



Aluminum Cans Market Assessment – South Korea

Context, quantitative baseline, options

May 2023

List of abbreviations – selection

Abbreviation	Description
b units	Billion units
C2C	Can to can
DRS	Deposit return scheme
EPR	Extended producer responsibility
Horeca	Hotel, restaurant, and catering
m units	Million units
MRF	Material recovery facility
MSW	Municipal solid waste
POM	Put-on market
UBC	Used beverage cans
WM	Waste management
WtE	Waste to energy

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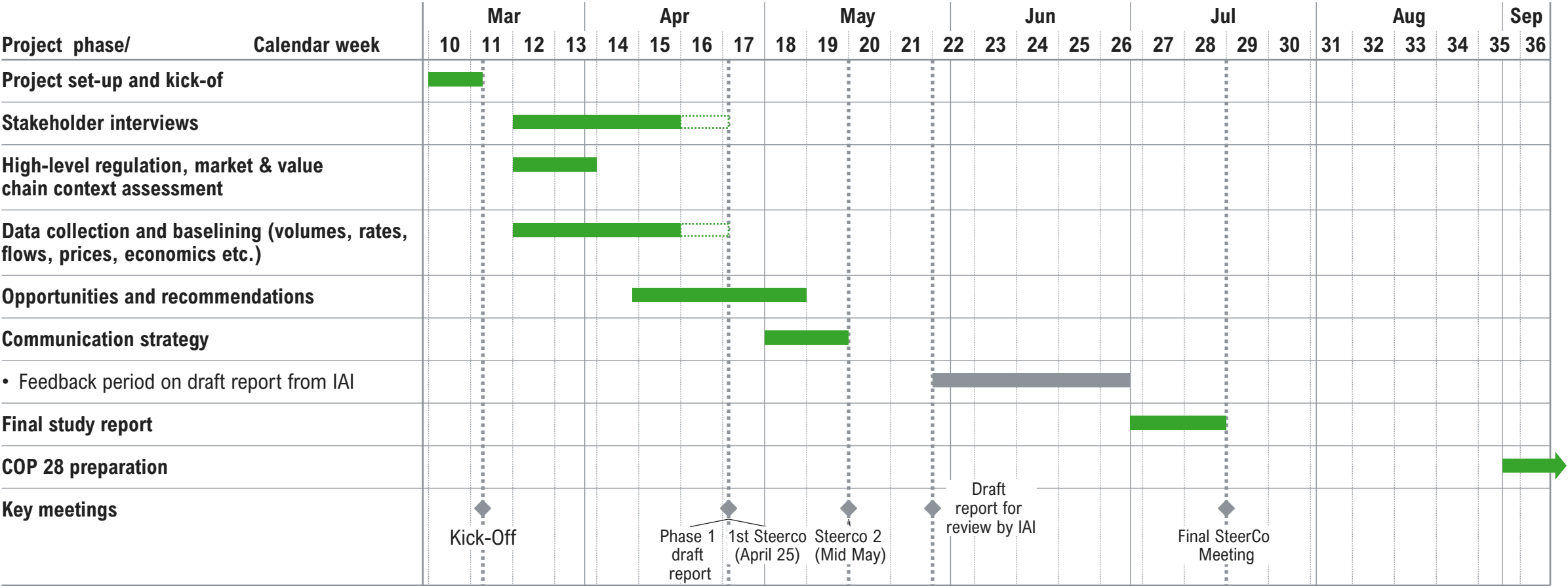
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1. Executive summary

The overall project timeline spans 2.5 months with the draft reports of phase 1 delivered at the end of April

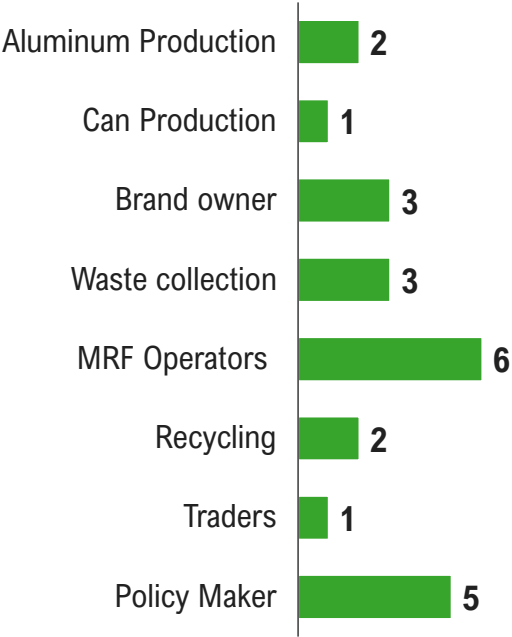
Project timeline



The analysis has been supported by expert interviews – 23 experts were interviewed

Overview of interviews conducted

Interviews by type



	#	Company	Position
Aluminum production	1	AI Techno Metal	Material Procurement Team Director
	2	DS Liquid	CEO
Can production	3	Hanil Copper Co., Ltd.	Manager
Brand owner	4	Lotte Chilsung Beverage	Can Procurement Manager
	6	Coca-Cola	Distribution Manager
Waste collection	7	Pyeonghwa Environment	Operation Manager
	8	Gangnam-gu Office	Resource Circulation Division Officer
MRF operators	9	Bucheon MnTech	General Manager
	10	Sejong Industrial Resource	Operation Director
	11	Nowon-gu MRF	Operation Team Leader
	12	Bucheon Circular Resource Center	Operation Manager
	13	Seoul-si MRF	Recycling Planning Team Officer
Recycling	14	Kangseo-gu MRF	Recycling Sorting Center Team Competent Officer
	15	Bucheon Recycling	Director
Traders	16	Novelis International Network	CEO
Policy maker	17	Korea Environment Cooperation	Packaging EPR Operations Manager
	18	Korea Packaging Recycling Cooperative	Manager
	19	Korea Resource Circulation Service Agency	Metal Can Paper Pack Team Head
	20	Ministry of Environment	Resource Recycling Division Director
	21	Ministry of Environment	Household Waste Division Director

Statistics/databases

- Aluminium Recovery figures
- Export data

UN Comtrade Database
 EUROMONITOR INTERNATIONAL

Industry players, experts, regulators

- Government and associations
- Recyclers

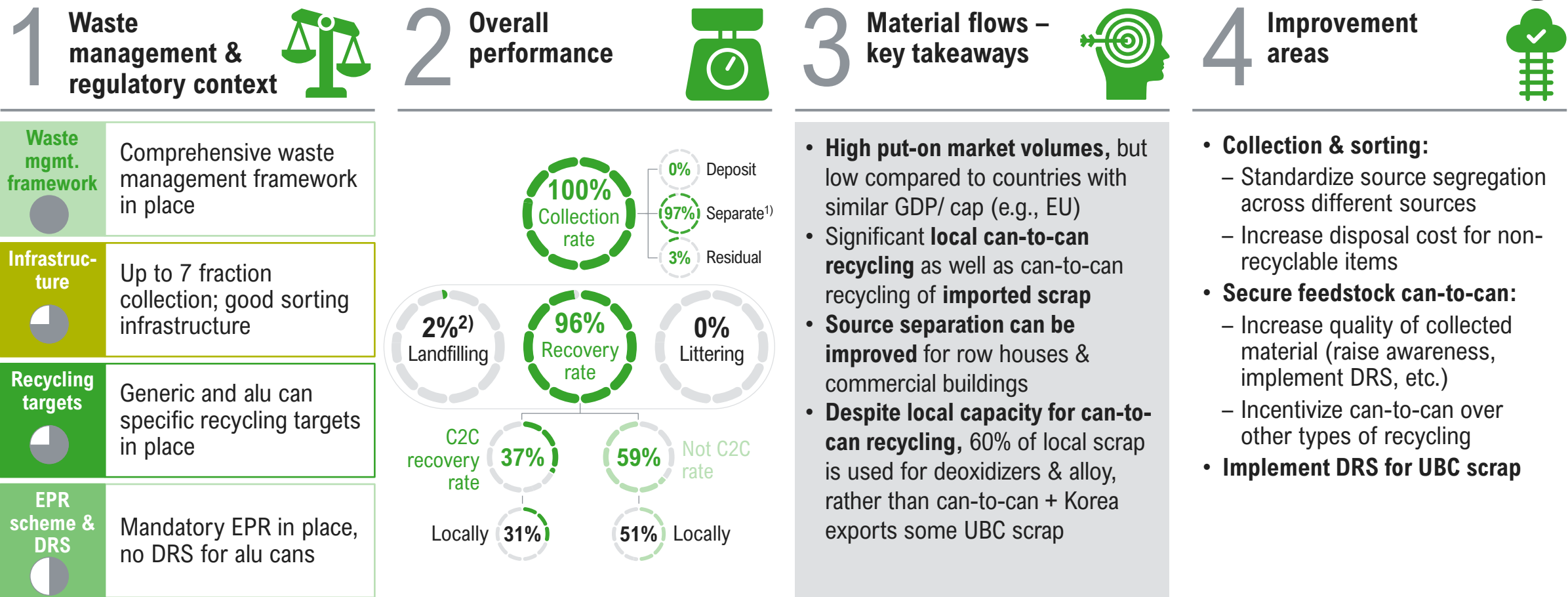
Market studies

RB sources

- Previous project experience
- Internal experts
- Industry contacts

South Korea has a mature can collection and sorting infrastructure, with room to improve source separation, only ~1/3 are recycled in closed-loop despite capacity

