ZERO WASTE EUROPE

SUSTAINABLE FINANCE FOR A ZERO WASTE CIRCULAR ECONOMY

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INTRODUCTION

The global community has set concrete benchmarks for the transformation of the global economy under the Paris Agreement[1], the Sustainable Development Goals[2] and other international commitments on climate and sustainability. Sustainable Finance has a key role to play in mobilising the necessary capital to deliver on the policy objectives. As financial and government leaders call for investments that support resilient economies and sustainable recoveries from the impacts of the COVID-19 pandemic,[3] Sustainable Finance will help ensure the right investments to meet these goals.

To make future economies more resilient, many countries will need systems that can build and retain more human and physical capital during the recovery – using policies that reflect and encourage the post-pandemic need for new types of jobs, businesses and governance systems.
(World Bank, June 2020)

The European Union is driving the transition to a net-zero emissions, more resource-efficient and sustainable economy. In December 2019, the Commission presented the European Green Deal (EGD)[4], a growth strategy which aims at making Europe the first climate neutral continent by 2050. The EGD will mobilise at least €1 trillion of sustainable investments over the next decade.

To guide investment, the EU developed the EU Taxonomy Regulation[5], providing criteria for what economic activities can be considered '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. The EU Taxonomy Regulation EU) 2020/852[6] has put forward a comprehensive list of activities within the waste sector that fulfill this criteria, **notably excluding Waste-to-Energy incineration as it may harm one of the key environmental objectives, to ensure the transition to a circular economy, waste prevention and recycling**.

Going forward, the **Sustainable Finance Taxonomy will become the basis for the development of new regulatory frameworks for the financial sector**, potentially integrated into the EU Green Bond Standard[7]. Moreover, this model could have an enormous impact all over the world: it may be replicated and adapted to European aid agencies operating in other regions across the world like for example GIZ (German Corporation for International Cooperation), AFD (French Development Agency) or SIDA (Swedish International Development Cooperation Agency), and it will be a critical precedent for all International Finance Institutions like World Bank

[1] ec.europa.eu/clima/policies/international/negotiations/paris_en
[2] sdgs.un.org/goals
[3] World Bank, Press release: Countries Can Take Steps Now to Rebuild from COVID-19 (June 2, 2020). www.worldbank.org/en/news/press-release/2020/06/02/countries-can-take-steps-now-to-speed-recovery-from-covid-19; C40 Cities
[4] ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
[5] ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en
[6] eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R0852
[7] ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-green-bond-standard_en

Group, the Asian and African Development Banks, Inter American Development Bank, and others, along with United Nations affiliated projects like those related to UN Development Program.

Indeed, at the international level there is still an important lack of common standards around what constitutes 'sustainable finance'; nor are there solid guarantees for transparency and disclosure to avoid greenwashing, which are important to boost investor confidence and ensure high quality impact.

The field of Zero Waste Circular Economy (ZWCE) is particularly vulnerable to the lack of sustainable criteria, since it includes a wide range of activities across sectors and it requires a systems thinking approach. This field is a forward-looking evolution from the conventional waste management aiming to maintain the value of products, materials and resources for as long as possible by returning them into the product cycle at the end of their use, while minimising the generation of waste[8]. The logic of this approach stands on the idea that the fewer products we discard, the less materials we extract, the better for our environment.

While the need to transition towards a circular economy from an economic, environmental and public health point of view is hardly disputed, the concept has often been driven and dominated by a business agenda which raises **the need to define clearly what do we mean by a Zero Waste Circular Economy, and what activities should be eligible and prioritised**.

Most importantly, the pressure from the Waste-to-Energy (WTE) industry to use green finance in Europe and also in countries such as Indonesia, the Philippines and Vietnam in Southeast Asia, to build waste disposal infrastructure is acute and highly problematic, posing a threat to undermine the truly sustainable local opportunities for circular economy and risking to lock these countries into a linear model for decades.

This report aims at responding to this lack of clarity and provides clear criteria to define what activities need to be included under the umbrella of a Zero Waste Circular Economy, looking at the social, economic and environmental benefits. It also analyses the proposed role of Waste-to-Energy incineration in the circular economy, and exposes why this technology is highly counterproductive to the aims and objectives of sustainable finance and should therefore be excluded.

[8] European Commission, Closing the loop - An EU action plan for the Circular Economy

BACKGROUND: THE EU'S CRITERIA FOR CIRCULAR ECONOMY FINANCE WITHOUT WASTE-TO-ENERGY INCINERATION

The EU has played a crucial role in defining sustainability criteria for a Zero Waste Circular Economy. This has been a progressive evolution over the years across different institutions and policies. Here is a recap of the main milestones in this journey:

- In 2011, the European Commission launched the **Roadmap to a Resource Efficient Europe** (COM(2011) 571)[9] 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, landfilling is virtually eliminated and high recycling is ensured*[10]".

- In 2017, **the Communication on Waste-to-Energy**[11] analysed the current role of Waste-to-Energy incineration and gave guidance to Member States on how to cope with the problems generated. For high capacity countries it recommended:

    - Make incineration more expensive with taxes (i.e. gate fees);
    - Phase out public support schemes for Waste-to-Energy incineration and use funds more efficiently to support upper tiers in the waste hierarchy[12], and
    - Put a moratorium on any new facilities and decommission old ones.

  For countries with low capacity, the recommendation was to improve separate collection obligation and recycling, bearing in mind long term targets and considering other infrastructure for waste disposal like cement kilns[13].

- In 2018, after 4 years of negotiations, the **Circular Economy Package** presented a new legislation which aims at recycling 65% of total municipal waste by 2035. Although the targets could have been more ambitious, the legislation contains the relevant elements to move towards a Zero Waste Circular Economy, such as separate collection of organic bio-waste and textiles that become compulsory by 2023 and 2025, respectively, and the call on the Commission to propose targets on waste prevention and food waste reduction[14].

[9] ec.europa.eu/environment/resource_efficiency/about/roadmap/index_en
[10] zerowasteeurope.eu/2011/09/new-eus-resource-efficiency-roadmap-points-in-the-zero-waste-direction
[11] eur-lex.europa.eu/legal-content/en/TXT
[12] zerowasteeurope.eu/2019/05/a-zero-waste-hierarchy-for-europe
[13] zerowasteeurope.eu/2017/01/towards-a-new-european-mindset-on-waste-to-energy
[14] zerowasteeurope.eu/2017/12/circular-economy-member-states-like-it-despacito

- The **Renewable Energy Directive** was revised in 2018, with the European Parliament and European Council approving phase-out subsidies to Waste-to-Energy incineration[15] if separate collection requirements and related recycling targets are not met . Up until then, WTE incinerators would receive subsidies for burning biogenic material, under the false assumption of producing renewable energy, providing up to 10-15% of the income for incinerators. Since then, WTE incinerators cannot receive subsidies if the separate collection targets at national level are not met[16].

- The **EU Cohesion Fund**, which aims at promoting sustainable development and reduce economic and social disparities among all European regions, is now stopping all funds going for increasing Waste-to-Energy incineration capacities with the exception for outermost regions. At the time of writing, the European Parliament has adopted this measure in its position in plenary and it's pending approval at the Council of Europe (where EU States are represented)[17].

- In 2020, the **Taxonomy Regulation** called for the minimisation of waste incineration and classed activities leading to a significant increase in incineration of waste as harmful to the circular economy[18]. On the basis of the Taxonomy Regulation, the draft delegated act on climate change mitigation Taxonomy excluded Waste-to-Energy incineration from a list of economic activities considered 'contributing to the climate change mitigation as it harms the circular economy.

- The **Just Transition Fund**, aiming to support the most affected territories in their economic transformation away from fossil fuels and carbon-intensive industries has included wording that leaves no doubt about waste incineration being ineligible[19]. What was meant for the purposes of Article 4(g) was that these investments follow the order of priority in the waste hierarchy and exclude investments in energy recovery and disposal.

- The **European Investment Bank (EIB)**, the biggest multilateral financial institution and one of the largest providers of climate finance in the world, published its Circular Economy Guide[20] in January 2019 which excludes incineration as a contributor to a circular economy[21]. In October 2019, the EIB pulled out of funding a controversial waste incinerator in Belgrade, Serbia, after the European Commission warned it could threaten environmental targets. The Commission had warned that the incinerator would prevent

[15] zerowasteeurope.eu/wp-content/uploads/2019/10/zero_waste_europe_policy-briefing_REDII_en.pdf
[16] zerowasteeurope.eu/2018/01/the-european-parliament-halts-perverse-subsidies-to-energy-from-mixed-waste
zerowasteeurope.eu/wp-content/uploads/edd/2019/09/zero_waste_europe_policy-briefing_REDII_0cotber2019.pdf
[17] zerowasteeurope.eu/2019/03/cohesion-fund-the-european-parliament-votes-to-help-europes-most-needy-regions-go-circular
www.euractiv.com/section/circular-economy/opinion/how-the-eus-cohesion-fund-can-support-the-circular-economy
zerowasteeurope.eu/2019/02/european-parliament-steps-forward-to-stop-burning-eu-funds
[18] eur-lex.europa.eu/legal-content/EN/TXT
[19] Article 4 g) Investments in enhancing the circular economy, including through waste prevention, reduction, resource efficiency, reuse, repair and recycling;
[20] www.eib.org/attachments/thematic/circular_economy_guide_en.pdf
[21] *While communication from the EC 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".* The EIB Circular Economy Guide. May 2020

Serbia from achieving its recycling and circular economy objectives under the EU Accession Agreement. Moreover, the EIB decided to align its lending with the EU Taxonomy which means that Mechanical Biological Treatment (MBT) , incineration and gas capture in new landfills will be excluded to align with taxonomy[22].

