EUROPEUM
INSTITUT PRO EVROPSKOU POLITIKU
INSTITUTE FOR EUROPEAN POLICY

May 2019

1

POLICY PAPER

Waste as a cause of climate change: what to do with it?

Štěpán Vaškevič

- **Climate change is a multidimensional issue in both its origins and its solutions as well. The aim of this paper is to provide an insight into human activity often neglected in climate policies – waste management and its impact on climate change.**

- **The paper will map main streams of greenhouse gas emissions in waste management sector with a focus on landfills, analyze existing approaches for improvement via optics of circular economy and make notes on existing obstacles and opportunities in Czechia.**

How landfill practices are affecting climate change

Despite the existence of various successful and progressive mixed solid waste treatment practices within Europe, a landfill is the most common way of waste disposal across the globe. The most prominent impact on climate change is the flux of methane (CH4), powerful greenhouse gas (GHG) during the process of anaerobic digestion of the organic fraction (eg. paper, food waste, garden waste and so on) of municipal solid waste (MSW). Release of methane from MSW is considered to be the third most powerful source of this GHG in the atmosphere with its 11 % of total anthropogenic CH4 emissions.[1] Waste on the landfill is mostly isolated from oxygen, which leads to slow digestion with continuous release of methane into the atmosphere, which is 21 (28 as per other sources) times more powerful GHG than carbon dioxide.

One of the rather common solutions for methane emissions is a technology, which captures CH4 with the help of vacuum pumps drilled within landfill and usage of captured gas as an energy source. This technology has a significant impact both on savings of fossil fuels, lowered risks of fires and reduction of GHG. This technology, however, should be considered as an "end-pipe" solution, or as a solution for existing old waste dumpsites, which still continue to emit methane till the present day. Unfortunately, this technology is not very common in Czechia, leading to significant risks of fires on landfill sites.

Burning landfills accelerate the speed and scale of GHG emissions in a short time, but those are not the only risks, which are linked to fires. Among them are:

- Landfill fires have high financial costs. Costs of fire extinguishing for one landfill fire are approximately 500 000 – 1 000 000 CZK daily in Czechia, mostly due to the complex nature of such fire site as landfill.
- During landfill fires smoke fumes are highly toxic, resulting in high public health risks.
- Fire extinguishing on a landfill requires tremendous water usage (eg. the landfill fire in Most region in Aug. 2018 required 13 million litres of water). This is particularly warning with regards to long droughts and water deficit risks in Czechia.

There is evidence of the growing number of landfill fires in Czechia, which saw 530 fires in 2018, with numbers growing up to 30 % on average in the period 2014-18 in comparison to previous years.

Other types of waste management and their impact on GHG emissions

Other types of MSW treatment have different impacts on GHG emissions, both positive and negative. There are at least five different impacts of waste treatment associated with climate change, among them is previously discussed leakage of methane and landfill fires, following are emissions associated with waste incineration and energy recovery; reductions of usage of virgin materials and energy in industry due to recycling; carbon sequestration forests due to decreased demand for virgin paper; and energy used in long-distance transport of waste.[2]

Waste incineration and energy recovery is a rather controversial topic in environmental discourse, with fiery debates about dioxin emissions and threats to the recycling of secondary resources. However, waste incineration with energy recovery provides substantial reductions in terms of GHG emissions released, due to a) replacing methane leakage with less powerful carbon dioxide due to waste reduction and chemical processes via burning; b) replacing

[1] Singh, C. K., Kumar, A., & Roy, S. S. (2018). Quantitative analysis of the methane gas emissions from municipal solid waste in India. Scientific reports, 8(1), 2913. doi:10.1038/s41598-018-21326-.

[2] Ackerman, Frank (2000) Waste Management and Climate Change, Local Environment: The International Journal of Justice and Sustainability, 5:2, 223-229.

conventional sources of energy like coal, oil or gas for energy production.

Replacing electricity and heat generation plants operating on coal with a waste incineration plants with combined heat and electricity production (CHP) would result in a net negative GHG flux of almost 400 kg CO2 eq/tonne MSW (numbers are projected for the EU average) if the incineration plant uses energy both from grid and heat and energy recovery from waste. If all the incinerators were in CHP mode, mass-burn incineration would be the best overall option inrms of greenhouse gas flux.[3]

Waste-to-Energy (WTE) schemes, however, have their major flaws and they still produce emissions, which are not captured at the present time. Moreover, burning materials which could be used in industry or agriculture should be considered as resource waste. The general argument in defence of modern WTE is that they produce much fewer emissions than landfills, as they are under strict emission monitoring and possess filters for harmful chemicals capturing. Latest EU legislation regarding waste management and circular economy counts with a maximum 25 % of total MSW burned in WTE plants.

Preserving value: circular economy impact on GHG emissions and climate change

Previously discussed options are the prevalent types of waste management in Czechia, with 45 % of all mixed municipal waste being landfilled in 2019, as the Ministry of the Environment states. This section will focus on the impacts of recycling of waste, composting of biomass and in-depth process connected with the circular economy, which seems to be the only solution for the present state of affairs in the waste management industry.

Currently, the global economy is only 7 % circular, the rest of the material is being continuously wasted. Half of the worldwide emissions are related to materials, a recent report from Circle Economy and Ecofys states.[4]

Circular economy strategies like remanufacturing, recovery and reuse, lifetime extension of the products, sharing and service business models, circular design and digital innovations, may provide modest reductions around 20-30 % in current material usage. That would lead to closing the gap between current climate commitments under the Paris Agreement and the 1.5 °C pathway end goal in 2030.