Aluminium can recycling in South Korea



○ Not existing ◐ Incipient, with limited scope ◑ Developing ◒ Matured ◓ Fully developed



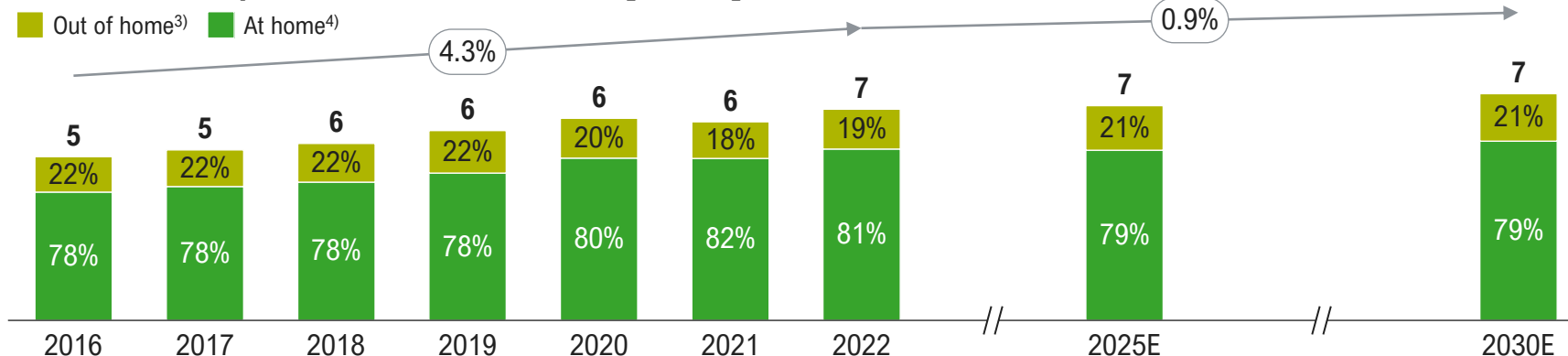
2. Aluminum Cans Market

The market has been steadily increasing in the past years and is forecasted to only slightly slow down its growth

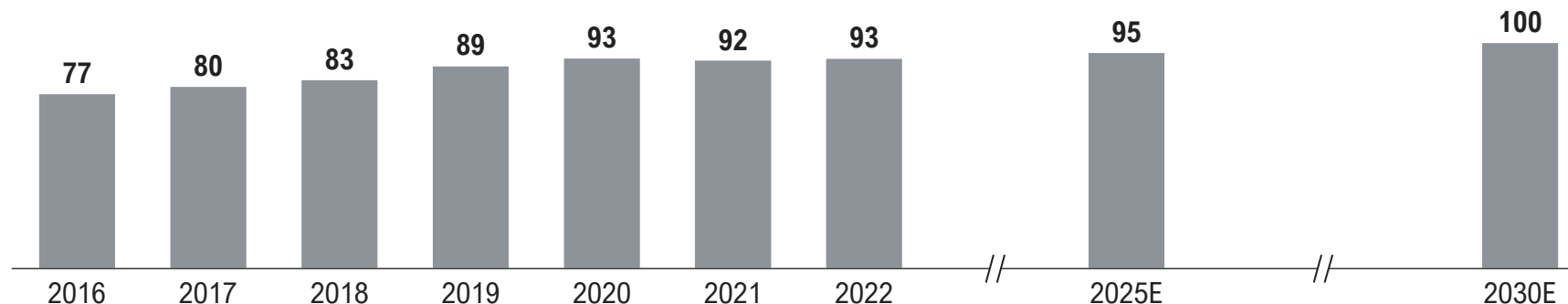
Overview of volumes put on market, aluminium cans



Aluminium cans put on market, 2016-2030E [b units]¹⁾



Aluminium cans put on market, 2016-2030E [k tonnes]²⁾



1) POM volumes are estimated by averaging input data from interviews with market stakeholders combined with reports from market research; 2) Estimated weight per can 15 g;

3) Out of home consumption includes hotels, restaurants, and catering; 4) At home consumption includes the remaining cans



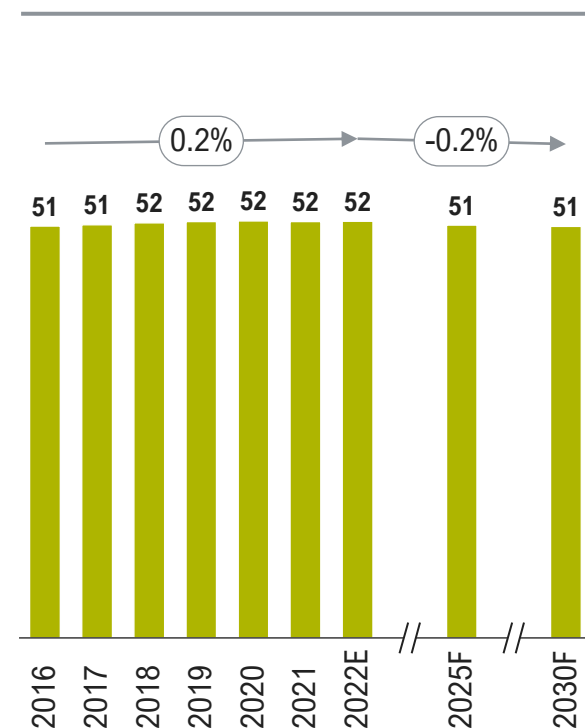
Key takeaways

- Aluminium beverage can volumes steadily increased by 4.5% per year, influenced by increasing consumption per capita and a shift from glass
- COVID-19 affected mainly on-trade consumption, which has very quickly recovered
- A continued increase is forecasted until 2030, with the dynamics from recent years only slightly slowing down
- The majority of the aluminum cans are consumed at home, with a moderate and relatively constant share in off-trade consumption

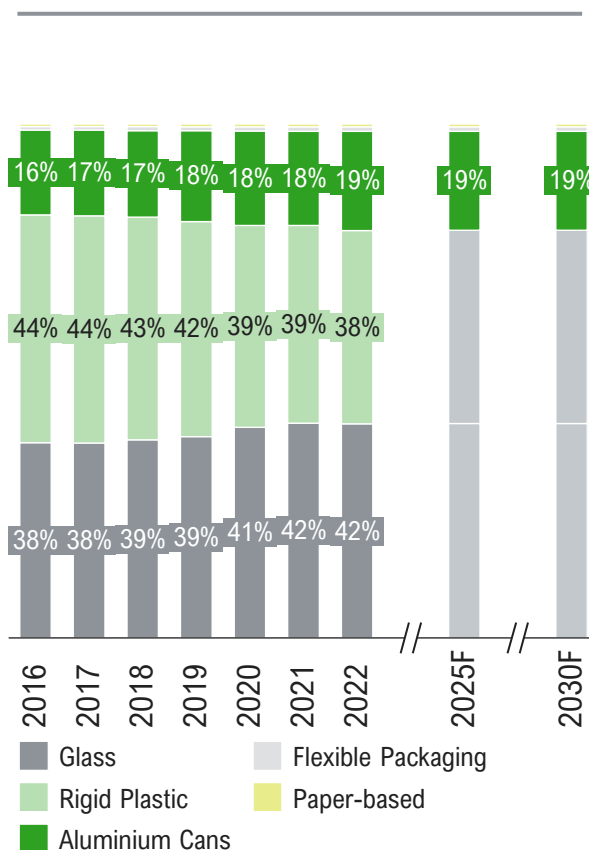
The increase can be in large attributed to a rising consumption per capita and a shift from glass to other materials

