be caused at long-distance shipping

Customer-focused support

- Real time-technical support from local-resident personnel
- Building a customer specific production line for over certain amount

Supply contract with major customers in progress

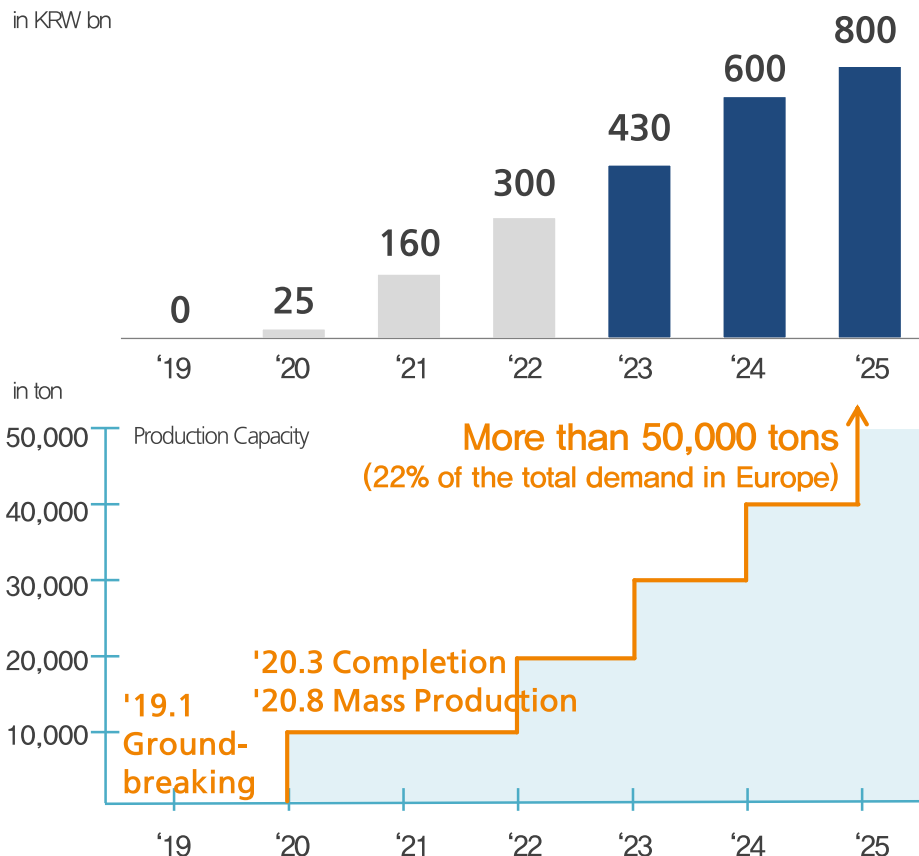


High-growth in Short-term

Expect 800 KRW Bn of sales in 2025 with timely expansion of capacity to meet battery customers' demand

Battery foil Sales Outlook

in KRW bn



Growth-accelerating strategy

Based on demand for battery customers

Preemptive, consecutive capacity expansion

- Securing land for 50,000tons/year, additional site priority purchase rights



Panoramic view of Hungary plant('19.8)



Bird's eye view of Hungary plant



Securing stable supplies by long-term supply agreement with major battery customers

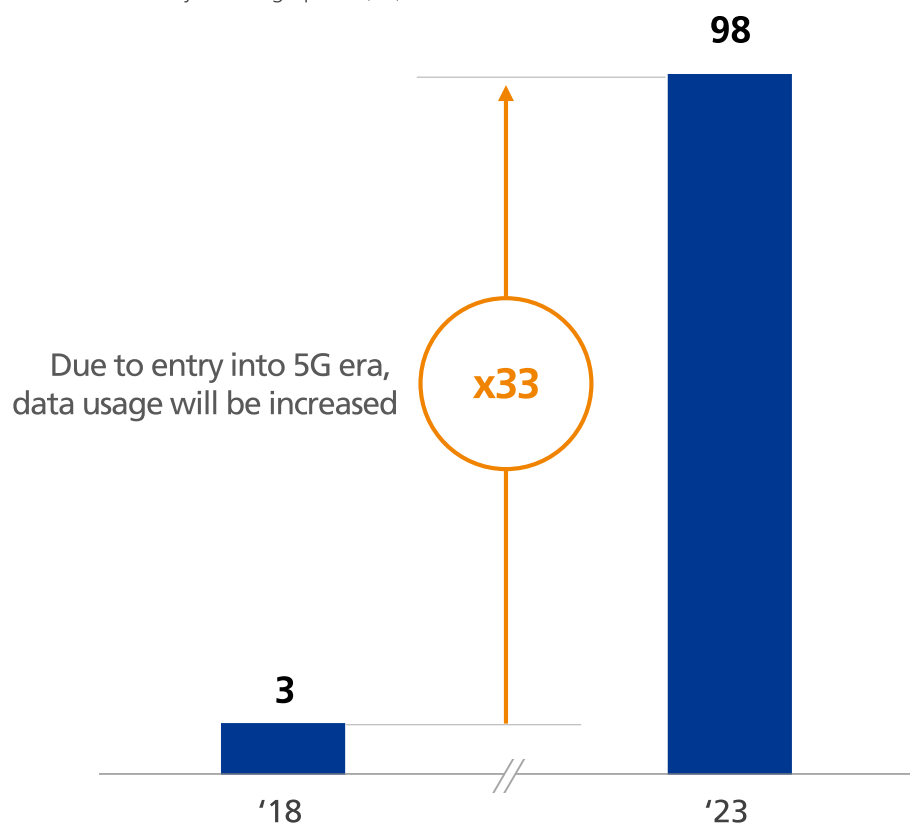


Future-oriented, High-growth Portfolio

With entry into the 5G era, demand for High-end Copper Foil is expected to increase x1.5

Mobile data usage forecast

in monthly data usage /person(GB)

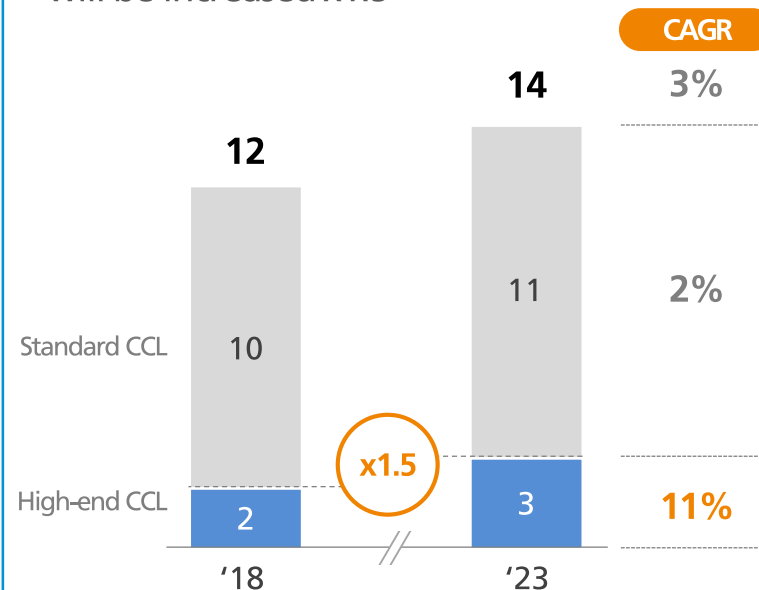


Source : 5G.CO.UK, Prismark

CCL¹⁾ demand forecast

in KRW tn

Demand for high-end copper foil CCL will be increased x1.5



Demand for high-end copper foil for 5G and semiconductor will surge x1.5
300KRW bn('18) → 450 KRW bn('23)

1) CCL(Copper Clad Laminate) : raw-materials of PCB which is major application of copper foil

Standing-out position in the market

Global No.1 high-end Copper foil manufacturer with 60 years of experience

High-end
Copper Foil
No.1

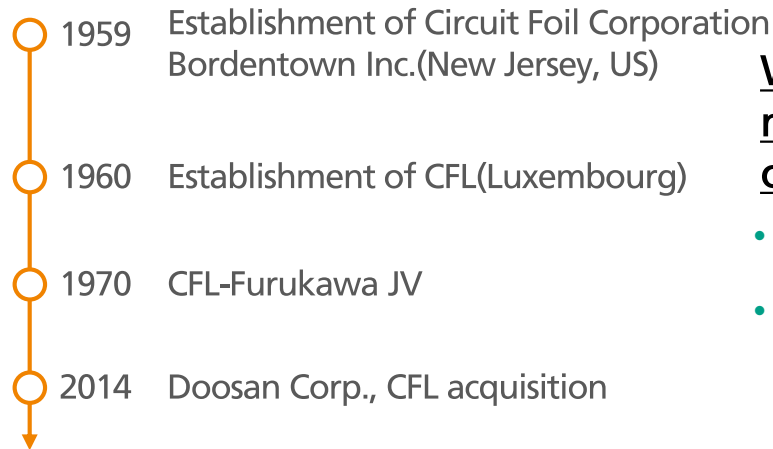


Copper foil for 5G M/S No.1(70%)¹⁾ for leading customers

- High-end Copper foil : Low loss, High-Frequency etc.



