



SHOULD WE INTRODUCE WASTE-TO-ENERGY IN MONGOLIA?

COMPARATIVE OVERVIEW OF INCINERATION AND ZERO WASTE
ALTERNATIVES IN THE EUROPEAN UNION AND IN ASIA



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EXECUTIVE SUMMARY

As governments and municipalities feel the need to find quick solutions to solve the waste crisis they are facing, many can be tempted to resort to incineration – especially since most incinerators are now equipped to produce energy and are thus referred to as “waste-to-energy” (WTE). Proponents of such waste incineration tend to present WTE as an ideal high-tech solution to solve all waste management problems, promising many things such as pollution-free operations, big returns in electricity sales, or creation of new jobs. To promote waste incineration in all countries, especially in the Global South, WTE supporters usually refer to the situation in the European Union, alleging that European waste incineration is a successful industry and a good example to follow.

Reality, however, is very different. An overview of WTE failures all across Europe – from Scandinavian countries to France, the Netherlands, Lithuania, Spain or Portugal – shows that problems are actually legion. **Not only does waste incineration turn out to be inefficient and incapable of solving the waste crisis in these countries; but it actually is very counter-productive and creates new unsolvable issues.** Analysis of available data and scientific knowledge inevitably leads to concluding that waste-to-energy incineration:

- **is not a clean renewable energy**, it is inefficient and totally incompatible with global and national objectives to mitigate climate change;
- **releases substances (such as dioxins) that are extremely toxic** and hazardous for human health and ecosystems;
- **is a dreadful disincentive to reducing, sorting, reusing and recycling** waste, and certainly not a relevant complementary technology to other waste management solutions;
- **is extremely expensive**: incinerators are a financial liability for states and cities that burden public budgets and household living standards;
- **does not make waste disappear and does not replace landfills**: incinerators turn relatively non-hazardous waste into highly toxic byproducts that need to be disposed of;
- **does not help the economy**, contrarily to simple and cheap alternative solutions that create much more local and green jobs;
- **is an old and failed technology from which many countries have been moving away** – it is not a promising new technology for the future.

On the contrary, assessment of many case studies all over Europe (Spain, France, Germany, Italy, Romania, Belgium, Slovenia) and Asia (Malaysia, Philippines, Japan, South Korea, India, Indonesia) clearly demonstrates that **relevant alternatives to WTE do exist to solve the waste crisis**. These solutions, broadly referred to as “Zero Waste”, are **not only very effective from a waste management perspective but also come with countless other advantages** – such as creating livelihoods, saving money to public funds, protecting human health and ecosystems, and mitigating climate change.

From the success stories in European and Asian countries analyzed in this report, we can conclude that **the waste crisis in Mongolia is not inevitable nor unsolvable**. Our country does not need incinerators but decision-makers who have the courage to **adopt and enforce ambitious Zero Waste long-term policies**. Such a Zero Waste approach would undoubtedly lead firstly to improving resource efficiency and reducing waste generation at the source, and secondly to effectively enabling reusing or recycling of whatever waste Mongolia still produces.

INTRODUCTION

Facing a waste crisis that seems insurmountable, governments and municipalities can be tempted to resort to incineration – as it is often regarded as a relatively simple way to make mixed waste disappear. Since most incinerators are equipped to produce electricity or other forms of energy, incineration is often referred to as “waste-to-energy” (WTE)¹ or “energy recover”, which seems to make such facilities even more relevant. Indeed, if we can produce energy while solving the waste crisis and preventing pollution, why would we refuse to do so?

Since the first incinerator was built in England in 1874², thousands of WTE facilities have been built around the planet. More than in any other region of the world, waste-to-energy is often portrayed as a successful industry in Europe. To promote incineration as a relevant solution to the waste crisis in all countries, especially in the Global South, WTE promoters usually refer to the situation in the European Union (EU) as a good example to follow.

But what has really been happening in Europe? How successful has waste-to-energy really been in the European Union?

In order to counterbalance the over-positive perception waste-to-energy often benefits from, this report aims to provide an overview of remarkable incineration failures in Europe. Based on case studies produced by Zero Waste Europe and GAIA (Global Alliance for Incinerator Alternatives), our goal is to demonstrate that WTE is clearly not the amazing technology its promoters claim it is. So much so that, like many countries, even the European Union itself has noticeably been moving away from WTE over the last decade.

However, the European Union does offer great examples of countries and cities that showed incredible success as they rejected incineration and adopted Zero Waste policies. Similar success stories can also be found in Asia, in countries such as the Philippines, Japan, India, Malaysia, Indonesia and South Korea. Thus, this report will also go over several case studies in order to learn from their experience and try to identify common features that could be inspiring for Mongolia.

In the end, this overview of incineration and Zero Waste policies in European and Asian countries should help us answer a question that has frequently been coming back in our country over the past years: should we introduce waste-to-energy in Mongolia?

EXAMPLES OF INCINERATION FAILURE IN EUROPEAN COUNTRIES

NETHERLANDS

REC (Reststoffen Energie Centrale), one of the 13 waste incinerators currently in operation in the Netherlands, located in Harlingen, shows how an incinerator once presented as state of the art is in fact far from clean: long-term tests reveal emissions of dioxins, furans and persistent organic pollutants (POPs) far beyond the limits set by EU laws.

¹ In this report, we use the words “incineration” and “waste-to-energy” (or “incinerators” and “waste-to-energy” facilities) as synonyms. Incidentally, we essentially use the word “waste” to refer to Municipal Solid Waste.

² Historia Sanitaria, [1874 - Furnace incinerator for refuse at Nottingham, England](#).

In November 2018, Zero Waste Europe and Toxico Watch released a study revealing that the dioxin emissions of the REC incinerator were underestimated, as they frequently went far beyond the limits set by the environmental permit.³ The study also exposed how breaches have been hidden thanks to unreliable testing which seriously understated the emissions level. The local community reacted and citizens, led by the association Stichting Afvaloven Nee Foundation, sued the REC for its toxic emissions.⁴

In May 2019, the Dutch Council of State – the highest administrative court of the Netherlands – stated that the management of the REC waste-to-energy plant had incorrectly applied the provisions concerning the measurement of toxic emissions. In order to keep these excessive emissions hidden, the REC systematically subtracted 4 mg/Nm³ from the annually average values. The ruling of the Council of State implies that for many years the incinerator has emitted thousands of kilograms of toxins more than reported in the annual emission reports. This doesn't appear to be an isolated case, but a common practice among waste incinerators in Europe.⁵

DENMARK

OVERALL SITUATION

Denmark is one of the EU countries that generates the most waste per capita, and is a world leader in incineration of household waste. According to data from Eurostat in 2018, Denmark incinerated 49% of its waste (generated 814 kg/capita and incinerated 397 kg/capita).⁶

Zero Waste Europe highlighted clear structural problems of waste management in Denmark, among which:⁷

- Incinerators are mostly publicly owned. If less waste is sent for burning – because it is being avoided, reused or recycled – the incinerator will function at reduced capacity, lowering the efficiency to generate heat and power. Yet the incinerator would have to meet the capital and operating costs with less income, which will result in an increase in the waste management fees. In other words, the more waste people generate, the more money incineration facility owners make. With the current system of incentives in Denmark, getting to Zero Waste would be a financial catastrophe.
- Burning waste is “justified” by the fact that it generates heat and power. But burning waste actually is an extremely inefficient way to generate energy.⁸ So, waste-to-energy is actually counter-productive because it comes in the way of adopting genuine carbon-neutral technologies (which are put on stand-by for as long as the incineration capacity is in place).
- In fact, incineration is one of the main obstacles in the path of Denmark towards becoming a carbon neutral country. Twenty percent of heat production and 5% of electricity in Denmark is generated from waste incineration, but this heat and power could be replaced with a combination of geothermal, wind and biogas from separately collected bio waste – all mature and available technologies.

³ Zero Waste Europe, [Hidden emissions: A story from the Netherlands – Case Study](#) (2018).

⁴ Stichting Afvaloven Nee, [Uitbreidingsvergunning rookgasdebiet afvaloven Omrin opgeschort](#) (2013).

⁵ Zero Waste Europe, [The story of REC: The hidden emissions of the youngest Dutch incinerator](#) (2019).

⁶ Eurostat, [Municipal Waste Statistics](#) (2023).

⁷ Zero Waste Europe, [The story of Denmark's transition from incineration to Zero Waste](#) (2014).

⁸ Morris (J.), [Comparative LCAs for Curbside Recycling Versus Either Landfilling or Incineration with Energy Recovery](#) (2004).

On the other hand, the Zero Waste movement in Denmark has also borne some fruit: Bornholm is a city committed to stopping incineration by 2032, when the city incinerator will be decommissioned.⁹ The city has pledged to build a different system.

THE NORFOS INCINERATOR

The Norfos incinerator has repeatedly exceeded the limit value for toxic emissions since 2014, as revealed by the Danish Environmental Protection Agency (EPA) which released an injunction showing the measurements in July 2019. The bar chart shows that since 2014, Norfos violated the dioxins emissions' limit for three years in the last five years.¹⁰

The problem of controlling and limiting dioxin emissions is a long-lasting issue for incineration plants. In 2004, the EU introduced stricter requirements for cleaning and controlling the incineration plants' emissions.¹¹ This led to reducing dioxin emissions by 68% in Denmark. Nevertheless, according to the EPA, the dioxin contamination of the environment has not fallen accordingly.¹²

After a thorough revision of the plant line, the EPA allowed Norfors to use the plant only if it immediately lowered the level of emissions and maintained them below the allowed limit. For this reason, Norfors had to take additional performance checks to monitor emissions and permanently intensify cleaning practices. The order also warned that if even only one of the performance checks showed a limit excess for dioxins and furans, the plant line would be immediately shut down. Unfortunately, the case of Norfors appears to be just another significant example that waste incineration plants have difficulties to control the emissions of dioxins.

THE AMAGER BAKKER INCINERATOR

The famous Amager Bakker incinerator with the ski slope in Copenhagen is a good example of how a highly dubious investment can be presented under a good light despite obvious flaws.¹³ As long as people and media are kept entertained talking about the ski slope, they don't think about avoiding or recycling this waste instead. The truth is that the construction of the Amager Bakke incinerator has sparked lots of debate in the country. Danish citizens and politicians are more and more aware that they are recycling too little and burning too much, and that the incineration overcapacity of the country is not something to be proud of. The construction of the Amager Bakke incinerator actually faced serious opposition from the Ministry of Environment itself, but the project was eventually greenlighted after strong pressure from the Ministry of Finance.¹⁴

Estimated to cost 500 million euros (1,900 billion MNT), the Amager Bakke incinerator is the most expensive of its kind. Although already astronomical, the 500 million euros figure is set to grow, as the plant has already experienced a technical failure since opening in May 2017 – a failure that has greatly impeded its ability to process the current stream of incoming waste.¹⁵

⁹ BOFA, [Bornholm showing the way](#) (2019).

¹⁰ Zero Waste Europe, [The not-that-well hidden risks of incineration: the case of the Danish Norfors Plant](#) (2019).

¹¹ European Food Safety Authority, [Dioxins and PCBs](#).

¹² ING, [Nordsjællands affaldsforbrænding står bag årelang forurening med et af verdens mest giftige stoffer](#) (2019).

