APEC Workshop on Reducing Food Loss and Waste by Strengthening Resilience and Digitalization in APEC Food System(July 20-21, Chinese Taipei)

Food Waste Policies and Management in the Republic of Korea

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Significance of Food Waste Management – SD goal

Transforming Our World: The 2030 Agenda for Sustainable Development (2015)

[Figure 1] SDGs

Goal 12: "Ensure sustainable consumption and production patterns" includes:

12.3“By 2030, halve per capita global food waste at the retail and consumer level, and reduce food losses along production and supply chains".

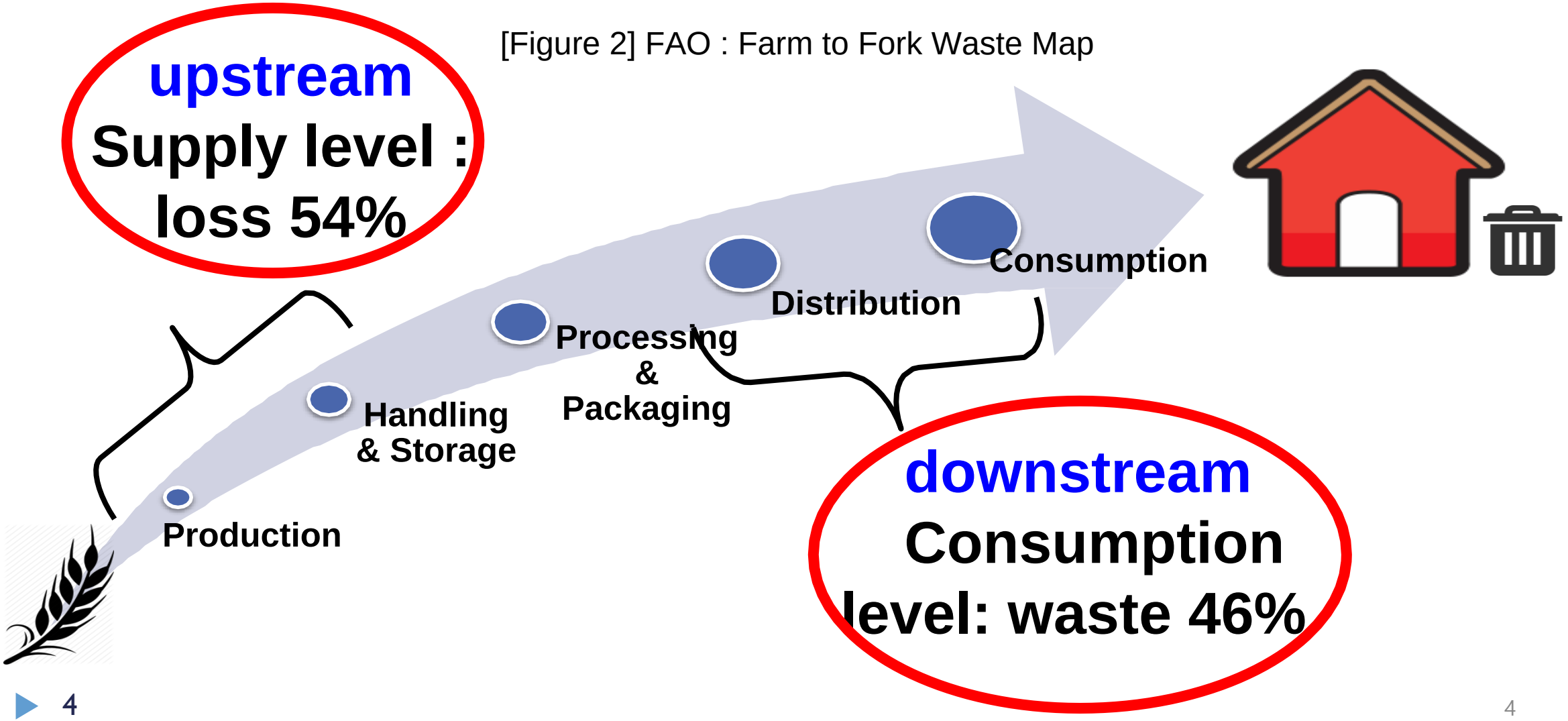
12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

Significance of Food Waste Management – Climate Change

- Environmentally, food wastes also causes **greenhouse gas emissions, and inefficient use of water and soil pollution by leachate.**
- Another need for reducing food wastes due to its permanent impacts on global greenhouse gas emissions.

Food Waste – waste generation by step (upstream and downstream)

[Figure 2] FAO : Farm to Fork Waste Map



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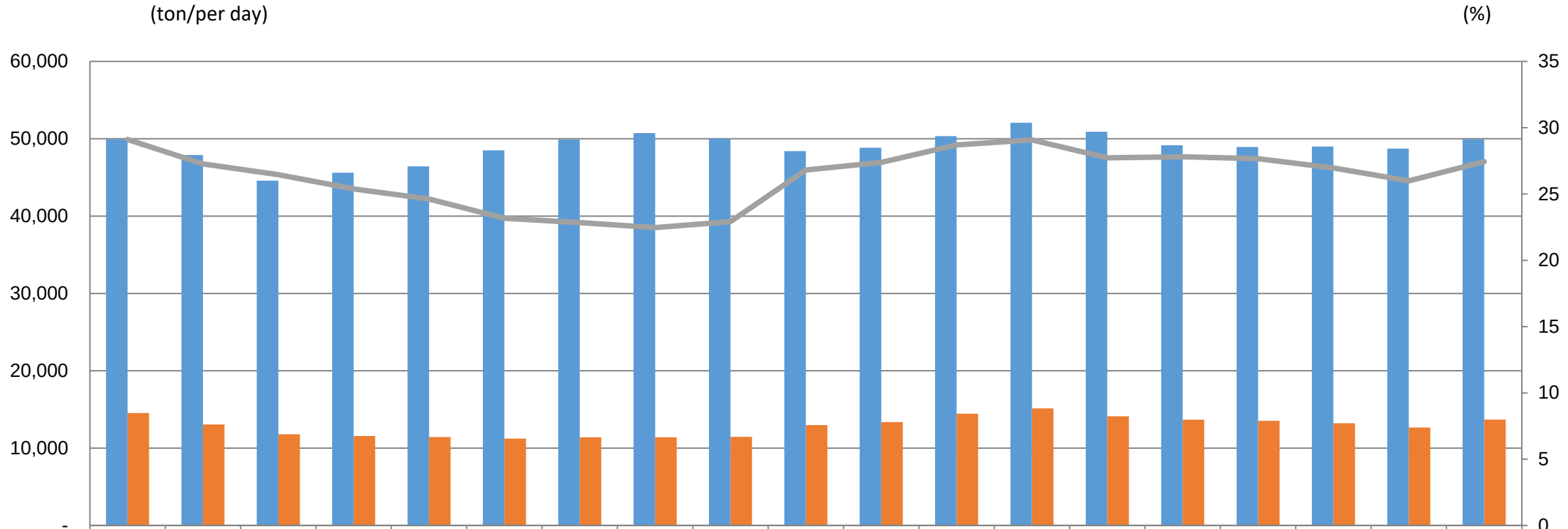
Food waste generation – consumption level

