# A guide for cities and municipalities faced with “waste-to-energy” incinerator proposals


## Why this guide?

Over the past several years, many cities in developing countries in Asia and the Pacific have been approached by companies selling waste incinerators.

Many of these are marketed as “waste-to-energy” plants--facilities that burn municipal waste, and which will supposedly generate electricity.

These come under many names such “gasification,” “plasma arc,” and “pyrolysis” plants.

Proponents of these plants will promise many things, such as pollution-free operations, big returns in electricity sales, and how the facility will solve all the municipality’s or city’s waste problems.

They will also claim that the electricity generated is “renewable energy,” and how it “eliminates” the need to segregate waste. How do you know if these promises and claims true?

This paper, meant for city and municipal officials, gives a brief introduction about incineration.

It aims to inform readers about the technical basics about incineration plants and their pitfalls, and equip them with questions to ask when they are faced with incinerator proposals.

Aside from being a guide for officials faced with incinerator proposals, this paper hopes to help decision makers aim for long-term directions toward sustainability, and to advocate for better and safer resource and waste management systems in their localities.

# Introduction

Burning waste is one of the oldest and most primitive approaches to dealing with discards.

In the past, people dealt with waste through open burning. Today, industries have created massive waste burning facilities, called incinerators, to mechanize the process. But whether open burning or incineration, the principle remains the same, to burn waste--anything that people throw away--in order to reduce it into ashes.

Rightfully, many people have begun to question this outdated system of dealing with waste. Modern society's improved understanding about toxic pollution resulting from waste burning, and the need for the sustainable management of the earth's resources, has shown that society needs a much better approach to dealing with discards.

Any process that burns materials produces hazardous emissions and prevents these materials from being reused. Toxic fumes in the air harm community health, and burning materials create the need to extract more and more of the earth's limited resources.

But in many countries today, incineration--despite its attendant hazards--is still considered an acceptable way to deal with the problem of waste.

Many companies are still aggressively promoting incinerators in different parts of the world.

Fortunately, in places such as Europe, policy- and decision-makers are now realizing that a better approach to waste is needed--and they are initiating changes that will enable cities and countries to shift toward a circular economy and finally leave incineration behind.

Other regions still need to follow suit. To help speed up this process, more people need to know the facts about waste and waste burning, as well as Zero Waste--the sustainable approach to resource management.

## What are waste-to-energy facilities?

Waste-to-energy facilities are plants that processes discards (what people throw away) into energy in the form of heat or electricity.

There are two types of waste-to-energy processes:

1. **Biological waste-to-energy**
   Biological waste-to-energy systems use biological processes to generate energy. These include biodigesters and other anaerobic digesters which are used for biogas production. Biological waste to energy systems are used for organic matter and rely on the decomposition process of organics to generate biogas.

2. **Thermal "waste-to-energy"**
   All thermal "waste-to-energy" processes involve incineration (burning of the waste material). In this document, these are called 'WTE incinerators.'

   These are facilities that
   a. require the external application of heat to directly burn waste material and recover the energy from that heat; or which
   b. heat materials to produce gases and/or liquids which are then combusted to produce electricity.

WTE incinerators rely on materials with high calorific value (meaning materials that burn well such as plastics and paper), rather than organics (which are high in water content and do not burn well).

Examples of WTE incinerators are mass burn (traditional) incinerators which also recover heat (useful for cold countries), as well as gasification, pyrolysis and plasma arc facilities.

**Question to ask the incinerator proponent:**

**Is the facility a biological or thermal waste-to-energy facility?**

Cities and municipalities need to be wary if the proposed facility is a thermal waste-to-energy facility or WTE incinerator. WTE incinerators are bad for the environment and community health. They also destroy resources and are the most expensive way to manage waste as well as generate electricity.

There are better and sustainable waste management options available which cities and municipalities can pursue, and which follow the sustainable waste hierarchy that prioritize reduction, reuse and recycling.

**The focus of this document is thermal waste-to-energy facilities or WTE incinerators.**

## Introduction to incinerators

An incinerator is any stationary or mobile structure or equipment used for the thermal treatment (or simply put, burning) of waste.

There are different types of incinerators. They may be classified according to the kind of thermal process used for burning (mass burn, gasification, plasma arc, pyrolysis, etc), the furnace or reactor design, or the kind of waste they burn (industrial, medical, or municipal solid waste).