Population, package & beverage trends

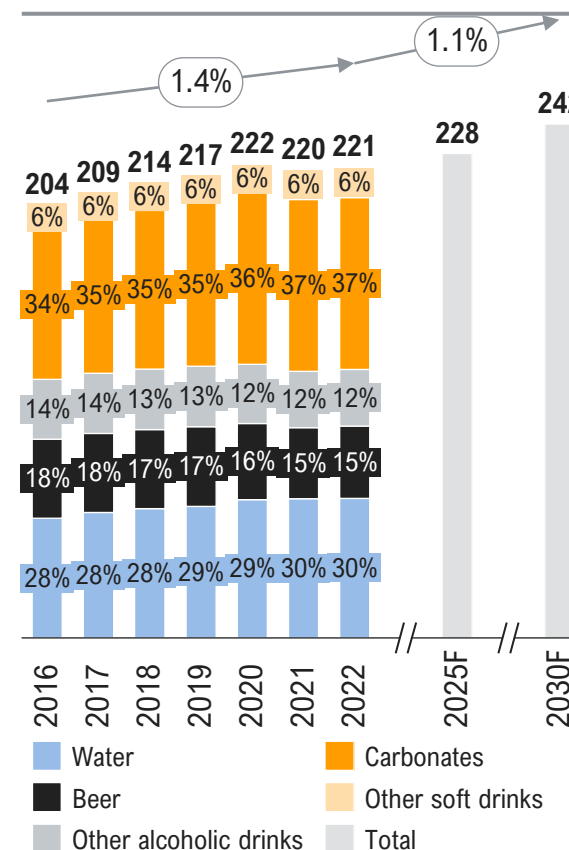
Population, 2016-2030E [m inhabitants]



Estimated annual packaged consumption [%¹⁾]



Estimated annual packaged beverage [l/ capita, %]



Key takeaways

- Although the population has been very slightly increasing in recent years, it is forecasted to decline in the future due to ageing population
- The share of glass used in packaging has been steadily declining, being replaced by aluminium cans, and in large part, rigid plastic
- There has been a significant increase in packed beverage consumption
 - It was accelerated in large by the growing water demand
 - The consumption is forecasted to significantly slow down in the future to ~1.2 % p.a.

1) Volume per package type of the total volume of packaged drinks



3. Waste management & regulatory context

The South Korean waste management framework is very mature, with developed legislation (incl. EPR) and ambitious targets, despite lacking a DRS

Regulation overview



Core legislation framework

- Korean waste management regulation was developed over a relatively short time frame (~20 – 30 years) in 3 phases:
 - The initial phase (in the late 1980s & early 1990s) was focused on ensuring safe waste disposal practices
 - The second phase (during the 1990s & early 2000s) was focused on establishing a culture & system for recycling
 - The final phase (starting around 2007) is focused on establishing a circular economy in South Korea



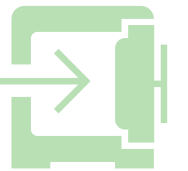
Recycling targets

- As Korea current landfills are filling up rapidly and the country, strong targets have been set:
 - 3% landfill rate target
 - 87% recovery rate target



DRS

- No DRS, but a returnable glass scheme for certain brands of beer, soju, sake and soft drinks in refillable glass bottles exists since 1985 in South Korea, and UBCs are not considered
- System is also operated by KORA (Korea Resource Circulation Service Agency)
- A trial to further expand the system in Korea is ongoing in 2 regions (Jeju-do island and the Sejong city)



EPR scheme¹⁾

- Mandatory EPR with progressively more ambitious recycling targeting, extensive reporting & transparent communication
- The system was introduced in 2003 and was reshaped in 2013, when it was transferred to a public operator KORA
- Fees are around KRW 50-100/ container (equivalent to approx. EUR 0.03-0.07)
- Targets are annually updating, currently at ~80% for aluminium cans



Maturity level, relative to most developed countries:



Not existing



Incipient, with limited scope



Developing



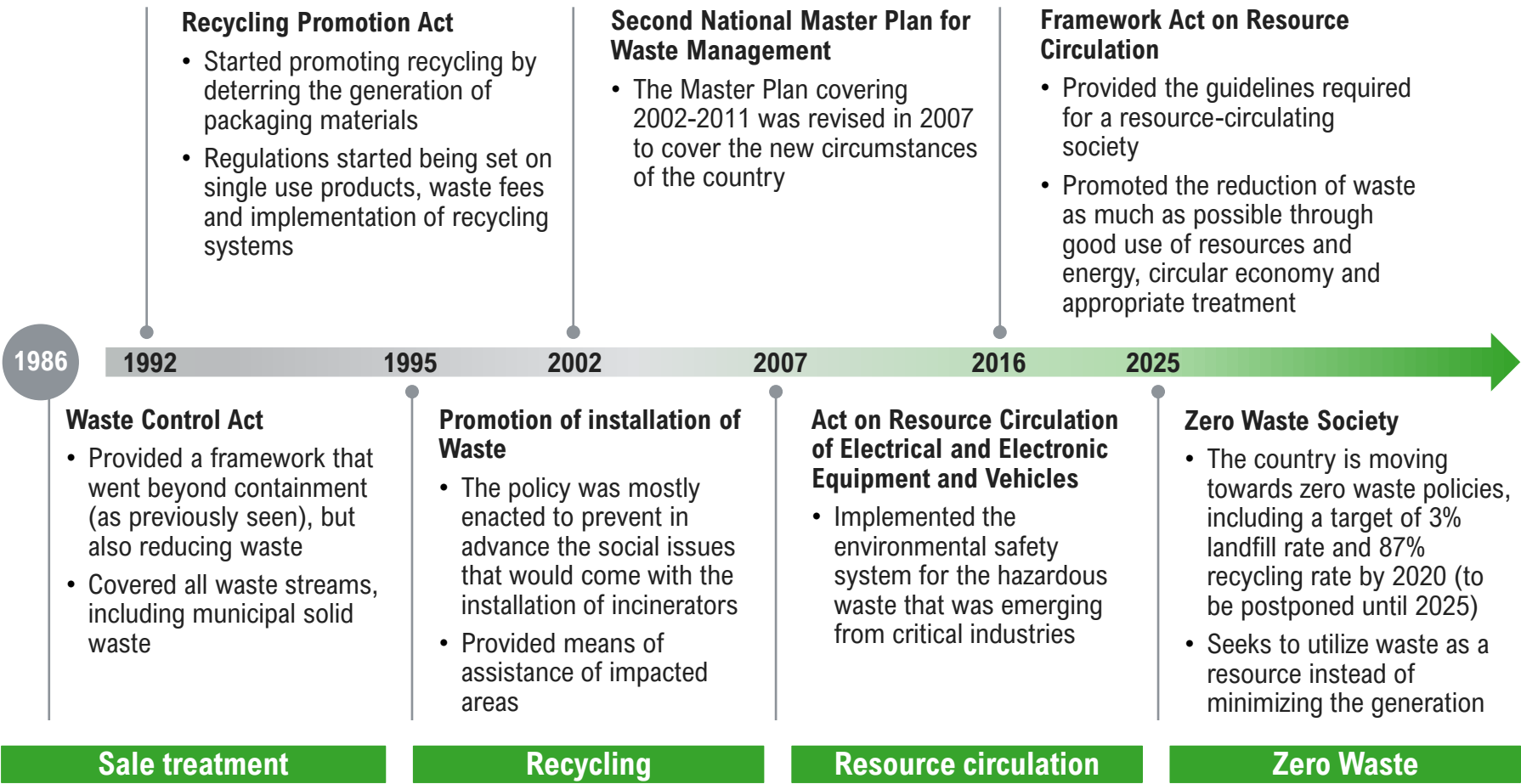
Matured



Fully developed

Despite problems in the '80s, Korea quickly developed from one of the least mature countries to one of the most