¹³ Zero Waste Europe, [Copenhagen goes all in on incineration, and it's a costly mistake](#) (2017).

¹⁴ Christiansborg, [Corydon blandede sig i speget Amager-beslutning](#) (2013).

¹⁵ Finans, [Kaos på nybygget milliardanlæg: Amager Bakke må lagre tonsvis af affald](#) (2017).

Apart from its already costly bill, the problem is that the plant's processing capacity is extremely high – 400,000 tons of waste annually. This means that to have a balanced budget, 400,000 tons of waste must effectively be burnt every year; if the plant operates under capacity and puts up losses, the taxpayers are the ones who have to bear the deficit. It is estimated that to reach capacity, an additional 90,000-115,000 tons of trash would be needed.¹⁶ Therefore, the Danish government has already envisioned importing waste to be incinerated, clashing with not only their own resource strategy, but also the EU's.

Another article about Copenhagen¹⁷ explains how plastic waste is systematically burnt in this city, even if it could be perfectly recycled or reused. Between 73 and 74 percent of all household waste in Copenhagen is incinerated and experts now say that a surprisingly large amount of it is plastics that could be recycled. Until recently, the page on the city's official website that explains how residents should sort their waste did not mention plastics as a type of waste that should be sorted to be recycled. Even the most common types of plastic like HDPE, which we perfectly know how to recycle (even in Mongolia), were explicitly considered as "things that go in the rubbish bin" to be incinerated. Clearly, the Amager Bakke incinerator comes in the way of reducing waste generation and increasing waste sorting and recycling in Copenhagen.

SWEDEN

Sweden claims to be undergoing a recycling revolution, boasting that they recycle nearly 100% of household waste.¹⁸ But how could that be true when, according to their own data, nearly 50% of their waste is actually incinerated? Burning waste does not count as recycling, even if it produces energy! In 2015, Sweden actually recycled only 32% of its total waste (48% with compost included), which is significantly below the European Commission's 65% objective for 2030. Considering that Swedish average recycling rate was already 33% between 2000 and 2015, Sweden's increased focus on incineration over the years has clearly led to stagnation of the recycling sector.

Sweden's increased dependency on incineration for their energy and economic needs has prompted them to continue building plants, which are very costly to both build and run, not to mention the pollutants that they produce. According to the EPA, incineration plants release about 33% more CO₂ per megawatt generated than burning coal does, and they have been shown to release many other toxic chemicals such as dioxins.¹⁹

From a cost perspective, a cost-benefit analysis on waste incineration conducted by Columbia University showed that plants can cost upwards of 100 million euros to construct and anywhere from 3 to 7 million euros yearly to maintain.²⁰ And in order to make a return on investment, incineration plants have to process steady amounts of waste, which goes against their Zero Waste claims and the very basis of the circular economy. More broadly, focusing so much on waste-to-energy has led the country to become very reliant on generating waste to produce energy and heat their homes.

¹⁶ Murmur, [Copenhagen's dirty white elephant](#) (2017).

¹⁷ Plastics Infomart, [Plastic surgery for Copenhagen's recycling policy](#) (2011).

¹⁸ Sweden, [Swedish recycling and beyond](#) (2021).

¹⁹ Treehugger, [No, Sweden Does Not Recycle 99 Percent of Its Waste](#) (2020).

²⁰ Zero Waste Europe, [Sweden's Recycling \(D\)evolution](#) (2017).

In 2019, the Swedish parliament approved plans to introduce a tax on “waste that is burnt”, with the explicit goal “for Sweden to be able to achieve the national climate targets and to create a more resource-efficient and non-toxic waste management.” In other words, Sweden implicitly acknowledged the unsustainability and toxicity of its current incineration-based model and the need to change it.

FRANCE

IVRY-PARIS XIII WASTE INCINERATOR

SYCTOM is the waste processing agency that covers the domestic waste of almost 6 million inhabitants in Paris and 84 municipalities in the Ile-de-France region. In order to do so, they massively resort to incineration through three high-capacity plants in the region. Since 2000, SYCTOM plans to reconstruct one of them – the largest incinerator in Europe, called Ivry-Paris XIII waste incinerator – but they are facing strong opposition from local communities, who have filed complaints against the project.²¹ These complaints are filed on the ground that the project jeopardizes waste minimization and the transition towards circular economy within the Ile-de-France region.

In fact, legislation has considerably evolved in the past years in France, with increased drivers to minimize waste, most notably:

- The “Energy Transition for Green Growth” Act in 2015, establishing new obligations and targets for local authorities such as: separately processing organic waste by 2025, redirecting 65% of waste to recycling or organic recovery by 2025.
- The EU “Circular Economy Package” in 2018, confirming the direction of French legislation and assigning targets even closer and more specific such as: organic waste sorting by 2023, recycling of 65% of packaging, clear minimization of food waste, etc.

Currently, only 16% of domestic waste is recycled within the municipalities covered by SYCTOM. More than half of the waste currently burnt by incineration plants is actually recyclable or compostable, and this percentage could rise up to 75% in the years to come. The projections put forward by SYCTOM to justify the reconstruction of the plant diverge significantly from the legislative obligations and targets mentioned above and would be a real obstacle to progress.

An alternative plan entitled “Plan B’OM” (“reduction of domestic waste plan”) was published by Zero Waste France and Collectif 3R to show that a radically different type of waste management is possible and desirable from an environmental, social and economic point of view. This plan clearly demonstrates that the region does not need this incinerator.²²

Opposition is also fueled by the fact that toxic substances have been emitted by the incinerators.²³ Analyses conducted in 2022 showed “exceptionally high concentration of dioxins” in the towns surrounding Ivry-Paris XIII waste incinerator – for some compounds, the concentrations are reported to be the highest ever measured in Europe.²⁴ In 2023, the Regional Health Agency (ARS)

²¹ Zero Waste Europe, [Zero Waste France takes on the reconstruction of Ivry-Paris incinerator](#) (2019).

²² Plan B’OM, [Non au projet du Syctom à Ivry-Paris 13](#).

²³ Le Monde, [Des niveaux de dioxines « exceptionnellement élevés » autour de l’incinérateur d’Ivry-Paris XIII](#) (2022).

²⁴ ToxicoWatch, [Recherche en biosurveillance Paris / Ivry-sur-Seine](#) (2021).

forbad people in the area to eat the eggs from their own chickens because levels of dioxins, furans and PCBs were significantly higher than health standards.²⁵

VAUX-LE-PENIL INCINERATOR

40km south of Ivry, another incinerator also became infamous for the terrible impact it had on human health. Built in 1974, the Vaux-le-Pénil incinerator (with a capacity of 32,000 tons per year) operated under the authority of the city of Melun until it closed in 2002. It was initially planned to create a new facility, but local residents opposed the project as they started suspecting that the dust they constantly found in their gardens and roofs came from the incinerator. Analyses on residents' blood and local eggs, followed by analyses in incinerator's smoke, confirmed that toxic substances emissions were incredibly high: dioxins were measured at a level 2,200 times higher than the reglementary limit.²⁶

In 2018, the incinerator's operator (the city of Melun) was finally found guilty of "deliberately endangering lives" – a sentence that was confirmed in appeal in 2019. In fact, it was proved that the operator perfectly knew of the incinerator's non-compliance situation and highly toxic emissions since at least 1999, but that they deliberately decided to keep the incinerator running until 2002.²⁷ Surrounding populations were severely impacted and many local residents were diagnosed with cancers (especially non-Hodgkin's lymphoma, a pathology typical associated with incinerators pollution). At least 15 of them died.²⁸

Vaux-le-Pénil clearly isn't an isolated case in France. In 2001, another incinerator located in Gilly-sur-Isère was closed after dioxins emissions 750 times higher than legal limit were measured. As a preventive measure, nearly 7,000 animals, mainly cows, were slaughtered; more than two million liters of milk and 24 tons of dairy products were destroyed due to the risk of human contamination. Following this episode, analyses all over the country concluded that at least 55 other incineration facilities had been exceeding reglementary standards for dioxins.²⁹

LITHUANIA

Fortum Klaipėda is a waste incineration plant located in the territory of Klaipėda, a windy seaside industrial town situated in western Lithuania. With nearly 150,000 inhabitants, Klaipėda is the third most populated town in the country. The waste incineration plant is part of the Finnish energy giant "Fortum Oyj" in Klaipėda's Free Economic Zone (FEZ), and is surrounded not only by other industrial plants, but also by residential areas. It was opened in May 2013 and it currently incinerates about 278,000 tons of municipal and industrial waste per year. For the moment it remains the first and only waste incineration plant in Lithuania, although two further facilities are currently being built.

Fortum Klaipėda incinerator is having a significant impact on waste management systems in Lithuania, and comes at a high cost for society and the environment. As usual with incinerators, air pollution is a major issue. Over the last few years, the plant has been responsible for several

²⁵ Reporterre, [En Île-de-France, les oeufs des poulaillers domestiques sont dangereux](#) (2023).

²⁶ GEO, [La pollution aux dioxines d'un incinérateur de Seine-et-Marne au tribunal](#) (2017).

²⁷ Zero Waste France, [Incinérateur de Vaux-le-Pénil: une condamnation historique pour mise en danger d'autrui](#) (2020).

²⁸ Reporterre, [La détresse et la colère de riverains empoisonnés par la dioxine d'un incinérateur](#) (2017).

²⁹ France 3, [Retour sur l'affaire de la dioxine à Gilly-sur-Isère en Savoie](#) (2012).

environmental breaches without being held accountable. According to the data provided by Fortum Klaipėda, the plant has regularly exceeded the daily limits for hydrogen chloride. For example, these occurred 11 times in May 2018, and 16 times in July 2018.³⁰

In 2016, Fortum Klaipėda incinerated a higher amount of waste than allowed in its official permit. Although the presence of the incinerator reduces the amount of waste being landfilled, it also unarguably discourages separation and collection of organic waste, and it hinders recycling and re-use, especially in the region of Klaipėda. On top of the environmental impact, the plant come at a high economic cost: built thanks to European subsidies, it is often the most expensive heat provider in the city.

PORTUGAL

Madeira is one of two autonomous regions in Portugal and is a tourist destination. The presence of an urban solid waste incinerator has directly contributed to very low recycling rates (only 10% in 2017) and abandonment of organic waste recycling, as the available amount of residual waste was not enough for the plant to operate at full capacity (which is essential to avoid financial losses).³¹

Likewise, in Terceira (Azores), the existing incineration unit requires to burn as much waste as possible in order to remain economically viable, and it has also absorbed much of the regional funding that might have otherwise supported an improved system of separate collection and recycling. In Saõ Miguel (Azores), the plan to build an incinerator is expected to absorb 20% of the financial resources assigned to municipal solid waste management in Portugal until 2020, while the plant would only treat 1.4% of the waste produced in the country.

These experiences should ring alarm bells about the financial burden that waste incineration can cast on Europe's outermost communities, while at the same time interfering with their vision of a more circular economy.

SPAIN

The municipal waste incinerator located in Sant Adrià de Besòs, close to Barcelona city limits, was inaugurated in 1975 and was the first large incinerator of its kind built in Spain. The plant has an incineration capacity of 360,000 tons of municipal waste per year, equivalent to a quarter of all municipal waste generated in the metropolitan area, with a total electrical output of 23.7MW. Since 2003 it has also supplied heat energy, steam for heating and cooling systems, and hot water to hotels and residential buildings.