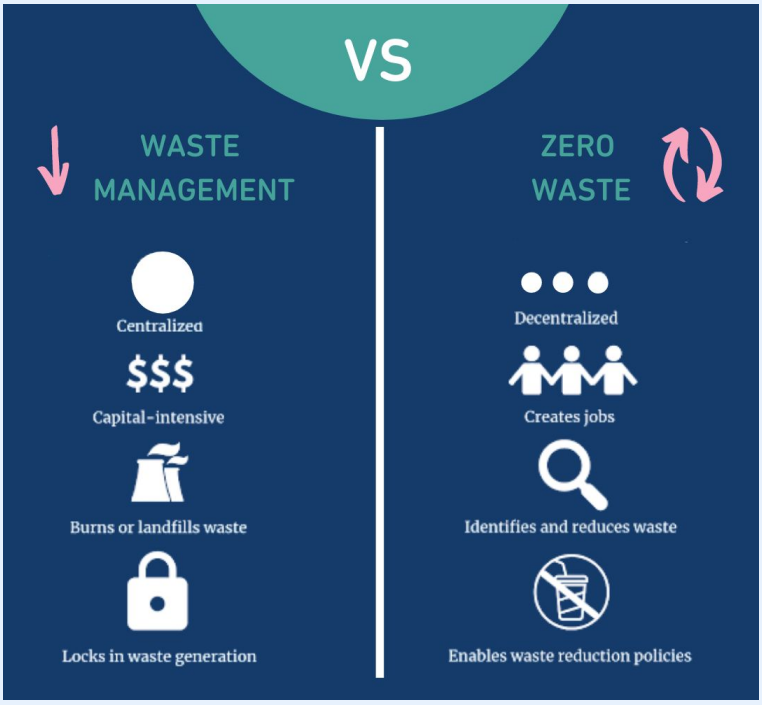
In conclusion, we have witnessed the development of circular economy policies embracing the principles of the waste hierarchy and zero waste, moving away from Waste-to-Energy incineration and prioritising the maximisation of material recovery. These are all critical precedents that need to be considered in the development of criteria for sustainable finance at European and global level.

[22] www.eib.org/attachments/consultations/draft_eib_climate_strategy_2020_12_update_en.pdf

WHAT DOES INVESTMENT IN A ZERO WASTE CIRCULAR ECONOMY LOOK LIKE?

Zero Waste Circular Economy

The basis of a circular economy is a zero waste society, where everything that we produce and consume can return safely to nature or society. The IPCC already recognises that programmes that reduce, reuse and recycle (3Rs) municipal waste are effective to reduce greenhouse gas emissions[23]. But in fact, a Zero Waste Circular Economy goes beyond the model of the 3 Rs and proposes a much more comprehensive transformation of our production and consumption patterns to achieve high resource efficiency and move towards zero waste and zero emissions.



Picture 1: Waste management versus zero waste. Credits: GAIA , www.no-burn.org

Zero waste solutions, alongside climate action in other sectors, can be a gamechanger to achieve the global target of a maximum of 1.5 °C global warming, embracing the principles of conservation of materials, reduction of toxics, equitable distribution, and access to resources. Moreover, these solutions – including waste reduction, product and packaging reutilisation, redesign, composting, biogas, extended producer

[23] IPCC, 2014: Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

responsibility, consumption habits transformation, community empowerment, and recycling – could be implemented today, using existing technologies and innovative policies, with immediate results.

In cities and regions around the world, cooperatives of recyclers and other waste management workers, social entrepreneurs, visionary policy-makers, and innovative practitioners are showing that zero waste is a viable strategy. In contrast to the primitive idea of burning waste, zero waste solutions create livelihoods, save money, and protect the environment and public health.

These efforts go hand in hand with clean production, extended producer responsibility, and waste minimisation programmes for dangerous and hard-to-recycle materials. Together, these practical, bottom-up strategies provide some of the most decentralised urban solutions for reducing climate pollution, conserving energy and natural resources. They present enormous opportunities for developing local economies.

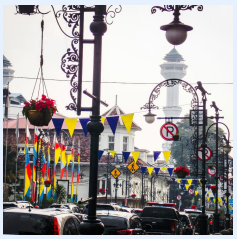
The Network of Zero Waste Municipalities in Europe,[24] and several other examples from Latin America, US and mostly from Asia such as Penang (Malaysia), Kerala (India), Kamikatsu (Japan), Bandung (Indonesia) and several city regions in The Philippines such as Port Bonifacio, Tacloban City or San Fernando, are testimonies of the many benefits that can be reaped when enough investments (and willingness) are mobilised to transition towards a zero waste circular economy[25].

Penang, Malaysia is host to various zero waste initiatives that are now ripe for scale up; the state can be an inspiration for a national direction towards zero waste. Thanks to the existing zero waste policies in Penang, the state has been performing fairly well in recovering materials from its households and businesses. It boasts the highest recycling rate in Malaysia at 43%, more than double than the national average of 21% [26].

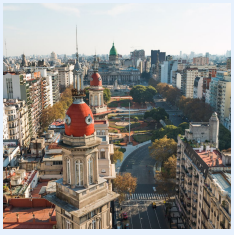
Thiruvananthapuram (Kerala, India) introduced in 2013 a decentralised system for waste management with source separation and door-to-door collection that successfully manages the waste without burning or burying. Moreover, in 2015, the Trivandrum municipality put forward a comprehensive program to reduce single-use plastic called Green Protocol, which applied a blanket 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. Today, Thanks to the extensive door-to-door campaign, 40% of households are segregating their wastes and managing their own kitchen and garden waste through at-home composting [27].

[24] zerowastecities.eu
[25] zerowasteworld.org
[26] zerowasteworld.org/wp-content/uploads/Penang.pdf
[27] zerowasteworld.org/wp-content/uploads/India.pdf

The City of San Fernando (The Philippines) is a busy capital that formed a partnership with Mother Earth Foundation (MEF), a GAIA member in the Philippines that actively promotes Zero Waste. After the city implemented a Zero Waste program, they have increased waste diversion from 12% in 2012 to 80% in 2018, proving that systemic change—not expensive technology—is what's needed to efficiently manage our waste. They plan to increase that to 91% by 2025[28].



Bandung (Indonesia) is the third largest city in Indonesia and the home of Yayasan Pengembangan Biosains dan Bioteknologi (YPBB), an organisation that developed a zero waste plan. Given that household waste is 63% organic, 23% recyclable, and 14% residual waste, Bandung City can potentially reduce the amount of household waste brought to landfills by as much as 86%, making it 7 times cheaper than landfilling it. 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. In one of them, a network of community-scale composting space captures almost all organic waste in the village[29].



In Buenos Aires, twelve recycling cooperatives of informal recyclers – or cartoneros, as locally called (cartón = cardboard)- turned the city of Buenos Aires into one of the leading models of inclusive recycling in Latin America and The Caribbean. Cooperatives of informal recyclers are now contracted by the government to run the door-to-door collection and processing of all recyclable materials. The system of recycling with social inclusion is framed under specific legislation and a more general "zero waste" law that sets goals to gradually reduce waste to landfill. The inclusion of informal recyclers in Zero Waste policies is about more than just the collecting of recyclables: It's about safeguarding the right of formal recyclers to a dignified livelihood.

A composting cooperative in Boston is moving the city towards zero food waste, and building stronger, more equitable communities in the process. The seeds of CERO were first planted at a meeting where local community members gathered to discuss how to improve recycling rates (under diversion rate 25%) and create good jobs for marginalized communities. CERO sought to combat the local economic inequalities head on by creating a diverse, bi-lingual worker co-op connected with Boston's working class and communities of color. Today CERO creates local "closed loop" systems for food, so that instead of disposing of food waste in landfills, they ensure that food is recycled back into soil that grows nourishing food for the community.

[28] zerowasteworld.org/wp-content/uploads/San-Fernando-1107.pdf
[29] zerowasteworld.org/wp-content/uploads/Bandung.pdf

Type of projects to be prioritised

Waste prevention with innovative zero waste business models

A Zero Waste Circular Economy aims at keeping products and packaging in use for as long as possible and preventing them from ever becoming waste. Thus, optimising the efficiency of traditional waste management systems is important but insufficient to transform the current production and consumption model towards a Zero Waste Circular Economy. Sustainable finance can play a critical role in supporting the development of new business models that design waste out of our systems and prioritise the upper tiers of the waste hierarchy.

Zero waste business models within a circular economy follow these innovative trends:[30]

- **Zero waste businesses plan to recover high-quality materials from their post-consumption products.** While linear businesses are not concerned with a product after it is sold, a zero waste business is designed to control and not lose track of it, so that the product can be easily taken back for reuse or feedstock in the production process. Downstream is the new upstream, especially when the alternative is virgin feedstock, with associated price volatility. In this way, companies are also motivated to ensure the delivery of high-quality, long-lasting products, supported by design for durability, reparability, upgradability, and modularity. Ensuring that the product can be repaired, upgraded, refurbished, remanufactured or remarketed is an essential added-value. Examples of this model involve deposit return schemes, or leasing.

eReuse, Catalonia[31]

Imagine expanding the life of electronic devices while incorporating blockchain traceability technology capable of creating 1 job for every 300 items reused. Now imagine ensuring a 95% recycling rate and transforming a cost for municipalities into revenue that stays in the community. This is not imagination, this is eReuse: a perfect example of how symbiosis between the digital agenda and waste management can create value, sustainability and jobs.

- **Zero waste businesses establish collaboration along the supply chain.** While linear businesses are based on downstream cost reduction and competitive relationships with suppliers, a zero waste business benefits from all the actors all along the supply chain working together, because the added value is the joint process of assembling and disassembling, delivering and recovering. Precisely, the value proposition is to promote platforms for collaboration among producers and consumers, either individuals or organizations and bring together supply and demand. For example, online refillable/reusable delivery models offer easy, sustainable alternatives to take-out single-use plastic

[30] Adapted from www.ellenmacarthurfoundation.org/assets/downloads/ce100/FinanCE.pdf
[31] zerowasteeurope.eu/2018/12/press-release-case-study-ereuse

dining and operate in a closed-loop system of reuse and redistribution. Customers utilise these services by downloading sustainable apps to directly order food delivery or locate pick-up restaurants that have sustainable container reuse and return models in place.

