Harmful subsidies to waste-to-energy incineration

A pending issue for the Renewable Energy Directive and Bioenergy Sustainability Policy.

Policy Paper

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Introduction

The path towards a low-carbon and resource-efficient Europe is clearly guided by the Waste Hierarchy, which defines waste prevention, reuse and recycling as the best options to make the best use of resources and reduce GHG emissions. Precisely, the Circular Economy Package is working towards increasing the European ambition in that direction and maximise the upper tiers of the Hierarchy.

Yet one of the key obstacles to the full implementation of a Circular Economy is the financial incentives provided to incinerate resources that should be prevented, reused, recycled/composted – on the grounds of the "renewable" energy generated by burning them.

These financial incentives, given under the umbrella of the Renewable Energy Directive, act as harmful subsidies and need to be phased out without delay, if real action is to be taken on climate, energy, resource and air pollution agendas. Not only are these harmful subsidies driving the incineration of organic waste that should not be burnt but treated according to the Organic Waste Hierarchy – but in addition, this is such inappropriate source of fuel that it can only be burnt along with fossil-based content, i.e. plastics present in residual waste, which provides the adequate calorific value. In sum, the financial support to burn organic waste for energy purposes is one of the most counterproductive financial mechanisms today in the EU, one that a reformed Renewable Energy Directive and the Sustainable Bioenergy Policy should not continue supporting.

The Renewable Energy Directive - a driver for waste-to-energy incineration

The European Renewable Energy Directive defines 'energy from renewable sources' as including only non-fossil sources, particularly *"wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases".*

Furthermore, biomass is defined as the "*biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the* ***biodegradable fraction of*** *industrial and* ***municipal waste***".

The biodegradable or organic fraction of municipal solid waste includes food waste from restaurants, households, farmers markets, gardens, textiles, clothing, paper and other materials of organic origin. Some of these resources can be mostly recyclable (paper), or reusable (clothing), while other wet organics can be fed to humans, animals, composted or turned into biogas, following the Organic Waste Hierarchy, as explained in the last section of this briefing.

However, in the absence of proper policies to ensure the source separation and separate collection of organic waste, as well as other waste management measures to maximise waste prevention, reuse and recycling, organic waste is too often mixed up with residual waste stream and ends up either in landfills or waste-to-energy incinerators.

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While the Landfill Directive has been successful in driving biodegradable waste away from landfill over the years, no other policy has effectively prevented the diversion of organic waste from waste-to-energy incinerators. In fact the opposite, the Renewable Energy Directive has increased the burning of organic waste with very severe consequences, as exposed below.

Across the EU, countries have developed national plans to meet their national Renewable Energy targets including the implementation different types of fiscal incentives to enhance the development of renewable energy sector. In practice, the inclusion of the organic portion of municipal solid waste in the definition of potential sources of renewable energy has allowed the waste-to-energy incineration industry to claim these financial incentives for burning residual waste, a severe distortion of the truly sustainable use of these subsidies.

Not only organic waste should be treated according to the Organic Waste Hierarchy – its low calorific value requires it to be burnt along with materials of higher calorific value that are present in the rest of residual waste, such as plastic, paper, etc. In this way, the subsidies are effectively enhancing the incineration of materials that should be recycled, contradicting the EU Commitments in the 7th Environment Action Programme that sets the objective of limiting waste-to-energy to only non-recyclable materials.

Moreover, the monitoring of the amount of organic waste versus the amount fossil-based waste is technologically difficult. It's often assumed that the proportion is 50% - even if often industrial and commercial waste get included in the mix of residual waste. Given the heterogeneity of waste and the great differences at the local level from plant to plant, it's known that this percentage is not reliable, which concludes that much of the so-called renewable energy from incineration comes in fact from incinerating fossil carbon based materials.

As exposed below, some countries rely heavily on this source of energy, at the expense of the environment, public health and the economy, and undermining not only the renewable and climate policy agenda, but also the Circular Economy and the Air Pollution policy frameworks.