There is a high level of concern among residents who live close to the plant regarding the potential risks of living close to the facility, especially as the area is already exposed to the impacts of other polluting infrastructures. These concerns increased in 2017, after the release of several scientific studies showing worrying levels of dioxins and furans in the area, which increased the risks of developing various diseases. As a result, the local associations and activists came together to set up the Metropolitan Residents' Coordination Group, 'Airenet' ('clean air') with the goal of controlling and reporting the environmental irregularities of the plants to local authorities.

³⁰ Zero Waste Europe, [Waste Incineration getting away with CO2 emissions unscathed](#) (2019).

³¹ Zero Waste Europe, [Paradise lost? EU funds to polluters will trash some of the world's most beautiful islands](#) (2019).

The plant has been shown to have several operational issues in the summer of 2017 alone, when activists started their survey:³²

- In theory, constant checks are performed on dioxins and furans, although oddly the checking system does not work while the furnaces are being ignited, or when they are being turned off, which is when dioxin emissions are the highest (because combustion is unstable at that specific moment). In other words, it seems that operating conditions are rigged to obtain results that fall within legal values.
- Combustion gases should be at a temperature of over 850°C for at least 2 seconds but internal measurements of this parameter show that this temperature has been below 850°C for several hours each year, which would increase the release of toxic emissions.
- During the night between the 16th and 17th of July 2017, the management of the plant lost control of its functions and emitted various pollutants (including carbon monoxide and Total Organic Carbon), exceeding the legal limit values. Strangely, the continuous dioxin filter did not analyze any emission between 13th and 18th of July. The incinerator's operator did not report this incident to the environmental authority, which ended up being informed about it by local campaigners. The operator has acknowledged that the incident lasted over 9 hours, during which the plant had to stop burning waste and completely shut down one furnace.
- For several weeks in July and August 2017, the emissions value for dioxins and furans were found above the limit value.
- For a long time, the toxic ash collected from sleeve filters was removed from the two warehouses by trucks, which transported it to an external company. These removals were often irregular as the telescopic sleeve hitched to the truck was not always adequate (because trucks were different sizes in the loading bay). As a result, dust was released into an area that was open to the outside, and particles considered as hazardous waste were released into the environment.

In theory, only the residual waste stream from the four Mechanical Biological Treatment plants in Barcelona and surrounding areas should be incinerated, as those plants are supposed to carry out the basic separation and recovery of by-products. But according to their management reports, 85% of what was incinerated in 2018 was actually recyclable (organic matter, plastics, paper-cardboard, textiles, metal, glass). Furthermore, incinerated waste also contains a non-negligible proportion of hazardous waste: electrical and electronic devices, medicines, sanitary waste, etc. – which are not separated prior to incineration.

NORTHERN EUROPE

The Nordic Council of Ministers is a coalition that involves the regional collaboration of Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland and Åland. In 2019, waste experts from Eunomia published a report entitled 'Analysis of Nordic regulatory framework and its effect on waste prevention and recycling in the region'.³³

³² Zero Waste Europe, [A story of hidden emission: the case of Sant Adrià de Besòs Incinerator](#) (2019).

³³ Eunomia, [Analysis of Nordic regulatory framework and its effect on waste prevention and recycling in the region](#) (2019).

This report clearly recommended for Nordic countries to:

- shift away from incineration, towards more recycling;
- increase separate door-to-door collection for recyclables and organic waste;
- increase taxes/implement bans on the incineration of recyclables and organic waste;
- increase recycling and composting/anaerobic digestion infrastructure;
- implement Pay-As-You-Throw³⁴ (PAYT) schemes.

All in all, this report makes no doubt about the fact that countries heavily relying on incinerators like Scandinavian countries would greatly benefit from shifting towards Zero Waste alternatives.³⁵

SUMMARY OF MAIN PROBLEMS WITH WASTE-TO-ENERGY

Of course, waste-to-energy doesn't raise problems solely in the European Union: incineration has been notoriously declining in the USA³⁶ and incinerators often have even more dramatic impacts in countries of the Global South, which usually don't have sufficient resources and health/environmental standards to effectively control the facilities and limit their damages. But this non-exhaustive list of incineration failures in Europe shows that even in the part of the world where waste-to-energy is presented as a well-functioning waste management solution and good model to follow, problems are actually legion.

Based on the feedback of these examples and current state of scientific knowledge about waste-to-energy, we can thus summarize what these main problems are and learn some lessons for Mongolia.

WASTE-TO-ENERGY IS NOT A CLEAN RENEWABLE ENERGY: IT IS INEFFICIENT AND TERRIBLE FOR THE CLIMATE

Some people probably think that burning waste to generate energy is brilliant, or that waste-to-energy is a low-carbon source of renewable energy which makes us avoid the use of fossil fuels. However, the reality is very different. First, we must emphasize that burning waste to produce energy cannot reasonably be considered a renewable energy since most of the waste we incinerate is made of non-renewable resources. As such, incineration does not get us closer to a circular economy in any way.

Then, incinerators do release a lot of carbon from burning waste, and hence significantly contribute to climate change. Plastic waste incineration without energy recovery can generate 2.7 to 2.9 tons of CO₂ equivalent.³⁷ Even when electricity generation is taken into account, each ton of plastic burned in an incinerator results in the release of 0.9³⁸ to 1.4³⁹ ton of CO₂. European incinerators

³⁴ Green Alliance UK, [Scandinavians call their waste incineration 'crazy', so why copy them?](#) (2020).

³⁵ Pay-As-You-Throw (PAYT) is a policy that charges people for the amount of waste they generate and throw away: the more waste you produce, the more you pay. PAYT policies aim to provide waste producers incentives to reduce waste generation at the source.

³⁶ The New School, [U.S. Municipal Solid Waste Incinerators: An Industry in Decline](#) (2019).

³⁷ Material Economics, [The Circular Economy – a Powerful Force for Climate Mitigation](#) (2018).

³⁸ CIEL, [Plastic & Climate: The Hidden Costs of a Plastic Planet](#) (2019).

³⁹ UKWIN, [Evaluation of the climate change impacts of waste incineration in the United Kingdom](#) (2018).

generate two times more greenhouse gases emissions than the current EU average electricity grid.⁴⁰ In the end, incineration produces more greenhouse gas emissions per unit of energy produced than any other form of energy production.⁴¹

Waste-to-energy is actually one of the least efficient ways to produce energy: after taking into account the embedded energy in incinerated waste, analysis shows that WTE actually wastes more energy than it produces.⁴² Reusing and recycling undoubtably save much more energy; therefore, considering that most of the waste currently burnt in incinerators are actually recyclable or compostable, waste-to-energy is highly counter-productive in terms of energy efficiency. Incidentally, incineration is one of the most expensive ways to generate electricity, costing four times as much per unit of energy as solar or onshore wind, twice as much as natural gas, and 25% more than coal.⁴³

INCINERATION IS EXTREMELY TOXIC AND HAZARDOUS FOR HUMAN HEALTH AND THE ENVIRONMENT

Environmental engineering is supposed to transform toxic substances into less or non-toxic ones, but incinerators do the opposite and essentially turn non-hazardous municipal waste into extremely toxic gases and ashes. Indeed, along with greenhouse gases, incinerators' emissions include highly hazardous substances such as dioxins, particulate matter, carbon monoxide, nitrogen oxides and other acidic gases (SO_x, HCl), metals (cadmium, lead, mercury, arsenic, and chromium), polychlorinated biphenyls (PCBs), and brominated polyaromatic hydrocarbons (PAHS).⁴⁴ Proven health impact of these substances notably include increased rates of preterm births, increased wheezing, headaches, stomach aches, and fatigue in schoolchildren, increased risk of miscarriages from exposure to particulate matter, increased risk of lymphoma due to dioxin emissions, and excess deaths due to stomach, liver, colon, and other cancers.⁴⁵

Both old and modern incinerators produce the same pollutants. Even with the most modern technologies, smokeless does not mean clean emission: the toxic cocktails and particulates released by incinerators can be colorless, odorless, or just too small to be seen by naked eyes. Incidentally, incineration releases ultra-fine particles that are too small to be filtered by modern Air Pollution Control units and that are not regulated in any country. By burning waste, we convert simple tangible issues into complex invisible problems.

In the case of dioxins, the periodic emission testing methods used in most countries do not capture episodes of high dioxin releases, which can only be found through continuous monitoring, a practice which many developing countries have no capacity to conduct. Regulation needs to cover

⁴⁰ Zero Waste Europe, [The impact of Waste-to-Energy incineration on climate](#) (2019).

⁴¹ Tangri (N.), [Waste Incinerators Undermine Clean Energy Goals](#) (2023).

⁴² Morris (J.), [Comparative LCAs for Curbside Recycling Versus Either Landfilling or Incineration with Energy Recovery](#) (2004).

⁴³ GAIA, [The High Cost of Waste Incineration](#) (2021).

⁴⁴ CIEL, [Plastic & Health: The Hidden Costs of a Plastic Planet](#) (2019).

⁴⁵ The New School, [U.S. Municipal Solid Waste Incinerators: An Industry in Decline](#) (2019); CIEL, [Plastic & Health: The Hidden Costs of a Plastic Planet](#) (2019); Tait (P.W.) and al., [The health impacts of waste incineration: a systematic review](#) (2020); National Research Council, [Waste incineration and public health](#) (2000); Garcia-Perez (J.) and al., [Degradation of polyethylene designed for agricultural purposes](#) (2013); Ranzi (A.) and al., [Mortality and morbidity among people living close to incinerators: a cohort study based on dispersion modeling for exposure assessment](#) (2011).

both emission limit and monitoring standards (including frequency) – not only on stack but also in the neighboring communities.⁴⁶

In any case, while modern air pollution control equipment can help reduce the amount of toxins in an incinerator's exhaust gas, it does so by concentrating some of the toxins in other byproducts like ash and wastewater. When toxic ash is disposed in landfills, it can easily be spread out by the wind and impact surrounding environments.⁴⁷ These toxic substances not only risk the well-being of workers and nearby residents that are directly exposed to emissions, but they also pose a larger risk when they are spread by the wind and waterways and deposited in the open environment.⁴⁸ The health impact of waste incineration is often delayed and happens in other places, outside and away from the incineration facility. There are no "safe limits" for Unintentional Persistent Organic Pollutants (UPOPs – such as dioxins and furans) emissions; these substances are persistent and bioaccumulative, which means they eventually enter and accumulate in our food chain, which harms our children's health and threatens the life of future generations.

As we've seen above with several examples in Europe, incinerators are prone to malfunctioning, which means that chances of releasing all these toxic chemicals and having all these terrible consequences are actually high – despite all the reassuring promises WTE promoters can make.