Phenix, France[32]

In 5 years, PHENIX has saved 30.000 tonnes of products from the bin 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, second they moved forward creating a complete support service.

- **Some zero waste businesses sell a service rather than a product.** While linear businesses sell products, zero waste businesses sell a service instead of merely the product itself. This development is also known as 'servitization' – providing the access to services to satisfy user needs without needing to own physical products. For example , a nappy laundry service provides clean nappies, not a washing machine, \ establishing a closer relationship between the business and its customers. Another notable example is businesses providing a deposit return scheme[33], a great reuse model for coffee shops and restaurants where to-go cups, cutlery, and containers are in high demand. Customers can use reusable containers by paying a fully-refundable deposit. The service is often run through local networks of similar businesses, on a subscription or membership basis. Many companies have developed mobile apps or website maps in order to help customers identify participating businesses.

ReCircle (Switzerland & Germany)[34]

ReCircle replaces over 50,000 single-use containers everyday through its 1,360 partners in Switzerlandand and in Germany. Partners include cities, schools, companies, meal services as well as cafes and restaurants. Each participating entity pays an annual subscription fee of $160 for 20 reusable containers and cutlery. The deposit customers pay for each container is about $10, which is fully refunded after use.

- **Zero waste businesses enhance innovation along the supply chain and are committed to redesign.** Zero Waste business models are constantly innovating along the supply chain, in response to a new paradigm for production and consumption that is reinventing the Product-Service-Systems relationship . These can include new owner platforms, or a pay-per-use system where the producer

[32] zerowasteeurope.eu/2019/06/the-story-of-phenix-a-recipe-to-effectively-enforce-food-waste-reduction-targets
[33] zerowasteeurope.eu/library/deposit-return-systems-drs-manifesto
[34] www.recircle.ch/en/

remains the owner. Redesign of products becomes a fundamental step to provide a zero waste product or service; whether it is redesign of the product itself to ensure better repairability, reusability and recyclability, or the redesign of the composition of materials to ensure high-quality and avoid toxic components. In this sense, it is important to note that this is a field in constant development and cutting-edge innovation with businesses that will develop their own specific model and products.

Nude Foods (South Africa)[35]

Plastic-free shop, offering non-GMO, healthy and affordable wholefoods and earth-friendly body and home products - all sold by weight. Curbside pick-up, home delivery and in store options. Customers are encouraged to bring their own containers. Additional benefits to the community involve the source of products: fresh produce from a local farm called Naturally Organic, an EU certified 100% organic farm in Phillipi, an agricultural area near Cape Town. Nude Foods sources everything locally, and by doing so, we support local business.""Although we have no formal partnerships, we seek suppliers that work with the same ethos, and are happy to help support other startups and entrepreneurs."

- **Zero waste businesses grow on the basis of ecological and social values that complement the overall business culture and philosophy.** Zero waste businesses are regenerative and restorative by design, keeping resources in use at their highest value for as long as possible, along with ensuring social-economical returns with better inclusive livelihoods, giving priority to local economies. They aim at replacing the linear economy based on take-make-throw away that assumes our planet has infinite resources. In this sense, the value proposition of a zero waste business model is the direct engagement in improving the sustainability of the overall system, going beyond the conventional eco-consumerism.

Hasiru Dala (India)[36]

Social enterprise whose vision is to integrate the generation of waste pickers into the mainstream circular economy and enable its accelerated adoption by consumers and producers, creating better livelihoods for waste pickers through inclusive businesses that have an environmental impact. Their current services include organisation and provision of zero waste events where all single-use plastic is replaced by compostable or recyclable options. It also provides brand owners with Extended Producer Responsibility (EPR) compliance and export high quality plastic waste to be upcycled (e.g. PET to PET) rather than downcycling to polyester yarn.

[35] Nudefoods.co.za
real-leaders.com/the-nude-experience-cape-towns-first-plastic-free-grocery-store
[36] hasirudalainnovations.com/event-waste-management

Beyond private sector initiatives, the public sector has also shown groundbreaking initiatives on the waste prevention front that should be considered eligible for sustainable finance given their significant contribution to circular economy and climate change mitigation goals. Some key examples are:

Self-service refill machines, Slovenia

The first automated liquid-refill station for dispensing ecological cleaning products in Slovenia was set up in a Depo store in Vrhnika in 2017. The public utility company, KP Vrhnika, provided the space, and NMC, an automation company (dairy and wine dispensers), provided the innovative technological solution for refilling. By offering plastic and packaging-free refills for cleaning products at the Depo store, the municipality wanted to bring Vrhnika's zero waste strategy closer to their customers and make zero-waste living more feasible for residents. The business model is based upon customers being able to refill reusable packaging with arbitrary amounts of cleaning products and other liquid supplies, with each customer bringing reusable packaging items and reusing them each time. The weight of the packaging and the volume of liquid dispensed are calculated together to decide the fee each customer pays. After the transaction, a sticker is produced and acts both as an invoice and as a product declaration. The machines themselves are also an example of reuse and recycling practices, as their frames are typically made of secondary materials. The use of these machines has since spread to the capital of Slovenia, Ljubljana The machine can be found in several locations around the city, and the one operated by the waste management company, Snaga[37], is called Bert. Euromonitor International selected the Bert vending machine as the most innovative retail concept of 2019 as part of its annual global retail market research.

Moreover, the machine also reached Croatia and is now present in Rijeka, as well as continuing to be implemented across other slovenian cities.

[37] www.vokasnaga.si

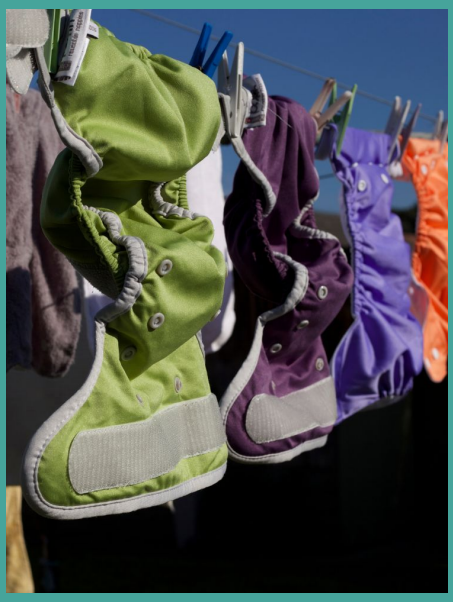
Refill waste stations in hundreds of cities all over the world

Making it easier for people to refill water bottles instead of buying single-use ones is an increasingly popular initiative led by local authorities all over the world.

While there is no data on how many cities have installed public water fountains, several apps help residents find the nearest water fountains. In the UK, the app Refill offers a database of 30.000 water fountains all over the world; Cambodia, Bulgaria, Chile, Ecuador, irelands, Italy, Japan, Thailand, Vietnam are amongst those countries that have specific apps with maps where residents can easily find public water fountains.[38]

Public water fountains can have a huge impact in reducing single-use plastic bottles, while promoting a healthy and sustainable lifestyle.

Reusable nappies - The Lavanda project by Eta Beta, Bologna (Italy)



For many zero waste municipalities, disposable nappies are one of the most common and problematic items, heavily contributing to the volume of residual waste. An essential part of any society, throwaway nappies often result in a large volume of the waste that cannot be recycled.

Recognising the need to tackle the issue of disposable nappies, the Bologna-based (Italy) social cooperative Eta Beta[39] created the Lavanda[40] project, which works closely with the local authorities. The project provides a collection and washing service of used cloth nappies to the local community, as well as delivering clean ones in return. This project originally began in 2009 through a collaboration with the University of Bologna, and has been formally operating within the city since 2013, with initial financing provided by the public administrations of the Emilia Romagna Region.Currently, the project only works with public administrations, organisations and cooperatives that manage nurseries. In the future, Lavanda wants to gradually open their services to families.

From traditional waste management to zero waste systems

Waste management is a very important source of GHG emissions and a primary source of leakage of useful materials out of the economy. Shifting **to a waste management systems that focus on achieving zero waste will progressively reduce the amount and toxicity of waste disposal and the associated GHG emissions**.