As long as the Renewable Energy Directive does not specify any further criteria to discern different types of biomass, neither provides a criteria for the sources that would maximise a pathway to a low-carbon economy, it remains blind to the harmful subsidies it's created in the waste sector.

Key countries relying on waste-to-energy incineration to meet Renewable Energy targets

According to Eurostat data, for some key countries in the EU (Table 1.) a significant proportion of so-called 'renewable' energy consumption comes from waste-to-energy incineration. Precisely, these are the countries that have shown to have overcapacity of incineration treatment - i.e. not enough production of domestic waste to feed the incineration infrastructure and therefore requiring imports from other countries, which ultimately is an obstacle to maximise resource-efficiency across Europe. According to the Impact Assessment related to the Circular Economy Package, Germany showed to have 25% overcapacity for incineration, for example.[1]

Table 1 - Share of renewables in gross inland energy consumption (GIEC) and share of 'renewable MSW' in 2014:

Countries with highest amount of MSW (biogenic origin) in their renewable energy consumption		
Country	**Percentage of RE in GIEC**	**Percentage of MSW (biogenic origin) in RE**
Netherlands	4.4	28.3
Denmark	26.2	11.0
Belgium	6.3	10.4
Germany	11.3	8.5
France	8.6	5.5
Luxembourg	4.5	5.4
Ireland	7.1	5.4
Sweden	35.8	5.0
European Union (28 countries)	12.5	4.6
United Kingdom	6.4	3.9

[1] Circular Economy Package - Impact Assessment, 2014: http://eur-lex.europa.eu/resource.html?uri=cellar:0c4bbc1d-02ba-11e4-831f-01aa75ed71a1.0001.02/DOC_4&format=PDF

Harmful renewable energy subsidies to waste-to-energy incineration are of various forms and shapes. Several countries rely on feed-in-tariffs to energy produced by incinerators, while others apply tax exemptions that would normally apply to all energy producers. One common financial incentive not directly related to the Renewable Energy Directive is the exemption of waste-to-energy incinerators from entering the EU ETS, which is an implicit subsidy, even if incinerators generating electricity might generate electricity with a carbon intensity of around 600g CO2 per kWh, almost double the carbon intensity of a modern gas fired power station.[2]

Recent reports from UKWIN and Biofuelwatch have exposed how the renewable energy subsidies in the UK are heavily biased in favour of bioenergy and waste.[3] Over 70% of all energy classed as renewable in the UK currently comes from biomass (including waste) and this proportion is set to increase.

The table above (Table 1.) exposes the countries with the highest reliance on waste as a source to comply with renewable energy targets. Overall, 4.6 % of total RE in the EU-28 comes from waste-to-energy incineration, which is a significant amount considering that the total consumption of RE represents the 12.5%. Then, the Netherlands shows the highest percentage of "renewable energy" coming from waste-to-energy incineration (28.3%), which appears to be quite a high proportion given the comparatively low percentage of RE produced in the country. In comparison, Denmark is the country in EU which generates the highest percentage of RE but almost half of it comes from incineration. Denmark is also the country producing most municipal solid waste per capita and 54 % of municipal solid waste is incinerated for energy recovery, the highest in the EU. Denmark is closely followed by Belgium, Germany, and France, all of them countries that have the highest percentages of waste generation and waste-to-energy incineration.

It's also worth point out that biomass and waste (including forestry, agriculture and municipal solid waste biomass) are by far the largest source of "renewable energy" in Europe, with a 63,1% (Fig.2). Moreover, Fig 3 shows how this share has increased in the last ten years.