[Figure 3] Food waste account for 22-29% of M.S.W (1996 – 2014), Korea

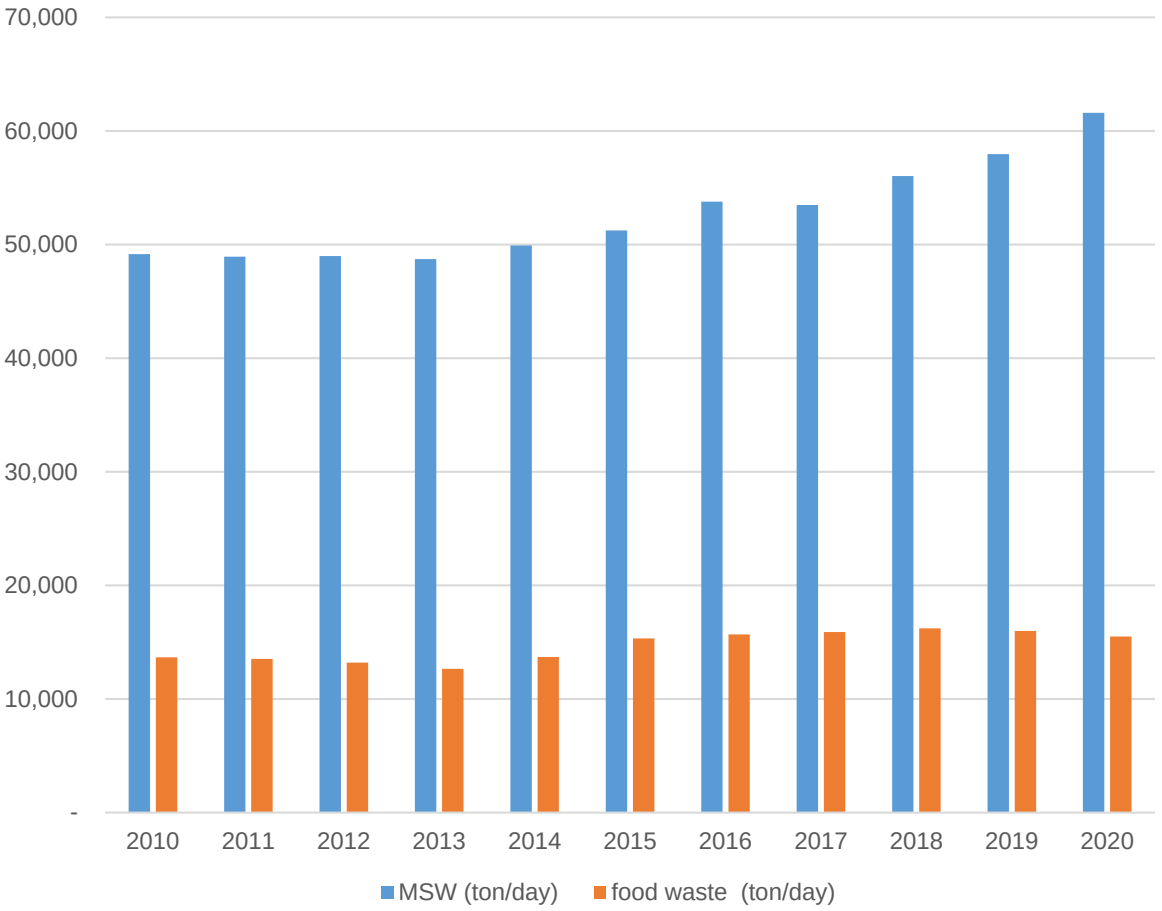


	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Municipal wastes (A)	49,925	47,895	44,583	45,614	46,438	48,499	49,902	50,737	50,007	48,398	48,844	50,346	52,072	50,906	49,159	48,934	48,990	48,728	49,917
Food wastes (B)	14,532	13,063	11,798	11,577	11,434	11,237	11,397	11,398	11,464	12,977	13,372	14,452	15,142	14,118	13,671	13,537	13,209	12,663	13,697
(B/A) %	29.11	27.27	26.46	25.38	24.62	23.17	22.84	22.47	22.92	26.81	27.38	28.7	29.08	27.73	27.81	27.66	26.96	25.99	27.44

**Source: The status of waste generation and treatment (Ministry of Environment)*

Food waste generation Trend

[Figure 4] MSW and Food Waste generation trend (2010-2020)