[38] Listed by the non-governmental organisation Refill Ambassadors: refillambassadors.com
[39] www.etabeta.coop/eta-beta
[40] www.etabeta.coop/lavanda

Key activities that need to be prioritised in receiving sustainable finance within a conventional waste management system to develop a Zero Waste Circular Economy include:

Activity	GHG emission reduction
Establishment of **source separation systems**.The separate collection of municipal solid waste (MSW) in source-segregated fractions prepares them for reuse and repair/or recycling, inorganic materials, and compost or digest organic materials[41]. Separate collection of organics (the largest portion of MSW) is particularly important to ensure a stream of clean, high-quality material to produce compost and biogas and it also improves the recycling rate because the materials remain free of contamination. Furthermore, it is critical to reduce methane emissions from landfills, the largest GHG source in the waste sector.	GHG emission reduction is enabled through a system of safe and efficient recovery of materials so that the discards that are inevitably produced are returned to nature or to manufacturing with the subsequent avoidance of virgin materials and higher emissions from its use (energy consumption for extraction, transport and production). Moreover, the maximisation of materials recovery ensures a net GHG emission reduction by displacing materials to be disposed of in downstream alternatives, (landfill and waste-to-energy incineration). Ultimately, source separation is a prerequisite for all post-consumer circular activities: recycling, reuse, composting, etc. because it minimizes cross-contamination of discarded materials, ensuring that they can be returned to the economy.
Establishment of reuse/repair systems, including reuse centres and networks, both public and private, to collect reusable discards before they become waste (reuse) or repair them (preparing for reuse) allowing further use of the resource.	GHG emission reduction is enabled through a system of safe and efficient recovery of materials so that the discards that are inevitably produced are returned to consumers with the subsequent avoidance of producing new products. Moreover, the maximisation of materials recovery ensures a net GHG emission reduction by displacing materials to be disposed of in downstream alternatives, (landfill and Waste-to-Energy incineration).
Recycling processes where discards are recovered and turned into new materials and objects.	GHG emission reduction is enabled through a system of safe and efficient recovery of materials so that the discards that are inevitably produced are returned to industry, with

[41] The report notes that climate mitigation net benefits of material recovery are proven by pertinent studies:
German Federal Environmental Agency (UBA), 2015: The Climate Change Mitigation Potential of Waste Management, sections 4.2.4 and 11.1 (Recovering dry recyclables, specific emission factors).
www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_56_2015_the_climate_change_mitigation_potential_of_the_waste_sector.pdf
Eunomia, 2015: The Potential Contribution of Waste Management to a Low Carbon Economy, section 3.2 (Quantifying the Impacts per Ton of Waste). www.eunomia.co.uk/reports-tools/the-potential-contribution-of-waste-management-to-alow-carbon-economy.
Joint Research Center, 2018: Best Environmental Management Practice for the Waste Management Sector, section 1.4.6 (Material recycling). susproc.jrc.ec.europa.eu/activities/emas/documents/WasteManagementBEMP.pdf
United Nations Environmental Programme / Division of Technology, Industry and Economics International Environmental Technology Centre: Waste and Climate Change: Global trends and strategy framework; Osaka/Shiga /Japan 2010;
www.unep.or.jp/ietc/Publications/spc/Waste&ClimateChange

	the subsequent avoidance of virgin materials being used thereby reducing GHG emissions from its use (energy consumption for extraction, transport and production).
Composting of organic waste: treatment of separately collected organic waste through composting (aerobic digestion) with the resulting production of compost for use as fertilizer/soil improver.	GHG emission reduction is enabled by avoiding emission from landfills, where organic waste produces methane when decomposing - a prominent source of GHG emissions from waste management. Composting also avoids GHG emissions from other waste disposal strategies (waste-to-energy incineration). Moreover, compost can be used as fertiliser/soil improver displacing synthetic fertilisers and eventually peat (e.g. in horticulture), plus increasing carbon sequestration capacity of soils[42].
Anaerobic digestion of organic waste: treatment of separately collected organic waste through anaerobic digestion with the resulting production and energetic utilization of biogas and production of digestate for use as fertilizer/soil improver, possibly after composting or any other treatment.	The GHG emission reduction is enabled in comparison to alternative options for organic waste disposal (landfill, waste-to-energy incineration). The production and energetic utilization of biogas and displacement of fossil fuels sources of energy, and the production of digestate that can be used as fertiliser/soil improver displacing synthetic fertilisers and increasing carbon sequestration capacity of soils[43].
Recovery of sorted materials in Material Recovery and Biological Treatment (MRBT) facilities that combine biological treatment (to stabilise fermentable materials still included in residual waste) with sorting equipment (to recover materials which were not targeted or captured by separate collection)[44].	The GHG emission reduction is enabled through system of safe and efficient recovery of materials: first, it involves the stabilization of organic waste thereby avoiding landfill emissions; second, it recovers materials for recycling with the subsequent substitution of virgin materials and avoidance of higher emissions from its use (energy consumption for extraction, transport and production). Moreover, the maximisation of materials recovery ensures a net GHG emission reduction by displacing materials to be disposed of in downstream alternatives (landfill and Waste-to-Energy incineration).

[42] www.marincarbonproject.org/science/papers

[43] www.carboncycle.org/strategic-partners/marin-carbon-project

[44] zerowasteeurope.eu/wp-content/uploads/2020/06/zero_waste_europe_policy_briefing_MRBT_en.pdf

Integration of the informal recycling sector, securing transportation for waste workers or other measures to facilitate their work. The informal sector has managed to become a key sector in the recycling industry in the Global South , achieving high recycling rates, most often by their own means. Yet, their work is not recognised and they are still under threat, suffering harassment and working under very disadvantaged and volatile conditions.	The GHG emission reduction is enabled through a system of safe and efficient recovery of materials with the subsequent substitution of virgin materials and avoidance of higher emissions from its use (energy consumption for extraction, transport and production). Moreover, the maximisation of materials recovery ensures a net GHG emission reduction by displacing materials to be disposed of in downstream alternatives (landfill and waste-to-energy incineration).

Prospects for climate change mitigation

Zero waste and circular economy strategies are key allies to achieve carbon neutrality as they ensure a reduction of GHG emissions at the source. This can be achieved through three main strategies:

1. In the first place, actions at the top of the waste hierarchy– such as waste prevention initiatives, reuse and recycling – have considerable scope to reduce climate change emissions. The overall materials economy -- the raw material extraction, processing, and goods manufacture and delivery-, is responsible for 62% of global GHG emissions,[45] so waste avoidance and recycling reduce "upstream" emissions in natural resource extraction, manufacturing, and transport, the most emissions-intensive processes.[46] In particular, reducing food waste, which is estimated to constitute a third of all food produced, reduces emissions between 0.8 and 4.4 tonne CO_2e per tonne of waste prevented, equivalent to 2% to 5% of national emissions.[47] Moreover, recycling also reduces emissions in processing/manufacturing, since emissions from secondary production are lower for all materials as recycled material is often closer in quality to the finished product than raw material is.[48] Ultimately, because waste management strategies can trigger emissions reductions in other sectors, its mitigation potential is greater than the total emissions from the waste sector.[49]

[45] zerowasteeurope.eu/2018/09/zero-waste-circular-economy-climate-change

[46] USEPA. (2006). Solid Waste Management and Greenhouse Gases: a Life-Cycle Assessment of Emissions and Sinks (p. 170). US Environmental Protection Agency.
USEPA. (2009). Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices (p. 98). US Environmental Protection Agency.

[47] Dorward, L. J. (2012). Where are the best opportunities for reducing greenhouse gas emissions in the food system (including the food chain)? A comment. Food Policy, 37(4), 463–466. doi.org/10.1016/j.foodpol.2012.04.006
Salem Deeb, R., Font Vivanco, D., Al-Tabbaa, A., & zu Ermgassen, E. K. H. J. (2017). A holistic approach to the environmental evaluation of food waste prevention. Waste Management, 59, 442–450. https://doi.org/10.1016/j.wasman.2016.09.042
Venkat, K. (2011). The Climate Change and Economic Impacts of Food Waste in the United States. International Journal on Food System Dynamics, 2(4), 431–446. doi.org/10.18461/ijfsd.v2i4.247

[48] Climate Benefits of Material Recycling. Inventory of Average Greenhouse Gas Emissions for Denmark, Norway and Sweden. Nordic Council of Ministers, 2015

[49] Hogg, D., & Ballinger, A. (2015). The Potential Contribution of Waste Management to a Low Carbon Economy. Eunomia www.eunomia.co.uk/reports-tools/the-potential-contribution-of-waste-management-to-a-low-carbon-economy

2. Secondly, the separate collection and treatment of organic waste avoids landfill methane emissions. Landfills are a prominent source of methane emissions due to the anaerobic decomposition of organic waste, so the separate collection and treatment of organic waste is an effective measure to avoid methane emissions[50]. Treatment methods include aerobic composting, which produces a carbon and nutrient-rich soil amendment but also some NO_x emissions[51]; anaerobic digestion, which has been successfully employed at small scales to produce usable methane gas; and animal feed[5.7]

3. Thirdly, the application of compost or digestate in soils can reduce emissions in several ways: avoided emissions associated with the synthetic fertilizer, peat, and/or pesticides displaced by compost; reduced N_2O emissions from reduced use of synthetic fertilizer; reduced emissions associated with tilth and irrigation; and the enhanced uptake of atmospheric carbon by the soil and plants[52].

It is important to note that one precondition to maximise the effectiveness of these three main strategies to reduce emissions is to ensure source separation of each waste stream, so that waste can be successfully recycled, composted, and diverted from disposal. Source separation is particularly important to ensure high-quality compost for land application.

In this way, many cities and regions across the network of Zero Waste Municipalities such as San Fernando (Philippines),[53] Bandung (Indonesia), [54]Fort Bonifacio (Philippines) [55], Tacloban City (Philippines)[56],Seoul (South Korea)[57], Kamikatsu (Japan)[58], Kerala (India) [59], Salacea (Romania)[60], amongst many others, **have shown how**

[50] Morris, J., Scott Matthews, H., & Morawski, C. (2013). Review and meta-analysis of 82 studies on end-of-life management methods for source separated organics. Waste Management, 33(3), 545–551.doi.org/10.1016/j.wasman.2012.08.004
Wilson, D. C., Rodic, L., Modak, P., Soos, R., Carpintero Rogero, A., Velis, C., et al. (2015). Global waste management outlook. United Nations Environment Programme.
MRA Consulting Group. (2019). Review of Separate Organics Collection Legislation: A submission to NSW Environment Protection Authority. MRA Consulting Group.

[51] Nitrogen Oxides are a family of poisonous, highly reactive gases. These gases form when fuel is burned at high temperatures.

[52] Favoino, E., & Hogg, D. (2008). The potential role of compost in reducing greenhouse gases. Waste Management & Research, 26(1), 61–69. doi.org/10.1177/0734242X08088584

[53]Dayrit, F. (2019). Picking up the Baton: Political Will Key to Zero Waste (Zero Waste Cities Asia). Global Alliance for Incinerator Alternatives.

[54] Ferdinand, F., & Fam, J. (2019). Kang Pisman: Paving the Way to a Zero Waste Indonesia (Zero Waste Cities Asia). Global Alliance for Incinerator Alternatives.