Regulation overview



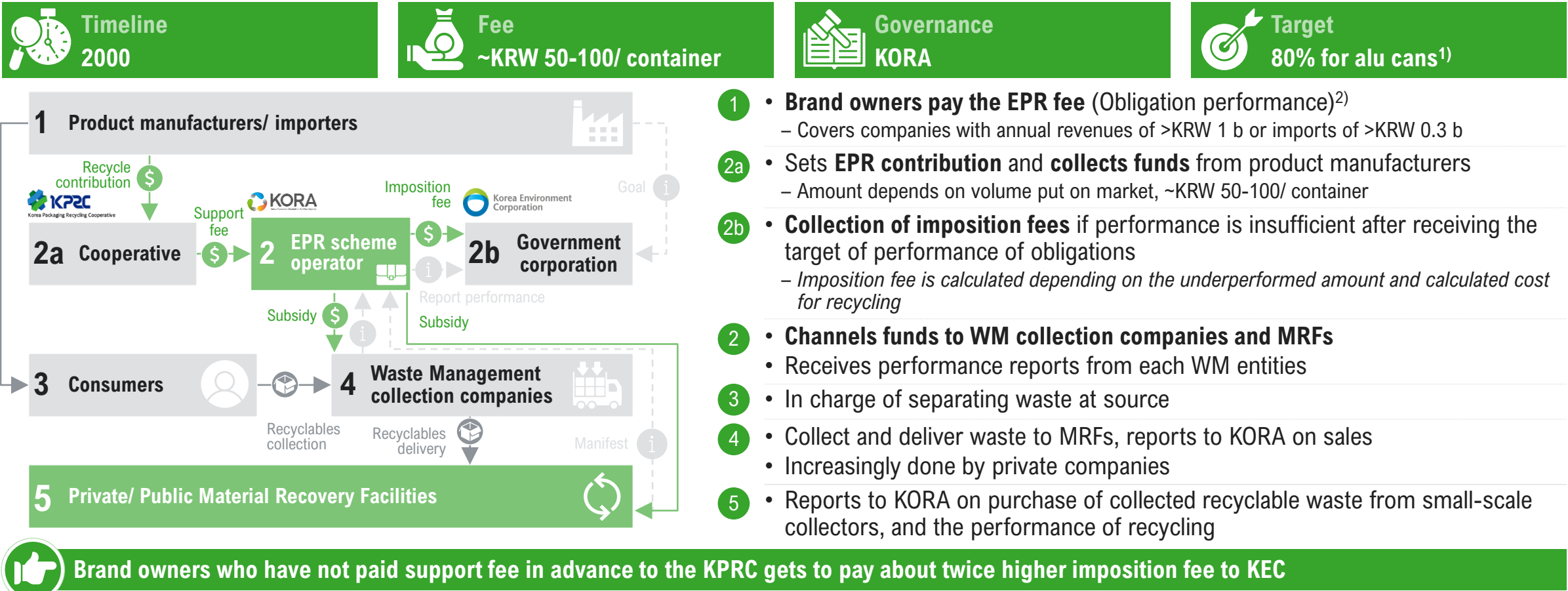
Key takeaways



- Waste management in South Korea has undergone a period of drastic transformation in the last decades
- In the 1980s, its waste management was still very incipient, mostly landfilling, and started introducing policies going beyond containment of waste
- In the last two decades, the country has been going through development stages promoting recycling and more recently resource circulation
- Latest policies set the country on a path towards zero waste, with some of the highest ambition and performant systems seen to date

In the EPR system, KORA is at the center of checking the performance of each mandatory recycling target, collecting fees, and subsidizing the WM entities

Packaging EPR system operation



Material flow
 Money flow

1) Product dependent, set yearly by the Ministry of Environment; 2) Performance of the obligation to recover and recycle (Article 16 of the Resource Recycling Act)

Source: EPR committee, MONRE, Roland Berger



4. Value Chain

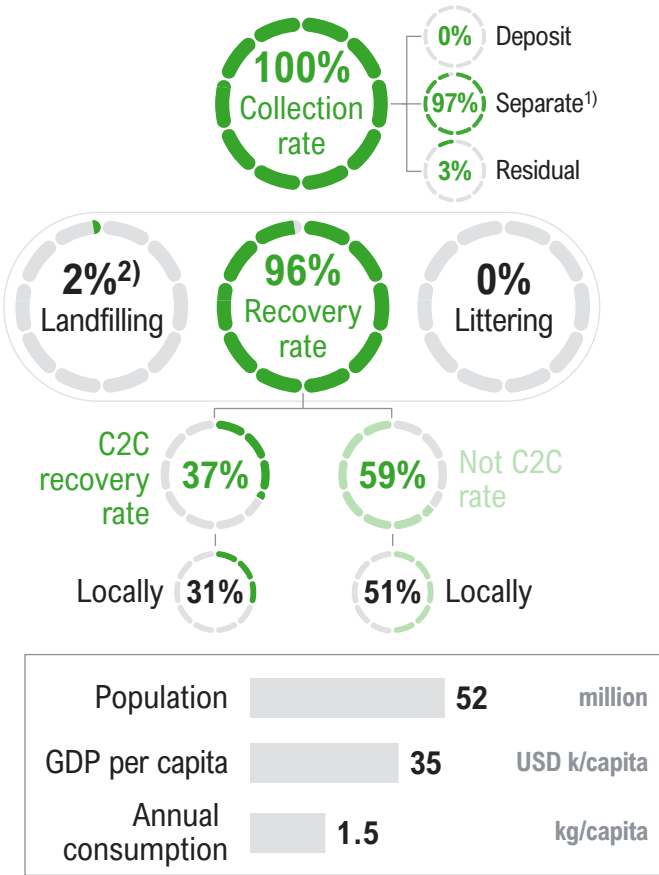
Widespread source separation & sufficient sorting capacity results in high recovery rates – through scrap imports, Korea plays a key global role in can-to-can recycling

Overview of aluminum cans value chain

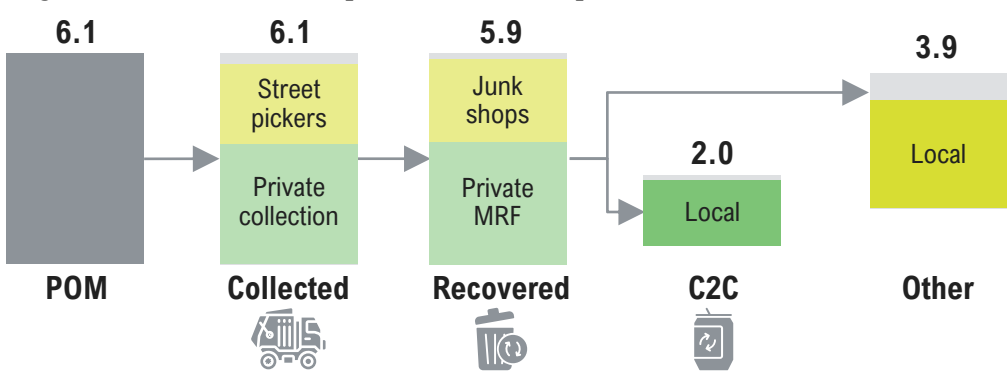


The vast majority of cans are collected separately and recovered, but only ~1/3 are destined for local C2C recycling

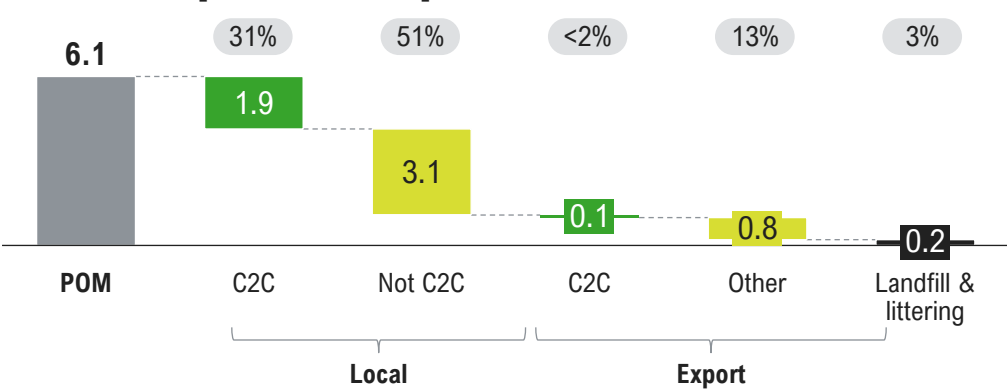
Summary of aluminium cans flows [b units, 2021]



Key market indicators [b units, %POM]



Destinations [b units, %POM]