INCINERATION IS A DISINCENTIVE TO REDUCING, SORTING, REUSING AND RECYCLING WASTE

First of all, it is worth reminding something obvious that WTE promoters seem to forget: recycling implies to recreate a comparable (and/or similar quality) item from an old one that reached the end of its life – recycling literally means "re-entering the cycle". As such, considering waste as fuel and burning it in incinerators certainly does not qualify as recycling, even if some energy is produced. In fact, the European Union's legislation specifically prohibits waste-to-energy to be considered as "recycling".⁴⁹

Then, as mentioned above with the example of Scandinavian countries, incineration does not coexist well with sorting and (true) recycling: if Nordic nations are not on track to meet the EU recycling targets, it clearly is because of their overreliance on incineration. The main reason is that not all types of waste easily burn, and mixed waste that include a significant share of organic waste are too wet to burn properly. Therefore, incinerators primarily require a lot of plastics to operate, because plastics are oil-based and burn very well. When there is not enough plastics, incinerators often add other fossil fuels to make sure that mixed waste will burn well enough (for instance, in China, incinerator operators routinely add coal to the municipal waste to make it combustible).⁵⁰

Thus, incineration is actually a very strong disincentive to both reducing waste (incinerators need a steady waste supply, even more so that they often are over-sized and have to operate under optimal capacity) and reusing/recycling (incinerators rely on plastics, single-use plastics being an

⁴⁶ Jurgen (R.) and al., [Validation Tests for PCDD/F Long-Term Monitoring Systems: Short Comings of Short-Term Sampling and Other Lessons Learned](#) (2008).

⁴⁷ IPEN, [Toxic Ash Poisons our Food Chain](#) (2020).

⁴⁸ Tait (P.W.) and al., [The health impacts of waste incineration: a systematic review](#) (2020).

⁴⁹ [Directive 2008/98/EC of the European Parliament and of the Council](#) explicitly says that "recycling [...] does not include energy recovery and the reprocessing into materials that are to be used as fuels".

⁵⁰ Economist Intelligence, [A greener shade of grey: A special report on renewable energy in China](#) (2020).

essential feedstock for them). In the end, incineration is not a relevant complementary solution to recycling and does not contribute to solving the waste crisis; on the contrary, incinerators directly compete with waste reduction and recycling. As such, they oppose the fundamental 3R rule and critically undermine Zero Waste goals and targets.⁵¹

INCINERATORS ARE EXTREMELY EXPENSIVE: THEY ARE A FINANCIAL LIABILITY FOR STATES AND CITIES

Incineration is one of the most expensive ways to manage waste, compared to both other waste processing technologies and Zero Waste approaches.⁵² And they are very expensive both in terms of investments (Capital Expenditures – CAPEX) and running costs (Operational Expenditures – OPEX). Capital investments for waste-to-energy facilities represent hundreds of billion Mongolian tugriks (up to 500 million USD for Copenhagen Amager Bakke incinerator), which usually leaves governments with an enormous long-term debt for at least for 20 or 30 years. This debt is a heavy burden on taxpayers and it undermines the ability of indebted countries to invest in other waste reduction and management solutions (or even in other kinds of public services).

And another problem is that this initial investment doesn't even pay off. According to the World Bank, operational costs (OPEX) are almost always substantially higher than investments (CAPEX) and often the most challenging to sustain. While countries are struggling to provide full coverage basic services, OPEX for incinerators – without accounting for revenues (electricity, heat sales, and other revenues) – is extremely expensive, usually ranging between 100-200 USD/ton.⁵³ According to GAIA, WTE can cost as much as 190-1200 USD/ton of waste handled per year, compared to landfill's range of 5-50 USD/ton.⁵⁴ Therefore, because it is so expensive to operate, governments and municipalities (and thus their taxpayers) not only need to contract a large debt for investments; they also need to subsidize operational costs, which increases even more the burden on public budgets and households' living standards.

These financial constraints linked with incineration increase the above-mentioned disincentive to reducing and recycling: once governments have invested so much into a WTE facility and have to reimburse a high debt, they can't afford for the incinerator to be in deficit. This situation creates a lock-in effect, which traps countries and cities that invested in WTE. In that sense, governments can't just say "let's try waste-to-energy and we'll see if it is not working or not". Once you invest, you are locked in for decades and all efforts to reduce waste generation and increase reusing/recycling rates are greatly compromised – if not made totally impossible.

Finally, costs are so high and inefficiencies so systematic that WTE facilities often have no option but to permanently shut down, which can end up costing municipalities considerable amounts of money to decommission and find waste management alternatives. For example, since 2000, 31 waste incinerators in the USA have closed.⁵⁵ There are several examples of cities (e.g. Harrisburg⁵⁶) that had to file for bankruptcy because of their investment in incinerators.

⁵¹ Luthra (A.), [Waste-to-Energy and Recycling. Competing Systems of Waste Management in Urban India](#) (2017).

⁵² GAIA, [The High Cost of Waste Incineration](#) (2021).

⁵³ World Bank, [What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050](#) (2018).

⁵⁴ GAIA, [The High Cost of Waste Incineration](#) (2021).

⁵⁵ The New School, [U.S. Municipal Solid Waste Incinerators: An Industry in Decline](#) (2019).

⁵⁶ CBS News, [Municipal folly bankrupts a state capital](#) (2011).

INCINERATORS DO NOT REPLACE LANDFILLS

Some people seem to think that once you have an incinerator, you don't need a landfill anymore. That is highly incorrect. Firstly, because incinerators can reduce initial waste by only 70 to 90%⁵⁷, which means that even after incineration, a landfill is still needed to dispose the remaining 10 to 30%. In other words, for every four tons of waste burnt, we get at least one ton of ash that need to be disposed. This amount is not negligible, especially considering that – as explained above – incinerators jeopardize objectives to reduce waste generation at the source.

Secondly, not all types of waste are allowed to be burnt anyway (e.g., halogenated products such as chlorinated plastic and fluorinated products), which means they require a secure storage space. If the goal is to reduce the volume of waste to bury in a landfill, Zero Waste policies are much cheaper and more relevant than incineration.

More importantly, ashes produced by waste incinerators are always extremely toxic. This means that while reducing waste volume, incinerators greatly increase its toxicity. Instead of requiring mainly regular landfills, cities that use waste-to-energy require more hazardous waste landfills, which are more expensive and more difficult to build and properly operate. With such toxic ash landfills, the risks to pollute soils and water and to impact human health – as described above – are much higher.

INCINERATION DOES NOT HELP FIGHTING UNEMPLOYMENT

Waste-to-energy promoters sometimes argue that incineration facilities create jobs. But the reality is that Zero Waste approaches that entail to reduce waste generation and to sort/reuse/recycle create much more jobs – and jobs that are safer and greener. According to the Geneva Environment Network, reuse, recycling and remanufacturing create about 200, 70 and 30 times more jobs, respectively, than landfilling and incineration.⁵⁸ A study from the Tellus Institute projected that Zero Waste policies that would lead to diverting 75% of waste from landfills and incinerators would generate over 2.3 million jobs in the United States alone.⁵⁹

A WIEGO study from 2019 explained that in developing countries, where informal workers play a significant role in the waste management chain, creation of incinerators actually leads to destroying more jobs than they create.⁶⁰ The same study showed that in the USA, recycling activities generated 10 to 20 times more jobs than incinerators. Another study from 2011 also highlighted that in Europe, the increased policy focus on material recovery and recycling between 2000 and 2007 has seen the overall employment related to this activity increase from 177,000 to 301,000 – not including at-source waste separation and collection activities.⁶¹

In addition, it is important to stress that contrary to the few jobs created in WTE facilities, Zero Waste jobs can be decentralized and spread all over the country, especially in rural and peripheric areas where unemployment rates can be very high. All in all, Zero Waste policies stimulate local economies much more than waste-to-energy.

⁵⁷ Funari (V.), [Sustainability assessment of bioleaching for mineral resource recovery from MSWI ashes](#) (2022).

⁵⁸ Geneva Environment Network, [Achieving Zero Waste and the Role of Geneva](#) (2023).

⁵⁹ Tellus Institute, [More Jobs, Less Pollution: Growing the Recycling Economy in the U.S.](#) (2016).

⁶⁰ WIEGO, [Waste Incineration and Informal Livelihoods: A Technical Guide on Waste-to-Energy Initiatives](#) (2019).

⁶¹ Fisher (C.) and al., [Green economy and recycling in Europe](#) (2011).

MOVING AWAY FROM WASTE-TO-ENERGY AND TOWARDS ZERO WASTE

Considering all these problems, more and more countries and municipalities have come to realize that waste-to-energy never delivered its promise and created more problems than it fixed. People who think that waste-to-energy is a promising new technology for the future are misjudging the situation: WTE is actually a failed technology from the past.

HOW EU POLICIES AND INSTITUTIONS ARE MOVING AWAY FROM INCINERATION

In the last decade, the European Union itself has been moving away from incineration, as the below list of chronological facts and policies clearly show.

- **BACKGROUND:** The Landfill Directive in 1998 required developments to improve technical landfills, including strict requirements not to landfill biodegradable waste and mandated pretreatment of waste before being landfilled. However, it did not provide guidance as to what to do with waste, thus a lot of the waste that was previously landfilled went to incineration, increasing the rate of incineration (especially in Northern Europe).
- **ROADMAP TO A RESOURCE EFFICIENT EUROPE (2011):** Eventually, the European Commission realized that the 1998 landfill ban had driven incineration overcapacity and undermined the EU goals to reduce and recycle waste. By 2011, the European Commission thus launched the Roadmap to a Resource Efficient Europe, with new ambitions for the EU to move towards a Zero Waste Europe. The roadmap had a strong push towards “residual waste close to zero” and it underlined that “incineration with energy recovery should be limited to non-recyclable materials” to ensure high recycling rates.”⁶²
- **COMMUNICATION ON WASTE-TO-ENERGY (2017):** The European Commission published a new report, which – despite being non-binding – analyzed the current role of waste-to-energy and gave guidance to Member States on how to cope with the problems WTE generated. It made three main recommendations for countries heavily relying on incineration: 1/ Make incineration more expensive through higher taxation; 2/ Phase out public support schemes for WTE and use funds more efficiently to support reducing/recycling; and 3/ Put a moratorium on any new facilities and decommission old ones.⁶³
- **CIRCULAR ECONOMY PACKAGE (2018):** After 4 years of negotiations, the Circular Economy Package was approved in 2018. Although the targets could have been more ambitious, the legislation does contain most relevant elements to move towards a Zero Waste circular economy, such as the separate collection of bio-waste and textiles that would become compulsory by 2023 and 2025, respectively, and the call on the Commission to propose targets on waste prevention and food waste reduction. Overall, the main key

⁶² European Commission, [The Roadmap to a Resource Efficient Europe](#) (2011).