[55] Liamzon, C. (2019a). Pioneer of Zero Waste: The Village that Inspired Cities to Go Zero Waste (Zero Waste Cities Asia). Global Alliance for Incinerator Alternatives.

[56] Liamzon, C. (2019b). Sunshine After the Storm: A Typhoon-Ravaged City Rises to Become Zero Waste (Zero Waste Cities Asia). Global Alliance for Incinerator Alternatives.

[57] Moon, D. (2019). Citizens at the Center: Seoul's Journey to Zero Waste (Zero Waste Cities Asia). Global Alliance for Incinerator Alternatives.

[58] Parras, P. (2019). Small Town, Big Steps: The Story of Kamikatsu, Japan (Zero Waste Cities Asia). Global Alliance for Incinerator Alternatives.

[59] Ramachandran, K. (2019). Greening Kerala: The Zero Waste Way (Zero Waste Cities Asia). Global Alliance for Incinerator Alternatives.

[60] Rastei, E., & McQuibban, J. (2019). The Story of Salacea (Case Studies No. 12). Zero Waste Europe.

effective separation at source of dry and wet waste streams has driven a major diversion of the majority of their waste stream to beneficial uses.

The remaining residual waste from a source separated and separately collected system still needs additional treatment before landfilling to avoid the methane emissions. The most effective means of stabilization is a "Material Recovery and Biological Treatment (MRBT)" system that combines biological treatment and sorting equipment. This approach stabilises the organics that are included in residual waste, so as to minimise their impact once buried in a landfill, while also helping to recover materials such as metals and plastics that are still included in residual waste after separate collection. While pursuing the goal of diverting waste from landfill, this option also embeds enough flexibility in its equipment and processing systems as to enable an ever-increasing amount of separately collected materials for recycling, without posing a risk of systemic lock-in[61].

In sum, the climate change mitigation potential of implementing these strategies is very significant. By advancing zero waste policies and programs, Europe and the UScan together conservatively reduce GHGemissions by 606 megatonnes CO_2e per year by 2030[62], which would equal to GHG emissions from more than 156 coal power plants or 128 million cars off the road.

New analysis undertaken at a global level suggests that GHG emissions savings in the order of 900 million tonnes CO_2 eq. might be achieved by applying similar waste management approaches to all countries across the globe - namely through increasing the recycling of materials such as paper, plastics and metals, alongside the collection and treatment of organic waste (including food)[63].

[61] Favoino, E. Building a bridge strategy for residual waste. Zero Waste Europe, 2020.

[62] ILSR, Eco-cycle, GAIA (2008). Stop Trashing the Climate; ZWE, Eunomia (2015). The Potential Contribution of Waste Management to a Low Carbon Economy

[63] Vilella, M. Zero Waste Circular Economy. A Systemic Game-Changer to Climate Change. Volume 44.3 of the Publication Series Ecology. Heinrich Boell Foundation.

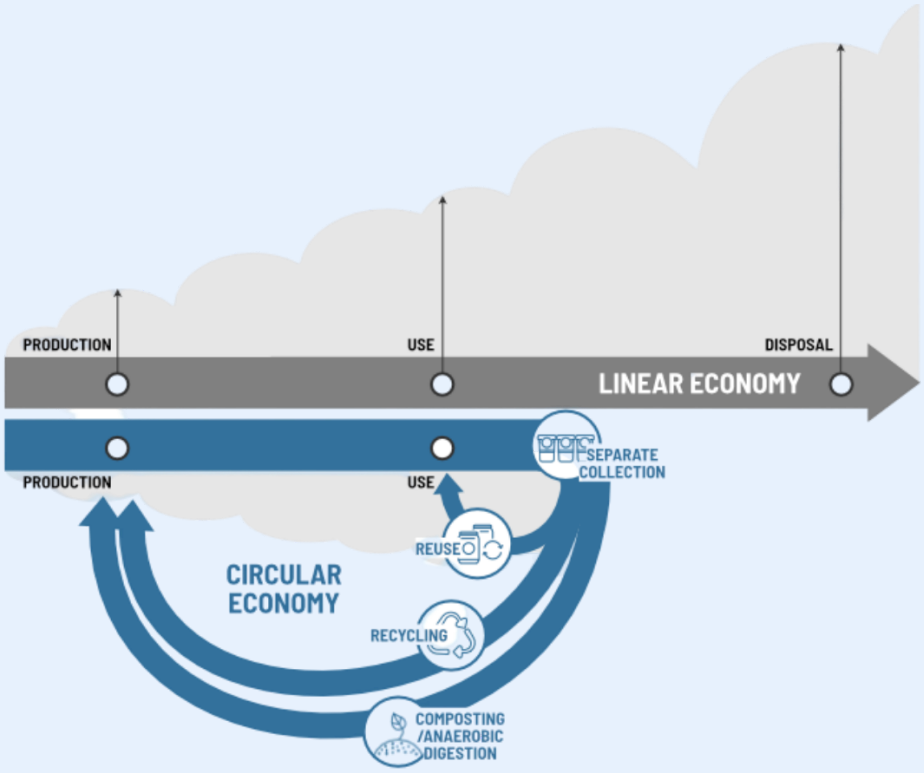


Figure 2: comparison between linear economy and circular economy . Credits: GAIA , www.no-burn.org

Job creation potential

As it has been shown in cities around the world, **recycling and composting programs create significantly more jobs per ton of waste than landfilling or waste incineration**, while **upstream activities like reuse and remanufacturing offer additional opportunities**. Furthermore, the informal recycling economy[64] supports thousands of livelihoods in developing countries, thus supporting the integration of waste-pickers into formal waste management systems is a fundamental field of work to be supported by sustainable finance.

Analysis of continued circular economy development in Italy, Poland, Germany, and Britain point out that as many as 326,000 net jobs could be generated by 2030, accounting for job losses in other sectors[65]. Examples below show more specific data to illustrate the point further.

[64]The informal recycling economy refers to the individuals or community enterprises who are involved in the recovery of material and waste management activities which are not necessarily financed, recognized, supported, organized, or acknowledged by the formal solid waste authorities. Valencia, M. (2019). Informal Recycling Sector (IRS), Contribution to the Achievement of the SDGs, and a Circular Economy.

[65] Opportunities to tackle Britain's labour market challenges through growth in the circular economy. www.wrap.org.uk/sites/files/wrap/Opportunities%20to%20tackle%20Britain%27s%20Labour%20Market%20Challenges%20full%20report.pdf

Unemployment and the circular economy in Europe a study of opportunities in Italy, Poland and Germany. www.green-alliance.org.uk/resources/Unemployment%20and%20the%20Circular%20Economy%20in%20Europe.pdf

Upstream jobs in reuse and remanufacturing

The reuse and remanufacturing models are a crucial part of a Zero Waste Circular Economy, preventing waste from being handled by a municipality at all. Many additional job opportunities that go hand in hand with municipal recycling and composting, come from the reuse sector, remanufacturing or use of processed waste products like compost.

In Europe, data from the reuse economy shows that the job creation is very significant, with a general analysis suggesting that reuse activities in the EU can reach 62-69 jobs/10,000 TPY[28]. Specific examples from Denmark in the refurbishment and resale of presorted reusable goods like pottery and bicycles at a local waste facility accounted for the equivalent of 33-100 jobs/10,000 Tons Per Year (TPY). In Finland, reuse activities accounted for the equivalent of 624.4 full-time equivalent jobs/10,000 TPY of disposed materials collected[66]. A survey of actual reuse facilities in the UK by the RREUSE Network estimated that collection and reuse of multimaterial goods could generate as many as 700-800 jobs/10,000 TPY[67].

Remanufacturing industries represent much of the indirect job creation potential of zero waste systems. These jobs are generated by utilising material that might have been otherwise landfilled or incinerated.

In the US, the remanufacturing of processed recycled goods could account for 30-170 jobs/10,000 TPY depending on the material/goods in question[28]. A 2013 survey of businesses in Maryland showed that businesses using finished compost provided an estimated 18 jobs/10,000 TPY of compost used, or 6.2 jobs/10,000 TPY of organics composted.[68].

Figures from Europe include an analysis of actual remanufacturing facilities in Spain which estimated an average of 47.8 jobs/10,000 TPY created by paper, glass, and plastic remanufacturing.

Job creation in informal recycling

Informal recyclers are a major labour force, according to the example below providing estimates of the number of jobs supported by distributed, informal waste sector workers around the world. Many are cases of existing informal workforces being recognized and integrated into the city system, bringing benefits to the workers and the city. Numbers vary greatly depending on the extent of formal waste management infrastructure, and the activities involved (education, collection, sorting, processing, reselling, etc).

[66] De Kringwinkel: A symbiosis between jobs for the long term unemployed and waste reduction? repository.uantwerpen.be/docman/irua/00597c/130571.pdf
[67] Briefing on job creation potential in the re-use sector. www.rreuse.org/Final-briefing-on-reuse-jobs-website-2.pdf
[68] Composting Makes ene: Jobs through Composting & Compost Use, ilsr.org/composting-sense-table

In Africa, a private sorting facility in Pretoria/Tshwane (South Africa) has 240 direct employees involved in sorting, cleaning, and baling recyclables, accounting for the equivalent of 20 jobs/10,000 TPY[69].

In Asia, the municipality of San Fernando (Philippines) hired waste workers as collectors, drivers, segregators, street sweepers, and Material Recovery Facility managers for a landfill diversion program that has generated 32 jobs/10,000 TPY of waste diverted from landfill since the efforts began in 2012[70]. In Bangalore, India, the local social enterprise Hasiru Dala Innovations employs over 200 former waste pickers to provide door to door waste collection and education services, diverting 80% of what they collect from landfill and accounting for the equivalent of 304 jobs/10,000 TPY collected[71]. Also in India, a company called VRecycle in Goa hires former waste pickers to offer recycling pickup, sorting, and education services, generating the equivalent of 140.9 jobs/10,000 TPY collected[72].