60 years
R&D/
Mass
production



With more than 60 years experiences of R&D/
mass production, securing leading technology
of copper foil & stable supply of products

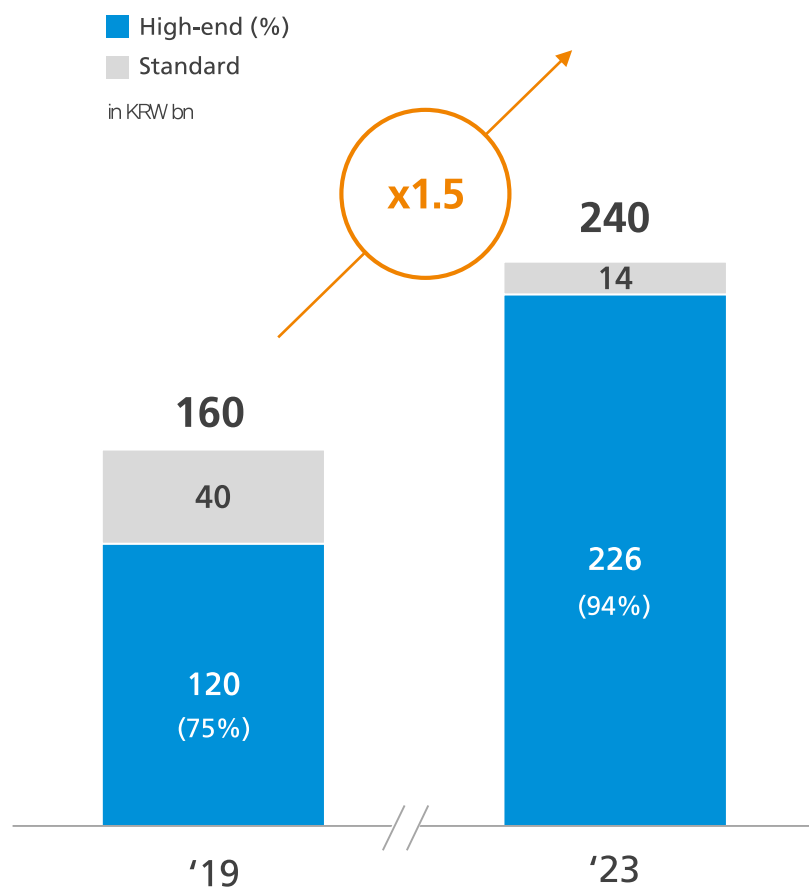
- Established in 1959, Know-how gaining for 60 years
- Securing manufacturing technology of ultra-thin copper(less than 2um) for semiconductor

1) Excluding Chinese local market

High-growth in Short-term

Achieve 240 KRW Bn of sales in 2023 due to expansion of high-end, high-margin products

Copper Foil Sales Outlook



Growth-accelerating strategy

Expansion of high-margin products for 5G

- Low-loss, low-roughness, high-frequency copper foil for 5G etc.



Leading the market with the development of ultra-thin copper foil technology (less than 2um) for semiconductor

- Mass production in 2020.2H

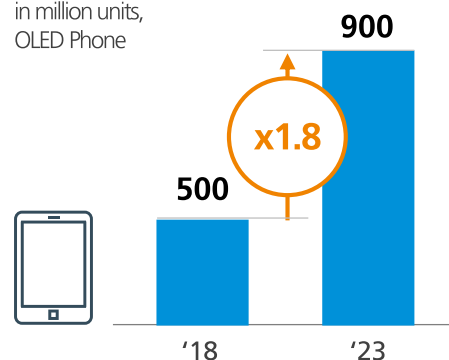


Future-oriented, High-growth Portfolio

Based on increasing adoption of OLED Display in Mobile & TV,
OLED materials market is expected to grow x3

Mobile

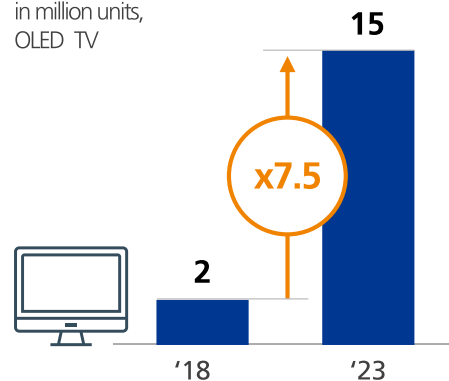
in million units,
OLED Phone



Major smartphone manufacturers are (Samsung/Apple)
Increasing adoption of OLED display
34%('18) → 60%('23)

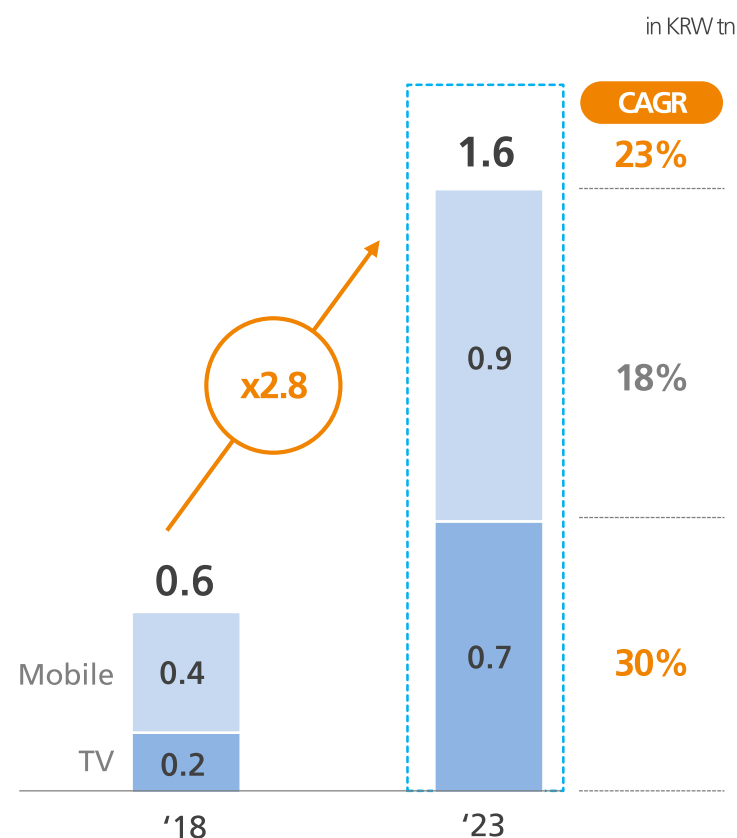
TV

in million units,
OLED TV



Due to development of OLED display technology, major TV manufacturers are (Samsung/LG)
Increasing OLED TV production

OLED materials market forecast



Source : Stone Partners, Yuanta securities.

Standing-out position in the market

Core IP for OLED functional material & References of Top-tier panel makers

Holding Core IP

Holding core IP for OLED functional material for blue (aETL1)¹⁾

- Improve blue layer efficiency by 30%
- Core IP : Application(Dec, 2013), Registration(Jul, 2016)

Leading smartphone manufacturer's adopting Doosan's aETL product, M/S of aETL ranked No. 1

- Samsung : S6 ~ S10, Note5 ~ Note10
- Apple : I-PhoneX ~ XS, XS Max

References of Top-tier Panel Makers

Product supply to Top-tier panel makers and Joint product development with customers



- Continuous supply of OLED materials for Mobile
- Joint development of functional materials for OLED TV

BOE



- From 2017, supply of OLED materials for Mobile
- Joint development of high-end materials for Mobile