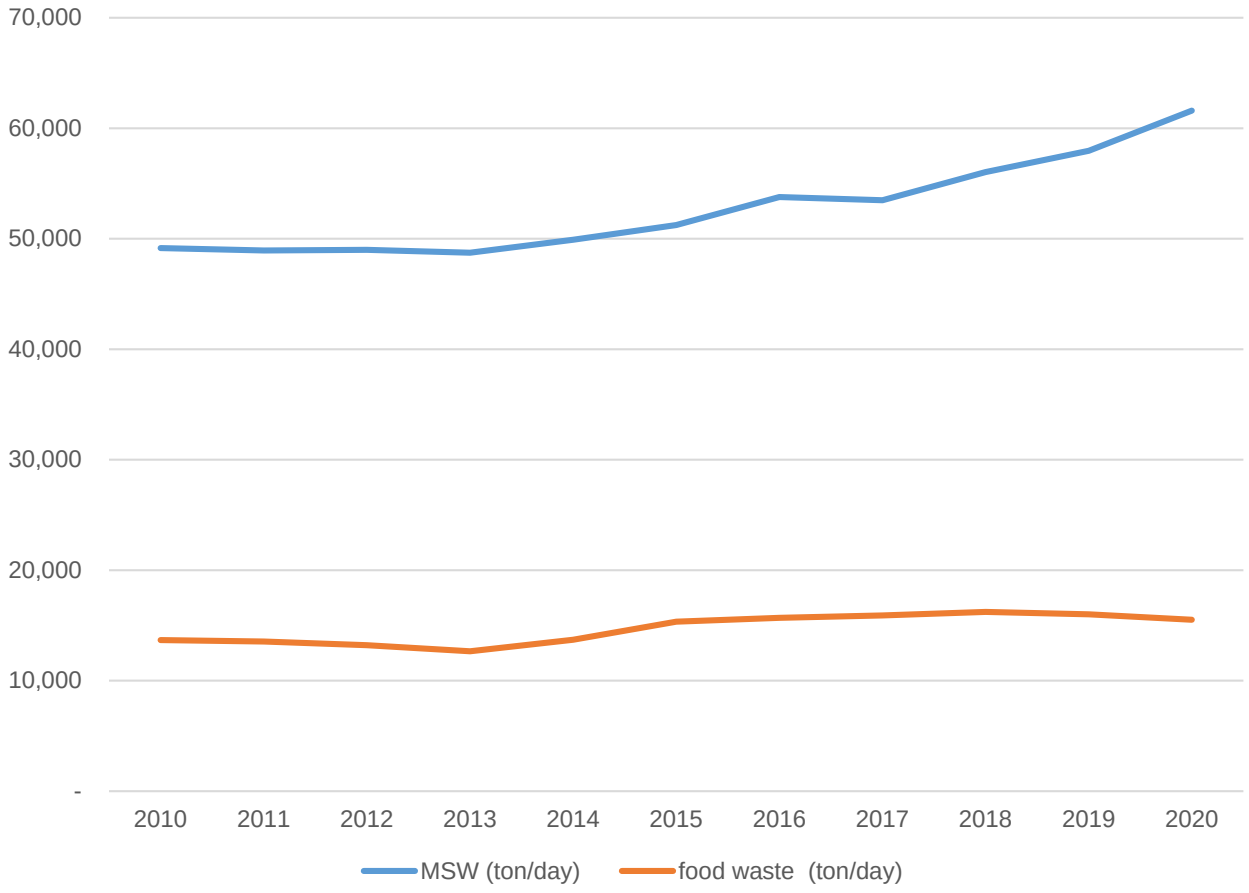


Source: ME Republic of Korea, Waste generation status statics, each year

- Food waste generation, 13,671 ton/day in 2010, becomes 12,663 ton/day in 2013; 15,999 ton/day in 2019; 15,506 ton/day in 2020
- We believe slight reduction in 2013 is due to volume-based food waste fee policy.

Food waste generation Trend

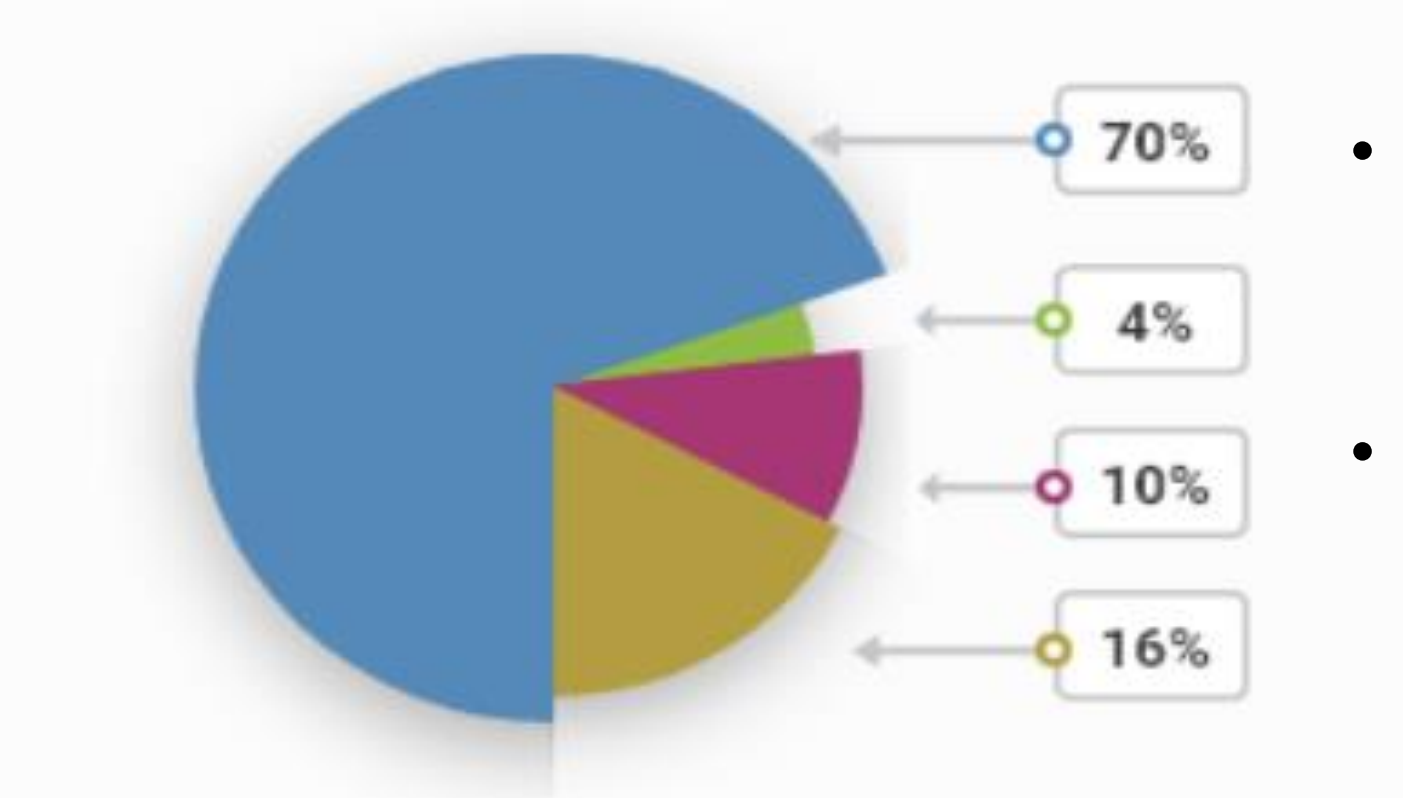
[Figure 5] MSW and Food Waste generation trend