Key takeaways

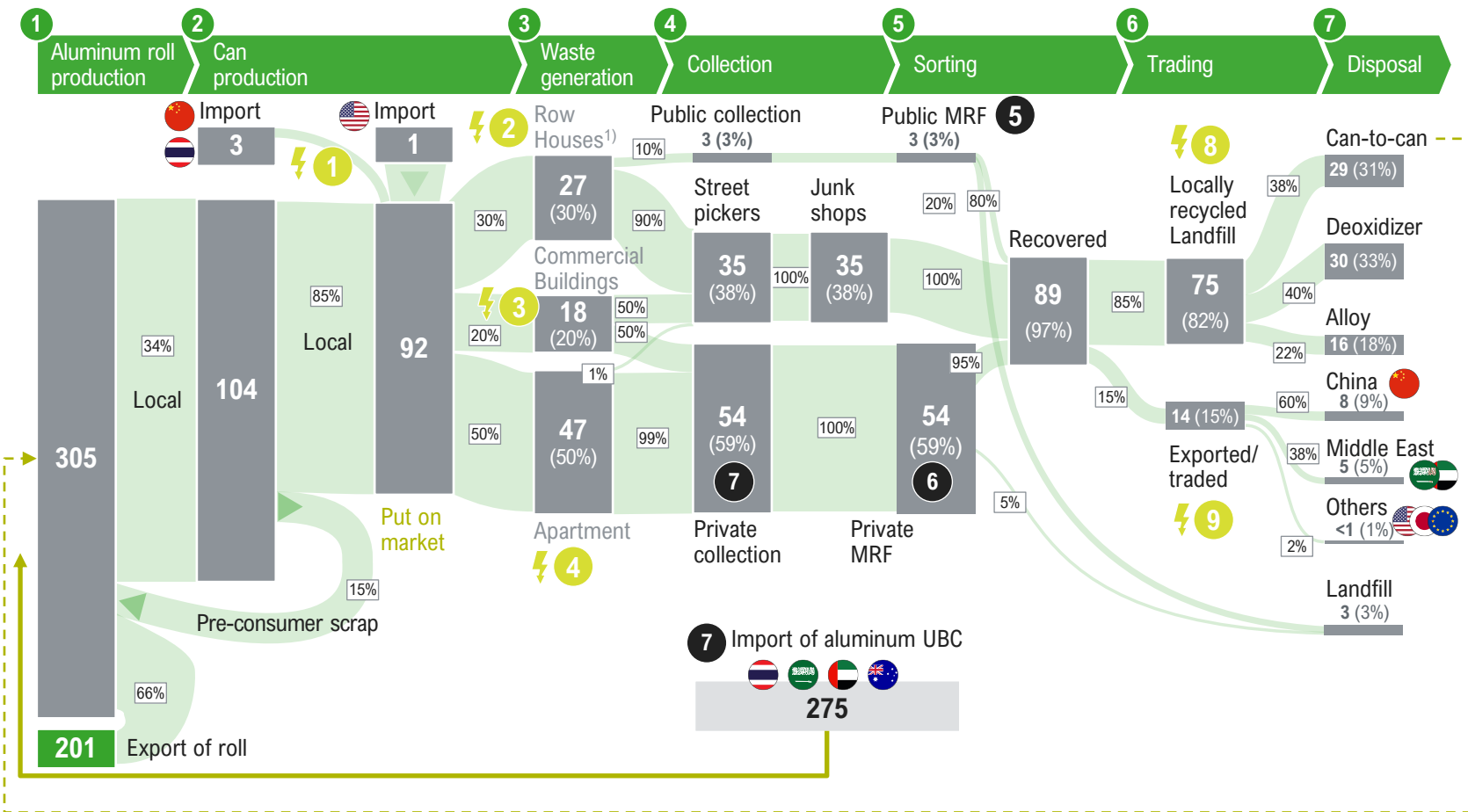
- **High put-on market volumes**, but low compared to countries with similar GDP per capita (e.g. European countries)
- **The largest facility for can-to-can recycling in Asia is located in Korea**, enabling local can-to-can recycling as well as can-to-can recycling of imported scrap
- **Very high collection rates**
- **Imperfect sorting at the source:**
 - Room for improvement in particular for row houses & commercial buildings
 - Further awareness raising can raise the quality of local scrap
- **Despite local capacity for can-to-can recycling**, ~60% of local scrap is used for deoxidizers & alloy making, rather than can-to-can; Furthermore, Korea exports some UBC scrap

1) Separate collection includes recovered after MRF & transfer station, and all UBCs picked by waste pickers; ; 2) Sorting losses from separate collection amount to ~c. 3.300 k tonnes, of which ~c. 50% is incinerated



High volumes of roll are exported and UBC are imported; Although most are collected privately or by street pickers, many are destined for local downcycling or export

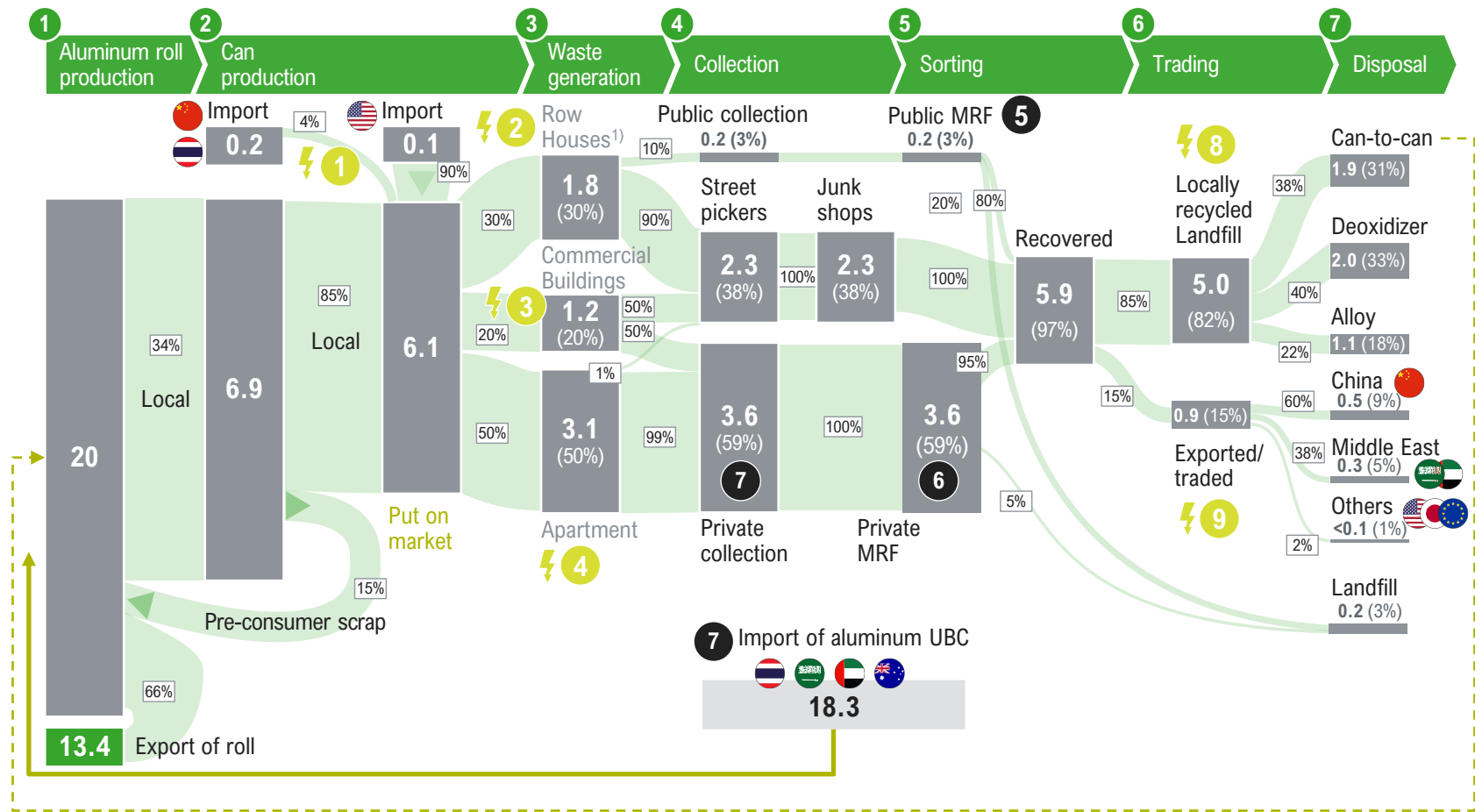
Material flows of aluminum cans [k tonnes , (% of total POM volume), 2020-21]



1) HORECA can be either in the form of row houses or commercial buildings depending on their size and daily waste emission waste

High volumes of roll are exported and UBC are imported; Although most are collected privately or by street pickers, many are destined for local downcycling or export