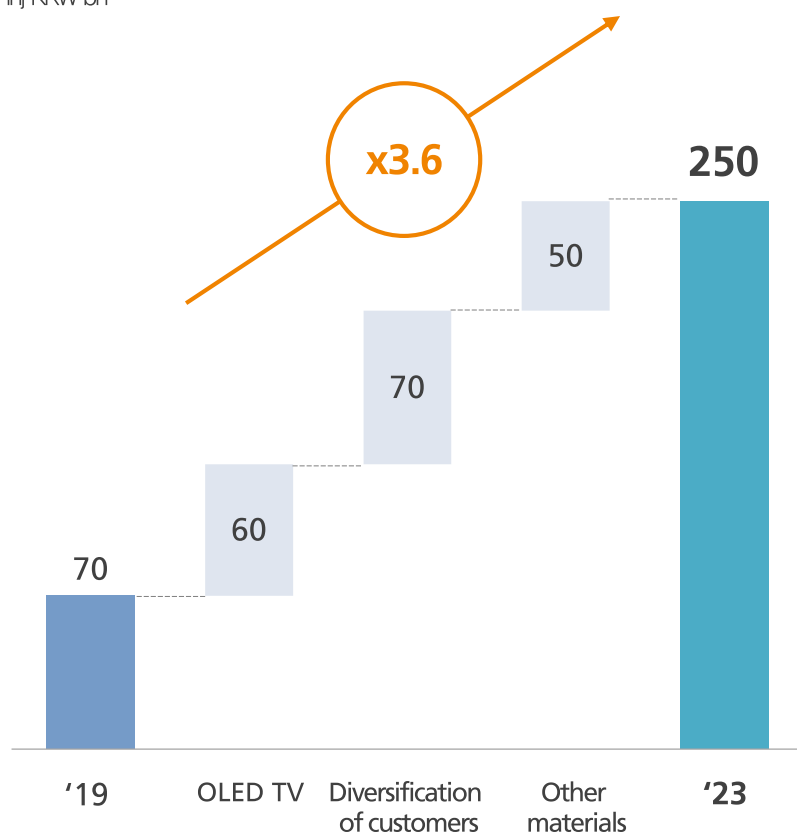
1) KR 2013-0157627

High-growth in Short-term

Achieve 250 KRW Bn of sales in 2023 due to expansion of OLED TV & Customer diversification

Display materials Sales Outlook

inj KRW bn



Growth-accelerating strategy

Product expansion for OLED TV



Joint development with global panel makers(Chinese) & Customer-focused support

BOE

TIANMA

华星光电
CSOT




Visionox

Sales diversification with other materials development
TFE¹⁾ / Sealant etc.

1) Thin Film Encapsulation (OLED encapsulation)

Future-oriented, High-growth Portfolio

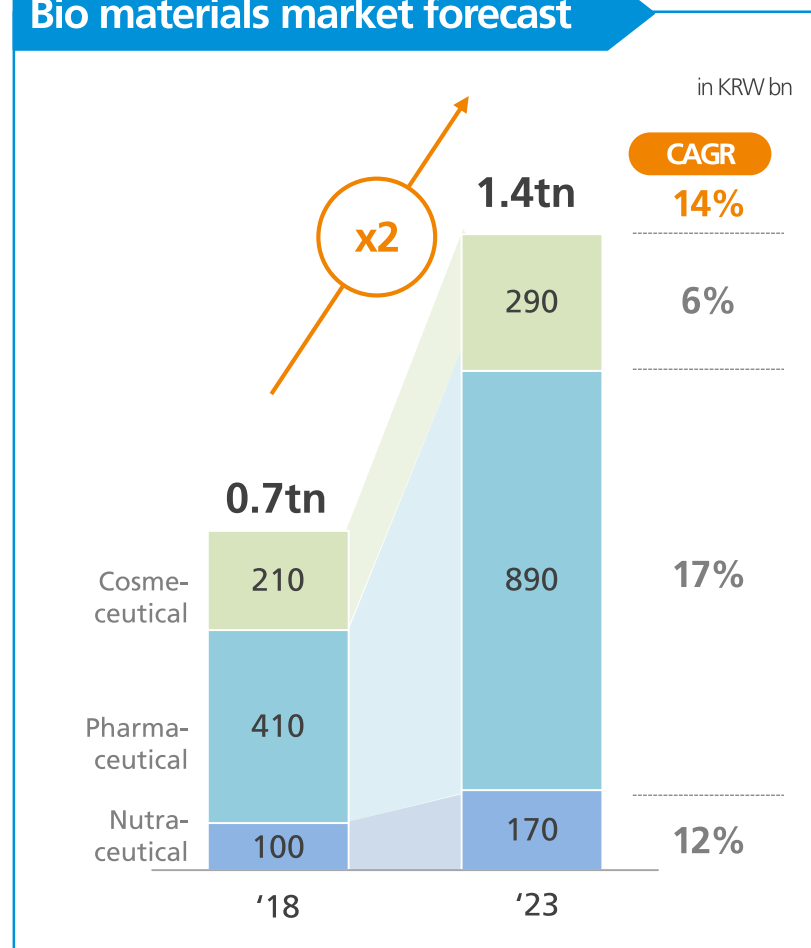
According to increasing needs for natural materials, Bio target market is expected to grow x2

Cosmeceutical Natural-based moisturizer (Ceramide)	Stable growth prospects with increased interest in preventing skin aging and moisturizing the skin barrier 
Pharmaceutical Natural-based emulsifier (PC ¹) etc.)	Prospects for high growth in PC markets, PC is effective in improving liver function (fat decomposition) with up-trend of metabolic diseases 
Nutraceutical Natural-Based Cognitive function enhancement materials(PS ²)	Prospects for high growth in PS market, it is effective in enhancing cognitive function that may be declined by aging 

1) Phosphatidylcholine : Typical Phospholipid (Rich in the brain/Neurotransmitter/Egg yolk lecithin)

2) Phosphatidylserine : A kind of Phospholipid (Rich in the brain/Neurotransmitter/Soybeans)

Bio materials market forecast



Source : Grand View Research, Credence Research, Kalorama Information, QY Research, Usiness Insight, IMS, SevenPlus

Standing-out position in the market

Core Technology for Natural-based Bio Materials

Only
Natural
Ceramide¹⁾
Manufacturer
in Korea

Only Natural Ceramide Manufacturer in Korea, M/S 95%

- Secondly securing natural ceramide manufacturing technology in global market²⁾
- Supplying natural ceramide to major domestic customers

AMOREPACIFIC

LG 생활건강



Technology
of
Natural-
based
Bio Materials

Bio material technology for various natural materials, such as egg yolk lecithin, yeast, soybeans, plants, milk etc.



Cosmeceutical

Pharmaceutical

Nutraceutical

- Yeast-based natural cosmeceutical materials(Ceramide)
- Egg yolk lecithin-based high purity phospholipid materials & Natural-based emulsifier : Awarded as Global top-class products by the Ministry of Knowledge Economy ('08)
- PS : Certification by the Ministry of Food and Drug Safety in Korea ('06), FDA Admission to Prevent Dementia ('10)

1) Ceramide is a functional material used in cosmetics as a moisturizing and anti-inflammatory effect

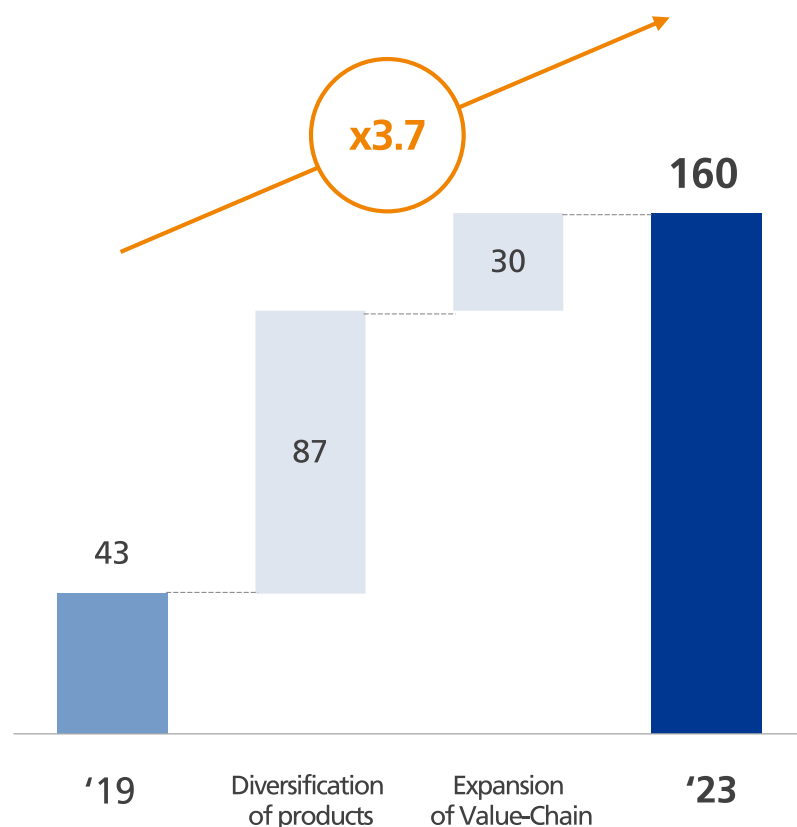
2) The world's first manufacturing technology holder is Evonik in Germany EVONIK
POWER TO CREATE