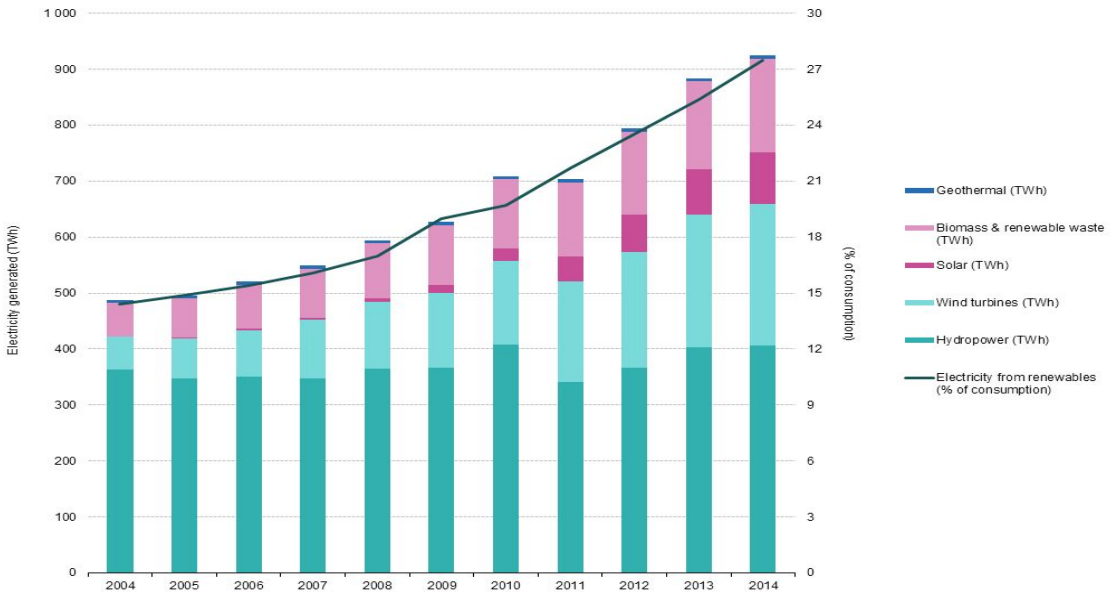
[2]Eunomia, The potential contribution of the waste management to a low-carbon economy, 2015.
[3]UKWIN and Biofuelwatch, Renewable Energy Subsidies in the UK: the case for excluding bioenergy and waste incineration, consulted here:
http://www.biofuelwatch.org.uk/files/Bfw-UKWIN-policy-recommendations.pdf

Figure 2: Primary production of renewable energy, 2004 and 2014

	Primary production (thousand toe)		Share of total, 2014 (%)				
	2004	2014	Solar energy	Biomass & waste	Geothermal energy	Hydropower	Wind energy
EU-28	113 134	195 814	6.1	63.1	3.2	16.5	11.1
Belgium	760	2 857	9.4	75.8	0.1	0.8	13.9
Bulgaria	1 009	1 842	6.9	63.6	1.8	21.5	6.2
Czech Republic	1 875	3 656	5.4	89.0	0.0	4.5	1.1
Denmark	2 447	3 144	2.6	61.5	0.1	0.0	35.8
Germany	14 568	36 018	10.3	70.8	0.5	4.7	13.7
Estonia	681	1 186	0.0	95.4	0.0	0.2	4.4
Ireland	282	854	1.4	39.6	0.0	7.1	51.8
Greece	1 571	2 329	22.2	47.1	0.5	16.5	13.6
Spain	8 816	18 003	17.3	39.1	0.1	18.7	24.8
France	15 769	21 002	2.9	63.1	1.0	25.7	7.1
Croatia	1 847	2 292	0.5	62.5	0.5	33.8	2.7
Italy	12 193	23 644	8.9	42.2	22.1	21.3	5.5
Cyprus	48	111	66.7	17.8	1.4	0.0	14.1
Latvia	1 837	2 371	0.0	92.3	0.0	7.2	0.5
Lithuania	849	1 358	0.5	92.8	0.1	2.5	4.0
Luxembourg	51	120	9.3	77.2	0.0	7.7	5.7
Hungary	950	2 051	0.5	89.2	6.3	1.3	2.8
Malta	0	13	80.3	20.5	0.0	0.0	0.0
Netherlands	1 881	4 555	2.1	86.0	0.8	0.2	10.9
Austria	6 618	9 370	2.7	55.8	0.3	37.6	3.5
Poland	4 321	8 054	0.2	89.0	0.3	2.3	8.2
Portugal	3 800	5 848	2.2	53.8	3.2	22.9	17.8
Romania	4 594	6 090	2.3	61.9	0.5	26.6	8.8
Slovenia	822	1 180	2.8	50.1	2.7	44.4	0.0
Slovakia	745	1 441	4.0	70.4	0.5	25.1	0.0
Finland	8 728	10 068	0.0	87.6	0.0	11.4	0.9
Sweden	13 147	16 660	0.1	61.2	0.0	32.9	5.8
United Kingdom	2 929	9 696	4.1	62.3	0.0	5.2	28.4
Iceland	2 333	5 223	0.0	0.0	78.7	21.2	0.0
Norway	10 542	12 965	0.0	8.4	0.0	90.1	1.5
Montenegro	–	329	0.0	54.2	0.0	45.8	0.0
FYR of Macedonia	304	278	0.4	56.9	3.1	37.4	2.2
Albania	704	621	2.0	32.5	0.0	65.5	0.0
Serbia	1 859	2 068	0.0	54.0	0.3	45.7	0.0
Turkey	10 783	12 010	6.7	28.8	29.3	29.1	6.1
Bosnia and Herzegovina	696	2 278	0.0	77.6	0.0	22.4	0.0
Kosovo (under UNSCR 1244/99)	176	263	0.1	94.9	0.0	5.0	0.0