Examples from Latin America include 12 cooperatives with over 5300 registered workers in Buenos Aires (Argentina) which represents 184 jobs/10,000 TPY for collecting, sorting, washing, shredding, and compacting of recyclables. In the Peñalolén district of Santiago, Chile, formally recognized former waste pickers provide door to door collection services of recyclables, accounting for 555 jobs/10,000 TPY collected; recyclers are paid a collection fee and keep recyclables for resale[73]. In Londrina, Brazil, waste pickers collect all waste types, as well as sort and bale recyclables, processing enough waste to sustain the equivalent of 302 jobs/10,000 TPY collected[11]. In Dois Irmãos, Brazil, a waste picker collective collects 100% of the city's waste, and goes even farther up the value chain than mere sorting and baling by pelletizing plastic. All together the employment from these services account for the equivalent of 288 jobs/10,000 TPY collected. Finally, the YouGreen waste picker cooperative in São Paulo, Brazil, offers collection, sorting, and waste stream analysis services to private companies, sustaining the equivalent of 292 jobs/10,000 TPY collected[74].

While waste pickers are a critical link in the global recycling infrastructure, waste picking is poorly-remunerated, dirty and often demeaning. The formalisation of waste pickers can help address these issues by offering formal recognition, involvement in municipal waste management decision-making processes, and access to facilities, which can improve dignity, personal safety, and earnings.

[69] The Waste Group.www.wastegroup.co.za/recycling-services
[70] Picking up the Baton - Political Will Key to Zero Waste.zerowasteworld.org/wp-content/uploads/San-Fernando.pdf
[71] Cleaning Up Waste and Recycling Management and Securing the Benefits A Blueprint for Cities.
laane.org/wp-content/uploads/2017/06/Cleaning-Up-Waste-1.pdf
Hasiru Dala Innovations. map-sa.net/Document/Doc/Hasiru.pdf
[72] VRecycle Who We Are. vrecycle.in/about_us/who-we-are "Only 1% Of Garbage Is Trash": This Man Shows The Way To A Zero-Waste Goa. thelogicalindian.com/exclusive/zero-waste-goa/?infinitescroll=1
[73] Leave No Trace: Vital lessons from pioneering organisations on the frontline of waste and ocean plastic
[74] Cleaning Up Waste and Recycling Management and Securing the Benefits A Blueprint for Cities.
laane.org/wp-content/uploads/2017/06/Cleaning-Up-Waste-1.pdf

Job creation in landfill and Waste-to-Energy incineration versus recycling

Several studies point out the low rate of job creation in terms of tons per year (TPY) in downstream waste management such as landfill and Waste-to-Energy incineration, in comparison with upstream options.

In the US, it is estimated that there are 2.2 jobs/10,000 TPY of accepted waste for landfill, and 1.2 jobs/10,000 TPY for incineration[75]. A similar study in the US provides estimates of 1 job/10,000 TPY for both landfill and incineration management (excluding collection) and 5.6 jobs/10,000 TPY including collection, in comparison with 16.7 jobs/TPY for recyclables and organics).[76] In Australia, the rate is similar, with an estimated 2.8 jobs/10,000 TPY for landfill activities, including collection and transportation[77].

Looking at Europe, estimations made in Spain showed direct employment at incinerators to account for 2.5 jobs/10,000 TPY in 2010[78].

In South Africa, the construction of a new incinerator predicted to generate the equivalent of 0.68 jobs/10,000 TPY (collection excluded)[79]. In Cape Town, South Africa, a Waste-to-Energy facility that produces liquid CO_2, compressed biomethane, renewable natural gas, organic fertiliser, and refuse-derived fuel, generating the equivalent of 4.38 jobs/10,000 TPY (collection excluded).[80]

In comparison, recyclable processing (including sorting, cleaning, and baling) generates 20 jobs/10,000 TPY in the US, while organics processing generates 5 jobs/10,000 TPY[81]. In Australia, a 2009 analysis estimated 9.2 jobs/10,000 TPY for the sorting, processing, and remanufacturing of recyclables[29]. In Denmark, the sorting, baling/palletizing, and reselling of recyclables (wood, plastic, and cardboard) diverted from an incinerator near Hjørring and Brønderslev, in 2016 generated employment equivalent to 2-10 jobs/10,000 TPY [82].

In conclusion, e**ven the most optimistic assessment of direct employment in landfill and Waste-to-Energy incineration would be three times lower than employment generated by recycling and organics**.

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[75] Composting Makes sense: Jobs through Composting & Compost Use, ilsr.org/composting-sense-tables
[76] More Jobs, Less Pollution: Growing the Recycling Economy in the U.S.
www.no-burn.org/wp-content/uploads/MoreJobsLessPollutionFinal.pdf
[77] Employment in waste management and recycling.
www.environment.gov.au/system/files/resources/files/waste-and-recycling-employment.pdf
[78] La incineración de residuos en cifras. archivo-es.greenpeace.org/espana/Global/espana/report/contaminacion/100720.pdf
[79] Nov. 8 march against incineration: Waste incineration is wasting jobs in South Africa!
globalrec.org/2013/11/07/march-against-incineration/
[80] City of Capetown inaugurates a Waste-to-Energy plant.
www.esi-africa.com/industry-sectors/renewable-energy/city-of-cape-town-launches-waste-to-energy-plant
The City of Cape Town is taking a step forward in waste management and renewable energy and this is great news for Capetonians.
www.goodthingsguy.com/environment/cape-town-waste-energy-plant
[81] More Jobs, Less Pollution: Growing the Recycling Economy in the U.S. www.no-burn.org/wp-content/MoreJobsLessPollutionFinal.pdf
[82] Capturing uncaptured values — A Danish case study on municipal preparation for reuse and recycling of waste.
www.sciencedirect.com/science/article/abs/pii

Cost effectiveness

By switching to a zero waste strategy, municipalities can immediately begin reducing the costs of their waste management. **A zero waste strategy is**, essentially, **good value for money**.

For instance, the city of Parma[83], in Italy (population 196,518), has seen a reduction in the overall annual costs for waste management of €450,000 after introducing a zero waste system. In northern Italy, the cost of managing residual waste in 50 municipalities oriented to a zero waste strategy is €178.9 per household/ year, compared to the average cost in Italy of €245.6 per household / year, representing 27% cost savings through zero waste[84].

The city of San Fernando, in the Philippines (population 306,659), has reduced the annual waste management budget in Php 36 million (594,745 EUR) after transitioning into a decentralized zero waste system[85]. The Philippine city of Tacloban (population 242,089), in turn, saved Php 21.6 million (348,065 EUR) in their annual budget after transitioning into zero waste, representing 27% cost reduction[86].

The Zero Waste Cities savings calculator[87] has been designed by our member Ekologi brez meja[88] to help visualise and understand the benefits that adopting zero waste policies can bring to a local area.

If a city is already paying for waste management, it is very likely putting its money toward a typical waste hauling system that collects waste and takes it to a centralised facility like a landfill or incinerator. In this case, strong arguments in favour of a zero waste system include reduced transport costs, operating costs of transfer stations, maintenance of sophisticated vehicles, landfill space, and gate fees at the landfill or incinerator. There are potential revenues that can accrue from the sale of recyclables and compost. Additional benefits to society include reduced healthcare costs, less transport related emissions, and less clean up costs of the city's soil, water and air.

In cities that already have centralized and technology driven waste management systems, one of the potential financial barriers to transition into a zero waste system is paying for the initial costs. Once set up, zero waste will be much more affordable than the conventional system, but overpaying for current waste management systems leaves cities without the resources needed to invest in new approaches.

[83] Zero Waste Europe, 2016: The Story of Parma. zerowasteeurope.eu/downloads/case-study-7-the-story-of-parma
[84] Zero Waste Europe, 2015: The Story of Contarina.
zerowasteeurope.eu/2015/02/new-case-study-the-story-of-contarina-85-recycling-is-possible
[85] GAIA, 2019: Picking up the Baton: Political Will Key to Zero Waste. Zero Waste Cities, Asia Series.
zerowasteworld.org/wp-content/uploads/San-Fernando.pdf
[86] GAIA, 2019: Sunshine After the Storm: A Typhoon-Ravaged City Rises
to Become Zero Waste zerowasteworld.org/wp-content/uploads/Tacloban.pdf
[87] zerowastecities.eu/academy/savings-calculator
[88] zerowasteeurope.eu/portfolio/ecologists-without-borders-association

WHY WASTE-TO-ENERGY INCINERATION IS NOT FIT FOR SUSTAINABLE FINANCE

Not a low carbon technology/source of energy

Waste-to-Energy incineration cannot be considered a low carbon technology for two main reasons: it is **the most carbon-intensive form of electricity generation** and, simultaneously, one of the **most carbon-intensive approaches to waste management**.

In the first place, the process of incineration releases a high amount of GHG emission itself. In 2017, the UK's incinerators released a combined total of nearly 11 million tonnes of CO_2, around 5 million tonnes of which were from fossil sources such as plastic. On average, incinerators release more than one tonne of CO_2e for every tonne of waste incinerated, even when energy is captured[89]. It is recognised that in Europe, without intervention, plastic incineration will result in additional 90 megatonnes of CO_2 by 2050[90].

Looking at the electricity provided by Waste-to-Energy incineration, this is one of the most carbon intense sources of electricity, far greater than other conventional fossil fuel sources. The carbon intensity of incineration is 580g CO_2eq/kWh, the double of the EU average carbon intensity of the electricity grid (296g CO2eq/KWh), also much more than fossil gas (340g CO2eq per kWh), and 23 times greater than that of low carbon sources such as wind and solar[91].

