Seoul, South Korea

GHG reduction potential in Road-to-ZW scenario: 885%

@Yoohwa Jeong

Key statistics (2017)

- **Population: 9,639,541**
- **Total municipal solid waste generation: 3,594,301 tonnes/year**
- **Per capita waste generation: 1.02 kg/day**
- **Waste collection: 66% separation collection**
- **Waste diversion rate: 59%**

The city of Seoul — a home to near 10 million inhabitants — is the cultural, economic, business and political center of South Korea, and an epicenter of massive waste generation and carbon emissions, ranked as the world's thirteenth largest greenhouse gas emitter among cities globally. Since the 1970's, the city has witnessed rapid industrialization and expansion in all directions, including mass production and consumption and a throw-away lifestyle, which resulted in increased waste generation.

According to our GHG emissions analysis, however, Seoul's waste system is already a net-negative GHG producer thanks to robust separate collection and recycling system. The nation-wide application of the volume-based disposal system has been the key to recovering over 95% of food waste, 88% of metals, and 79% of glass. Only paper and cardboard (55%) and wood (56%) have relatively low recycling rates.

With little organic material going to landfills, methane from food waste is not a major concern; the majority of Seoul's GHG emissions come from its incinerators. Seoul currently operates four incinerators to process maximum 2,850 tonnes of waste each day, emitting 681,134 tonnes of CO_2e. With a direct landfill ban coming into effect in 2026, the government is looking to build more incinerators in the greater Seoul area, much like the incinerator build-out plan that the city had in 1991. Due to strong opposition expected from nearby communities, only four incinerators were built in the 1990's which ended up sourcing waste from other districts after struggling with a low processing rate.

In 2030, Seoul is projected to have a population of 9.16 million and per capita waste generation of 1.11 kg/day. As it's highly unlikely to find a place for landfills or incinerators in this densely-populated city, Seoul is left with one viable solution: zero waste centered around source reduction. The city already developed a roadmap toward a plastic-free future by 2022 (in 2018) as well as a carbon neutrality goal for 2050 (in 2020), with key policy elements included such as source reduction of waste, bans on single-use plastic, and expansions of reuse infrastructure. When these efforts are met with an incineration phase-out, the city can unlock the potential of saving over 885% of annual GHG emissions (or 538,220 tonnes of CO_2) by 2030, which is equivalent to annual emissions from 1.4 natural gas-fired power plants.

Seoul in 2030 — Business as Usual vs. Road to Zero Waste

The below chart shows estimates for annual GHG emissions associated with waste management in Seoul by 2030 in two scenarios: 1) Business as Usual (BAU) based on the data from 2019, and 2) Road to Zero Waste. Assumptions that informed each scenario are detailed in the table below.

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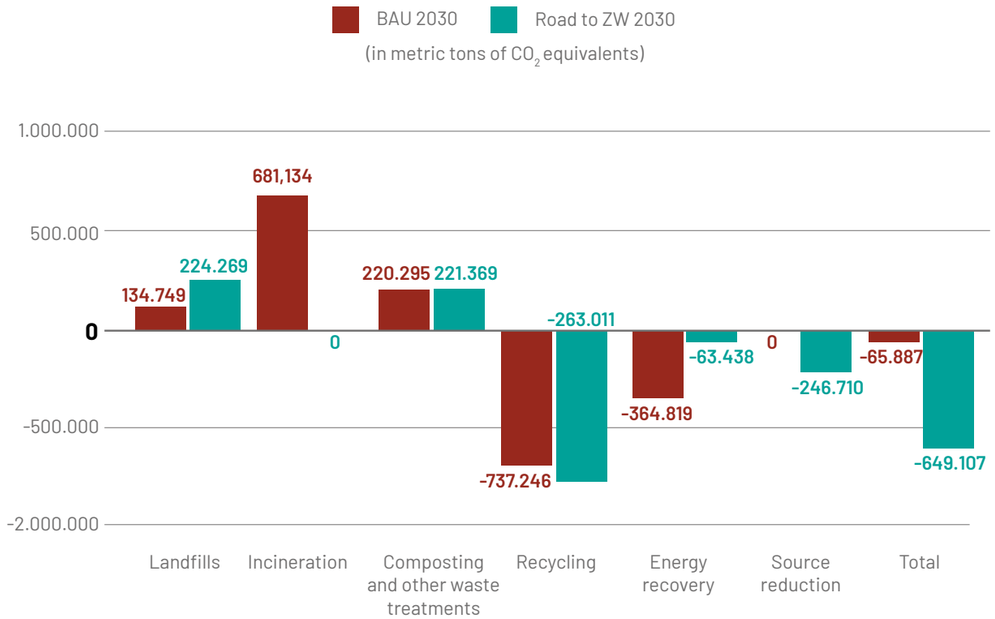