Source: Eurostat (online data codes: ten00081 and nrg_107a)

Figure 3: Electricity generated from renewable energy sources, EU-28, 2004–14



Source: Eurostat (online data codes: nrg_105a and tsdcc330)

Key issues related to harmful renewable energy subsidies to waste-to-energy incineration.

1. **<u>Undermining the Circular Economy Package</u>**

The misdirected subsidies for waste-to-energy incineration undermine important progressive goals of European legislation, particularly the Circular Economy Package and the Roadmap for a Resource-Efficiency in Europe.

First, financial support to waste-to-energy incinerators subverts the Waste Hierarchy and prevents in waste policy and management focussing on the upper tiers with the highest ambition. Despite being classified as 'renewable energy' and encouraged by financial subsidies, 'energy recovery from waste' is still one of the least desirable options of the waste hierarchy and directly conflicts with higher tier options such as reduction or increased recycling.

Secondly, these subsidies are contributing to an already problematic situation: the reality of incineration overcapacity in Northern Europe. This is a reflect of the lock-in situation created by this large infrastructure, whose inflexibility to adapt and large cost becomes an obstacle to increase recycling and waste prevention. Solid commitment to ensuring a fair transition to a Circular Economy requires to shift subsidies according to the best waste management options.

The incineration industry has long argued that this treatment is necessary for the portion of MSW that cannot be recycled, and have promoted the belief that after maximizing recycling, reuse and composting, the best thing a community can do with leftover waste is to create energy with it. However, this is a political choice with little science behind.

According to a scientific study recently published which compares the environmental impacts of the three most common disposal methods used globally, the best approach to protecting the public health and the environment isn't mass burn waste-to-energy.

The report found that, after aggressive community-wide recycling, reuse and composting, the most environmentally-sound disposal option for any waste that may still remain is a third option: Materials Recovery, Biological Treatment (MRBT), or in other words, pre-treat the waste, recover as much as possible, biologically stabilise and landfill it. The Waste Hierarchy published by the World Bank corroborates the concept of landfilling scoring higher than waste-to-energy incineration.[4]

Ultimately, the waste that today can't be recycled or composted amounts to 5 to 20% of total household waste -depending on the community-. For instance in the first European town to declare Zero Waste, Capannori, this amounts to 8%. In the Gipuzkoa province the waste that is not recyclable is 19%. This is a very small percentage of waste which does not justify any further investment in waste-to-energy incineration.