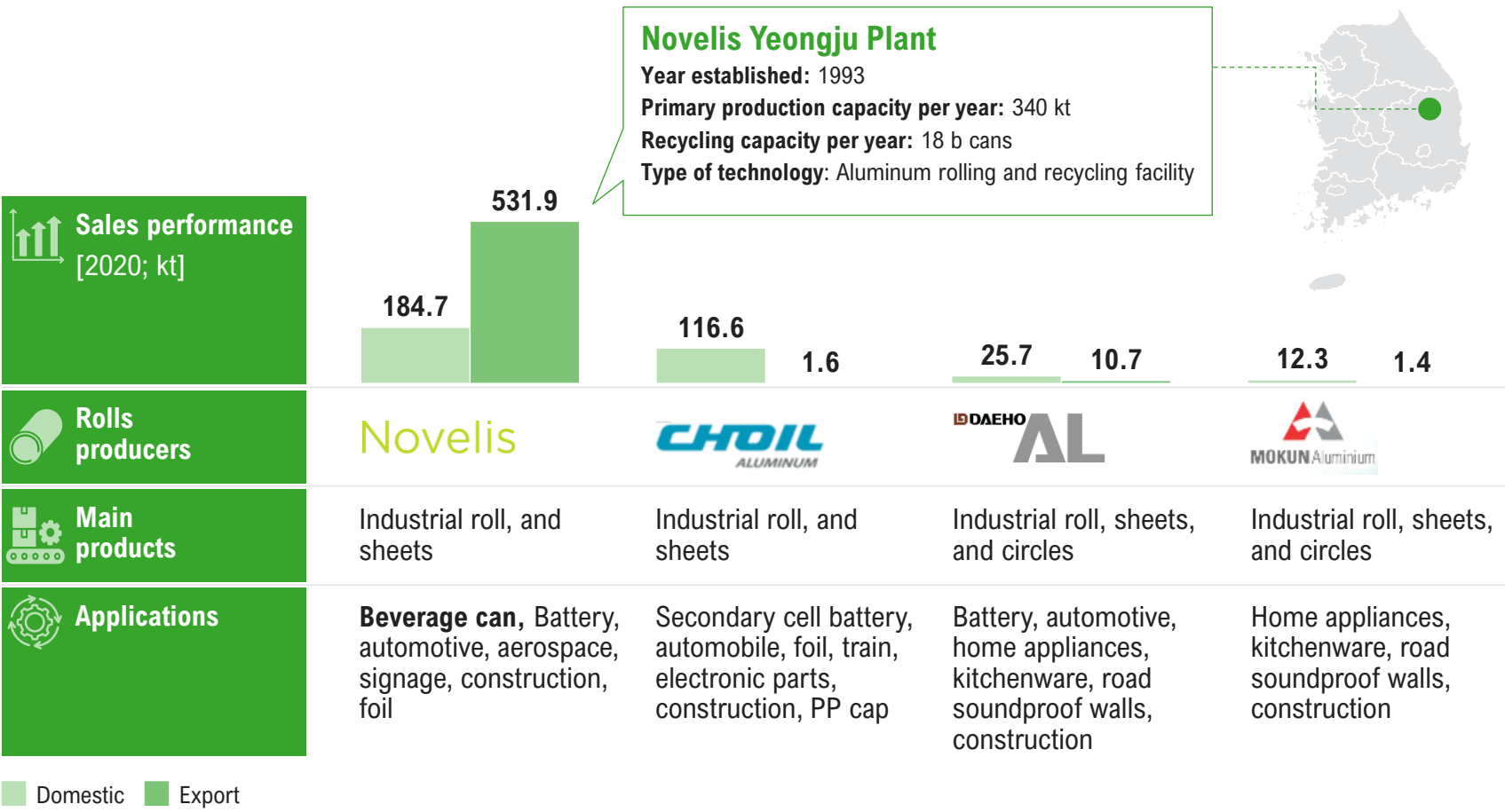
Material flows of aluminum cans [b units²], (% of total POM volume), 2020-21



1) HORECA can be either in the form of row houses or commercial buildings depending on their size and daily waste emission waste; 2) Estimated weight per can: 15 g

The top 4 aluminum roll producers produce ~884 kt of aluminum rolls domestically, with Novelis accounting for ~81% of the total volume

Top aluminum roll producers in Korea



Key takeaways

- Novelis Yeongju plant is **Asia's largest aluminum can recycling facility** with annual capacity of 340 kt
- Novelis has export-dependent structure that **exports 3/4 of its production**
- The second to fourth-largest producers are supplying domestic demand first
- **Novelis is the only beverage can roll manufacturing company** in Korea that makes coils by rolling aluminum ingots

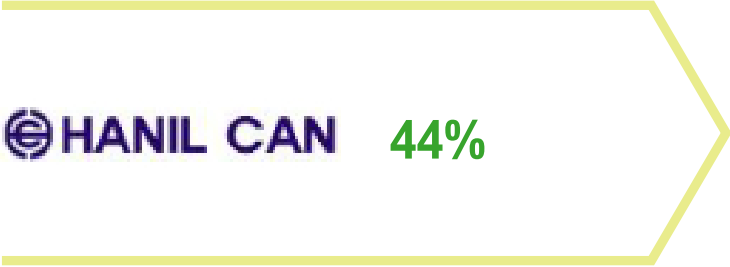
"A lot of aluminum was used in home cooking appliances, but the use of aluminum decreased as home appliances changed to stainless steel in Korea"
 – Industry expert

There are 3 main can producers in Korea, Hanil Can leads the market with the production capacity of 3.5-4 b cans (M/S 44%)

Overview of canning companies



Manufacturer Market share



"Make cans from aluminum roll during manufacturing and resell the remaining pre-consumer scrap to Novelis" – Can producer

Overview of Hanil Can Company

- Procurement**
- Mostly procure aluminum roll from **Novelis**
 - Lids containing some special colors unavailable from Novelis are **imported from China and Thailand** (~2-3% of the overall production)



- Production capacity**
- Produce **500 m cans** annually **per 1 can line** (common for all can manufacturers)
 - With **7 can lines** in Korea, **~3.5 – 4 b cans** are produced every year



- Client**
- Manufacture and deliver can body and lid to Lotte Chilsung, Coca Cola, OB Beer, and Hite



- Pre-consumer scrap**
- Proportion of by-products vary by the size of can
 - 250mL: **13%**, 350mL: **15%**, 500mL: **17%**
 - Due to high volatility of aluminum scrap price, it is more stable to consistently recycle in closed loop system

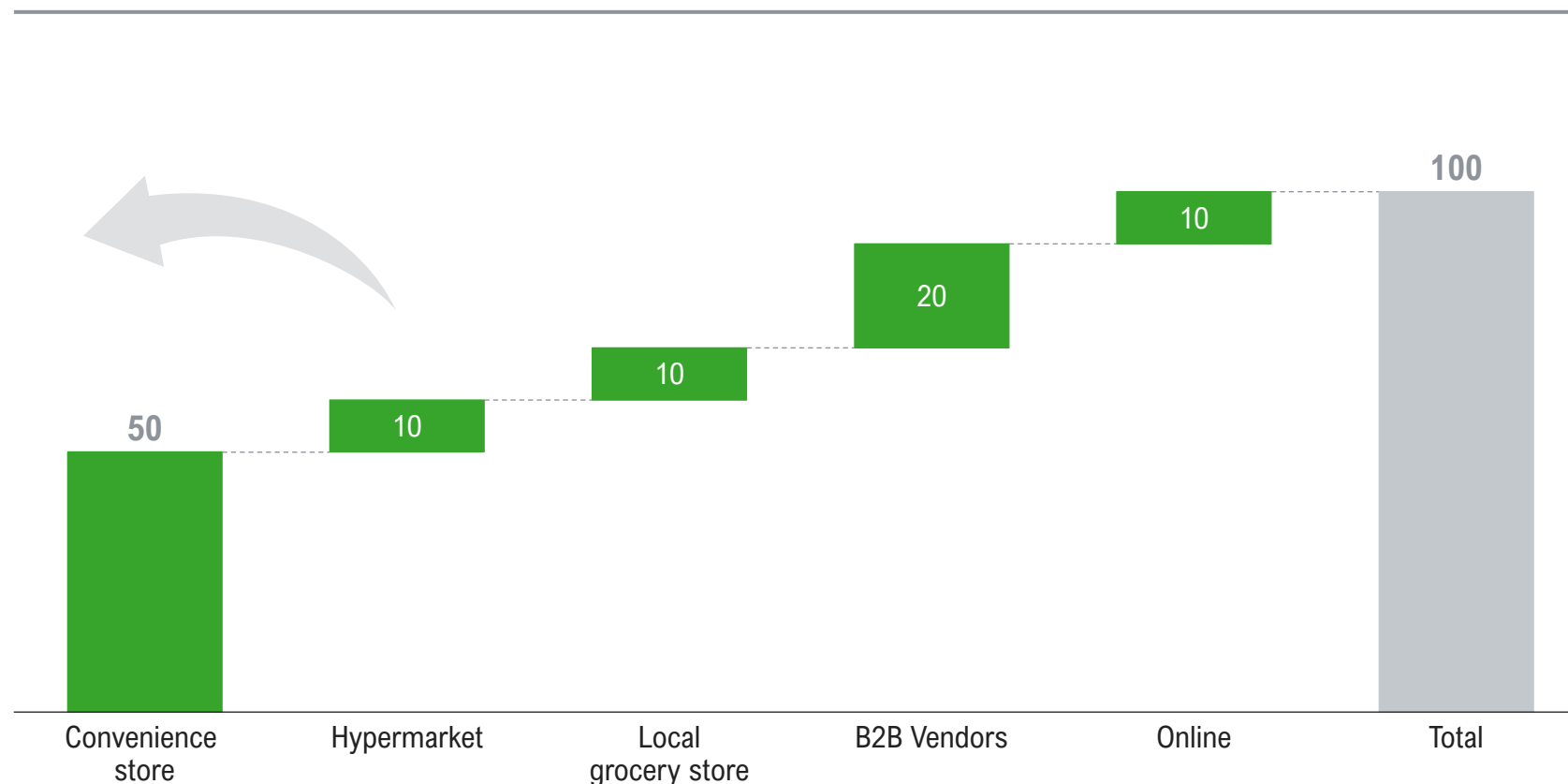


20% of the filled cans are directly distributed to restaurants and cafe, while the remaining 80% are distributed through retail stores – residential type connection