High-growth in Short-term

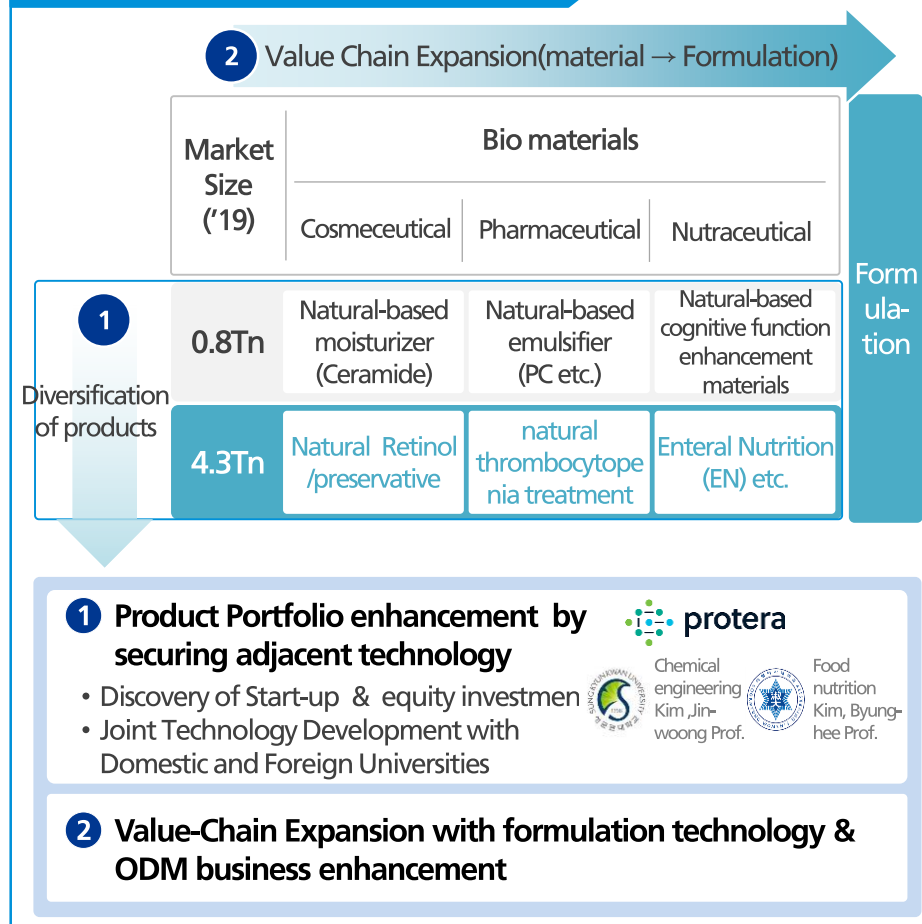
160 KRW Bn of sales in 2023 is expected with product diversification and value-chain expansion

Bio Sales Outlook

in KRW bn



Growth-accelerating strategy



Doosan Solus Vision

GLOBAL NO.1 MATERIAL SOLUTIONS PARTNER

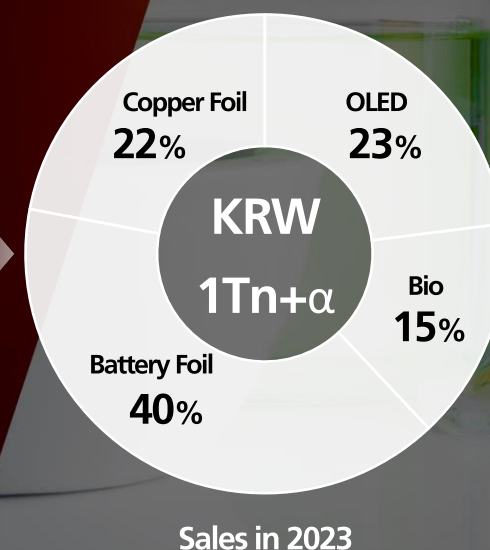
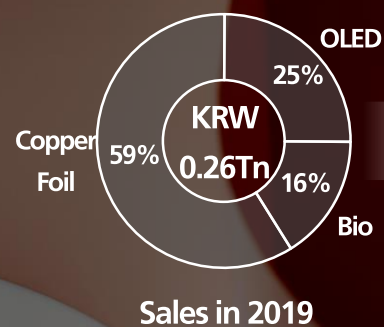
Slogan

**Design the Future,
Spark the Growth**

Vision Statement

Doosan Solus will be a global leading company,
providing advanced materials and innovative solutions
to the customers with future value creating
technological capabilities.

Aspiration





Investor Relations 2019

DOOSAN FUEL CELL

Chapter 1. Company Overview
Chapter 2. Highlights of Doosan Fuelcell





Chapter 1.

Company Overview

01. Company Overview

02. History and Doosan Fuelcell after Spin-off

01. Company Overview

Company Overview

<u>Name</u>	Doosan Fuelcell
<u>CEO</u>	Sookyung Yoo
<u>Establishment</u>	2019.10.01
<u>Listing</u>	2019.10.18(KOSPI)
<u>Assets</u>	422 KRW bn ¹⁾
<u>Employees</u>	312
<u>Head Office</u>	627 Seodong-ro, Iksan-si, Jeollabuk-do

1) ' As of 4Q18, Consolidated basis

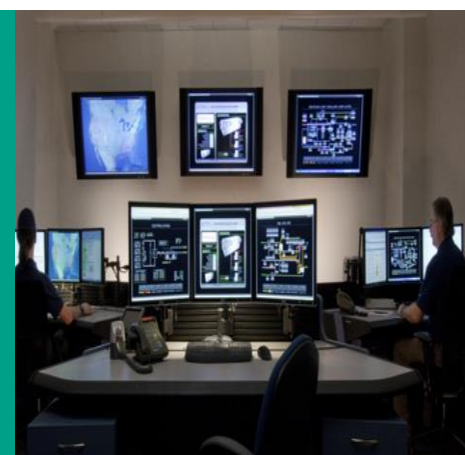
Introduction of business

Supply of fuel cell for power generation



Provide fuel cell generating power and heat

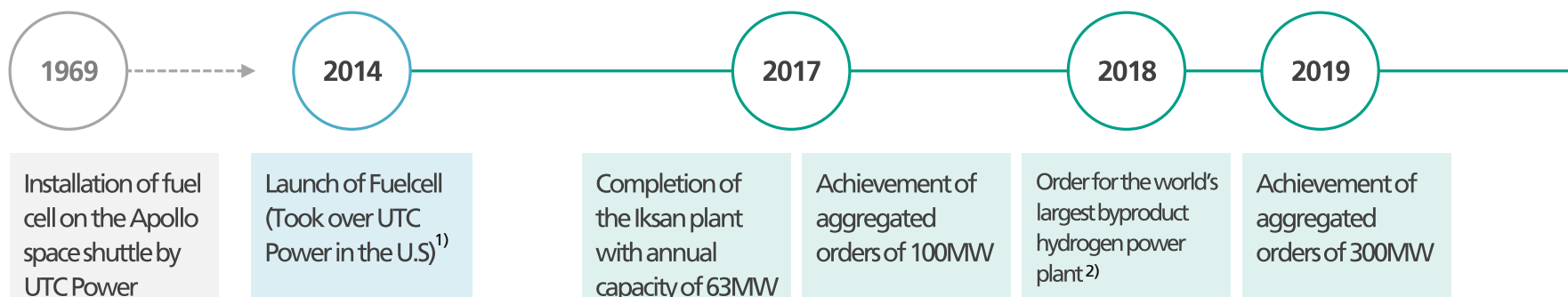
Long-term maintenance service offer



Provide stable maintenance/management service of the plant for 20 years

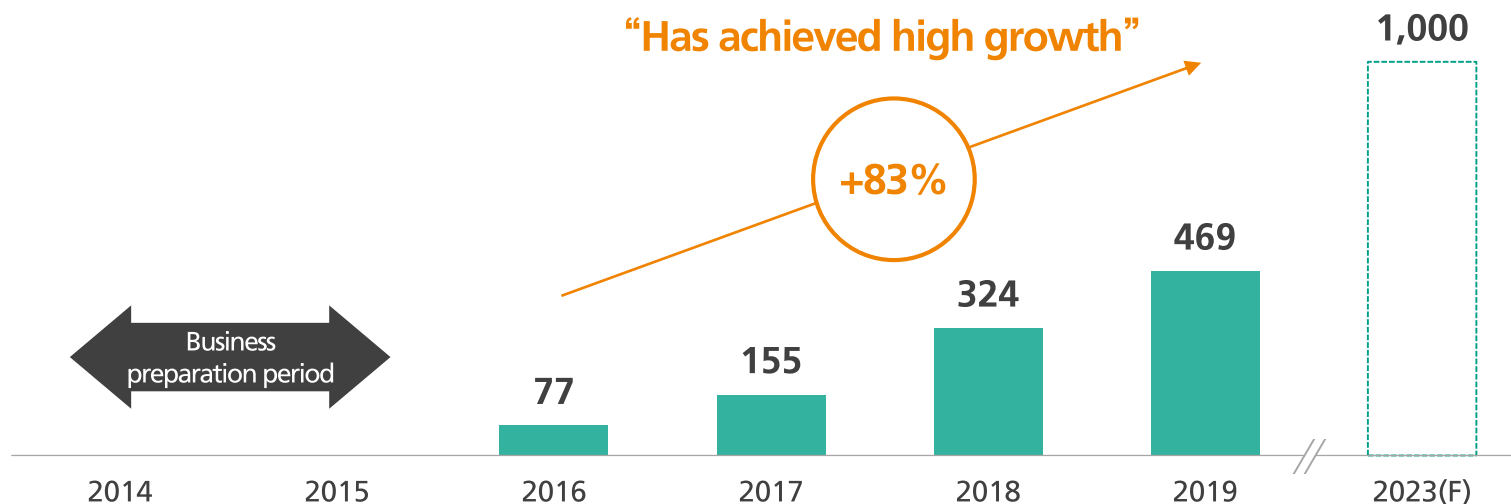
02. Business History and Doosan Fuelcell after Spin-off