- In 2020, we assume that increase of MSW in the Republic of Korea is due to Corona.
- However, food waste generation trend is stable since 2015 with slight change

Food waste generation by source

[Figure 6] food waste generation by sector



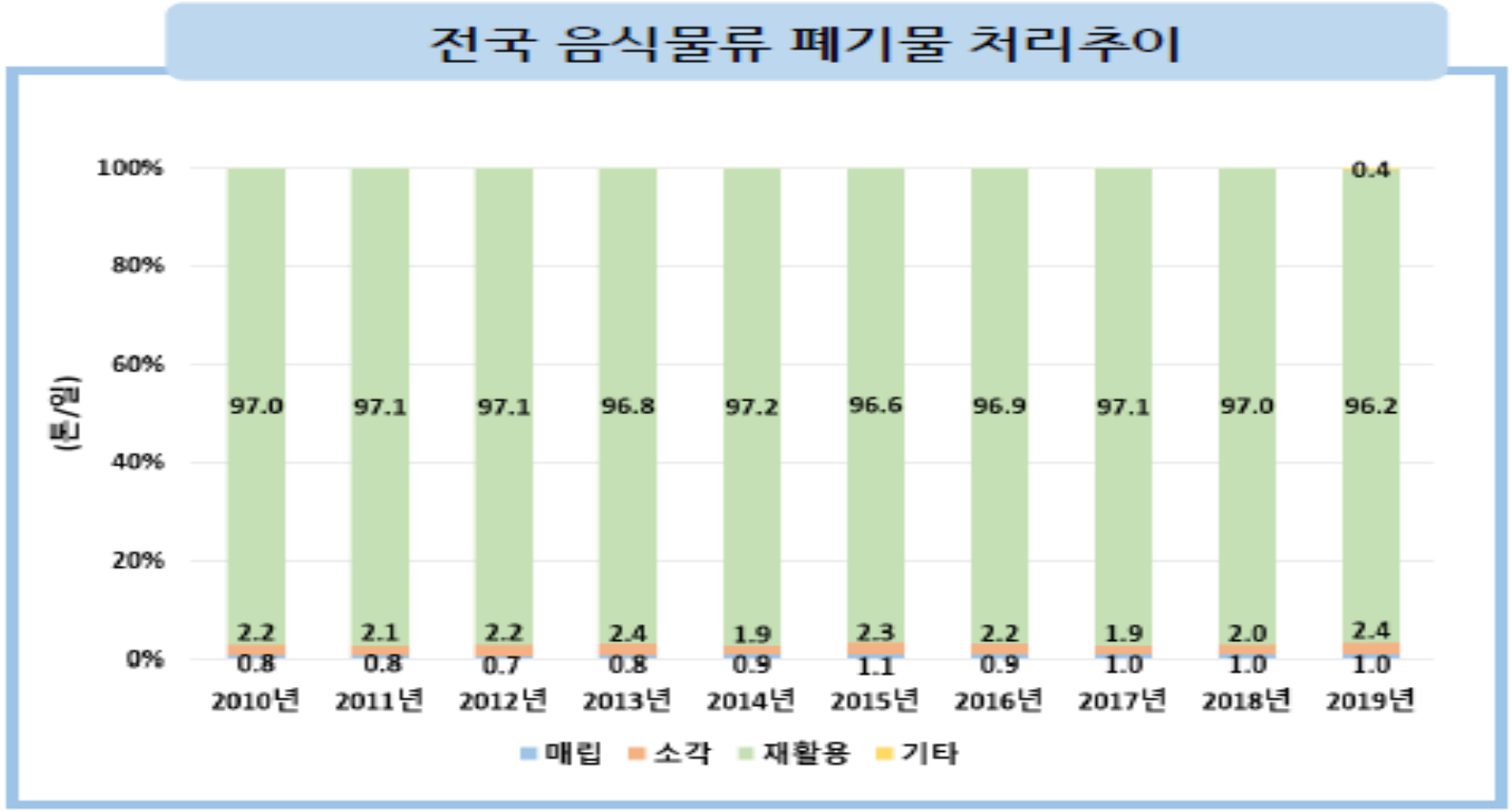
- blue : household, small restaurants
- yellow: big restaurants
- pink : cafeteria,
- green: distribution step

- Food waste from household and small restaurant mainly, showing 70% generator.
- Next big generator is big restaurants (16%) which are responsible for their food waste on its own expenditure.