⁶³ Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions, [The role of waste-to-energy in the circular economy](#) (2017).

targets we can highlight from the Circular Economy Package are: 1/ Mandatory separate collection of biowaste (which is between 35-50% of municipal solid waste); 2/ Stronger separate collection obligations for all waste streams; 3/ Clearer producer responsibility obligations; 4/ 65% recycling target 2035; 5/ 10% maximum landfilling by 2035; 6/ New vision to maximize material recovery.⁶⁴

- **RENEWABLE ENERGY DIRECTIVE (2018):** This Directive⁶⁵ was revised and finally approved by the European Parliament and European Council in June 2018 to phase-out subsidies to incineration.⁶⁶ Burning biowaste would be considered Renewable Energy but no subsidies for WTE would be granted if separate collection targets are not met.⁶⁷ The European Parliament thus halts perverse subsidies to energy from mixed waste.⁶⁸
- **EU COHESION FUND (2019):** A lot of incinerators were getting public funding from EU Cohesion Fund – a huge sum of money that aims to promote sustainable development and reduce economic and social disparities among all European regions. Over the last few years, the Fund invested billions of euros into incineration (half of the overall budget for waste management). As a result of the European Commission’s change of vision, the Fund is now stopping all funds going to waste-to-energy.⁶⁹
- **SUSTAINABLE FINANCE - TAXONOMY (2019):** The EU officially excluded waste-to-energy incineration from its list of economic activities considered as ‘sustainable finance’ – those that can make a substantial contribution to climate change mitigation and which do no significant harm to other environmental objectives such as transition to a circular economy, waste prevention and recycling.⁷⁰
- **EUROPEAN INVESTMENT BANK (2020):** The EIB is the largest multilateral financial institution in the world and one of the largest providers of climate finance. In January 2019, the EIB published its Circular Economy Guide, in which it excludes incineration as a contributor to a Circular Economy: *“While communication from the European Commission acknowledges that energy recovery from non-recyclable residual waste contributes to the circular economy, it is in practice difficult to judge whether a waste stream is non-recyclable or not. Therefore, the EIB does not include energy recovery through incineration and other forms of thermal treatment of: (1) mixed residual waste and fuel generated therefrom; and (2) plastics, as a category that contributes to the circular economy”*.⁷¹ In October 2019, EIB had already pulled out of funding a controversial waste incinerator in Belgrade, Serbia, after the European Commission warned it could threaten environmental targets. EIB confirmed that its support to the project was cancelled because of the effect the plant would have on the country’s recycling and circular economy targets under the EU accession process.⁷²

⁶⁴ Zero Waste Europe, [Circular Economy? Member States want it ‘despachito’](#) (2017).

⁶⁵ Official Journal of the European Union, [Directive \(EU\) 2018/2001 Of The European Parliament And Of The Council Of 11 December 2018 on the promotion of the use of energy from renewable sources](#) (2018).

⁶⁶ Zero Waste Europe, [Member States to phase-out subsidies to incineration, separate collection obligations prevail](#) (2018).

⁶⁷ Zero Waste Europe, [Guidelines for the implementation of article 3\(3\) of the REDII regarding support schemes for waste incineration](#) (2019).

⁶⁸ Zero Waste Europe, [The European Parliament halts perverse subsidies to energy from mixed waste](#) (2018).

⁶⁹ Zero Waste Europe, [European Parliament steps forward to stop burning EU funds](#) (2019).

⁷⁰ European Commission, [EU taxonomy for sustainable activities](#) (2019).

⁷¹ Bankwatch Network, [EU bank drops Belgrade incinerator, citing impact on recycling: EBRD and other banks press on](#) (2019).

⁷² European Investment Bank, [The EIB Circular Economy Guide](#) (2020).

EXAMPLES OF ZERO WASTE SUCCESSES IN EUROPE

As they realized waste-to-energy was not an adequate solution, many cities in Europe started implementing Zero Waste policies instead. This section presents a few examples of Zero Waste success stories in the European Union.

PONTEVEDRA (SPAIN)

For a long time, the Spanish province of Pontevedra, which includes 61 Northern municipalities, had extremely low waste management results with only 9% of its waste being separately collected, leaving the remaining 91% (including a large proportion of organic waste) to be transported more than 100 km away to be either burned or landfilled. To shift from this unsustainable, centralized and expensive waste management system, and to comply with the EU recycling obligations, the province launched a project named “Revitaliza” which built a decentralized, community-led composting system for biowaste.⁷³

This system is relying on 3 key factors:

- a suitable location for the composting process to be conducted at, which has been adapted to the area’s specific needs and context;
- the design and implementation of an effective monitoring system to ensure the success of the process, by identifying and solving issues that arise throughout the implementation phase;
- a strong communication plan.

In only 3 years, Pontevedra went from providing no option for bio-waste to establishing itself as a best practice example for decentralized bio-waste management in Spain and beyond. The project rolled-out in more than two-thirds of the province’s municipalities and more than 2,000 tons of biowaste were locally composted.

SALACEA (ROMANIA)

Located in the north-west of Romania, the small city of Sălăcea quickly became a model for rural communities across Romania. Within only 3 months, Sălăcea not only managed to quickly rise from 0 to 40% recycling rate, but also to reduce its overall waste generation by 55%. This incredible success was made possible when local authorities, in partnership with expert NGOs, began their journey towards Zero Waste by implementing the following key measures:⁷⁴

- a complete door-to-door separate collection system on five streams, including biowaste;
- engagement of local stakeholders, including principally ‘Eco Bihor’, a regional operator for a sorting and treatment plant;
- a comprehensive four weeks education program and a strong communication strategy to engage the community.

After only 3 months the results were outstanding:

- Total waste generated fell from 106.7 to 47.93 tons, a drop of 55%.
- Separately collected waste rose from 1% to 61%.

⁷³ Zero Waste Cities, [The story of Pontevedra](#) (2019).

⁷⁴ Zero Waste Cities, [The story of Sălăcea](#) (2019).

- Waste that went to landfill dropped from 105 ton (98% of previous total) to 26.3 (55% of new total generated waste).
- Rates of local citizen engagement increased from 8% to 97%.

BRUGES (BELGIUM)

The case of Bruges shows how a medium-sized city can effectively tackle food waste by developing a comprehensive strategy that includes all local stakeholders.⁷⁵ In 2015, after assessing that 750 tons of edible food were wasted every year by retailers, the city of Bruges launched an ambitious Zero Food Waste strategy following 3 steps:

- Strategic analysis to measure how much and where food was wasted;
- Action plans built through a participatory approach: supported by local organizations, the municipality created the Bruges Food Lab, a local stakeholder council on sustainable food;
- Specific focus on healthcare sector, which was wasting in total 318 tons of food per year in 2015 (just from hot meals) – equivalent to 195,000 euros.

After only 2 years the results were outstanding:

- Bruges became a European forerunner with up to 43% of food waste prevented in the main local hospital.
- For every euro invested in preventing food waste, the city saved 8 euros usually dedicated to manage food waste.
- In 2017, this project won the special mention award on Food Waste at the Milan Urban Food Policy Pact conference.

SARDINIA (ITALY)

In 2000, Sardinia was Italy's worst performing region in waste management, with a separate collection rate of only 3.8%.⁷⁶ But the situation changed when local authorities decided to set up a Regional Program for organic waste within its Waste Management Plan in 2004. The program included four main measures:

- Compulsory separate collection of organic waste;
- Increase of the landfill tax;
- Bonus/malus system on the cost of residual waste management based on the municipalities performances;
- Promotion of door-to-door collection, Pay-As-You-Throw systems, and home composting.

Today, Sardinia is the best performing island in the whole Mediterranean Sea and sits at the forefront of Italian and European regions with:

- Separate collection rate reaching 60%;
- Waste generation per capita decreased consistently, moving from 520 kg to 443 kg in a decade;
- Residual waste went from 500 to 176 kg per inhabitant.

⁷⁵ Zero Waste Cities, [The story of Bruges](#) (2018).

⁷⁶ Zero Waste Cities, [The story of Sardinia](#) (2018).

BESANCON (FRANCE)

Located in eastern France, the city of Besançon and its surroundings have a population of 225,000 residents of whom half is living in densely populated areas. Before 2008, waste was burnt in an incineration plant which had two furnaces, one of them built in 1975 and thus obsolete. Instead of rebuilding the old incinerator, authorities decided to shift towards a Zero Waste plan with 3 main measures:⁷⁷

- Implementation of a Pay-As-You-Throw system;
- Adoption of a waste prevention plan (-15% of residual waste over 5 years);
- Development of an extensive decentralized composting system.

Ten years later, the plan clearly paid off:

- Total waste generation went from 531kg/capita in 2000 to 464kg/capita in 2017;
- Residual waste was reduced by 77 kg/capita between 2008 and 2017;
- In 2016, more than 7,400 tons of organic waste were composted, leading to save around 800,000 euros of waste management costs.

ROUBAIX (FRANCE)

The town of Roubaix, situated in northern of France, is a post-industrial area, considered to be the poorest town in France, with 46% of people living below the poverty line. Lacking the legal competency to decide and change waste collection and treatment practices, Roubaix had to find new ways to transition to Zero Waste. In 2014, the town addressed waste at source, by creating a vibrant constellation of actors committed to reducing their waste: families, schools, businesses, associations, and the municipality itself.⁷⁸

In only one year the city of Roubaix achieved impressive results:

- 25% of households managed to reduce their waste generation over 80%, and 70% of them reduced it by 50%;
- Families who took up the challenge have also seen important economic savings;
- The network of actors involved in moving the town forward grown fast and helped to create a social fabric.

Now, Roubaix is not only contributing towards the national path to Zero Waste but it also portrays a new image of itself as a city.

PARMA (ITALY)

In the North of Italy, Parma is located in Emilia Romagna, the top waste producer among Italian regions, with 636 kg of waste per capita in 2014. With its 190,000 inhabitants, Parma was not in a better situation than the rest of the region: separate collection had stagnated around 45% for years and waste generation was significantly high. This led the province to propose the construction of an incinerator in 2012.⁷⁹

⁷⁷ Zero Waste Cities, [The story of Besançon](#) (2018).

⁷⁸ Zero Waste Cities, [The story of Roubaix](#) (2018).

⁷⁹ Zero Waste Cities, [The story of Parma](#) (2018).

However, thanks to social mobilization, the need for a new model of waste management became a central element during the local council elections, which removed the pro-incineration mayor and elected a new one that was committed to start a journey towards Zero Waste. Two main measures were taken:

- Introduction of door-to-door separate collection system;
- Introduction of a Pay-As-You-Throw scheme.

Parma became a vivid example of transition from traditional waste management to Zero Waste. Thanks to political will, involvement of civil society and a clear strategy based on minimizing residual waste, Parma achieved significant results in only 4 years:

- Total waste generation reduced by 15%;
- Separate collection increase from 48% to 72%;
- Residual waste rate decreased by 59%;
- Reduction in the overall annual costs;
- Increase in the number of jobs connected to waste management.

GIPUZCOA (SPAIN)

Thanks to an alternative infrastructure plan, the Spanish province of Gipuzkoa has managed to almost double its recycling rate in 4 years and made investing in an incineration plant obsolete.⁸⁰ In 2011, Gipuzkoa struggled to meet EU recycling targets (50% by 2020), but its new plan aimed at phasing out the disposal of recyclable waste and stopping landfilling of untreated waste. To achieve these ambitious goals four measures were implemented:

- Intensive separate collection;
- Special attention to the treatment of organic waste, for which especially dedicated practices such as home-composting and community composting were encouraged;
- Specific projects were developed with social players to build awareness about waste reduction and reuse;
- To prevent food waste, the government collaborated with the Food Bank of Gipuzkoa to work with people with risk of social exclusion.

Today, the province is the living proof that a transition towards a circular economy is possible:

- Waste generation reduced by 7%;
- Residual waste reduced by 32%;
- Recycling rate raised from 32% to 51%;
- Creation of 10 times more jobs in the treatment of waste;
- Distribution of hundreds of tons of food to people in need.