Jump up to be a leading company in fuel cell for power generation, sales expected to reach 1 KRW tn by 2023



Sales Trend

(in KRW bn)



1) Took over fuel cell business of UTC Power in 2013

2) Hanwha Total Petrochemical 50.16MW



Chapter 2.

Highlights of Doosan Fuelcell

Stable High-growth Market

Stable High-growth Market Outlook
Expansion of Fuel cell business opportunities in
Foreign countries

Unique Position in the Market

Expansion of domestic M/S with commercially proven PAFC technology
Price competitiveness through the establishment of automated
facilities and localization of components

Promotion of Growth-Accelerating Strategy

Growth Strategies

- 1 Expansion of new heat applications
- 2 Commercialization of LPG combined model and Entry into the hydrogen market for transportation
- 3 Promotion of SOFC Technology Development and Commercialization

Vision of Doosan Fuelcell

Highlights of Doosan Fuelcell

Stable High-growth Market

- **Prospects for high growth through stable market environment**
 - RPS Policy :
30% of renewable generation by 2030
 - Roadmap for Hydrogen Economy :
8GW of fuel cell generation by 2040¹⁾
- **GENCO Plans to expand the fuel cell installation by 2030**



1) Based on the domestic market

2) No.1 M/S with a 79 percent in 2015~2019(F)

Unique Position in the Market

- **Expansion of domestic M/S with commercially proven PAFC technology**
 - High CHP (Combined Heat and power) and long life-span
 - Commercialization of multi-storied/ hydrogen generation technology
 - No.1 M/S in the domestic fuel cell market for power generation²⁾
- **Competitive price through the establishment of automated facilities and localization of components**
 - Cost reduction of 48% or more since launch of business



Promotion of Growth-accelerating Strategy

- **Expansion of new heat demand applications**
 - Replacement of old CHP plant and Incinerator
 - LNG Boil-off-Gas, Smart farm
- **Commercialization of LPG combined model**
- **Entry into the hydrogen market for transportation with the Tri-gen model**
 - Entry into the hydrogen station market
- **Promotion of SOFC technology development and commercialization**



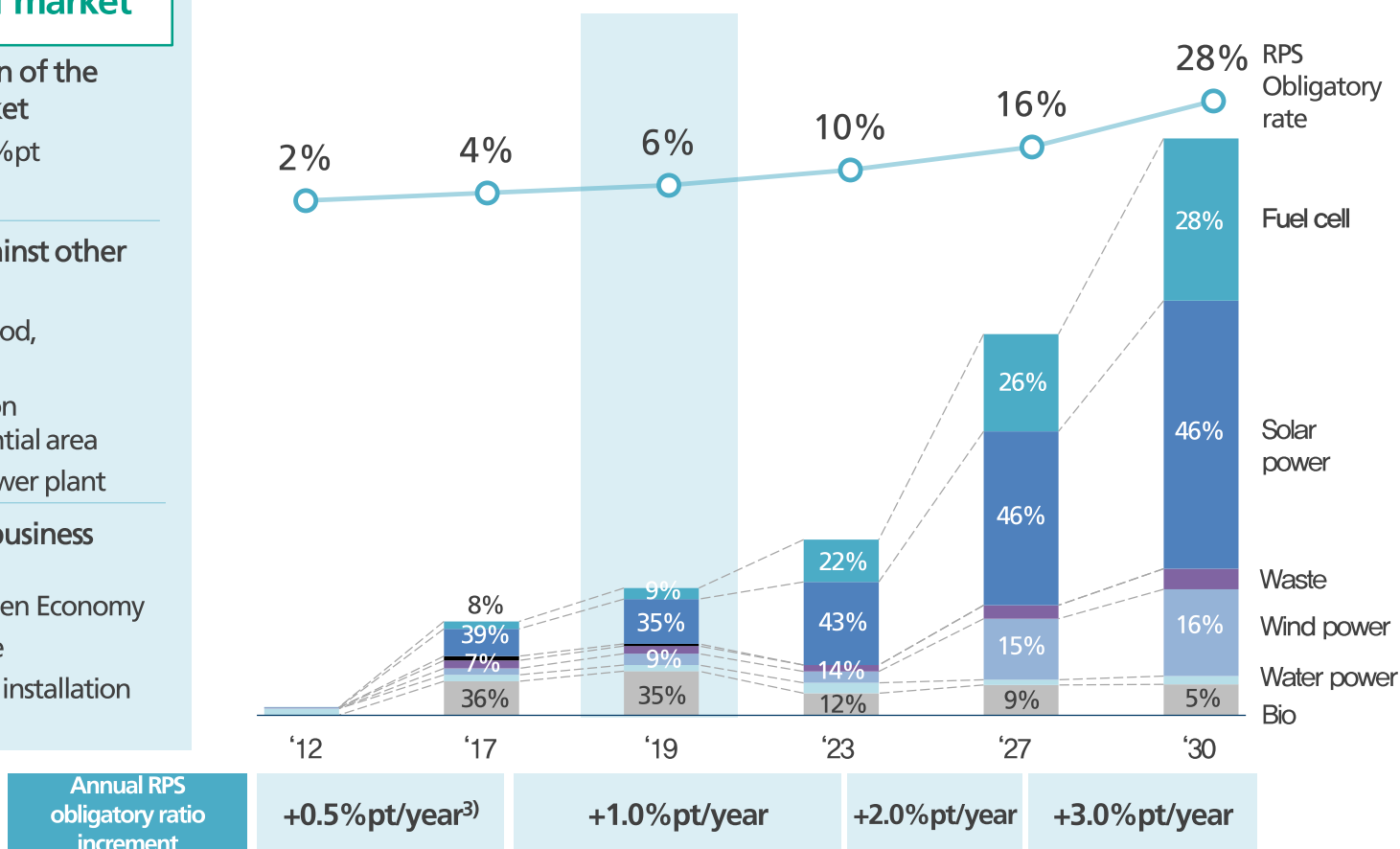
Stable High-growth Market Outlook (1/2)

The market is expected to grow stably based on the increase in RPS¹⁾ obligatory renewable service supply ratio and policy support

Stable expansion of market

- 1 Continued expansion of the increase in RPS Market
 - Initial +0.5%pt~+3.0%pt increase expected
- 2 Competitiveness against other power sources
 - Short installation period, small installation area
 - Distributed generation installable near residential area
 - Eco-friendly clean power plant
- 3 Continued friendly business environment
 - Roadmap for Hydrogen Economy
 - Fuel cell exclusive rate
 - Expansion of fuel cell installation plans by GENCO

RPS obligatory renewable service supply ratio and composition by power source²⁾



1) Renewable Portfolio Standard : A system that enforces power producers to supply a certain amount of the total power generation by new and renewable energy

2) Capacity calculated inversely based on power generation (92% fuel cell operation rate assumed)