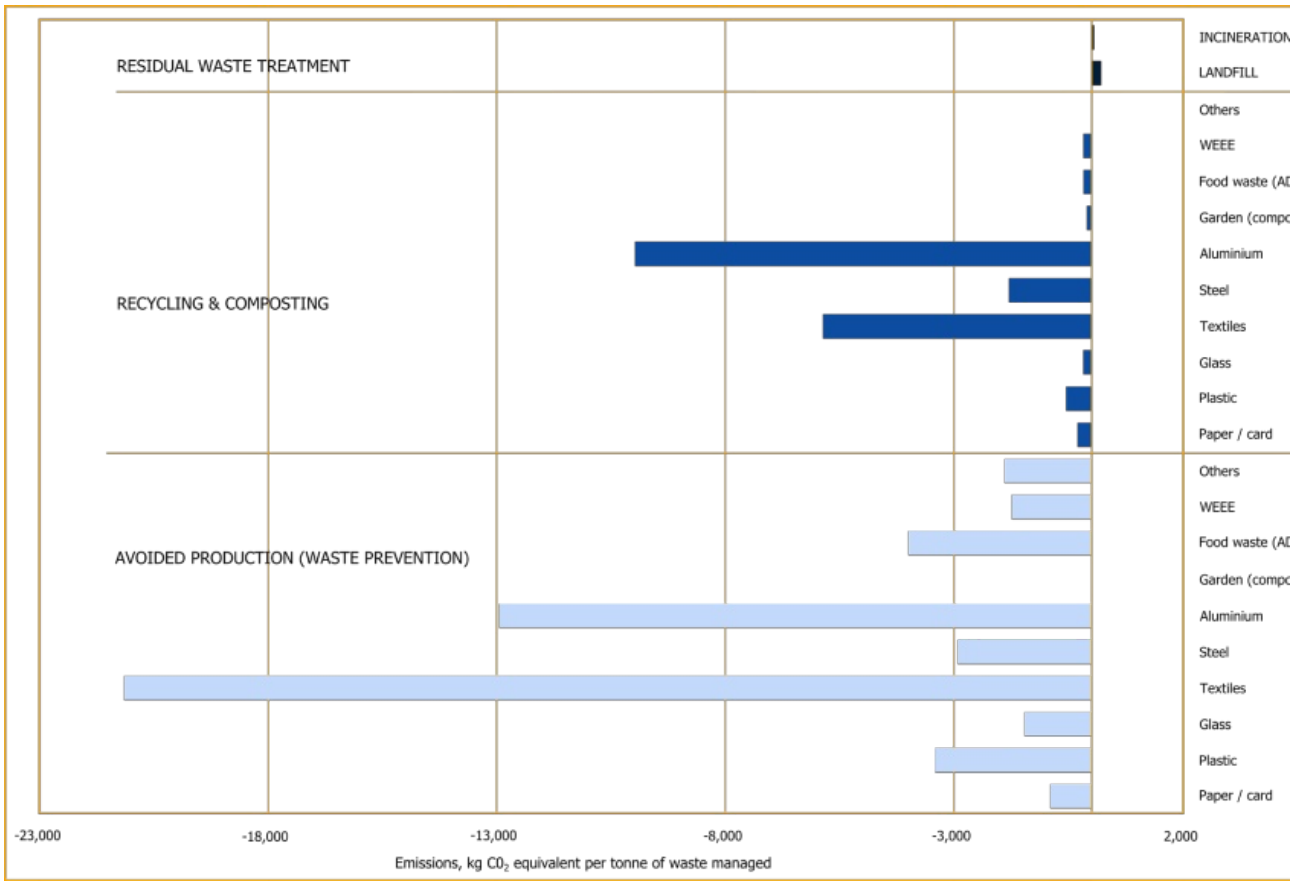
2. Undermining of the Climate and Energy Policy Agenda

Evidence shows that waste-to-energy incinerators emit more CO_2 per megawatt-hour than any fossil fuel based power source, including coal-fired power plants. Moreover, it has been highlighted time and time again that waste is not burned because it is a good source of energy and that as exposed by Eunomia 'to the extent that waste is *renewable* incinerating it generates very little *energy;* to the extent that incinerating it produces *energy*, little is *renewable.*'

Eunomia's report 'The Potential Contribution of Waste Management to a Low Carbon Economy' showed how the waste sector can be a key player to drive GHG emissions reductions applying the highest tiers of the Waste Hierarchy, whereas the burning of waste contributes to climate change emissions, rather than helping to reduce emissions overall. Previous reports on this matter have pointed out that proper lifecycle calculations found that " energy scenarios using incineration were amongst the poorest performing".