LJUBLJANA (SLOVENIA)

In 2014, the Slovenian capital Ljubljana became the first European Capital to officially move towards Zero Waste. The city has managed to multiply its separate collection of organic waste and to reduce the amount of waste sent for disposal by 59% while maintaining waste management

⁸⁰ Zero Waste Cities, [The story of Gipuzkoa](#) (2018).

costs among the lowest in Europe.⁸¹ To do so, Snaga – the public company that provides waste management in the province of Ljubljana – adopted three main strategies:

- Introduction of a door-to-door collection system, specifically focused on the collection of organic waste;
- Lower the frequency of collection for residual waste while keeping the collection of recyclables and organic waste the same;
- Strong communication strategy focused on prevention and reuse to engage citizens.

After 10 years, data speak for themselves:

- Total waste generation decreased by 15 %;
- Recycled or composted waste average went up to 61%;
- The amount of waste sent to landfill decreased by 59 %.

The city has committed to reducing the amount of residuals and increasing separate collection to 78% by 2025.

CONTARINA (ITALY)

The public company Contarina is responsible for waste management in the district of Priula and Treviso in Northern Italy, serving 50 municipalities and more than 554,000 inhabitants. The decision to keep incineration out of the system, taken by the local administration in 2005, was the pre-condition for maximizing recovery of value, and pushed the province to become the best performer in Europe.⁸² The main success factors were:

- Good political will and commitment to continuously improving the system;
- Transparency thanks to a shared database among stakeholders;
- Great waste separation at source;
- Waste reduction incentives through a Pay-As-You-Throw system.

As a result, separate waste collection reached 85%, with peaks around 90% in some municipalities, ranking far above the national average (42%) while maintaining low waste management costs (178 euros/year/household on average). To improve this already winning system, in 2015 Contarina set to open a Material Recovery and Biological Treatment plant, which reduces the final residues to only 46,5% of the total residual waste. Now, Contarina recycles twice the European average and generates five times less residual waste.

VHRNIKA (SLOVENIA)

In a country that until 2001 had no national targets for separate collection of waste, the case of the small municipality of Vrhnika (18,000 inhabitants) in Slovenia shows how a community can make strides towards a Zero Waste objective in a short time. Without a tradition of recycling, Vrhnika managed to reach 76% separate collection of municipal solid waste, showing how a small area can go from landfilling everything to recycling most of its waste in 20 years.⁸³

⁸¹ Zero Waste Cities, [The story of Ljubljana](#) (2019).

⁸² Zero Waste Cities, [The story of Contarina](#) (2018).

⁸³ Zero Waste Cities, [The story of Vrhnika](#) (2018).

In 2004, the Municipality started implementing the first separate collection model in Slovenia, in several steps:

- Setting up the necessary logistics and legislative framework for the new separate collection of recyclable waste through a mix of door-to-door and “eco-islands” collection system;
- Introducing a Pay-As-You-Throw scheme;
- Engaging the community with activities in schools and partnerships with local businesses;
- Implementing a strong awareness-raising communication strategy to change the public’s perception of waste and encourage separate collection.

As a result, the municipality's waste decreased from 201 to 80 kg/capita between 2004 and 2013. Moreover, in 2014 the waste management company opened a reuse center on its collection site, to upcycle waste into desirable goods and recover items that would otherwise be sent to landfills.

ARGENTONA (SPAIN)

The town of Argentona (12,000 inhabitants), in the north-east of Barcelona, spearheads the network of Catalan Zero Waste municipalities. Up until 2004, Argentona was recycling less than 20% of its total waste as most of the waste generated was taken to the local incinerator. The opportunity to move away from this system came after the incinerator in Mataró showed signs of saturation.⁸⁴

In 2004, the municipality started its journey towards Zero Waste introducing a new door-to-door collection system and a Pay-As-You-Throw system that pools further some of the unsorted recyclables within the residual waste. Doing so, Argentona achieved impressive results and paved the way for other Catalan municipalities to walk the path to Zero Waste:

- The recycling rates more than doubled in the area reaching a peak of 68.5% in 2012.
- The number of jobs tripled, improving social inclusion and raising the environmental awareness of the community.
- The municipality managed to save up to 35,000 euros per year.
- The overall residual waste decreased by 15%.

Over the last few years, more and more Catalan municipalities have been adopting the door-to-door collection system and other prevention measures that have proven to be successful in Argentona.

CAPANNORI (ITALY)

Located in the North of Italy, Capannori (46,700 inhabitants) is the first town in Europe which declared the Zero Waste goal in 2007. Led by a primary school teacher, Rossano Ercolini (President of Zero Waste Europe), a small but determined movement stopped the construction of an incinerator and convinced the municipality to commit to sending zero waste to landfill by 2020. Transparency and public consultations with residents were the keys of the successful strategies, which featured:⁸⁵

- Creation of a door-to-door collection system;

⁸⁴ Zero Waste Cities, [The story of Argentona](#) (2018).

⁸⁵ Zero Waste Cities, [The Story of Capannori](#) (2018).

- Introduction of a Pay-As-You-Throw fee;
- Trainings for the community and strong engagement of the residents;
- Creation of the first Zero Waste Research Centre in Europe in 2011;
- Opening of a Reuse Centre where items such as clothes, footwear, toys, and furniture can be repaired and sold to those in need, thereby diverting them from landfill and serving a vital social function.

In less than 10 years, results have been astonishing:

- Waste generation per person was reduced by 39%;
- Separate collection rate increased to 82%;
- Residual waste per capita reduced by 57%;
- Waste tariffs for residents have been reduced by 20%;
- 93 tons of items were offered at the Reuse Centre;
- Capannori became an international example: inspired by its success, today nearly 400 European municipalities are walking the path towards Zero Waste.

FREIBURG (GERMANY)

With a high-performing waste management system that reaches a 70% recycling rate, innovative projects in renewable energy, green mobility and energy savings, the beautiful city of Freiburg is known to be the “greenest city in Germany”. But although the city is a leading example in sustainability, it could not escape the pressing current issue of single-use coffee cups.

That is why in 2016 Freiburg’s mayor decided to launch the FreiburgCup scheme. The voluntary scheme of reusable cups under a deposit was introduced with three main objectives: the promotion of reusable cups, the reduction of litter and the promotion of a more sustainable consumer behavior. Thanks to the media coverage when the project started, there was a quick rise in the local cafes involved in the scheme, which started with 15 and reached 45 cafes in a month.

It is very simple to enter the deposit scheme: customers who want to participate just have to pay a one-euro deposit when ordering their coffee. They can get the deposit back when they return the reusable cup to any of the cafes or shops that have joined the scheme. This does not seem to be an inconvenience for the customers, since it is estimated that currently around 60-70 % of local coffee shops participate in the FreiburgCup project.⁸⁶

As of now, some challenges remain, especially due to the fact that the system is still voluntary-based, not mandatory. But it is clear that the scheme has achieved its main objectives: the amount of litter is reduced, consumers are given an alternative to disposable cups, and the FreiburgCup has managed to raise awareness on the need to cut on single-use cups.

EXAMPLES OF ZERO WASTE BUSINESS SUCCESS IN EUROPE

It is worthwhile to highlight again that Zero Waste policies are a good way to stimulate the economy and create new jobs. Here are a few examples of successful Zero Waste businesses in the EU:

⁸⁶ Zero Waste Europe, [Meet the FreiburgCup: paving the way for zero waste coffee to go](#) (2018).

- **PHENIX:** In 5 years, PHENIX has saved from the bin 30.000 tons of products and distributed 60 million meals across France. A winning solution that effectively prevents waste, creates jobs and makes businesses and individuals save money while helping charities. The PHENIX Connect platform puts businesses having food surplus in contact with structures able to use this supply; secondly, they moved forward creating a complete support service.⁸⁷
- **REPACK:** RePack shows that Zero Waste and online shopping can work together. This company ensures a closed-loop system that can reduce ecommerce packaging by 96% while providing the same consumer experience as the disposable one.⁸⁸
- **EREUSE:** eReuse is a perfect example of how symbiosis between the digital agenda and waste management can create value, sustainability and jobs. This company expands the life of electronic devices while incorporating blockchain traceability technology capable of creating 1 job for every 300 items reused. Its approach ensures a 95% recycling rate and transforms a cost for municipalities into revenue that stays in the community.⁸⁹
- **RECIRCLE:** This company's approach has transformed take-away restaurants in Switzerland. In two years, more than 400 restaurants across the country have been using Recircle's 70,000 reusable meal boxes. A winning solution that prevents waste and saves money to restaurants and cities.⁹⁰

EXAMPLES OF ZERO WASTE SUCCESSES IN ASIA

Of course, Zero Waste policies has not proved successful only in the European Union. All around the world, including in the Global South, great success stories have also been paving the way towards a Zero Waste planet. The following examples show that, in fact, Zero Waste solutions are already working successfully in Asia, with tailored programs that are far more adequate than incineration to the realities of these countries.

PENANG (MALAYSIA)

The state of Penang, Malaysia is host to various Zero Waste initiatives that are now ripe for scale up. In 2016, the Consumers' Association of Penang (CAP) started to leverage the existing waste segregation-at-source policy in the state of Penang. This policy was limited to separation and collection of dry and clean recyclables such as paper, plastic, glass, aluminum cans, and metals, among others. Organic waste, meanwhile, was collected twice a week and discarded as general waste.

Therefore, CAP focused on recovering organic waste from the general waste by introducing various methods of composting at the domestic level. CAP partnered with schools and residential complexes in Penang to introduce various types of composting methods. CAP also worked closely with several schools to manage garden waste, kitchen waste, and food waste in their schools.

⁸⁷ Zero Waste Europe, [The story of PHENIX: a recipe to effectively enforce food waste reduction targets](#) (2019).

⁸⁸ Zero Waste Europe, [The Story of RePack. A simple solution to the growing problem of e-commerce waste](#) (2019).

⁸⁹ Zero Waste Europe, [eReuse: how to dramatically increase reuse and recycling rates in the WEEE sector](#) (2018).

⁹⁰ Zero Waste Europe, [Recircle: who said that take-away food cannot be zero waste?](#) (2018).

Thanks to CAP efforts, waste generation per capita decreased by 25% in one year, from 2016 to 2017. CAP repeatedly urged the state government to stay on course towards Zero Waste. With Penang achieving a record-high 43% recycling rate in 2018 (more than double than the national average of 21%), the state has great potential in reaching a higher waste diversion target and is now an inspiration for the rest of the country.⁹¹

TRIVANDRUM (KERALA, INDIA)

In 2011, the city's only municipal landfill was forced to shut down following local protests over the mismanagement of the waste in the site. Facing public pressure, the Trivandrum municipality introduced in 2013 a decentralized system for waste management with source separation and door-to-door collection that successfully manages the waste without burning or burying.⁹²

Moreover, in 2015, the Trivandrum municipality put forward a comprehensive program to reduce single-use plastic called Green Protocol, which applied a ban on plastic bags, banners, bottled water, food containers, Styrofoam decorative materials, and replaced single-use cutlery with stainless steel materials in festivals and events.