Recycling of some materials saves energy and therefore reduces GHG emissions. A common example is aluminium, which requires only 5 % of energy for recycling in comparison to raw material extraction or 40 times less the greenhouse emissions of secondary production per tonne of this metal. For various different industrial materials, primary production emissions are 4 – 5 times as great as secondary emissions per tonne.[5]

Landfilling biodegradable waste has a significant negative impact on GHG emissions mainly due to methane emissions. Among the best options are strategies focusing on composting biodegradable waste, which provides valuable input for agriculture, replacing fossil-fuel based fertilizer inputs, recovering topsoil and more benign and ecologically sound agricultural production methods, however, composting has only a slightly positive impact on GHG emissions reduction.

Net benefits of reduction of GHG emission are greater for technologies, which combine Mechanical

[3] Smith, A., Brown, K., Ogilvie, S., Rushton, K., & Bates, J. (2001). Waste Management Options and Climate Change, 2001. Final Report to the European Commission, DG Environment, AEA Technology.

[4] Blok, K., Hoogzaad, J., Ramkumar, S., Ridley, A., Srivastav, P., Tan, I., ... & de Wit, M. (2016). Implementing Circular Economy Globally Makes Paris Targets Achievable.

[5] Ackerman, Frank (2000) Waste Management and Climate Change, Local Environment: The International Journal of Justice and Sustainability, 5:2, 223-229.

Biological Treatment (MBT) of MSW and energy production from biogas captured during this process. This technology is used, for example, across Northern Europe and biogas recovered both from organic matter of MSW and sewage is being used as a fuel for public transport. This technology is producing composted organic matter (of much lower quality than discussed in the previous paragraph) and recovers metals and other inorganic materials for recycling, replacing some part of raw extraction.

Harnessing wasteful habits: the case of food waste

Some waste should better not be wasted. This paper has moved from the least preferred methods of waste management – from landfilling, through energy recovery, recycling, reuse and remanufacturing to waste prevention, which is the best possible option. This is a matter of particular importance in case of food waste where one-third of all food produced in the world is wasted across the food chain, according to FAO.[6] The carbon footprint of food wastage is enormous – if food wastage were a country, it would be the third largest emitting country in the world with 4.4 GtCO2 eq per year. Simply composting food waste would only partly offset GHG emissions.

In the past years, much effort has been done to reduce food waste. Czech NGOs like Zachran Jidlo, Food Bank Association or Reduce Food Waste platform, realize educational programs and technical measures tackling the food waste issue in households, restaurants and agricultural production.

Circular economy transformation in Czechia

There are major obstacles to the reduction of GHG emissions via improved waste management and a circular economy approach in Czechia today. Those are the following:

- 45 % of MSW is being landfilled. This issue was supposed to be a subject of change with the upcoming ban on landfilling of recyclable materials in 2024, but now there is a harsh debate going on around the prolongation of this legislative change till the end of 2030. This would result in continuous landfill gas emissions, filling up the capacities of existing dumpsites and ongoing landfill fires issue.
- Prices of secondary materials are much higher than of raw ones. This harnesses the business development in the recycling industry, but the positive change could be facilitated with a tax reform, putting higher taxes on raw material usage and extraction and lowering labour taxation. Green public procurement would provide a significant boost to demand on recycled materials market.
- Regulatory and legislative barriers. Revising some of the legislative restrictions would facilitate a change in some fields like gastronomy or construction, allowing the use of resources, which are now treated as waste with risks to public health.
- Weak engagement on the production side. Many of today's products are designed to become waste. State, business and consumers should coordinate the effort in the prolonging life cycle of products, but at the same time, the design of products should consider also their end.
- Low numbers in recycling capacities in Czechia. The government should consider subsidiary measures for building strong recycling capacities on a local level, in order to exclude the situation when waste is being shipped to other countries in order to be recycled. Best solutions are based on pairing industries on a local level, trading waste of one industry as inputs for another one.

[6] FAO. (2015). Food Wastage Footprint & Climate Change.

Transactions could be realized on a digital platform as the new Czech startup Cyrcl does.

Concluding remarks

Waste contributes significantly to the climate change problem. The issue is discussed relatively rarely when we speak about climate change mitigation, however, implementation of the circular economy principles would bring significant reduction of GHG emissions.

Ellen McArthur Foundation estimates that GHG emissions in the EU from the transport sector, food, and built environment can decrease by 48 % by 2030 and by 83 % by 2050 compared to 2012 emissions, if these sectors become more circular. This is including measures like material efficiency, renewable energy and energy efficiency. With this 48% reduction in 2030, we are already on a 1.5 °C pathway.

Our waste is not only a climate change problem, but also an area where doing the right thing – fixing our wasteful habits – is politically popular. It is much easier to persuade people to change their waste production habits, rather than convince them to abandon flying, meat consumption or to rebuild their housing.

However, to meet the Paris goals, circular economy is not enough. It will work only in combination with the massive transition to renewable energy, changes in our consumption and restoration of natural ecosystems, which together will make the necessary decrease of CO2 in the atmosphere.

Štěpán Vaškevič

Štěpán Vaškevič is an editor of Zajímej.se, first media in Czechia promoting principles of circular economy among the public, running under INCIEN, Institute of Circular Economy. He studied Environmental studies and Sustainable development at Palacky University in Olomouc, where he started a student environmental association Udržitelný Palacký. Currently, he is finishing his master degree in International Development studies, and does study exchange at University of Oslo.

Co-funded by the
Europe for Citizens Programme
of the European Union