[4] What a Waste a Global Review of Solid Waste Management
https://openknowledge.worldbank.org/handle/10986/17388

Figure 4: Emissions avoided (CO_2 equivalent) for different waste portions for treatment and avoidance



The classification of waste-to-energy incineration as renewable is in part based upon an assumption that CO_2 from non-fossil fuel sources doesn't matter, due to its 'short-cycle' nature. This assumption is false, as all sources of CO_2, regardless of their origin, contribute towards climate change. With this fact in mind, it is clear that the burning of waste does not present a sustainable climate change solution. Instead it should be disincentived as a carbon-intensive climate change contributor.

Most importantly, waste-to-energy incineration is a particularly inefficient method of energy generation which requires high-calorific value materials, ie plastics, paper or dry biomass to function. Essentially, waste-to-energy incineration ends up being a more inefficient, expensive and polluting version of traditional power sources, far from deserving any financial support that should instead be devoted to guarantee a real transition to a Low-Carbon Economy.

3. Undermining international and EU regulations on air pollution and toxics.

Air pollution is an inevitable consequence of the waste burning process. Despite complex and expensive filter technologies, it is impossible to completely eliminate the toxic pollutants emitted. Incinerators emit hundreds of different pollutants into the environment, some of them including persistent organic pollutants (POPs) such as dioxins and furans (PCDD/PCDF), which are banned under the Stockholm Convention.

POPS pose a global threat to human health and the environment due to their specific characteristics. They are toxic and persistent in the environment, can travel long distances and accumulate in the food chain. The current safety measures, and pollutant limits do not factor in the bioaccumulation of the toxins in the food chain, and the chronic illnesses this can cause over a longer time period, and wider geographical location.[5]

As the EU is a signatory to the Stockholm Convention, any promotion of the major sources of POP's generation, such as waste incinerators, is contrary to the intent of the convention.

These and other POPs are also released to the environment through disposal of incinerator liquid wastes and ash, not only through air pollution. Ash is a by-product of incineration, both bottom and fly ash (if compacted it represents about the 30-50% by volume of the original waste), which requires transportation to landfill sites for disposal.

Similar to the incinerator emissions some of this ash also contains high concentrations of toxic substances such as dioxins and heavy metals. Abatement equipment in modern incinerators merely transfers the toxic load, that of dioxins and heavy metals, from airborne emissions to the fly ash which may leak into the environment[6].

At the EU level, the recently approved National Ceilings Directive has included targets for abatement of Particulate Matter ($PM_{2,5}$), which are often the result of waste-to-energy incineration. A recent study (Aboh, et al. 2007) that looked into a medium sized city in

[5] In this sense, see Position paper ISDE Italia, *"La gestione sostenibile dei rifiuti solidi urbani"*, International society of doctors for Environment, A. Di Ciaula; P. Gentilini (2015) http://www.isde.it/pubblicato-il-position-paper-di-isde-italia-sullo-smaltimento-dei-rifiuti-solidi-urbani/

[6] The Health Effects of Waste Incinerators, 4th Report of the British Society for Ecological Medicine (2008), http://www.bsem.org.uk/uploads/IncineratorReport_v3.pdf

southwestern Sweden, clearly identified their new modern incinerator as the single most significant source of PM2.5's.[1]

Still, evidence from the waste incineration industry shows that filter bag systems used to collect the Particulate Matter and other toxic emissions have a much lower efficiency rate with fine PM <2.5: "…baghouse filter collection efficiency was 95-99% for PM10s, 65-70% for PM2.5s, and only 5-30% for particles smaller than 2.5 microns, even before the filters become coated with lime and activated carbon".[2] In conclusion, the real solution to preventing air pollution from waste incineration is minimising this activity as much as possible.