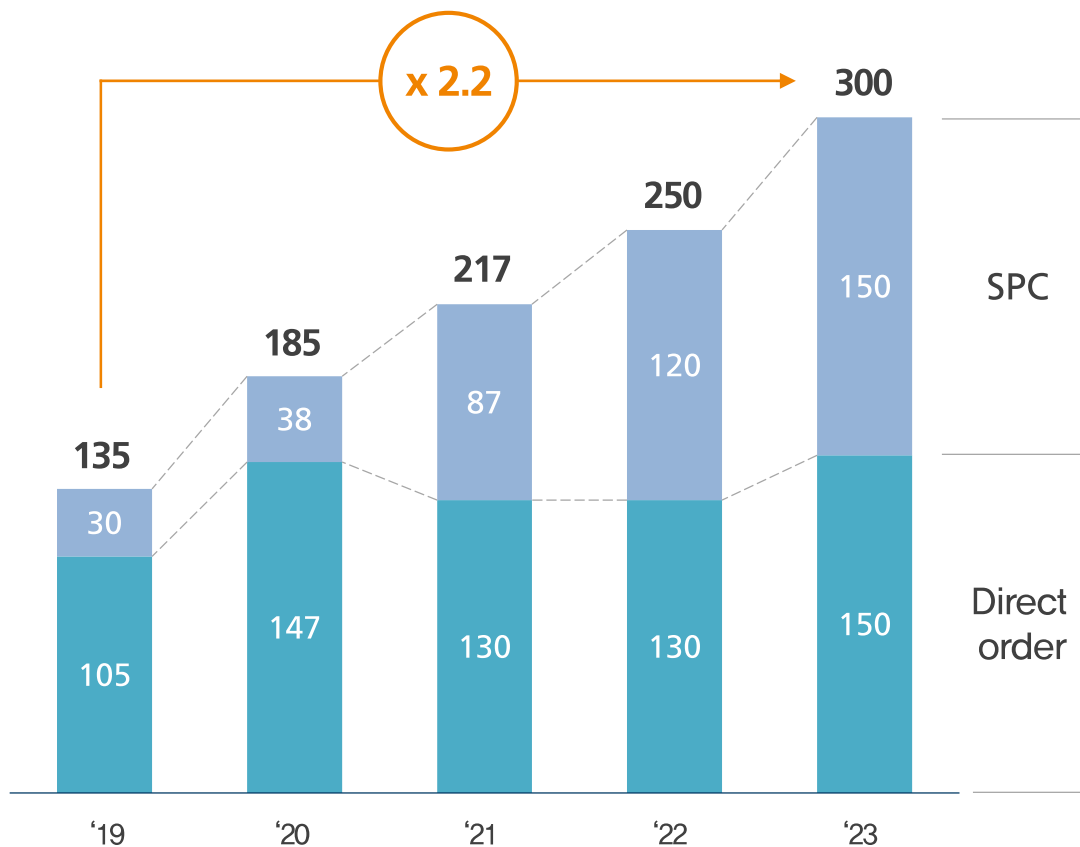
3) Excluding 2015 (3% is the same as 2014 without a rise)

Stable High-growth Market Outlook (1/2)

300MW-market is certainly expected by 2023 and there is additional market potential when considering SPC PJT under development

- Considered PJT with higher feasibility among GENCO's plan and SPC PJT pool

(Unit : MW)



SPC Capacity approved by Electricity Commission ~2GW¹⁾

70 projects of 2GW under development

Existing owners
0.4GW

New owners
1.6GW

Stable plan of GENCO²⁾

'18
0.2GW

'30
2.5GW

1) Main SPC : Yulchon (110MW), Naepo Green Energy (60MW), Paju Energy Service (19.8MW), Hanwha Energy (19.8MW), Daelim Energy (19.8MW), Busan City Gas (9.68MW), Daesan Green Energy (50MW) with 30 other PJT

2) Accumulated

Expansion of Fuel cell business opportunities in Foreign countries

Opportunities for fuel cell business are expected to grow driven by establishment of hydrogen value chain in foreign countries

Progress status by country



China

- Starts to utilize abundant byproduct hydrogen resources¹⁾
- Development of hydrogen pilot city by local government and state-owned company
- Implementation of subsidy for hydrogen vehicle
- Reduction of subsidy for EV, solar and wind power



Europe

- Increases production and utilization of hydrogen energy by using surplus renewable energy
- Launch of 'FCH JU²⁾' a public-private partnership to expand the supply of hydrogen fuel cell (May, 2018)



Australia/Japan

- Australia promotes large-scale hydrogen production and export
 - Hydrogen extraction after gasifying coal
- Japan accelerates entry into the hydrogen society with the start of Tokyo 2020
 - 800,000 hydrogen vehicles and 5.3million ENE-FARM by 2030

Others

- Saudi Arabia expands infrastructure in the country in accordance with hydrogen energy strategy

"Establishment of hydrogen value chain"

Production of hydrogen

storage/
transportation
of hydrogen

Application
of hydrogen

Expanding opportunities for fuel cell business
for electricity generation

1) The establishment of the world's largest hydrogen station by using byproduct hydrogen in Shanghai

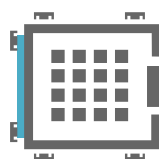
2) Fuel Cells and Hydrogen Joint Undertaking

Domestic market leader with commercially proven PAFC based technology

High CHP efficiency and long life-span based on PAFC

Combined Efficiency
90%

Electricity 42% + Heat 48%



Life-span of
Cell Stack 10 years
guarantee

20 years of life-span of main
components guarantee

Commercialization of the world's first/largest multi-storied/hydrogen fuel cell plant



Busan Green Energy (30MW)

The world's first/largest
multi-storied fuel cell plant



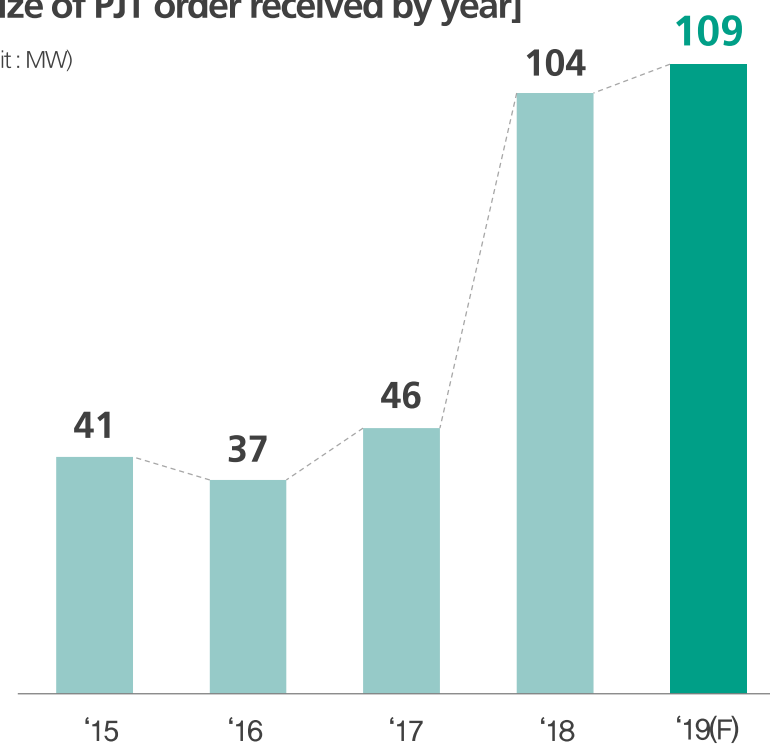
Hanwha Total Petrochemical (50MW)

The world's first/largest
byproduct hydrogen fuel cell plant

No.1 with a 79 percent M/S in 2015~2019(F)

[Size of PJT order received by year]¹⁾

(Unit : MW)



Annual RPS
Obligatory ratio
increment

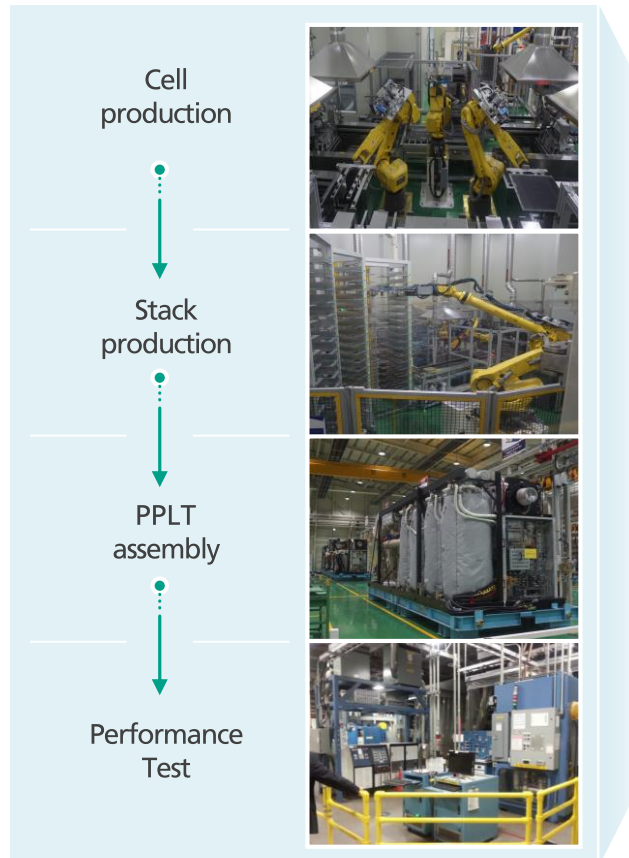
+0.5%pt/year

+1.0%pt/year

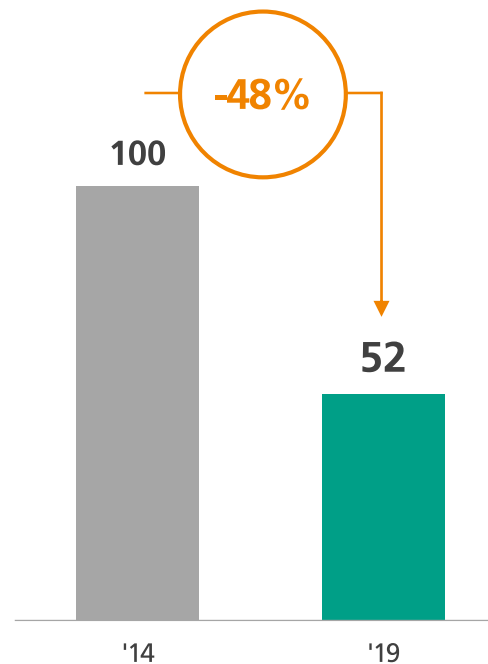
1) Orders received in 2018 due to delay are reflected in 2017