Thanks to the extensive door-to-door campaign, 40% of households are now segregating their waste and managing their own kitchen and garden waste through at-home composting. The application of the plastic-free Green Protocol to Attukal Ponkala, one of the largest religious festivals in the world, reduced its waste from 400 tons down to just 65 tons. Overall, the success of the program has been ensured by a strong engagement and leadership of the community, which are included in the institutional governance structure to design, plan, implement and monitor solid waste management in the city. The Green Army International, a group of young volunteers, have been instrumental in the implementation of the Green Protocol.

KAMIKATSU (JAPAN)

In 2001, the town of Kamikatsu banned the use of their incinerators installed just three years prior, following a national regulation due to health concerns about the amount of dioxins produced by small-scale incinerators. In 2003, the town declared its Zero Waste goal of eliminating waste by 2020, without resorting to incinerators or landfills.⁹³

In 2005, the Zero Waste Academy, a local non-profit organization, was born to provide services to turn waste into something useful. The Zero Waste Academy trains local shops on how to recycle waste products and partners with them in conducting waste audit reports to identify the different categories of waste. On top of that, the NGO manages a Zero Waste accreditation scheme, where local businesses are given certification according to their efforts to reduce waste and control its use of single use products. It also manages the waste management center, which later expanded to include a circular shop, where locals can drop off items they no longer need and take away any of the items that were also dropped off there for free.

Today, households themselves sort their waste into 45 categories. There are no trash collectors in Kamikatsu: people wash and dry their waste before to transport it by themselves to the waste

⁹¹ GAIA, [Making a Case for Zero Waste. Laying the Groundwork for Zero Waste](#) (2019).

⁹² GAIA, [Greening Kerala. The Zero Waste Way](#) (2019).

⁹³ GAIA, [Small Town Big Steps. The Story of Kamikatsu, Japan](#) (2019).

management center, where the final waste segregation is done. Only the waste of the elderly is collected by a waste collector following a fee-based scheme. This approach has led the town to where it is today: 81% of its garbage is recycled. That is on top of what is reused and composted.

Following the implementation of the Zero Waste program, Kamikatsu has saved a third of the town's former costs from waste incineration. Recycling earns them 3 million Japanese Yen (75 million MNT) per year – which technically is more cost-efficient than incinerating – and selling waste like paper or metals helps offset Kamikatsu's waste disposal costs. The only thing that prevents the town from becoming 100% Zero Waste is the reality that some manufacturers refuse to change the nature of their production process – they still use non-recyclable packaging and materials in their products.

PHILIPPINES

OVERALL

The Philippines is an Asian country that has adopted progressive laws on municipal solid waste management for a while now. The country's solid waste management law requires the decentralization of waste collection down to the smallest unit of government, defines the roles of various actors (households, communities, cities and municipalities), and mandates the creation of materials recovery facilities and the closure of open dumpsites. The country also has a law that totally bans incineration, including for producing energy. Cities and communities that have strictly implemented these laws are now among the most advanced Zero Waste models in the country.

Waste management in the Philippines is governed by a national law called the Ecological Solid Waste Management Act of 2000 or Republic Act 9003 (RA 9003). This law puts the prime responsibility of waste management on the barangay (small administration unit equivalent to Mongolian soum or khoroo). It requires the barangay: to implement waste segregation at source; to collect and manage all biodegradable, reusable, and recyclable wastes; to build necessary facilities and to acquire the appropriate land and vehicles to manage waste; and to employ personnel to deliver waste services.

It is mandatory for households to sort their waste, and the waste collectors employed by the village collect this sorted waste regularly. Collected waste is brought to a materials recovery facility, where the biodegradables are composted, the recyclables are temporarily stored until they are sold, and the residuals are kept until the city truck picks them up for disposal.

POTRERO MALABON

Malabon City (a highly-urbanized and densely populated city in Metro Manila, Philippines) has to deal with massive flooding throughout the year and especially during the rainy season. The volume of waste generated by the residents is a key factor contributing to the flooding. Potrero, its largest and most-populous barangay (with 54,000 residents from approximately 13,500 families) took on the Zero Waste challenge and emerged successful, thanks to the will and support of elected officials, institutional funding, and the guidance of Mother Earth Foundation (MEF) – an organization that actively promotes Zero Waste in the Philippines. Moreover, their success has encouraged the wider City of Malabon to implement a city-wide Zero Waste program starting in 2017 to the rest of the barangays in the city, many of which are now in advanced implementation.

Today, almost 90% of Potrero residents practice waste sorting at source. Flooding still occurs (because of the topography); but unlike before, there are no plastics or food waste floating in floodwaters anymore. After the first flood following implementation of the Zero Waste policies, the absence of floating waste was a significant eye-opening event for the residents of Potrero.

An informal waste picker in Potrero used to earn about 20-40 USD a month from selling recyclable materials to junk shops; whereas now they receive a monthly salary of 60 USD as a formal village waste worker, on top of what they earn selling recyclables from the recyclable waste they collect from households.⁹⁴

SAN FERNANDO

The City of San Fernando is a busy capital divided into 35 villages or barangays. It initially struggled with the implementation of national law RA 9003 with several missteps, including a contract to build a gasification plant (which was still not built three years into the contract). In 2011, to remedy this poor situation, San Fernando formed a partnership with Mother Earth Foundation.

The positive results have been striking:⁹⁵

- The city has now covered all 35 barangays and has reported 93% compliance with RA 9003, with 85 fully functional materials recovery facility (MRF) located in barangays, private subdivisions, schools, health care facilities, public markets and business establishments. A policy of “no-segregation/no-collection” has also been strictly implemented.
- The city's waste hauling costs were reduced by 50% within just a few years. Additionally, the savings that come from diverting waste from landfills also increased dramatically. For 2018, San Fernando has saved approximately 20 million PHP (over 1.2 billion MNT) all from proper solid waste management from the barangays.
- After the city implemented a Zero Waste program, they have diverted most of their waste, from 12% in 2012 to 80% in 2018, proving that systemic change – and not expensive technology – is the best way to efficiently manage our waste. They plan to increase that to 91% by 2025.
- As of June 13, 2015, San Fernando has declared a total ban on plastic bags, which today has an 85% compliance rate.
- Through the partnership with MEF, waste workers have been formalized and fully integrated into the waste management program at the barangay and city levels since 2012. Waste workers have also organized themselves into the city-wide San Fernando Waste Workers Association, the president of which sits in the city's Solid Waste Management Board.

TACLOBAN CITY

Already burdened with a waste problem due to lack of an efficient waste management system, the city of Tacloban had to suddenly deal with massive wastes from the wreckage brought by typhoon Hayan in 2013. Having to clear the city of the debris from uprooted trees and broken buildings and houses, the city immediately filled up its dumpsite. At the time, the city was providing collection

⁹⁴ GAIA, [Route to Zero Waste. A Flood-Prone City Shows How It's Done](#) (2019).

⁹⁵ GAIA, [Picking Up the Baton. Political Will Key to Zero Waste](#) (2019).

services to only 30% of the households with an annual budget of 80 million PHP (5 billion MNT), most of which went to waste collection services operated by private companies.⁹⁶

Tacloban City sought affordable and feasible options to expand waste collection services to the remaining 70% households. In 2017, the city passed legislation requiring residents to segregate at source. Moreover, they took on a multi-pronged approach, using policy instruments, an IEC (information, education, and communication) campaign, and enforcement mechanisms. The key element was the household door-to-door visits – they reached 36,615 households – which served as a one-on-one learning experience for residents.

After the IEC campaign, Tacloban city implemented a door-to-door waste collection system. For the first time, residents in areas with narrow roads that are not accessible to large dump trucks experienced the convenience of at-source waste collection thanks to 52 pedicabs (bicycles with a sidecar attached) and plastic drums. A cash assistance of 15,000 PHP (930,000 MNT) was also provided to barangays to help with the initial set-up and construction of their Material Recovery Facilities.

This Zero Waste strategy quickly paid off: while waste collection services prior to the implementation of Zero Waste program covered only 30% of the households, now they reach almost 100% and reduced their bill by almost 22 million PHP (1.4 billion MNT) thanks to the waste diverted from landfill (dumped waste has already decreased by 31%). Tacloban City aspires to elevate its waste diversion rate to 95%. City officials and MEF staff are hopeful that Tacloban City, the only highly urbanized city in eastern Visayas, will serve as a Zero Waste model for the region.

FORT BONIFACIO

The barangay of Fort Bonifacio in Taguig City was facing an untenable situation in regards to waste: local residents simply left most waste in an informal dumpsite and four trucks came every day just to collect that waste and bring it to a landfill. Following national law RA 9003, the barangay formally established an ecological solid waste management program, mandating correct segregation, collection, recycling, and disposal, as well as a materials recovery facility (MRF) site.⁹⁷

The barangay's eight zones trialed the collection of segregated wastes one by one, with a one-week grace period to get it right. When the project went into full operation, local workers started to collect the waste every day, but organic waste and recyclables were collected separately. Once segregation was established, hauling trucks were no longer allowed to enter the barangay, except to go to the MRF.

The ordinance also stipulated the creation of a team (comprising several groups from local communities) to support operations and enforcement of the law. As the “eyes and ears” of the project, the influential community organizers regularly engage with households and monitor the collection of sorted waste. At the same time, they have an intimate knowledge of the community. Brochures about the program were distributed door-to-door while carefully explaining its contents. Despite the project team's tireless efforts, getting all people on board is always a long and difficult battle. But difficulties were solved with a combination of further education and a

⁹⁶ GAIA, [Sunshine After the Storm. A Typhoon-Ravaged City Rises to Become Zero Waste](#) (2019).

⁹⁷ GAIA, [Pioneer of Zero Waste. The Village that Inspired Cities to Go Zero Waste](#) (2019).

system of fines. Having a strong policy, coupled with the dedication of residents, community organizers, and local waste workers, has helped the barangay pull through.

The project team, together with volunteers, cleaned up the infamous dumping area for residential and commercial mixed waste. They built a fence enclosing the site, and added a shed and pathway. As a final touch, they created a garden, thus transforming the site into the MRF and eco-park. Barangay Fort Bonifacio reached a milestone when it became a model community for solid waste management, inviting others to learn from its experiences.

At least five barangays in Taguig have introduced door-to-door collection, while students from the school next door are learning how to segregate first-hand and applying this knowledge in their own homes. As an eco-tour site, it has drawn many visitors inspired by their story, including representatives from 22 municipalities and cities of the province of Pampanga.

As of June 2019, Fort Bonifacio boasts a 95% household compliance rate. Waste diversion serves as an indicator for both income – as recyclables are sold – and project success, insofar as most residents continue to segregate. The most evident impact of the project is the complete transformation of the dumpsite into a park that people can visit and enjoy.

Today, Fort Bonifacio's waste diversion rate is 80% – around the same level as other Zero Waste models like San Fernando (Philippines) or Kamikatsu (Japan). As the number of dump trucks dropped from four in 2012 to one per day in 2013, just a year after the project began, hauling expenses have similarly been slashed by 75%.

SEOUL (SOUTH KOREA)

In Seoul, South Korea's progressive waste diversion policies are a model for the world. Given the space limitation for landfill and the level of population density, waste reduction and waste diversion from landfills have been the key priorities for Seoul. Today, the city's visionary solid waste management policies include a volume-based waste disposal fee system, a deposit refund system, extended producer responsibility, and bans on problematic products and packaging.