A source of pollution at all levels

Burning waste in Waste-to-Energy incinerators releases various types of emissions including lead, mercury, dioxins and furans, particulate matter, carbon monoxide, nitrogen oxides, acidic gases (i.e., SO_x, HCl), metals (cadmium, lead, mercury, chromium, arsenic, and beryllium), polychlorinated biphenyls (PCBs), and brominated polyaromatic hydrocarbons (PAHS). Many of these toxic emissions are Persistent Organic Pollutants (POPs), which have been banned by the Stockholm Convention and should therefore be also excluded from a circular economy where they continue to pose a threat to both human health and the environment.

Incineration also generates new toxic chemicals such as dioxins and furans, which can leach into soil and groundwater and accumulate in food chains. Direct exposure to such toxins risks the health of facility

[89] Emissions related to electricity generated by waste incinerators (including gasification and pyrolysis) will increase and be worse in climate change terms as they are measured against an increasingly decarbonised energy supply. UKWIN (2018). Evaluation of the climate change impacts of waste incineration in the United Kingdom; CIEL (2019). Plastic and Climate: The Hidden Costs of a Plastic Planet.

[90] CIEL (2019). Plastic and Climate: The Hidden Costs of a Plastic Planet.

[91] ZWE – Zero Waste Europe (2019) The impact of waste-to-energy incineration on climate. Policy Briefing.

workers and residents in nearby communities while indirect exposure, through the food chain, poses global risks.[92]

Incineration creates another waste management issue, as it **produces highly toxic byproducts, such as fly ash, bottom ash, and wastewater**. While advanced air pollution control equipment removes some of the toxic pollutants from the exhaust, it concentrates them in these other byproducts:

- Bottom ash, also known as "slag", comes from the furnace. Approximately 25% of the quantity of municipal solid waste (MSW) fed to the grate furnaces ends up as bottom ash after the combustion process.[93] Mixed bottom ash can carry high levels of dioxins and heavy metals[94].

- Fly ash is particulate matter collected from the flue gases, which contain hazardous substances such as mercury, dioxins, and furans. The toxicity of fly ash is greater than bottom ash because filters and scrubbers capture toxins in the waste and concentrate them in fly ash. The more pollutants an air pollution control system removes, the more toxic its fly ash is. Fly ash is also readily windborne and more likely to leach into groundwater or surface water supplies.

- Waste incineration also produces other residues, such as boiler ash and wastewater. Some incinerators produce scrubber salts, filter cake, and sludge depending on the pollution control system. The residues may contain dioxins and high levels of other persistent organic pollutants. The toxins in the residues are available to leach and travel, especially in contact with rainwater.

Pollutants remaining in the ashes threaten air and water quality and pose health risks for workers and nearby communities, whether they end up in landfills, cement kilns, mines, or agricultural lands, where the ash can spread via wind and air. While the residues require special treatment and separate disposal in hazardous waste landfills in order to minimize the environmental health impact, many companies attempt to use the toxic ash for road and construction material - mixed into concrete, mixed into asphalt for roads - or it's even spread on agricultural lands for food production, mislabeled as soil fertilizer, reintroducing the toxins in the environment.[95]

A locked in trap to waste recyclable materials

Waste-to-Energy incineration undermines recycling. Rather than operating in tandem where recyclables are recycled and only non-recyclables are burned, **incineration and recycling typically compete for the same waste materials, the same government funds, and the same waste management contracts**.

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[92] zerowasteeurope.eu/library/air-pollution-from-waste-disposal-not-for-public-breath

[93] IPEN Dioxin, PCBs, and Waste Working Group, After Incineration: The Toxic Ash Problem, (Prague, Manchester: IPEN, 2005)

[94] Genon, G., & Brizio, E. (2008). Perspectives and limits for cement kilns as a destination for RDF. Waste management, 28(11), 2375-2385.

[95] Katima, J. H. Y., Bell, L., Petrlik, J., Behnisch, P. A., & Wangkiat, A. (2018). High levels of PCDD/Fs around sites with waste containing POPs demonstrate the need to review current standards. Organohalogen Compounds, 80, 700-704.

This conflict is particularly clear in Waste-to-Energy incinerators, and is also true for incinerators that do not recover energy. Despite the fact that incinerators are below recycling in the waste hierarchy, they are very often prioritised above recycling at the local level. Incinerators that produce some energy depend upon the materials in waste that have high calorific value, and the items with high calorific value are precisely the materials readily processed by recycling programs: paper, cardboard and plastics. As a result, they have had a consistently negative impact on waste prevention and recycling efforts, as well as on workers who make a living from recycling.

In the UK, studies indicate that most of what is currently in the 'residual' waste stream is readily recyclable, meaning a significant proportion of what is currently incinerated could have been recycled or composted.[96] A Defra report published in August 2020 stated that: "0*f total residual waste from household sources in England in 2017, an estimated 53% could be categorised as readily recyclable, 27% as potentially recyclable, 12% as potentially substitutable and 8% as difficult to either recycle or substitute*".[97]If incinerators limited their feedstock to genuinely residual waste then it would free up more than half of their current capacity, undermining the rationale for building new incinerators in the UK.

Incineration is an expensive and rigid, technology-dependent, long-term waste management strategy. Thus, for many local governments, **opting for this method means using all or most of their waste management budgets, leaving little funds for strategies such as prevention, recycling, and composting**.

When competing for the same materials, incineration tends to beat out recycling for several reasons:

- Incineration contracts typically include a "put-or-pay" clause that requires the municipality to deliver a minimum quantity of waste or pay fees to compensate the incinerator company for lost profits. Put-or-pay agreements, which the incinerator industry typically includes in contracts, encourage the incineration of discards and undermine waste prevention, composting, and recycling.

- Investing in an incinerator sets a community on a long-term path tied to this outdated, inefficient approach. Incinerators are among the most expensive and least efficient forms of generating electricity. The associated high costs lock up funds instead of making them available for less expensive, more effective strategies.

- Incinerators often win out over less powerful recycling businesses that may be managed by the informal sector, not consolidated, and/or not big enough to confront such a centralized and capital-intensive technology that also has a highly paid public relations arm.

[96] ukwin.org.uk/files/pdf/UKWIN-2018-Incineration-Climate-Change-Report.pdf

[97] assets.publishing.service.gov.uk/government/uploads/system/resources-and-waste-strategy-monitoring-progress.pdf

Expensive investment, operation and maintenance

Incinerators are the most expensive method to generate energy and to handle waste, while also creating significant economic burdens for host cities. According to the U.S. Energy Information Administration Annual Energy Outlook 2013 data[98], the projected capital cost of new waste incinerator facilities is 7.454 EUR per kilowatt hour. That is twice the cost of coal-fired power and 50 percent more than nuclear energy. Waste incinerator operations and maintenance costs[99] are ten times greater than coal and four times greater than nuclear.

Capital costs for new waste incinerators, as well as their operation, maintenance, and meeting regulatory compliance of these facilities, are no small investment for local governments. In Hennepin County, Minnesota, for example, the county had to borrow a significant portion of the 135 million EUR necessary to construct the Hennepin Energy Recovery Center (HERC) in the late 1980s. HERC has not always met its operating costs or debt obligations, relying on county subsidies to continue operating. In 2010, HERC required a EUR 1.2 million operating subsidy from the county, or EUR 4.17 per ton of waste[100].

Some knew better than to expect an economic windfall from incineration. Lawmakers in Rhode Island passed a law in the early 1990s, for example, banning municipal solid waste incineration in the state. They justified the decision based on the simple economics.

A recent study published in the American Economic Review found that among U.S. industries, the waste incineration industry has the highest ratio of negative economic impacts from air pollution compared to the financial value added by the industry[101].

[98] www.eia.gov/analysis/studies/powerplants/capitalcost/pdf/capcost_assumption.pdf
[99] www.eia.gov/analysis/studies/powerplants/capitalcost/archive/2013/pdf/updated_capcost.pdf
[100] ilsr.org/wp-content/uploads/2018/12/ILSRIncinerationFInalDraft-6.pdf
[101] www.aeaweb.org/articles?id=10.1257/aer.101.5.1649

OTHER RED FLAGS

Red flag on chemical recycling

Industry is now pushing for a new technological fix for plastic waste, called "chemical recycling". New proposals are making their appearance in Australia, the EU, Indonesia, Malaysia,Thailand, and the U.S., increasingly supported by favorable legislations.

While plastics-to-plastics (P2P) and plastics-to-fuel (PTF) facilities are in principle different, industry increasingly touts certain facilities as "chemical recycling," when in fact, these companies turn plastic back into a fossil fuel, which is later burned.

Chemical recycling is a collective expression for technologies such as solvolysis, depolymerization, pyrolysis and gasification. When considering the full life cycle of chemical recycling operations, the high carbon losses induced do not justify the misguided belief that chemical recycling could be a useful tool in the climate mitigation toolbox.

In addition to CO2 emissions associated with the external energy inputs, the chemical conversion itself generates significant quantities of CO2. This is particularly the case for pyrolysis and gasification, which lose more than half of the carbon in the plastic feedstock during the gas or oil upgrading phase.

Despite decades of attempts, **the technologies have not proven successful on a commercial scale and costs are not competitive compared to virgin materials.** Yet, heavy investments are increasingly flowing towards the more energy intensive options such as pyrolysis. European investors should learn from the global experience where, as of 2017, similar technologies had wasted at least EUR 1.7 billions of investments with cancelled or failed projects. The plastic industry is expected to grow its production capacity by a third by 2025. The push for breaking plastic waste down to feedstock for the petrochemical industry or turning it to fuel risks stimulating the over-production of plastic with a total increase in global GHG emissions as a result.