Several independent scientific studies have shown adverse health effects, including increased morbidity and mortality for people living near waste-to-energy incinerator plants:

- Increased risk of developing cancers, in particular the risk of developing sarcomas is 3.3 times higher for people who lives near incinerator plants, but also non-Hodgkin lymphomas, pulmonary tumours, cancers in children, increased risk of malignant tumours of the stomach, colon, liver and breast cancer in women,
- Increased risk of miscarriage in pregnant women, birth defects and preterm births;
- Increased risk of ischemic heart defects and respiratory diseases[7].

[7] Kim Y. M., Kim J. W., Lee H.J. *Burden of disease attributable to air pollutants from municipal solid waste incinerators* in Seoul, Korea: a source-specific approach for environmental burden of disease. Sci.Total Environ. 2011;409:2019-28, for a detailed analysis; For respiratory disorders among men, living in areas with high PM_{10} levels due to incinerators, see *Morbidity in a population living close to urban waste incinerator plants in Lazio Region (Central Italy): a retrospective cohort study using a before-after design,* Golini M.N., Ancona C., Badaloni C., Bolignano A., Bucci S., Sozzi R., Davoli M., Forasiere F. https://www.ncbi.nlm.nih.gov/pubmed/25387747

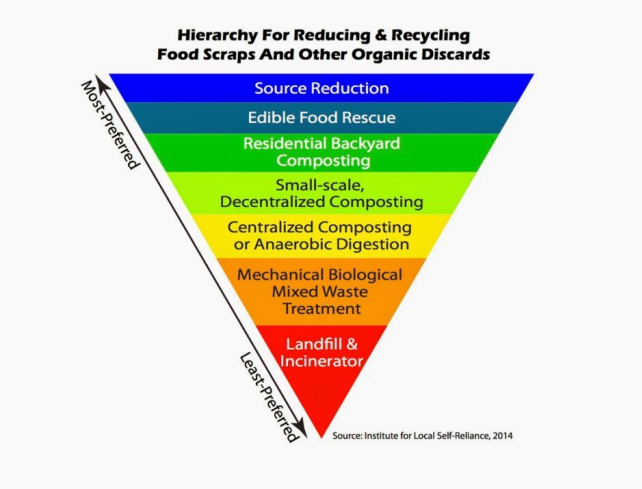
What to do with organic waste instead of burning it?

It is essential for organic waste to be dealt with in a sustainable manner. This requires the phasing out of 'renewable energy' subsidies which support polluting and hazardous practices such as waste-to-energy incineration. The question is: what should we do instead?

The organic waste hierarchy aims to answer that question. With clear guidelines on the preferential handling of food waste with reuse by people at the top and disposal options at the bottom.

First, organic waste can be reduced through various measures, e.g., improved labeling, better portioning, awareness raising and educational campaigns around food waste and home composting. Secondly, priority should be given to the recovery of edible food so that it is targeted at human consumption first, and alternatively used as animal feed. Next, non-edible organic waste should be composted and used as fertiliser for agriculture, soil restoration and carbon sequestration. Additionally, garden trimmings, discarded food and food-soiled paper should be composted in low-tech small-scale process sites whenever possible. In larger areas, composting could be done in a centralised way with more technologically advanced systems.

As an alternative to composting, depending on local circumstances and the levels of nitrogen in the soils, non-edible organic waste should be used to produce biogas through Anaerobic Digestion technology, a truly renewable source of energy as well as soil enhancer. If there was any organic waste within the residual waste stream, a Material Recovery – Biological Treatment (MRBT) could be considered because it allows for the recovery of dry materials for further recycling and stabilizes the organic fraction prior to landfilling, with a composting-like process. In the lower tier, landfill and incineration are the least preferable and last resort options.