Food waste treatment

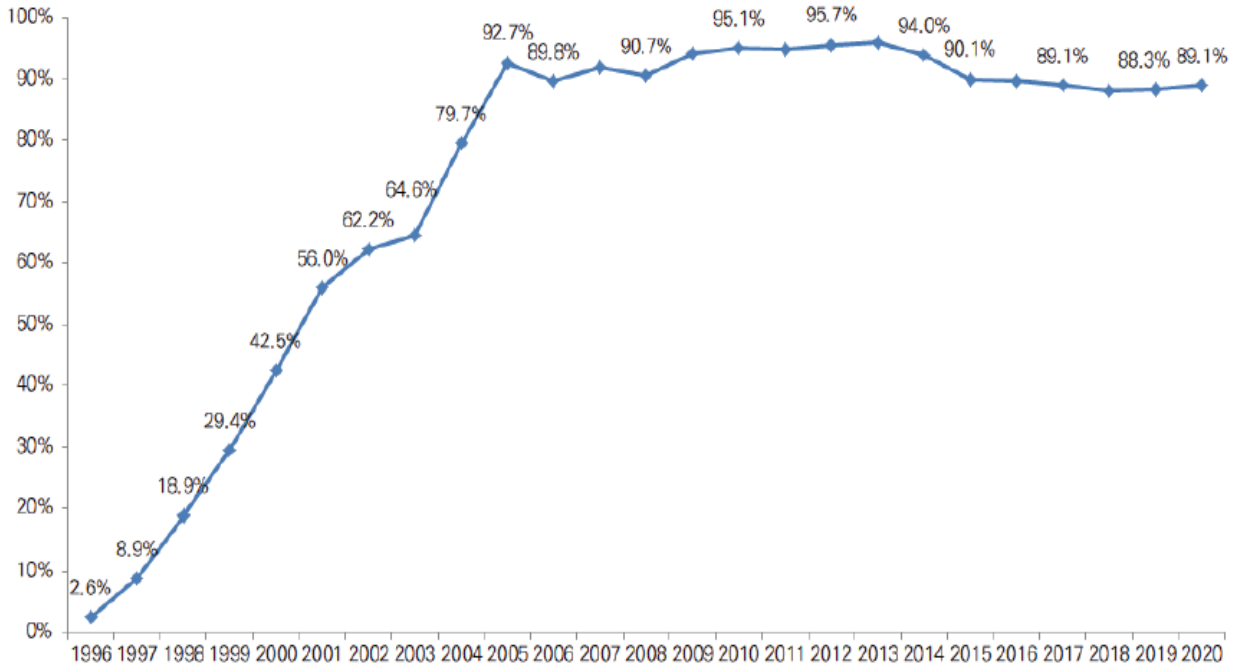
Household food waste treatment in 2019 year, recycling 96.2%, others are incinerated 2.4%, or landfill 1%
Recycling facility: public 46%, private 53% ,

[Figure 7] Food waste Treatment Trend in the Republic of Korea (2010-2019)



Food waste recycling

[Figure 8] Recycling rate of food waste(household) separated

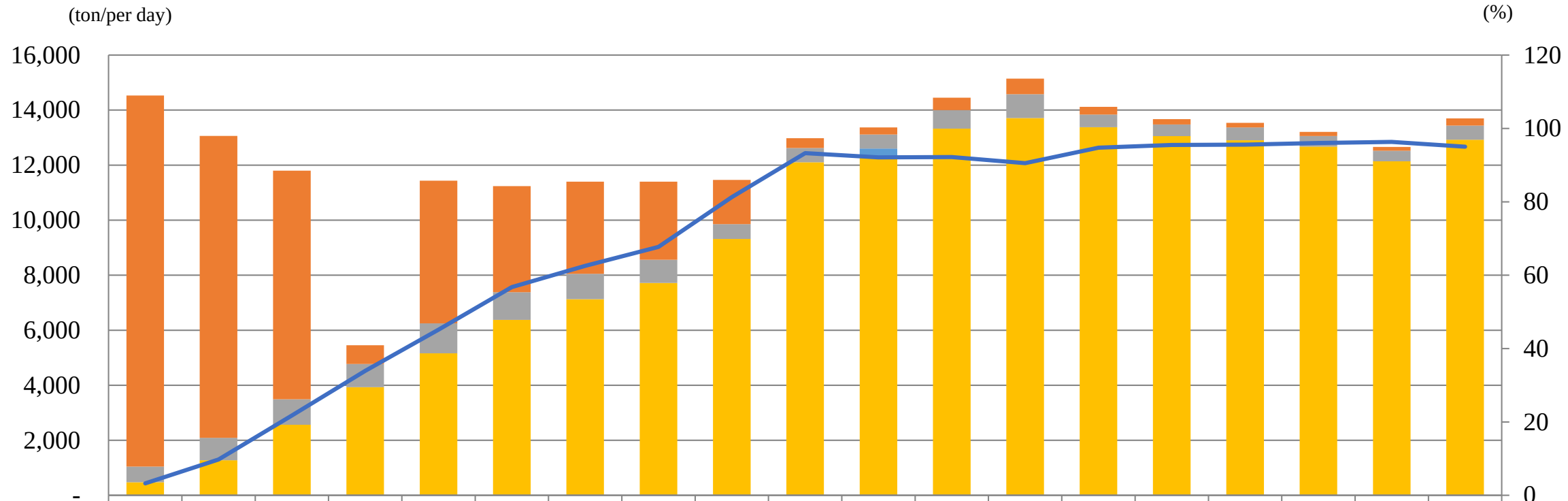


Source : Moon sol Joo and etc., Food Waste Recycling Issues and Policy Tasks, KEI, 2022

- The recycling rate of separated food waste is 97% at max, 89% in 2020.
- The main recycling methods are feed and compost, and the proportion of biogas has recently increased to 14%.
- As of 2021, there are 345 food waste recycling companies.
- As of 2021, the proportion of food waste by recycling method was found to be feed conversion 51% (dry feed 36%, wet feed 14%, livestock feed 1%), compost 26%, and biogas 14%.