Gained competitiveness through the establishment of automated facilities and localization of components

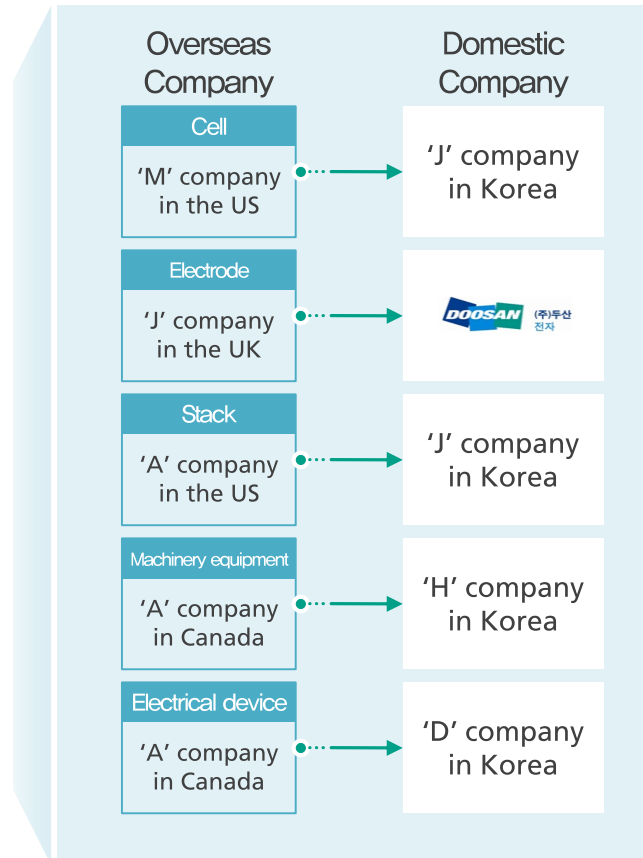
50 year mass production technology & Industry-first automation facility



Total production costs



Localization of components [Localization ratio 98%]¹⁾



1) Based on costs

Growth Strategies

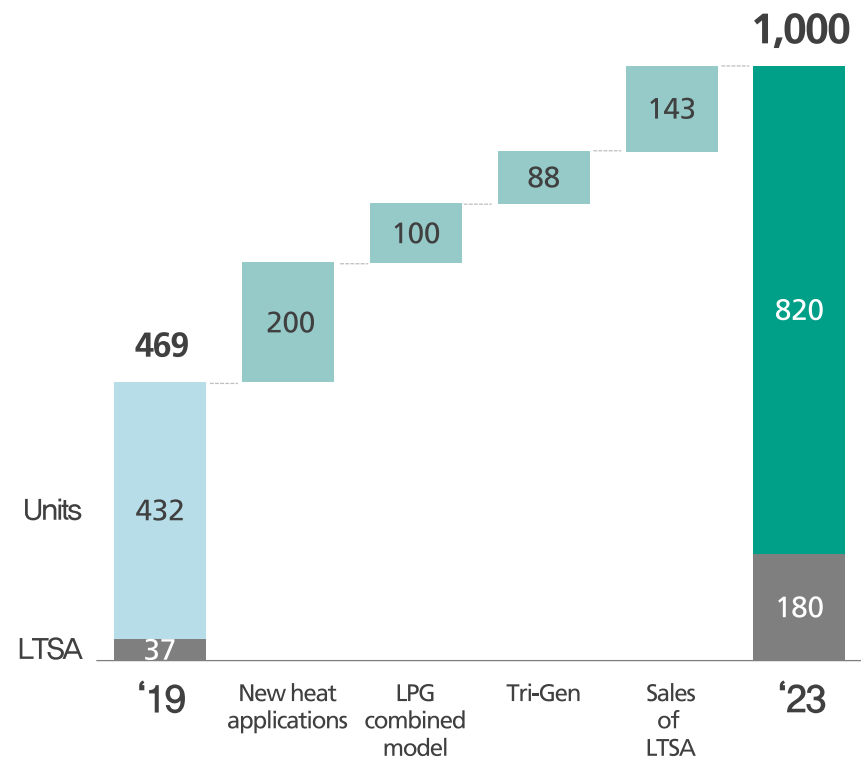
Target to achieve KRW 1 trillion in sales of units and LTSA by accelerating growth until 2023

Growth Strategies

Expansion of the existing market	1 Expansion of heat demand applications	<ul style="list-style-type: none"> Replacement of aged CHP plants/incinerator Discovery of LNG Boil-off-Gas and smart farm
Expansion of the new market	2 Commercialization of LPG dual model	<ul style="list-style-type: none"> Expansion of market through LPG/NG dual model
	Entry into the hydrogen market for transportation	<ul style="list-style-type: none"> Entry into the hydrogen market for transportation through securement of electricity/heat/hydrogen generation model
Long-term growth	3 SOFC development and commercialization	<ul style="list-style-type: none"> Competitiveness improvement in the E-only market

Sales Target in 2023

(in KRW bn)



1 Expansion of heat demand applications

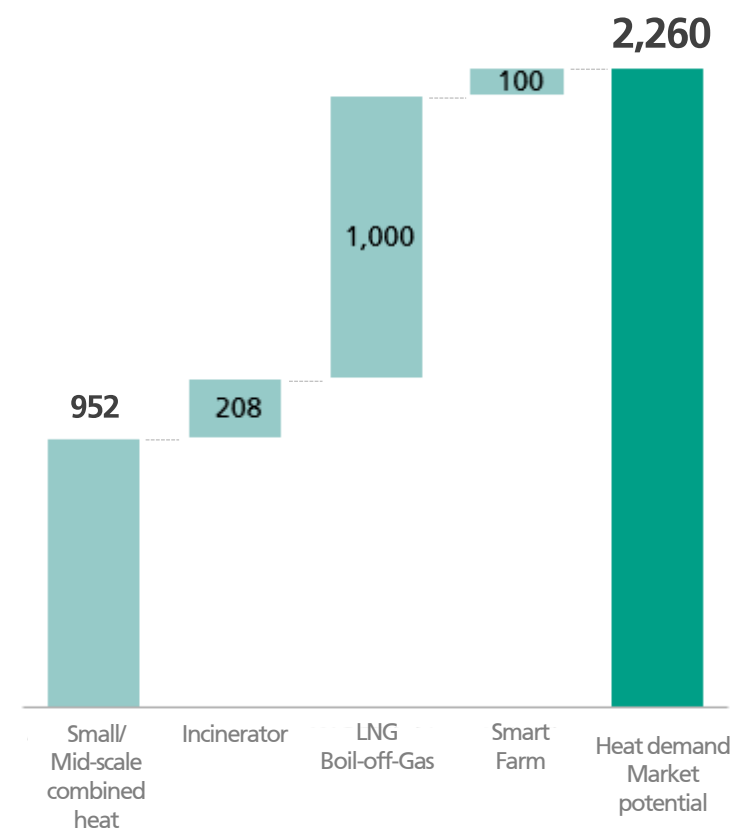
To accelerate growth by expanding new heat demand applications that can utilize heat generated by fuel cell

Heat application generated by fuel cell

As is	Extended Target	Details
Complementation of large-scale combined heat	Small/Mid-scale combined heat / Incinerator	• <u>Replacement of heat</u> generated in old/small-scale CHP plants and incinerator heat source
LNG cold energy	LNG Boil-off-Gas	• Conversion of vaporized gas in LNG tanks to fuel
Hot spring	Smart Farm	• Supply of energy for farms → <u>Proper growth environment for crops</u>
	⋮	⋮