Beverage can distribution in Korea



Distribution of Put-on Market Volumes [%]



Key takeaways

- In the past, hypermarkets and local grocery stores purchased a lot, but sales via CVS is growing recently
- Bulk purchase through online is increasing, in order to save the delivery fee
 - There is a combination of individual consumers and retail restaurants
- B2B vendors include direct transactions with a variety of industries, in addition to delivery, restaurants, bars, and food service providers

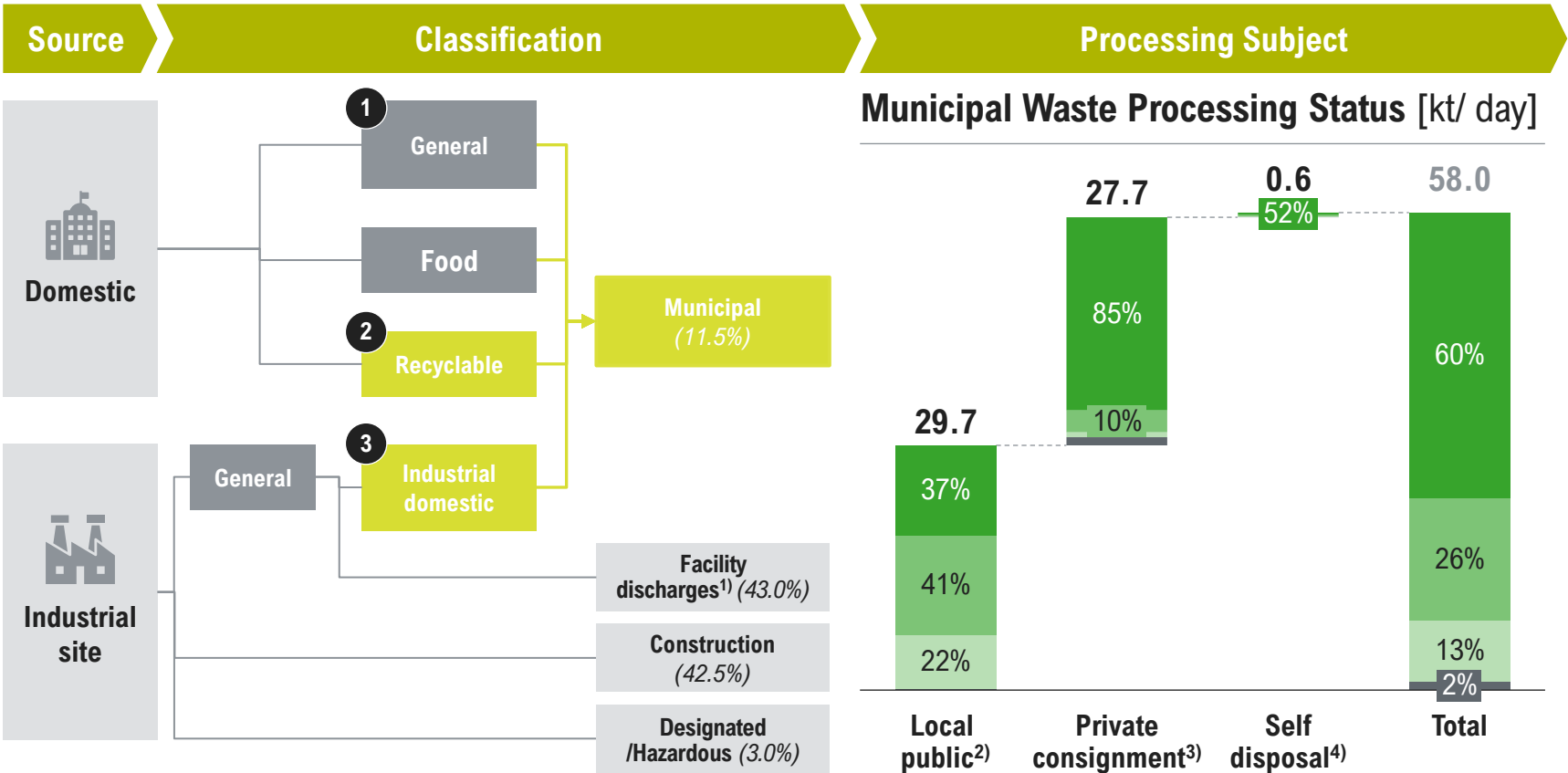


"Increasing demand in sodas – especially low sugar beverages. Growing bulk purchase via online platform like Coupang, more individual consumers purchase boxes"

– Distributor

Under the waste type categorization system, local governments entrust most of recycling to private companies, and landfill or incinerate residues and general waste through public MRF

Waste type categorization in Korea



Key takeaways








































- 1 General household waste**
 - Waste discharged in the **standard plastic garbage bag**
- 2 Recyclable**
 - Collect and discharge by recyclable type (e.g. plastic, can)
- 3 Industrial domestic waste**
 - Any type of waste generated by **> 300 kg/ day** (Complex facilities like terminals, large shopping malls are applicable)

1) Wastewater treatment facilities and waste treatment facilities installed and operated, and wastes from workplaces discharged at least 100 kg per day; 2) Throughput by local government processing facilities or national processing facilities (Metropolitan Landfill Management Corporation, etc.); 3) Throughput of waste disposal facilities by licensed private companies; 4) Waste discharged directly from the waste discharger's self-disposal facility (emitter = handler)

Residential and non-residential wastes in the Korea are discharged and collected in different ways, resulting in different separation quality

Overview of waste collection system by waste generators in South Korea



Waste Generator	Common aluminium cans collection methods		Segregation at generation source			Primary collection	Secondary collection	Separation degree
Households								
Apartments						Private collection	Street pickers	Complete separation
Row houses						Street pickers	Public collection	Most non-separated
Commercial building								
Restaurants						Private collection/ Street pickers		Depends on building
Cafes & clubs						Private collection/ Street pickers		Depends on building
Hotels						Private collection/ Street pickers		Depends on building
Shopping centers	 ¹⁾					Private collection/ Street pickers		Depends on building
Business areas						Private collection		Depends on building
Public spaces								
Parks						Street pickers	Public collection	Highly mixed up
Terminals						Street pickers	Public collection	Some segregation
Schools & universities						Street pickers	Private collection	Some segregation

 DRS
  Curbside
  Contracted
  UBCs sorted at source
  UBCs mixed with other recyclables
  UBCs mixed with general waste

1) Voluntary DRS

Source: Market research, Waste Management Act, Roland Berger

Key takeaways

Residential

- Apartments have the **most developed contracts**, long-term yearly with private collection companies
- Waste is not picked up if wrongly sorted
- When row houses put a transparent bag with **mixed recyclables** in front of their house, street pickers collect cans, and local government consignment collectors collect the remaining

Non-residential

- For **small buildings**, similar waste collection system to row houses
- In the case of large buildings and complex public spaces with **total daily waste emissions over 300kg**, **private collection consignment is required**
- **Large integrated recycling bins are open in parks** with many waste emissions, so street pickers pick up all cans first

The quality of separation and number of collection bins differs from public bins (low separation for parks) to apartments, with 7 different streams

Examples of waste collection systems by waste generator



Field examples

Residential



Apartment

- Recycling classified into **7 types**:
 - Paper/ plastic/ vinyl/ **scrap metal cans**/ styrofoam/ clothes/ glass bottles



Row houses

- All recyclables mixed up** in one bag
- Standard plastic garbage bag for general incinerable wastes



Collection truck

- Apartment - 2.5 ton cargo truck**
- Mighty collects bottles and cans

Non-residential



Park

- Non/-recyclables are separated but low citizen practice
- Street pickers collect almost all cans



Commercial building/ public

- Similar to apartment system for large commercial buildings
- Public facilities briefly separate non/-recyclables



Collection truck

- Commercial buildings** – only small collection clipper can get in the alleys



Innovative collection

superbin

- Since 2015, various Industry 4.0 technologies have been incorporated : AI, Big data, Remote control, robotics
- 800 machines located nation wide
- Recovers 150 tons of cans per month (120 million cans per year)



”

"Biggest issue is aluminum cans mixed with multiple materials from production phase (such as construction materials)" – Collector

Street pickers, which are the key for collecting cans in Korea, are mainly composed of elderly people for economic livelihood

Overview of street pickers in Korea

Street pickers

The elderly picking up recyclables, the bare face of poverty among the elderly in our society

- In 2020, there were **8.12 million** elderly people aged 65 or older in Korean society, accounting for **15.7%** of the total population... **The relative poverty rate of senior citizens aged 65 or older** in Korea is **43.8%**, the highest among OECD member countries



- The number of elderly people picking up recyclable waste nationwide is estimated to be about **15,000**
- The labor intensity is very high as the **elderly over 65 years old** spend an average of **20 hours outdoors per week**
- It has been confirmed that most of the elderly who pick up recyclable waste have started to pick them up for **economic reasons**



“

"70-80% of the sales of the junk store are from scrap paper and scrap metal brought by the elderly."