Treatment	BAU 2030	Road-to-ZW 2030
Landfill	378,173 tonnes of municipal solid waste landfilled per year Very little landfilling but still 13% of GHG emissions	1,057,795 tonnes of municipal solid waste landfilled per year. More landfilling but GHG emissions from landfill only go up by 89,520 tonnes CO_2e
Incineration	867,060 tonnes per year This produces 66% of Seoul's GHG emissions from waste	No incineration removes the largest source of GHG emissions: 681,134 tonnes
Composting & other treatments	96% of organics are composted or fed to animals	96% of organics are composted or fed to animals
Recycling	High recycling rates give Seoul a slightly negative carbon footprint	Strengthened recycling of paper and cardboard generate further emissions reductions
Energy recovery	The energy generated by incineration has twice the GHG emissions of replacement energy from the grid. Landfill gas energy is minimal because of low organics landfilling	Minimal energy recovery via landfill gas
Source reduction	none	Bans on single use plastic reduce plastic waste generation by 188,871 tonnes
Overall diversion rate	59%	64%

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Key takeaways

1. Seoul's waste system is already net-negative, with a 100% collection rate and a 96% organic waste diversion rate. With little organic material going to landfills, methane from food waste is not a major concern; the majority of Seoul's GHG emissions come from its incinerators.

2. In the Road to Zero Waste scenario**, Seoul would achieve an increase in overall diversion rate from 59% to 64%, avoiding annual GHG emissions by 583,220 tonnes CO_2e in 2030.**

3. **This approach would reduce annual residual waste by 15%, landfill methane emissions by 66%, and overall GHG emissions by 885%, compared to the Business as Usual 2030 scenario.**

4. The Road to Zero Waste scenario includes phasing out incineration, expanding bans on plastic bags, foam plastic, and other plastic packaging, and increasing recycling rate (80%) for paper, cardboard, and wood; all other recycling rates stay constant.

5. Civil society, including Korea Zero Waste Movement Network has played a vital role in tackling climate change with zero waste solutions, leading with a wide range of initiatives like SUP bans, building a reuse and refill culture, organizing for zero waste towns, and community outreach and education on waste prevention, sustainable production and consumption, and climate change.

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Recommendations

- **Phase out waste incineration**. The city government's recent plan to build more incinerators by 2026 contradicts the nation's carbon neutrality goal for 2050. Shutting down the four existing incinerators alone would result in avoiding 681,134 tonnes annual CO_2e emissions in 2030. The city must withdraw the plan to build more incinerators by 2025 and gradually shut down incinerators as they are reaching the end of their life span in coming years.
- **Ban single-use plastic**. Continue and expand bans on single use items such as bags, cups, bottles, to-go containers, cutlery, etc.
- **Establish public-private governance** for greater public support on zero waste policies, and institutionally support the role of junk shops in collecting as much as 80% of discarded materials by amending the National Land Planning and Utilization Act.

Written by: Doun Moon. This case study was prepared as part of the report, "Zero Waste to Zero Emissions: How Reducing Waste Is a Climate Gamechanger (GAIA, 2022)." Please visit www.no-burn.org/zerowaste-zero-emissions to access the full report and detailed notes on data and methods.