Food waste recycling trend

[figure 9] Trend of food waste recycling: over 95% in 2014

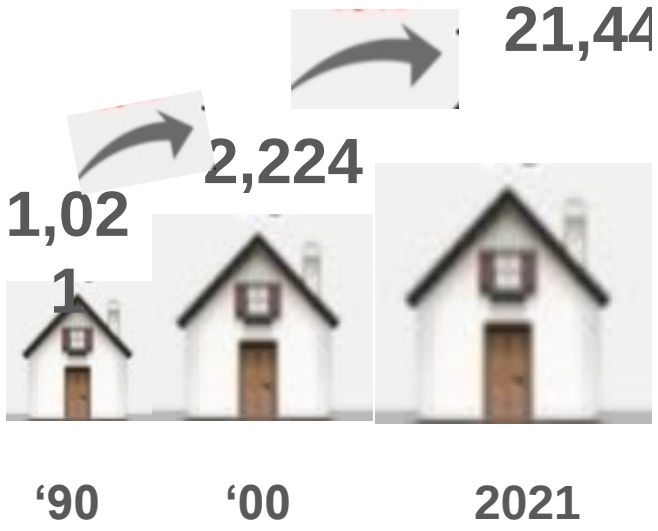


	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Landfill	13,486	10,974	8,309	681	5,185	3,855	3,345	2,836	1,607	356	261	451	565	281	194	167	152	140	259
Incineration	570	815	923	846	1,088	1,003	922	844	541	516	509	674	867	459	422	465	381	384	517
Other	-	-	-	-	-	-	-	-	-	-	286	1	-	-	-				
Recycling	476	1,275	2,566	3,929	5,161	6,378	7,130	7,718	9,316	12,104	12,317	13,326	13,710	13,378	13,055	12,905	12,675	12,139	12,922
Recycling (%)	3.27	9.76	21.75	33.93	45.14	56.76	62.56	67.71	81.27	93.28	92.11	92.21	90.54	94.76	95.49	95.59	96.02	96.34	95.02

**Source: The status of waste generation and treatment in the Republic of Korea (Ministry of Environment)*

Causes of Food waste increase

(1) Growth of 1 person household



Number of household(1,000)

(2) Change of dietary pattern

- Income growth
- Increase of Dine out

GNI per person (US dollar)

(3) Cultural background

- Large quantity of food
- Large number of side dishes

**Source: The statistics Republic of Korea, Korea ZeroWaste Movement Network*

Food Waste- Policies in the Republic of Korea

*Source: The statistics Republic of Korea, Korea ZeroWaste Movement Network

Food Waste - Policies

- **Volume-based Waste Fee System (VBWF system) on Municipal solid waste was introduced in the Republic of Korea.**

- **all over the Republic of Korea on Jan. 1, 1995**
- **The first economy-wide VBWF system in the world**
- Food waste was a serious problem during early 1990s due to growing population, over-prepared meal and a large number of small dishes.
- Before VBWF system, solid waste collection fee was charged with **fixed rate in property tax or monthly fee**, regardless of the amount of solid waste generation.

Food Waste - Policies

- In the very beginning of VBWFs, food waste was required to throw in a waste bag with other municipal waste.
- Wet food waste generates a large amount of leachate, and the cost of leachate treatment increases significantly.
- Since 1997, food waste has been separated into a food waste bag and collected separately, mainly for mass generators.
- Separation/collection of food waste was required for all households since 2005.

Food Waste - Policies

- **‘Pay as You Throw’ principle**
- With this system, households and small-sized private sector business are required to purchase government-issued plastic bags of different sizes.
- During 1994-2004, municipal solid waste generation has decreased by 13.96%; which shows effectiveness of economic incentive system.
- The government of the Republic of Korea introduced the pilot **volume-based food waste fee system to 144 local regions in 2012 (pilot), start in 2013 and expanded to the whole economy in 2015.**
- Introduce an economic incentive system to control food waste
- Payment methods - Plastic bags, chips or stickers, RFID tags

Food Waste - Policies

- Food waste disposal bag's capacity ranges from 1 liter to 5 liter (households)
- many of local governments raised the price of bags.
- **Achievement: 15% reduction of food waste in 2012 → 30% in 2015.** :
- **Source: Ministry of Environment*

Food Waste - Policies

Plastic bag

Payment chip or Sticker

RFID system

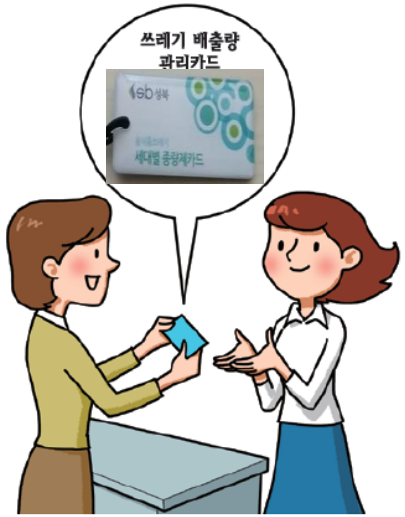
- size of plastic bags : 1 liter to 5 liter (households)
- achievement**: 15% reduction of food waste generation in 2012 → 30% reduction in 2015**

**Source: Ministry of Environment*

Food waste collection for recycling

Food waste separate collection container (RFID system attached)

Food waste volume/weight-based fee (RFID)



1 Issuing the card

2 Contact the card

3 Discarding the food waste

4 Information transfer

5 Sending bill

Source: Ministry of Environment

- Residents buy a payment chip and touch it to collection container to throw food waste. Radio Frequency Identification system identifies electric chip on collection container and impose fee by weight.

Food Waste - Policies

- **Voluntary Agreement to reduce food waste and Campaign**
  - Campaign to reduce number of side dishes at a restaurant
    - ✔ Traditionally, Korean households prepare meals with a large number of small dishes, which is considered courteous.
  - “Take out food that is left ”
  - “empty dish ” movement
  - Food bank donation

Food Waste - Policies

- Beyond the separate collection for food waste, government has also recognized the importance of alternative policies such as **recycling**.
- Ministry of Environment implemented the ‘Master Plan of Food Waste Utilization as a Resource’ (1998-2002).
  - Prohibition of direct landfilling of food waste (from January 2005)
  - Started food waste separation and food waste recycling activities
  - Government provides financial support to public recycling facilities that recycle food waste (feed, fertilizer, biomass, etc.)

Food Waste - Policies

- **Separate collection of Food Waste from 2005**
  - Food waste must be separated from general waste and placed in disposal bags that could be purchased at local supermarkets.
  - **The separate collection of food waste is necessary to conduct food waste recycling as well as solid waste recycling.**
  - **Recycling rate of food waste is over 95% since 2012.**
  - 95% of local municipalities join separate collection of food waste.