Incinerators vary in complexity in the way they burn waste and their pollution control systems. These are the two important components of waste incinerators.

Pollution control systems are particularly important. Regardless of how they burn waste, no incinerator is "pollution-free." Burning waste always creates pollution.

The emissions from incinerators include cancer-causing chemicals such as dioxins and furans which occur when certain materials such as plastic is burnt, as well as well as heavy metals and particulate matter which cause severe health problems, and even death.

Because of the pollution produced during waste burning, incinerators have become increasingly complicated as the industry tries to build more and more models that are "safer" than previous ones.

A considerable part (and cost) of large incinerator facilities (more than half the total construction cost, and a recurring operating cost) are pollution control structures and systems.

As a consequence, the latest incinerator facilities in developed countries are major infrastructure projects that can cost upwards of USD 150 million. (As of 2017, the most expensive facility so far cost USD 670 million.[i])

## What are the kinds of incinerators?[ii]

There are notable process differences between conventional mass burn incinerators and staged incinerators such as gasification, pyrolysis and plasma arc facilities.

In basic terms, while mass burn incinerators combust waste in one single chamber in an oxygenated environment, gasification, pyrolysis and plasma incinerators heat waste materials in one chamber with limited oxygen present, and then combust the released waste gases (and char and other solid byproducts in the case of some staged incinerators) in a separate chamber.

Gasification, pyrolysis and plasma incinerators typically utilize either a steam or a gas turbine to generate electricity. Steam powered technologies generate electricity by combusting waste gases to create heat; using the heat to create steam; and then using the steam to power a turbine.

In addition to these processes, some companies claim that they can use waste gases and oils to create liquid fuels to be combusted in vehicles or industrial facilities off-site.
The major variations between gasification, pyrolysis and plasma incineration technologies have to do with the different temperature levels used in the processes and the amount of air or oxygen present.

Precise definitions of these technologies are not clearly established and there is a lack of consistency across the industry in the use of each term.

The following is a list of incinerators according to thermal process used[iii]

**1. Combustion**
Combustion is simply put, burning or oxidation of compounds. The ash produced is a combination of materials incompletely combusted and new solids formed during oxidation. The two most common combustion technologies for solid waste are:

a. **Mass burn**, in which waste is directly burned. Often the heat produced during the burning is used to convert water to steam to drive a turbine connected to an electricity generator.
b. **Refuse-derived fuel (RDF)**, in which mixed waste is processed prior to direct combustion. The level of processing varies among facilities, but usually involves shredding and removal of metals and other materials with low heat potential. The processed materials are then used as fuel either in the same manner as at mass burn plants or to fuel existing facilities such as cement kilns.

**2. Pyrolysis[iv]**
Pyrolysis is the thermal degradation of materials by heat in the absence of or with a limited supply of oxygen, that is, without the addition of air or oxygen. However, there is always oxygen present, whether trapped among the waste material or in the chemical composition of waste.

In a pyrolysis unit, materials are heated to a temperature between 1,000 to 8,000 degrees Celsius (in municipal, industrial and medical waste incinerators). The lack of oxygen aims to prevent combustion. However, as mentioned earlier, eliminating all oxygen is virtually impossible. Some oxidation occurs and results in the formation of dioxins and other related hazardous compounds.

Pyrolysis reactions are endothermic, that is, they require the addition of energy. The types of pyrolysis are based on the energy source. These are: natural gas, syn gas, and/or fuel oil combustion; resistance heating; induction heating; and plasma pyrolysis (ionized gases that release energy when current is passed through).

Aside from the release of harmful emissions, the process results in a solid residue called “char” or “slag” (which is likely to contain heavy metals).

**3. Gasification[v]**
Gasification is similar to pyrolysis except that the thermal transformation of solid waste takes place in the presence of a limited amount of air or oxygen, producing a combustible synthesis gas (usually called ‘syngas’). This gas can then be used in either boilers or combustion turbine/generators.

Gasification plants typically operate up to 1,600 degrees Celsius for municipal solid waste. The gases produced are non-condensable. When operated with limited amounts of air it produces what is known as ‘producer gas’ which has 25% the calorific value of natural gas. When the process involved limited amounts of oxygen, ‘syngas’ is formed, which has 25-40% the calorific value of natural gas.