Organic Waste Hierarchy (source: Institute for Local Self-Reliance, 2014)

The Organic Waste Hierarchy in Practice: the case of Fairfield Environmental Services

In Manchester, UK, a waste management company are challenging the idea that incinerators make up a vital part of the the municipal waste toolbox, and putting the food waste hierarchy into practice. Inspired by a successful battle against an East Manchester incinerator in 1996, activists began to look to alternative waste management systems, and finally set up what was to become Fairfield Environmental Services Ltd. in 2003. Since then Fairfield Materials Management has expanded to become the solely responsible for the management of waste from New Smithfield Market, the largest wholesale market in the North West of England.

New Smithfield Market occupies 35 acres just 2.5 miles from the centre of Manchester and is open everyday with weekday trading from 2.30am to 12.30pm. The traders at the market pay a flat service charge which covers waste, including plastics, wood, cardboard and food waste, offering little incentive for them to reduce the amount of waste. However, Fairfield's comprehensive approach and dedication to the Waste Hierarchy mean that they have managed to reach 85% recycling rates overall, with much of the waste being diverted to the upper-tiers of the Hierarchy.

Fairfield follows the Organic Waste Hierarchy in the separation of food waste

In the market, the vast majority of the waste is organic, with food, wood and cardboard being the largest portions. With many traders abandoning perfectly edible produce in an attempt to make the largest profit, Fairfield works to prevent the produce being wasted by directing it to people in need, by working with Fareshare, a 'food supply organisation for the vulnerable and needy'.

When the food is not suitable for human consumption, or Fareshare are unable to handle the quantities, Fairfield work to sell it as animal feed, with some of the waste being supplied to Pig Inn Heaven 'a safe haven for pigs in need of rehoming'.

The remaining biowaste is used for either, anaerobic digestion or composting, processes which are carried out off-site. The compost is produced by Brosters' a local farm with a strong emphasis on eco-production who generate high-quality PAS 100 compost from the waste.

Compost from the organic waste at Fairfield Environmental Services

Fairfield demonstrates what is a possible alternative to large scale waste-to-energy incineration, minimising the waste for disposal and rigorously following the food waste hierarchy in their management of waste for the market.

Policy Recommendations

The main recommendations for a Sustainability Bioenergy Policy, included in Zero Waste Europe's official response to the consultation are:

1. The Sustainability Policy on Bioenergy should explicitly exclude Municipal Solid Waste as a source of sustainable energy.

EU climate and energy policies, particularly policies on bioenergy and RE, should be aligned with the Waste Hierarchy embedded in the Circular Economy Package, respecting the priority for reduction or composting/Anaerobic Digestion, before incineration.

This needs to be ensured by recognizing that municipal solid waste is not a sustainable source of energy and therefore should be excluded from the legislative definition accordingly.

It is time for the EU Climate and Energy Policy to fully account for the contribution of the waste sector to a Low Carbon Economy, and foster appropriate alignment for the most climate-friendly options in the waste management sector, as described in the Waste Hierarchy.

2. The European Commission should encourage MS to phase out harmful renewable energy subsidies to extract energy from residual waste.

Harmful subsidies for waste-to-energy incineration pervert the path towards a Circular Economy. Extracting energy from residual waste is a net contributor to greenhouse gas emissions inventories rather than a saver.[8] These harmful subsidies are one of the major obstacles to fully implementing a Circular Economy, this being an extremely counterproductive misalignment between two fundamental pillars of current EU policy. This is a fundamental mis-allocation of resources and they should be discontinued without delay.

3. EU Climate and Energy Policy should work towards valuing energy embedded in products and establishing an energy preservation paradigm rather than burning limited natural resources for the extraction of energy.

Energy policies for a low-carbon economy should progressively move away from extracting as much energy as possible from waste and instead increase measures to preserve the embedded energy in products, a far more efficient and sustainable approach to resources.

[8] Eunomia, The contribution of waste management to a low-carbon economy, 2015.

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