Food Waste RFID system

- Food waste RFID system has been introduced in 166 municipalities and 6,520 thousand households. This covers 65% of apartments in the Republic of Korea.

[table 1] municipalities that RFID system registered

	Pilot period	Main project Period								
year	2010-2011	2012-2014	2015	2016	2017	2018	2019	2020	2021	total
Municipality registered	18	85	16	10	8	12	3	9	5	166
Number of households registered(10 thousand)	17	220	56	70	60	59	63	56	51	652
Number of RFID equipment	2.307	32,618	10,160	11,071	10,545	9,400	11,067	12,234	11,115	110,517

Waste bag price – volume-based waste fee

[table 2] waste bag price

size of waste bag	price/bag (dollar)	
	for household	for business
5 liter	130 won (0.13 dollar)	
10 liter	250won (0.25 dollar)	
20 liter	490 won (0.49 dollar)	520 (0.52 dollar)
30 liter	740 won (0.74 dollar)	780 (0.78 dollar)
50 liter	1,250 won (1.25 dollar)	1,330won (1.3 dollar)
75 liter		2,000 won (2 dollar)
100 liter		2,680 won (2.68 dollar)

- For household
- Price differ by size of food waste bag
- Korean won is converted to dollar at exchange rate 1,000 won/$ for easy calculation.

Food waste bag price

- Household food waste bag price
- - it is different by municipality, ranges are small
- - following data is for Gangnam-gu, Seoul in 2019
- Much more expensive than general waste bag price(about 4 times).

[table 3] food waste bag price

1 liter	2 liter	3 liter	5 liter	10 liter	20 liter	30 liter
100 won (0.1$)	200 won (0.2 $)	300won (0.3 $)	500won (0.5 $)	1,000won (1 dollar)	2,000won (2 dollar)	3,000won (10 cents)

Note: Korean won is converted to dollar at exchange rate 1,000 won/$ for easy calculation.

Food waste bag price

- Small business – food waste bag price

[table 4] food waste bag price for small business (restaurant)

5 liter	10 liter	20 liter	30 liter	60 liter (proof of payment)	120 liter (proof of payment)
700 won (70 cents)	1,400won (1.4 dollar)	2,800won (2.8 dollar)	4,200won (4.2 dollar)	8,400won (8.4 dollar)	16,800 won (16.8 dollar)

- Distributor of volume-based food waste bags and payment receipts: Same as those selling volume-based waste bags at grocery market, convenience stores, etc.
- small business : General restaurants with an area of less than 200 square meters

Food Waste – Policies

- **Biogas Production from food waste, recent trend**

  - Landfill of food waste causes soil pollution by leachate, bad smell
  - Livestock companies, Big food waste generators are required to generate biogas from 2025.
  - (Law concerning fertilization of the production and consumption of Biogas from organic waste)
  - priority on biogas production from Organic waste since composting and feed also causes other environmental problems such as bad smell, compost residue .
    - ✓ Biogas as a renewable energy reduces greenhouse gas emission.

**Source: Ministry of Environment*

Food Waste Recycling Process

Food (Organic) Waste

Food Waste-to-Biogas Plant, Busan

Food Leachate-to-Biogas Plant

Sewage Sludge-to-Fuel Plant

**Source: The statistics the Republic of Korea, Korea ZeroWaste Movement Network*

Food Waste Recycling – Energy anaerobic digestion

- Change of food waste recycling method (focus on energy conversion)
- The most difficult thing about recycling food waste from households is that it is distributed in small amounts and takes time to collect and transport.
- In order to remove foreign substances or salts, it must be sorted, crushed/washed, etc. in a recycling facility. This is because a large amount of organic matter flows out together with foreign substances or wastewater.
- In the case of food waste discharged from households, it is difficult to secure a demand for compost or feed because the quality of recyclable products is not high.
- Especially, farmers hesitate to use feed from food waste due to **African Swine Fever, Avian Flu(AI) and other disease.**