This process generates solid and liquid byproducts, which may contain high levels of toxic contaminants. The solid residues are char and ash.

**4. Plasma arc[vi]**
Plasma arc processes are usually described as being part of a gasification system. This process enables the rapid thermal decomposition of material by partial oxidation through the addition of limited amounts of air or oxygen. It uses electrical energy and high heat with temperatures ranging approximately from 1000–4500 °C.

In general, pyrolysis uses less air or oxygen in the process and lower temperatures than gasification. As a result, (in addition to syngas produced) other byproducts in addition to gases can vary; char and pyrolysis oil are produced through pyrolysis, rather than bottom ash produced through gasification. In addition, high temperature gasification and plasma gasification or plasma arc gasification can produce a vitrified slag residue.

Again, all four processes enumerated above--combustion (including mass burn and RDF), pyrolysis, gasification, plasma arc (as well as their variants (e.g. plasma gasification, plasma pyrolysis, etc)--produce dioxins, furans and other persistent and very harmful pollutants. They also produce solid and liquid residues which are also toxic and are classified as hazardous waste.

**Question to ask the incinerator proponent:**

**What kind of incinerator is it?**

Proponents will say that gasification, pyrolysis and plasma arc facilities are not incinerators. This is not true. Gasification, pyrolysis and plasma arc rely on combustion (thermal treatment) and are classified and regulated as incinerators (thermal treatment of waste).

## Are incinerators disposal facilities?

## How will the ash and other residues be disposed?

Incinerators are not waste disposal facilities, but rather waste treatment facilities. The waste is not disposed of but merely transformed to other forms of waste which also need further disposal, usually in a specially designed hazardous waste landfill.

These by-products include polluting air emissions (cancer causing dioxins and furans; as well as particulate matter), fly ash (the fine particles of ash that are carried through the facility's filter systems), bottom ash or clinker (residue from the facility's furnace), and liquid releases from water used during operations.

Because most of the materials burned by incinerators have toxic content, and because the burning process itself also creates toxic chemicals, the waste by-products of incineration end up more toxic than the original waste processed.

## Will having an incinerator mean my city/municpality will not need a landfill?

No. Any city or municipality which operates a WTE incinerator still needs a landfill--in this case, a landfill specifically designed for hazardous waste since incinerator ash is considered toxic waste.

Because the byproduct includes fine ash (including particulate matter) the ash needs to be packed and secured before being dumped in a landfill due to the risk of being scattered by the wind.

Transporting the ash from the facility to the hazardous waste landfill also needs to be conducted with specialized trucks as the ash cannot be handled safely with ordinary hauling or garbage trucks.

**Question to ask the incinerator proponent:**

**How will the company manage and dispose of the ash?**

Incinerator ash is classified as hazardous waste. Companies need to follow proper protocols in transporting and disposing this by-product. They also need to be transparent in stating where they will locate the ash landfill as this will be harmful to communities.

In incineration, the "cleaner" the air emissions, the more toxic and hazardous the ash. What is removed from the air emissions will be trapped in the ash as well in the pollution control filters that need to be regularly replaced. Where and how will the facility dispose of these?

## The incinerator company says that with an incinerator, my city/municipality does not need to segregate waste. Is this true?

This is not true. Waste experts around the world recognize that a sound approach to waste management begins with waste segregation. This ensures that materials can be reused and recycled.

Incinerator companies who say that incineration plants eliminate the need for waste segregation are not informed of the latest practical science of waste management, and cities and municipalities need to be wary of these claims.

Besides, incinerators--especially WTE incinerators--cannot work efficiently if the waste is mixed. And even in countries where waste segregation is mandated, the many gasification plants have closed because they cannot handle heterogenous waste such as municipal waste.