As part of Seoul's plastic-free policy initiatives, local environmental groups are leading several campaigns to phase out plastic products, including plastic cups and straws, plastic bags, food delivery containers, and plastic laundry covers. Seoul City has been making a leap forward to become the forefront of Zero Waste, with its commitment to sending zero municipal solid waste to landfills and achieving a recycling rate greater than 66% by 2030. On plastic pollution, the city plans to halve the amount of disposable plastic items used by 2022, while increasing the recycling rate to 70%.⁹⁸

The volume-based waste disposal fee system was one of the keys to success. Residents pay different fees for the bags depending on the size and the regions in which they reside, while enjoying a free service for collection of recyclables. The law requires that residents properly sort out their waste and imposes fines of up to approximately 3.5 million MNT per violation of the rules.

After introducing this disposal rate system for food waste in 2013, which is also aligned with Seoul's highly digitalized waste information databases, the city achieved a 20% reduction in food waste. Instead of providing disposable items free of charge, a deposit scheme was applied, which requires

⁹⁸ GAIA, [Citizens at the Center. Seoul's Journey to Zero Waste](#) (2019).

a monetary deposit on beverage containers. The city has organized multi-stakeholder meetings including government officials, residents, small business owners, and NGOs in order to evaluate the existing infrastructure and build a Zero Waste (single-use-free) community. In 2017, Seoul Government opened Seoul Upcycling Plaza, an upcycling center that aims to raise awareness on environmental, social, and economic advantages of upcycling.

BANDUNG (INDONESIA)

Bandung is the third largest city in Indonesia, where 2.5 million people live and produce above 1,500 tons of waste every day. On February 21st, 2005, a wall of waste collapsed on more than 80 houses surrounding the Leuwigajah landfill in the Greater Bandung area – killing 157 people. In 2018, three years after the incident, Indonesia enacted a new Waste Management Law with an intention to change its waste management system from a collect-transport-dump scheme to a more integrated system that incorporates collection, sorting, recycling, and waste processing. The national policy seeks to manage 100% of waste by 2025, 30% by reduction and the remaining 70% should at least be handled safely.⁹⁹

YPBB (a non-profit environmental organization based in Bandung) developed a Zero Waste plan for the city. Given that household waste is 63% organic, 23% recyclable, and 14% residual waste, Bandung can potentially reduce the amount of household waste brought to landfills by as much as 86%. Reaching this goal would bring down its waste collection, transportation and landfill expenses to only 19 billion IDR (4.4 billion MNT) per year instead of current 137 billion IDR (32 billion MNT). Potential savings can later be utilized in hiring more waste workers and in developing more collection, decentralized recycling and composting facilities.

YPBB adopted this approach in four villages, implementing waste segregation in households, door-to-door waste collection, and composting of organic waste. In a year, these pilot sites achieved a 44% compliance rate among households, one of the highest in Indonesia. Sukaluyu, one of Zero Waste model districts in the city, manages a network of community-scale composting spaces where almost all organic waste from area is processed.

⁹⁹ GAIA, [Kang Pisman. Paving the Way to a Zero Waste Indonesia](#) (2019).

CONCLUSION

Overall, this review of case studies clearly shows that waste-to-energy falls short of being a relevant option to solve the waste crisis in Mongolia – like in the rest of the world. Analysis of available data and scientific knowledge inevitably lead to concluding that:

- Waste-to-energy incineration is not a clean renewable energy: it is inefficient and totally incompatible with global and national objectives to mitigate climate change;
- Waste-to-energy incineration releases substances that are extremely toxic and hazardous for human health and ecosystems;
- Waste-to-energy incineration isn't a complementary technology to other relevant waste management solutions: it is a dreadful disincentive to reducing, sorting, reusing and recycling waste;
- Waste-to-energy incinerators are extremely expensive: they are a financial liability for states and cities that burden public budgets and household living standards;
- Waste-to-energy incinerators do not make waste disappear and do not replace landfills: they merely turn relatively non-hazardous waste into highly toxic byproducts that will contaminate the environment even more after being disposed in landfills;
- Waste-to-energy incineration does not help the economy, contrarily to alternative simple and cheap solutions that create much more local and green jobs;
- Waste-to-energy incineration is not a promising new technology for the future: it actually is an outdated failed technology from which many countries and organizations – starting with the European Union – have been moving away.

Through the example of a several case studies in Europe and Asia, this report also clearly demonstrates that alternatives do exist to solve the waste crisis. These solutions, broadly referred to as “Zero Waste”, are not only very effective from a waste management perspective but also come with countless other advantages – such as creating livelihoods, saving money to public funds, protecting human health and ecosystems, and mitigating climate change.

The Zero Waste approach entails a virtuous cocktail of policies and practices that lead firstly to improving resource efficiency and reducing waste generation at the source, and secondly to effectively enable reusing or recycling of whatever waste is still produced. As such, embracing Zero Waste means to primarily focus on upstream core challenges like clean production, producer accountability, or waste minimization programs for dangerous and hard-to-recycle materials – rather than constantly be looking for silver-bullet waste management technologies. Simply put, the Zero Waste approach doesn't aim to find technological “solutions” like waste-to-energy to manage our waste; Zero Waste aims to make waste disappear in the first place and thus make high-tech “solutions” unnecessary.

The European and Asian success stories displayed in this report show that the waste crisis in Mongolia is not inevitable nor unsolvable. But they emphasize that we need authorities to make the right choices and have the political courage to adopt and enforce bold Zero Waste long-term policies. Although each solution needs to be adapted to the local context, the experience of the most successful Asian cities and villages show clear commonalities. These main common features lead to conclude that:

- **ZERO WASTE SOLUTIONS ARE DECENTRALIZED:** Separation of waste at the source and door-to-door collection allow a much higher rate of material recovery than sorting mixed waste in a downstream facility. In Zero Waste communities in the Philippines, for example, waste management is decentralized down to the village level, just like we can and should do in Mongolia at the soum-level.¹⁰⁰ Households are mandated to sort their waste, and the waste collectors employed by the village collect these discards regularly. Collected wastes are brought to a materials recovery facility, where the biodegradables are composted (when they are not home-composted directly by households), the recyclables are temporarily stored until they are sold, and the residuals are kept until the city truck picks them up for disposal. To a large extent, these measures are similar to those successfully implemented by Ecosoum in Khishig-Undur soum since 2020. The same approach could easily be implemented in all other soums and aimag-centers – and even in each khoroo in Ulaanbaatar.
- **ZERO WASTE SOLUTIONS PAY SPECIAL ATTENTION TO ORGANIC WASTE, THE LARGEST SHARE OF HOUSEHOLD WASTE:** In Asian developing countries, organic share of household waste is typically 50 to 70% of all municipal solid waste, while in high-income countries organics account for typically 20 to 40%.¹⁰¹ Thus, a relevant Zero Waste program ensures source separation and collection of organic waste to do composting or biogas, instead of any thermal technology which is completely inadequate to deal with organic waste. Ecosoum’s analysis of the waste management situation in Bulgan city showed that separating organic waste at the source would be one of the few key measures that would lead to immediate and significant improvement of the local waste management system.¹⁰²
- **ZERO WASTE SOLUTIONS ARE COMMUNITY-LED AND COMMUNITY-CENTERED:** Efficient programs not only have the buy-in of the community, they are also community-led. This ensures that the program supports community organizing, education, and democracy, so that all citizens can participate and shape local resource management plans and tailor it to their specific needs and context. In Trivandrum, India, young volunteers have been instrumental in the implementation of the Green Protocol, a government initiative to excise single-use plastics out of public events. Likewise, in Khishig-Undur soum, the entire waste management system was designed and has been implemented by local citizens within Ecosoum NGO.
- **ZERO WASTE SOLUTIONS ARE COST-EFFICIENT:** Zero Waste upstream programs can be far more affordable than downstream industrial infrastructures. For example, prior to Zero Waste program implementation, the City of San Fernando (Philippines) was spending 1.4 million USD annually on waste collection and disposal; with its Zero Waste program, the city has reduced its spending for waste disposal to 677,404 USD – a savings of nearly 50%. With adequate Zero Waste policies, Ulaanbaatar could also save a lot of money while improving waste management in the city – instead of contracting another tremendous debt for an unnecessary incinerator that would not lead to any real improvement.

¹⁰⁰ Ecosoum, [How to set up proper waste management at the soum level](#) (2021).

¹⁰¹ Ecosoum studies show that in rural Mongolia, food waste accounts for app. 23% of all household waste, excluding stove ash. See Ecosoum, [Waste composition study. Data analysis report](#) (2020).

¹⁰² Ecosoum, [Recommendation report for waste management scheme in Bulgan aimag](#) (2022).

- **ZERO WASTE SOLUTIONS PROVIDE LIVELIHOOD AND EMPOWER WASTE WORKERS:** Zero Waste programs integrate waste workers as the heroes in program implementation. Without them, the program would not stand a chance. Zero Waste improves the lives of waste workers by providing them livelihood and giving dignity to their work. In the Philippines, the waste workers that used to pick waste from the streets and landfills have been officially integrated into the Zero Waste program as formalized waste workers, which allowed them to earn better wages under better working conditions. Mongolian informal waste workers in both urban and rural areas could play a similar role and likewise benefit from adequate Zero Waste programs while providing an essential public service.
- **ZERO WASTE SOLUTIONS HAVE CHAMPIONS AND LEADERS WITH STRONG POLITICAL WILL:** In communities and villages that have made big strides in their Zero Waste program implementation, there is always at least one leader championing Zero Waste. Program implementation is beset with many challenges, among them changing people’s behavior. Without strong political will, Zero Waste programs cannot fly. In rural Mongolia, Ecosoum’s experience does show that local authorities’ motivation and commitment is an essential key to success.
- **ZERO WASTE SOLUTIONS HAVE SUPPORTIVE POLICIES THAT ARE STRICTLY IMPLEMENTED:** Zero Waste programs drive the development of progressive policies addressing social, economic and environmental concerns, with proper enforcement mechanisms. In South Korea, Seoul’s visionary solid waste management policies include a volume-based waste disposal fee system (where residents are charged based on the volume of waste generated), a deposit refund system, extended producer responsibility, and bans on problematic products and packaging. South Korean waste management law also requires households to sort their wastes and imposes a penalty of 1,000 USD per violation. If Ulaanbaatar city’s authorities were willing to follow Seoul’s example, there is no doubt similar results could be quickly achieved.
- **ZERO WASTE SOLUTIONS ARE AGAINST WASTE-TO-ENERGY TECHNOLOGIES:** Incineration, even when called “waste-to-energy”, undermines Zero Waste objectives by committing the system to ongoingly feed incinerators with easy-to-burn (plastic) waste. Moreover, incinerators create new financial, environmental and health problems. In 2001, Kamikatsu banned the use of their incinerators installed just three years prior; today it is one of the most advanced villages in the world in terms of proper waste management. In the end, the lesson learnt from all these success stories is that there is no need for magical high-technologies to solve the waste crisis, whether it is incineration or other dubious “solutions” like plastic-to-fuel, chemical recycling or bioplastics – which are all proven to bring at least as many problems as they claim to solve.¹⁰³ Unarguably, adopting simple but effective Zero Waste policies is the way to achieve truly sustainable waste management.

¹⁰³ Break Free From Plastic, [Plastic Solutions Review](#) (2022).