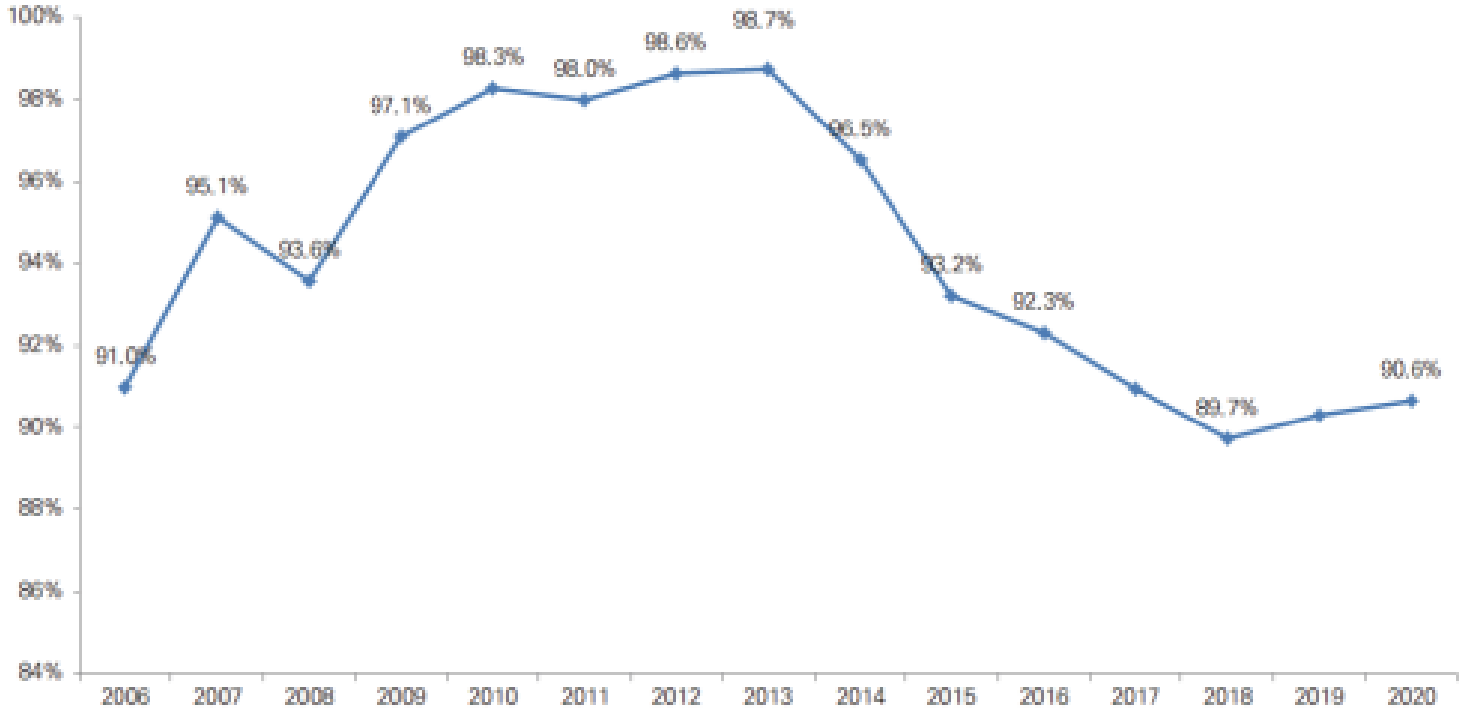
Food Waste recycling – weak point

- We focus on the recycling of End-of-pipe food waste
- We do not cover prevention of food waste generation- before consumption level.
- Recycling after generation is very limited to achieve waste reduction target as requested by UNSD goal.
- Prevention before consumption (production or distribution level) is not a work range of Korean Ministry of Environment. – the most weak point.

Food Waste recycling – weak point

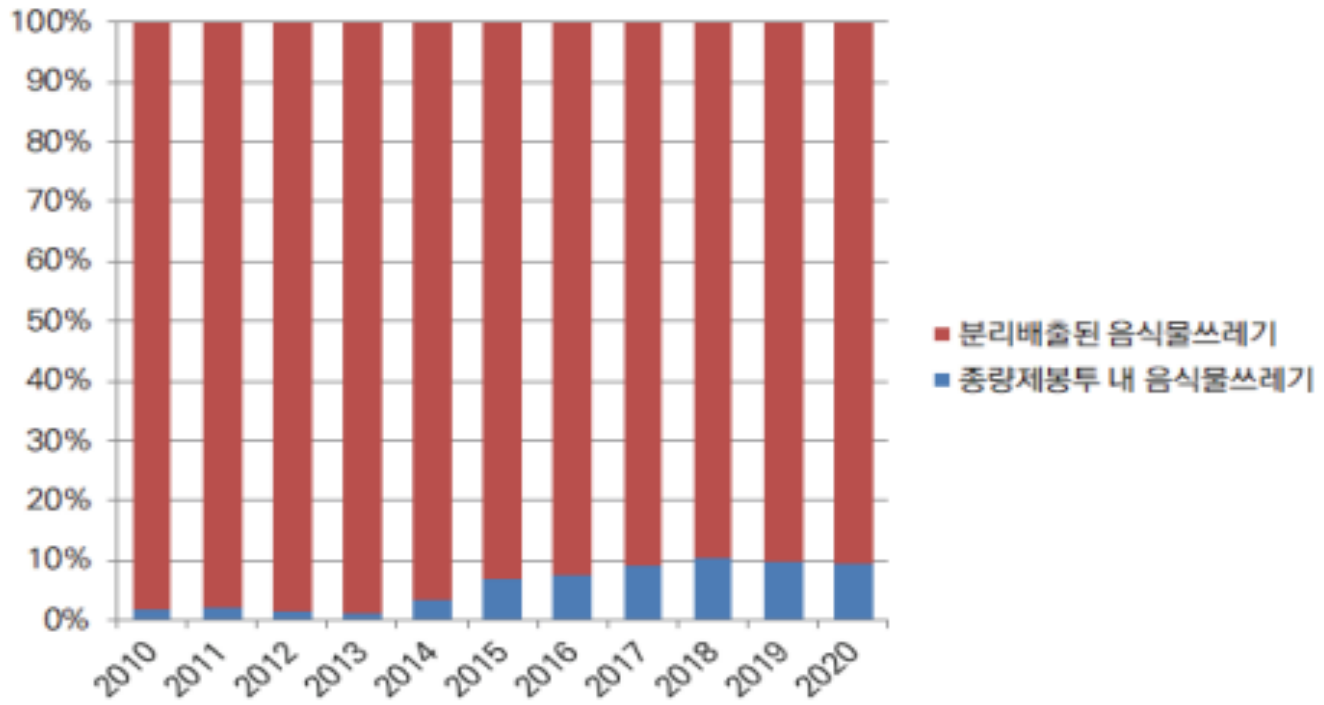
Food waste 'separation rate', which refers to the amount of household waste generated separately, increased to 98.7% in 2013, then fell to the 89% level in 2018, and then recovered to about 90% level in 2020 .

[figure 10] food waste separation rate



주: 분리배출률=분리배출량/(종량제봉투로의 혼합배출량+분리배출량)×100
혼합배출량과 분리배출량을 같이 집계하기 시작한 2006년 이후의 수치를 활용하여 계산.
자료: KOSIS, "전국폐기물발생및처리현황", 검색일: 2022.5.25를 바탕으로 저자 재구성.

Food Waste recycling – weak point



- Food waste mixed with M.S.W in a volume-based waste bag has increased since 2013
- It is growing even though it is small portion.

blue bar: ratio of food waste discharged (with mixed) through volume-based waste bag
Red bar: food waste separated

Food Waste – Major issues and discussion

- Separating food waste from household waste is very important in increasing the recycling of both wastes.
- The pay-as-you-throw economic incentive system can increase efficiency while reducing food waste.
- In order to reduce food waste, additional efforts are necessary:
- Reduce surplus purchases,
- reduce food waste at market (distribution level)
- **Reuse and recycle food before it becomes waste**
- **Educate consumers on the environmental / health effects of food waste Need for public-private partnership for consumer education**
- Food waste management is a key issue for climate change and sustainable development.

Thank you very much for your attention…