To mobilise finance towards more sustainable technologies, t**he taxonomies should take a cautionary approach to chemical recycling and clearly distinguish between recycling operations, chemical recovery of feedstock and plastic-to-fuel.** It should also respect the principles of the waste hierarchy to ensure there is no competition with mechanical recycling feedstock. Finally, when assessing the life-cycle GHG emissions of plastic manufactured by chemical recycling there should be no credits awarded through attribution of avoided emissions from alternative end-of-pipe waste management options such as incineration or other processes which are not directly attributable or where there is no causal physical relationship.

Red flag on burning of RDF in cement kilns

Co-incineration is the burning of waste,generally in the form of Refuse-Derived Fuel (RDF) alongside other fossil fuels, although not exclusively, in cement kilns or other non-traditional incinerators. The report from the EU Taxonomy Technical Working Group (TEG) concluded that "**Co-incineration of waste has significant impacts on health and the environment due to the polluting nature of the associated emissions, and higher emissions ceiling for cement plants in comparison with dedicated waste incineration plants. Furthermore, promoting waste as an eligible fuel source may undermine waste minimisation efforts in other sectors**".[102] Thus undermining the purpose of the Taxonomy Regulation and recommended to delete it from the list of Taxonomy compliant activities. However, at the time of writing, this deletion has not been made effective, despite clear evidence that co-incineration of RDF is not Taxonomy-compliant.

The first and most important issues related to co-incineration is that **burning RDF in cement kilns makes climate change worse**. The direct emissions of burning of 1 tonne of waste are in a range of 260–780kg CO_2 t-1 waste[103]. The calorific value of waste is highest for plastic, which is mainly fossil based, therefore, cement manufacturing will still be using fossil based fuels. With this knowledge, RDF cannot be considered as a low-carbon fuel. It would be environmentally irresponsible to channel and label this process as a green investment for manufacturing cement as it uses fuels that are already largely outperformed even by conventional fossil fuel sources such as gas (340gCO_2eq per kWh).

In terms of other environmental impacts, **co-incineration is known for the release of harmful pollutants into the surrounding environment**. Moreover, legislation allows higher emissions ceiling for cement plants in comparison to dedicated waste incineration plants[104]. Research shows that the emission of pollutants such as heavy metals and dioxins will increase with higher shares of waste in fuel[105]. Several case studies about co-incineration in cement plants show the environmental impacts of this practice and the lack of an appropriate monitoring systems and regulatory framework, ie the case of cement plants of Alnito Anhovo[106] (Slovenia), Lafarge Trbovlje[107] (Slovenia), and Calusco d'Adda[108] (Italy) show how the partial switch from petroleum coke to waste-based fuels has substantially increased the emissions of many pollutants, which can have significant effects on human health.

In practice, the case studies mentioned above show that the **regulatory framework for the management and control of pollution from co-incineration is not always effective and appropriately implemented**. To continue such an unsafe activity, **strict monitoring and review by competent authorities is essential and will**

[102] ec.europa.eu/info/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-report-taxonomy
[103] www.researchgate.net/publication/26875721_Determination_of_reliable_CO2_emission_factors_for_waste-to-energy_plants
[104] www.researchgate.net/publication/285322278_Air_Pollution_from_Waste_Disposal_Not_for_Public_Breath
[105] www.sciencedirect.com/science/article/pii
[106] www.ekokrog.org/wp-content/uploads/2019/07/Salonit-Anhovo-Case-FNL.pdf
[107] zerowasteeurope.eu/wp-content/uploads/2019/11/zero_waste_europe_cs_burning_waste_in_cement_kilns_lafarge_trbovlje_en.pdf
[108] zerowasteeurope.eu/wp-content/uploads/2019/11/zero_waste_europe_cs_calusco_dadda.pdf

require management by professional, **well informed and technically competent regulatory authorities** - which are not the reality in many countries.
Ultimately, the inclusion of co-incineration as a green activity within the Taxonomy Regulation will create a perverse incentive to subvert the waste hierarchy and undermine the circular economy in two main ways:

- In the short-term, co-incineration creates a vacuum cleaner effect: waste that could be recycled ends up being incinerated. By creating an economic or greenwashing incentive to burn RDF, EU member states may be less motivated to implement the Circular Economy Package, which aims at ambitious targets for separate collection and recycling that would reduce the production of RDF. In the best case, it will certainly contradict and hinder that ambition.

- In the long-term, co-incineration creates a lock-in effect: prevention of progressive policies on waste management. Similarly to the lock-in effect created by waste incinerators, the strong economic and reputational interests from the cement industry will become barriers to improve waste reduction, separate collection and recycling.

REMARKS ABOUT GOVERNANCE, TRANSPARENCY AND ACCOUNTABILITY

It is widely recognized that the financing needs for the deepening and increasingly complex global challenges are vast and thus will need to unlock private capital to complement the public sector funds. Engagement with private sector finance should strictly adhere to the important safeguards and mechanisms that have been put in place in multilateral development banks following the numerous cases of development aggression.

it is imperative that capital markets committed to a sustainability agenda be governed by the same mandatory and due diligence requirements to mitigate risks, and guarantee accountability mechanisms.

Furthermore, the sophistication of financial instruments for development is often not matched with the required sophistication on transparency. This lack of traceability and early disclosure of ongoing investments leaves the public unable to participate, review, and monitor the impacts of development investments that promise to deliver on social and environmental goals. In the era of co-financing modalities and blended financing, there is high risk of EU banks and financial markets contributing to GHG-inducing projects even with a standing EU Taxonomy if there is no full disclosure of all sources of funding. For example, an integrated waste management project with several components can have different sources of funding, which without full disclosure it can be difficult to assess.

The EU must also be cautious about the role of financial markets in becoming a vehicle for the corporate capture of public goods including waste management services. While waste management already constitutes a large share of municipal budgets, incentives and subsidies to the private sector can siphon additional public resources and trap municipalities in debt. In this sense, **it is important that sustainable finance commits to the values of equity and justice as much as to a climate-neutral future, and thus it is necessary that any gaps on governance, accountability and transparency are addressed**.

CONCLUSIONS AND RECOMMENDATIONS

The Zero Waste Circular Economy offers investment opportunities that are good for the environment, the economy and, in particular, the post-covid recovery. **New zero waste business models and zero waste public initiatives are showing how investing in the upper tiers of the waste hierarchy**,such as waste prevention, redesign, reuse, recycling, -o**ffers a much bigger return in job creation, economic recovery and resilience than the conventional end-of-pipe industrial alternatives** (Waste-to-Energy incineration or co-incineration), while driving the sustainability agenda and delivering a net reduction of GHG emissions and air pollution.

In the EU, circular economy policies have progressively shaped the resource management field according to the principles of the waste hierarchy and zero waste, **moving away from Waste-to-Energy incineration and prioritising material recovery**. This positive process has reached a milestone with the EU Taxonomy Regulation, a tool that can serve as a starting point to continue developing criteria for the financial sector in alignment with the sustainability agenda. On the other hand, **this report has pointed out specific industrial activities** - Waste-to-Energy incineration, incineration of Refuse-Derived-Fuel in cement kilns, chemical recycling - **that can jeopardise the environmental objectives related to the circular economy and climate neutrality and therefore should be excluded from the the EU Taxonomy and other international sustainable finance mechanisms**.

In light of the above, the recommendations to the European Sustainable Finance Platform to drive sustainable finance towards the building of a long-term Zero Waste Circular Economy society are as follows:

- **Prioritise investment in zero waste businesses and public initiatives that set up systems for waste prevention, reuse, recycling and composting activities.** The support to the upper tiers of the waste hierarchy - instead of supporting downstream technologies - is a critical step to build a truly climate-neutral and sustainable circular economy and one that remains critically underfunded. New initiatives in the waste prevention and reuse sector are already delivering groundbreaking results, but will need significant levels of investment to be scaled up and reproduced as needed. Ensuring that these solutions receive the support they deserve can be a game-changer across the sustainable finance world.

- **Maintain the exclusion of Waste-to-Energy incineration from the Taxonomy** and expand it to other forms of incineration in disguise such as incineration of Refuse-Derived-Fuel in cement kilns and plastic-to-fuel. These technologies pose several environmental, economic and social challenges; namely their contribution to climate change, air pollution, and resource exploitation will exacerbate the ecological crisis that has created the conditions for a pandemic to take place in the first place. In economic terms, these technologies generate few jobs and lock cities into an ever increasing spiral of debt (in the case of Waste-to-Energy incineration), syphoning the budgets that are needed now more than ever to build the recovery and resilience agenda.

- **Establish the EU Taxonomy Regulation for mandatory compliance** for all European aid agencies acting at the EU and international level to avoid double standards and ensure that the zero waste circular economy principles are supported, not jeopardised, globally. **While the EU is showing positive leadership at the regional level, it is yet to be seen how this positive trend can benefit other regions in the world**. The credentials and reputational capital of European sustainable finance will be at risk if double standards are not prevented and avoided. The field of sustainable finance has an opportunity to demonstrate that double standards are not acceptable and that the EU can walk the talk at international level in the same way that it does at home. Ultimately, the EU can play a visionary role in leading the sustainable finance agenda at the international level and encourage other International Financial Institutions and aid agencies to meet Zero Waste Circular Economy standards as a further contribution to this mission.

- **Ensure transparency and accountability mechanisms, mandatory regulations and people-centered finance be the principle of Sustainable Finance.** The EU must encourage national governments and authorities to impose early and full disclosure of risks, public participation and establishment of grievances, and mandatory regulations and measures on the different segments of the financial sector. The EU is also responsible for raising public education on the different financing instruments for sustainable development including accountability mechanisms and how financial sector regulations should be at the service of the public interest. The Zero Waste Circular Economy is a people-centered approach and climate-neutral waste management model but it can be unlocked to its full potential with the right environmental and socially-reinforcing financing.

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Zero Waste Europe is the European network of communities, local leaders, experts, and change agents working towards the elimination of waste in our society. We advocate for sustainable systems and the redesign of our relationship with resources, to accelerate a just transition towards zero waste for the benefit of people and planet.

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