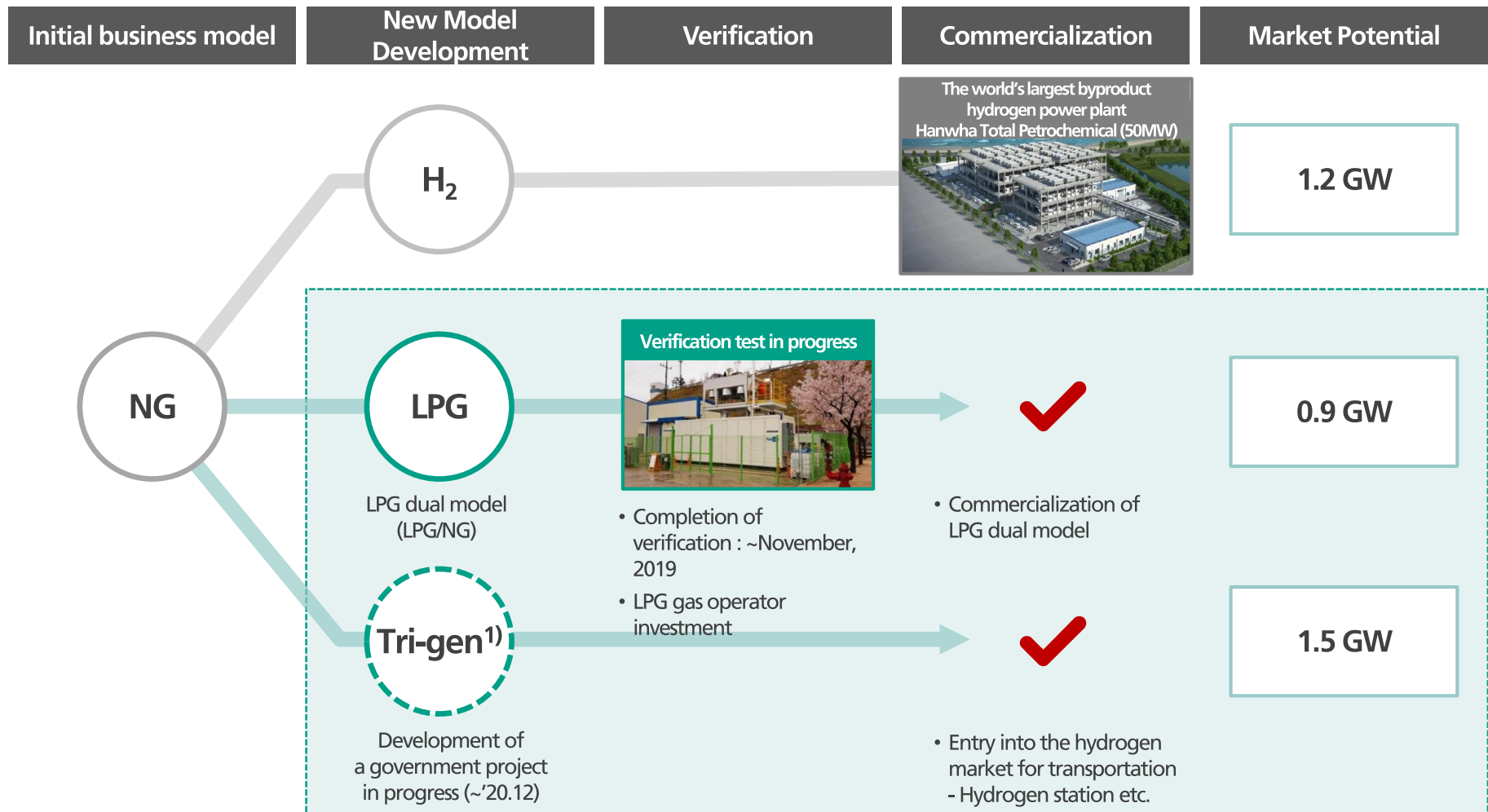
Market Potential until 2023

(Unit : MW)



1) B.O.G (Boil-off-Gas) : Evaporating gas in the part of the LNG tank

2 Commercialization of LPG combined model & Entry into the hydrogen market for transportation



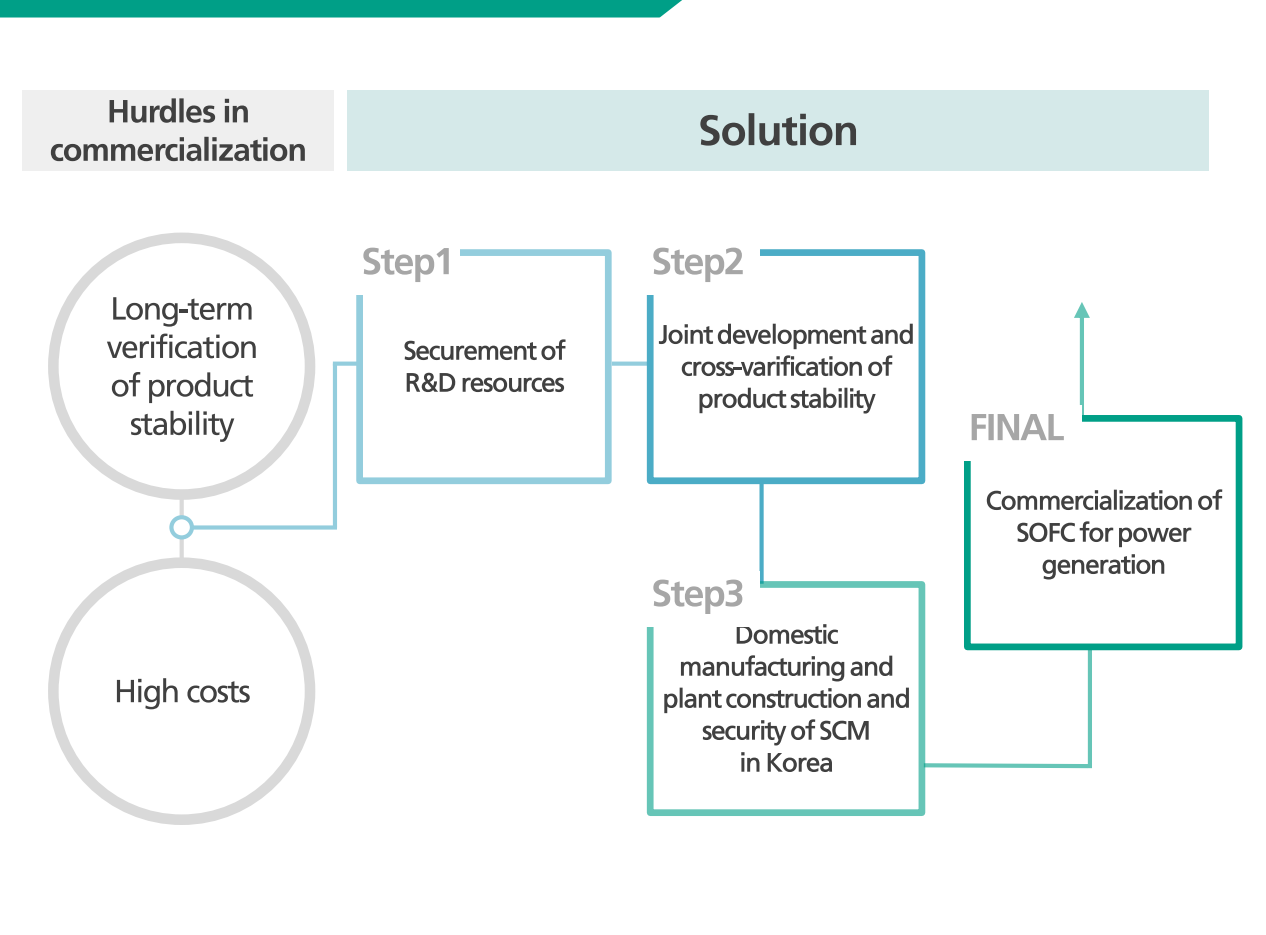
1) A fuel cell model capable of producing electricity, heat, and hydrogen

3 Development and Commercialization of SOFC model

Purpose of SOFC technology development

- Improve E-only market, a market requiring only electricity without heat
 - To Expand and improve the business along with PAFC models
- Achievement of the 20205 Grid Parity goals
 - Target cost level of small to medium gas turbine
- Response to the shut-down of coal-fired power plants
 - To prepare for the shut-down of coal-fired power plants after 2026

Hurdles and Solution to SOFC development



Vision of Doosan Fuelcell

Hydrogen Energy Global No.1 Player

Slogan

Accelerate the hydrogen world

Vision Statement

Doosan Fuelcell leads the transition to an eco-friendly hydrogen society by providing a clean, reliable, and best energy solution for our customers

Aspiration