> A number of [gasification] plants were built in Europe and a number of efforts were done to successfully scale up the technology. However, it didn't work anywhere unless you had a very very homogenous input of fuel to the reactors.
>
> Waste is not a homogenous fuel. It has so far turned out to be too heterogenous to be able to treat in a gasification or pyrolysis process, irrespective of how you pre-treat the waste.
>
> It is absolutely not applicable for mixed MSW with today's technology. Another very negative factor is that the energy balance very often has turned out to be negative.
>
> *--Hakan Rylander, former President of the International Solid Waste Association (ISWA) and CEO of South Scania Waste Company (Sweden), a conventional waste incineration company.*
> http://mavropoulos.blogspot.com.au/2012/04/lets-speak-about-waste-to-energy.html

## Will an incinerator, or WTE incinerator, solve my city's waste problems?

## Is constructing a WTE incinerator really killing two birds with one stone--energy and waste?

No. In fact, a 2017 guidebook for decision makers published by the German Development Cooperation (GIZ), *Waste-to-Energy Options in Municipal Solid Waste Management*, advises cities and municipalities to be very cautious when approached by incinerator and WTE incinerator companies with these claims.

This is significant advise particularly because the GIZ is *not* against incineration and WTE incineration. It warns:

> *Decision makers at national and local level in developing and emerging countries may be tempted by technology providers who promise that WtE plants will solve their waste disposal problems, create a lucrative business opportunity and contribute positively to energy supply. As such, waste seems to be an ideal feedstock for energy recovery. So far however, only a limited number of projects built in developing and emerging countries have operated successfully in the long term.*[vii]

The GIZ report devotes a chapter to myths that incinerator companies propagate and which city and municipality officials need to be wary about. (Please see box below.)

Many policymakers, city planners and waste experts agree that there's no such thing as a one-shot solution to waste issues. Waste is a complex issue that cannot be solved by the construction of a single facility.

What is advocated by many experts today is a systems approach or an integrated approach to the management of resources and waste where the 3Rs (reduction, reuse and recycling) are at the core. Coincidentally, this is also the approach that is embedded in RA 9003 or the Ecological Solid Waste Management Act.

Modern waste management aims to reduce and eliminate the disposal or the destruction of materials (eg. landfilling and incineration) by ensuring the efficient use of materials (reduction) and preserving their value (reuse and recycling). This approach is the vision of the Circular Economy, which has at its core Zero Waste principles.

## Myths about Waste-to-Energy*

*From: *Waste-to-Energy Options in Municipal Solid Waste Management, GIZ, 2017*

….It is important to be aware of several common myths that persist around Waste-to-Energy and may be pushed by inexperienced companies looking to take advantage of municipalities:

**Myth 1: "WtE is an easy going solution to get rid of all the waste problems in a city"**

The situation is much more complex and WtE needs professional planning, construction and operation. Unfortunately, there are several companies on the market which are inexperienced with the conditions in developing and emerging countries. Decision makers need to be aware that their objective is first and foremost to "sell" their product and not to solve the local problem.

**Myth 2: "A WtE plant can finance its costs exclusively through the sale of recovered energy"**

In Europe where calorific values of waste and energy prices are higher, the revenue from non-subsidized sale of energy (in form of heat and power) might cover operating costs but never the entire investment and capital costs.

**Myth 3: "With a WtE plant in operation, a big fraction of the energy demand of a city can be covered"**

In reality, energy from household waste will only be able to contribute a small fraction to the overall electricity demand of a city (~ 5%). Utilization of heat is the most efficient application in Europe, but hardly used in developing countries.

**Myth 4: "You can make gold from garbage; even unsorted waste can be sold with profit to be used for further energy and material recovery"**

In reality, WtE is not a business model that generates cost covering incomes. Revenues from energy sales help to cover part of the overall costs of thermal treatment but additional gate fees or other forms of revenues are required to cover full costs. In all countries, waste management as a whole has costs and cannot be considered as a profitable business that could depend exclusively on the sale of energy, Refuse Derived Fuel (RDF) and recycling materials at current prices for these products.

**Myth 5: "Qualified and experienced international companies are queuing up to invest and operate large WtE plants in developing and emerging countries at their own risk"**

This is only partly correct as experienced international companies are presently reluctant to invest in WtE in developing and emerging countries. The legal, financial and reputational risks are high and any project of the private sector has to be bankable.

These myths are often kept alive and can obstruct informed discussions.

## Are gasification, pyrolysis and plasma arc pollution-free?[viii]

No, all incinerators, regardless of type or process use, produce pollution. The most notable is cancer-causing dioxins. Studies show a significant risk of dying from cancer in areas near incinerators[ix].