– Manager, junk shop in Seoul

*"The absolute amount of income earned from picking up recyclable waste is small, but even this was meaningful as an important source of income. **The reason why the old people started their job was eventually due to absolute poverty**"*

– Associate researcher, Korea Senior Human Resources Development Institute

*"Compared to the past when it was called 'Nungmajui,' the current recycling collection work is more advanced. In the past, if the job of Nungmajui was a simple transaction between junk dealers and waste buyers, today it is mediated by resource circulation policies and recycling industries in the waste disposal process. **Nevertheless, this labor is not recognized by any system and is not converted into any official statistics**"*

– Journalist, Hankookilbo

”

Korea's waste can collection goes through junk shops and is divided by the volume of handling – Cans are resold with a margin of KRW 100-200 for each transaction

Overview of junk shops and their sourcing dynamics



	Small	Mid	Large	Key takeaways
# of facilities	<ul style="list-style-type: none"> • ~590 	<ul style="list-style-type: none"> • ~170 	<ul style="list-style-type: none"> • ~40 	<ul style="list-style-type: none"> • Officially 62 junk shops (40 big, 22 mid) treating aluminum cans registered in KORA database • Among the large players, low collection quantity ones are mostly located in rural areas <ul style="list-style-type: none"> – Nevertheless, collection system covers the whole country • The large junk shops are the end sellers, they also carry out sorting and sells to the industry players <ul style="list-style-type: none"> – USD 1.2 / kg to deoxidizers – USD 1.3 / kg to export
Cans collected [tonne/month]	<ul style="list-style-type: none"> • 1-3 	<ul style="list-style-type: none"> • 10-20 	<ul style="list-style-type: none"> • Top: 300-400 • Mid: 150-200 • Low: 4-50 	
Source & price	<ul style="list-style-type: none"> • From street pickers: <ul style="list-style-type: none"> – KRW 800-1,000 / kg 	<ul style="list-style-type: none"> • From direct collection¹⁾: <ul style="list-style-type: none"> – KRW 67,000 / kg (paid) • From small junk shops: <ul style="list-style-type: none"> – KRW 1,200 / kg 	<ul style="list-style-type: none"> • From direct collection¹⁾: <ul style="list-style-type: none"> – KRW 67,000 / kg (paid) • From small junk shops: <ul style="list-style-type: none"> – KRW 1,250 / kg • From mid junk shops: <ul style="list-style-type: none"> – KRW 1,500 / kg 	

🔍 Details on next page

1) KRW 67,000 per ton is paid by local governments for entrusting their waste disposal obligations – Junk shops collect mixed and collected recyclables, sort them, and sell them to end-users such as cans, deoxidizers, and alloy producers

Public MRFs sell the sorted waste to mid/large-sized junk shops, also called as private MRFs, and they sort and compress cans to sell them to end-users

Public/ Private MRF in Korea



	Public MRF	Mid/ large junk shops (Private MRF)	Key takeaways
Main Players (Selective)			<h3>Public MRF</h3> <ul style="list-style-type: none"> Lack of facilities – Only 15 of the 25 Seoul districts have their own public MRF Publicly collected wastes are all mixed-up, that generally 50% are landfilled, but cans are 80% recovered as of the identifiability <h3>Private MRF</h3> <ul style="list-style-type: none"> Lack of workforce results to lower utilization rate that lowers the production capacity <ul style="list-style-type: none"> Avoidance due to low wages, poor working condition, odor, and noise issues Large junk shops purchase bulk amount that contains impurity
Capacity	<ul style="list-style-type: none"> Depends on the local governments 	<ul style="list-style-type: none"> Mid: 1-2; Large: >10 conveyor belts 	
Recovery ratio	<ul style="list-style-type: none"> 80% 	<ul style="list-style-type: none"> Mid: 97-98%; Large: 90% 	
Process & Technology	<ul style="list-style-type: none"> Semi-automatic <ul style="list-style-type: none"> Mostly manual Magnetic sorter 	<ul style="list-style-type: none"> Semi-automatic <ul style="list-style-type: none"> Magnetic sorter Some new technologies like laser 	
Pain point	<ul style="list-style-type: none"> Lack of facilities and work force Long-term storage difficulties due to lack of space to stack¹⁾ <ul style="list-style-type: none"> Prefer contracts with fast takers 	<ul style="list-style-type: none"> Lack of work force Purchase of mixed waste from the beginning <ul style="list-style-type: none"> Meal kits foil, spam caps, steel cans 	

1) Lack of storage space - In the case of Seoul, most of the waste has been landfilled in the surrounding Incheon, but the landfill limit has been exceeded

Recovered scrap exports to China surged after lockdown boosted imports via ports, and import preference from Southeast Asia is rising due to high quality

Aluminum can scrap export/ import status



Export

VS

Import

Background

- Export started as demand arose for new aluminum factories in the Middle East, and currently shifted to China with the demand caused by COVID-19 lock down
- Export happens when importers offer higher prices than domestic deoxidizers

- Asia's largest aluminum plant exists in Korea (340K tons of production capa), and imports are essential due to insufficient domestic can supply (~ 30K tons)
- Southeast Asia has many can factories, but there are no aluminum rolling companies, so the amount of export is high

Proportion



Trend

Pre-Covid

Middle East



- Temporary demand for the **newly established aluminum factories in the past 3-4 years**
- Demand for scrap imports is not high due to recent aluminum melting production
- Import demand is shifting to SE Asia

Post-Covid

China



- China is increasing the use of scraps
- Land transportation in China has been blocked during COVID-19, triggering massive import via ports
- Export volume rises sharply when gap widens between **SMM price¹⁾** and **LME²⁾**

Low quality

Australia



- Due to **high labor cost**, quality is degraded by the lack of re-classification workforce after collection
- Most of the waste scraps from Australia is supplied to deoxidizer/ alloy manufacturers

High quality

Thailand



- Thicker cans lead to higher aluminum ratio – 1 can weighs **25-30 g** (15-18 g in Korea)
- Hot weather dries liquid during shipping and lightens the weight – Korean cans contain **5-7g** of liquid per can
- Low labor cost increases sorting accuracy

1) Shanghai Metals Market prices, independently reflect local Chinese market, regardless of LME; The London Metal Exchange

85% of aluminum can scrap is recycled in Korea, 1/3 is recycled as a can, but the remaining 2/3 is used for deoxidizers and casting alloys

Distribution status of aluminum can scrap recycling



Demand status of recycled aluminum cans and application area

Industrial sector		Domestically secured	Product	Procurement	Required quality	Reproducibility
Can	Novelis	38%	Can	<ul style="list-style-type: none"> 58-60% of the previous month's LME price Long-term contract with suppliers 	<ul style="list-style-type: none"> High Must be 0% of other impurities other than <1.4% of Mg 	<div>High</div> <div>60 days</div>
De-oxidizer	PJ Metal Co., Ltd. POSCO M-TECH	40%	De-oxidizer	<ul style="list-style-type: none"> 55-56% of the previous month's LME price Secondary source 	<ul style="list-style-type: none"> Low No big restrictions on impurities content 	<div>Low</div> <div>End of life</div>
Alloy	(주) 우산금속 DONGNAM Corporation 한용금속주식회사 SEJIN METAL CO.,LTD.	22%	Auto-motives (80%) Others ¹⁾	<ul style="list-style-type: none"> 53-55% of the previous month's LME price Sporadic contract; cans are auxiliary 	<ul style="list-style-type: none"> Mid Other impurities can be up to 2%, but Mg needs to be < 0.3% 	<div>Mid</div> <div>Depends on car's life cycle (8-12 years)</div>

Implication

- From the MRFs, recovered aluminum cans are sold **based on the monthly LME price index**
 - Novelis offers the best price, but also requires the best accurate sorting quality
- Large-scale collectors in each region classify aluminum cans and supply them in compressed form to customers in need
- Just as can-to-can recycling can be reproduced indefinitely, qualitative upcycling should be ensured that can continuously create added value**

1) Electronics, aviation systems, household goods (kitcen equipment, etc.)

Roland
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