Aside from dioxins, the same toxic by-products can be released from these WTE incinerators as from other incinerators, including furans, mercury and other heavy metals, particulate matter, carbon monoxide, hydrogen chloride, sulfur dioxide, and more, as well as toxic contaminants in the char or ash residues, and contaminated waste water.

Many of these pollutants are carcinogenic and threaten public health even at very low levels. Recent tests from municipal solid waste (MSW) in a test pyrolysis facility in southern California found more dioxin, volatile organic compounds (VOCs), nitrous oxides (NOx), and particulate emissions than existing mass burn incinerators.

Some companies claim that these technologies are “pollution free” or have “zero emissions,” but these claims have been shown repeatedly to be untrue.

Since 2003 numerous proposals for waste treatment facilities hoping to use plasma arc, pyrolysis, catalytic cracking and gasification technologies failed to receive final approval to operate when claims of the companies did not withstand public and governmental scrutiny.

Companies using or promoting these technologies claim that they are not incinerators, ignoring the fact that the toxic gases created by heating the waste are in fact combusted, in other words, incinerated.

**Questions to ask the incinerator proponent:**

- **Can the company provide details of all stack emissions, their chemical profiles and their effects to health and the environment?**
- **How does the technology treat/filter air emissions? What exact pollution control equipment/ devices will be used?**
- **What exact methodology will the proponent use to measure dioxin emissions and how often will it be done?**
- **How will the technology filter nano or ultra-fine particulate emissions?**
- **Will the company monitor and measure emissions continually, not only during optimum conditions, but also during upset conditions or malfunctions, and during start-up or shut-down?**
- **What regulatory standards for health and environment will apply to dioxin emissions?**

It is important to ask as many questions as possible regarding the pollution from the facility, and to double check this against data not provided by the company. You can also ask for the details of the pollution control system. As a general rule, half the price tag or more of an incinerator with a working pollution control is the pollution control system. Many companies who sell facilities to developing nations whose cities and municipalities have less money to invest lower the price of the facility by cutting corners on pollution control.

Carcinogenic dioxins, as a by-product of thermal treatment, are the biggest problems with incinerators. The production of dioxin is not continuous. The majority of dioxins are usually produced in short-term emissions peaks during start-up or shutdown, or under “upset” conditions (conditions in which the incinerator is operating outside specified parameters). Many facilities only test for dioxins during peak operation and not during start-up, shutdown or upset conditions, thus skewing actual data. Even gasification, pyrolysis and plasma arc facilities produce dioxins.

Today, the accepted way to measure dioxins is continuous dioxin monitoring throughout operations. Unfortunately, this kind of dioxin monitoring is not required in many developing countries. In some countries there is only one dioxin lab (as in the Philippines), or none at all. This means that the dioxin sample will take weeks to months to study, after the dioxins have already been spread in the environment and inhaled by nearby communities.

## Is gasification/pyrolysis/plasma arc proven systems for the treatment of municipal solid waste (MSW)?

No. Gasification/pyrolysis/plasma arc are not proven systems for the treatment of MSW. No commercial application of gasification, pyrolysis or plasma arc facilities has succeeded anywhere in the world.

The GIZ, which is not against incineration, confirms this in its 2017 report[x]. In the report's chapter on gasification and pyrolysis, it qualifies that no large scale gasification facilities of are currently in operation:

- Page 38: *At present, no plant for the treatment of MSW is in operation on a larger scale in Europe, Africa or Latin America and the few plants in Asia (mainly Japan) and the USA are operating as an integrated element of a more complex MSWM system or for specific waste streams only. The advanced technology and operating requirements, highly specific waste input needs and high upfront capital costs make this technology difficult to apply at scale.*

- Page 39: *Some of these developments met technical and economic problems when they were scaled-up to commercial sizes, and are therefore no longer pursued. Some are used on a commercial basis (e.g. in Japan) and others are being tested in demonstration plants throughout Europe, but still have only a small share of the overall treatment capacity when compared to incineration and are applied for selected waste only.*

  *There are no successful experiences with the treatment of bigger volumes of mixed MSW due to its heterogeneous composition.*

**Question to ask the incinerator proponent:**

**What are some examples of previous similar facilities for MSW which you built and which are operating successfully?**

Chances are, the incinerator proponent will not be able to give an example because no commercial WTE gasification plant is currently operating in the world.

If the proponent does give an example, it is easy to do a quick check in the internet to verify the claim.

## What is the cost of a WTE incinerator?

## Is a WTE incinerator a good investment?

## Will my city or municipality earn money from it?

Incinerators are the most expensive method to generate energy and to handle waste, while also creating a significant economic burden for host cities and their taxpayers.

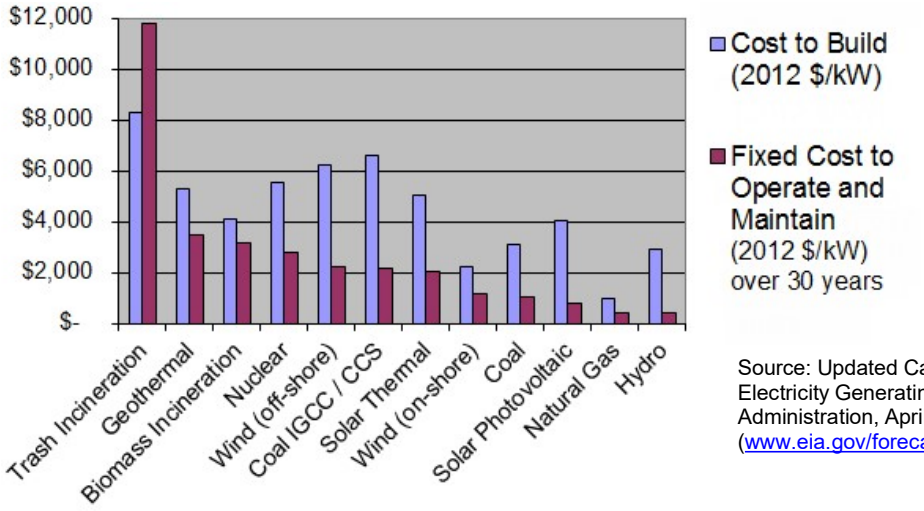
WTE incinerators, particularly gasification, pyrolysis and plasma arc facilities, are the most expensive options to manage waste, both in terms of construction costs and operational expenses.

A 2013 U.S. industry trade journal estimated the following capital costs for facilities with 15 MW output:

| Estimated Costs (in U.S.Dollars)[xi] | | |
|---|---|---|
| Ranges for Capital Costs for each of the Thermal Technologies: | Low Range | High Range |
| Direct Combustion (Mass Burn and RDF) ranges from$7,000 to $10,000 per kW | 105,000,000 | 150,000,000 |
| Pyrolysis ranges from $8,000 to $11,500 per kW | 120,000,000 | 172,500,000 |
| Conventional Gasification ranges from $7,500 to $11,000 per kW | 112,500,000 | 165,000,000 |
| Plasma Arc Gasification ranges from $8,000 to $11,500 per kW | 120,000,000 | 172,500,000 |

Many WTE incinerator plants have failed because of financial non-viability. Gasification, pyrolysis and plasma arc facilities are the most expensive ways for both dealing with waste and producing electricity.

According to the US Energy Information Administration, the projected capital cost of new waste incinerator facilities is twice the cost of coal-fired power plants and 60% more than the cost nuclear energy facilities.[xii] Waste incinerator operations and maintenance costs are also 10 times the cost for coal plants and four times the cost of nuclear plants.[xiii]




Source: Updated Capital Cost Estimates for Utility Scale Electricity Generating Plants," Energy Information Administration, April 2013, p.6. (www.eia.gov/forecasts/capitalcost/pdf/updated_capcost.pdf)

Additional costs for repairs (it is a high maintenance plant), pre-treatment of waste (necessary for MSW), and replacement of parts, filters, etc, also need to be factored in. At the same time, revenues are uncertain and a lot lower, and the energy produced is not sufficient to cover capital and operational costs.

## Can my city/municipality make money from the electricity produced by a WTE facility?

## Will the earnings be enough to offset the costs for its construction and operation?

No. WTE facilities, including gasification, pyrolysis and plasma arc, produce very little electricity and frequently consume more energy than the amount it generates. Because of the unreliability of energy generation, the income from electricity sales is also unreliable.

Waste is a highly inefficient fuel, due to its relatively low calorific value. Municipal solid waste is mostly composed of organic waste such as food discards, paper and yard debris, which contains a lot of water (80%). This means that incinerators need to input additional energy to process the waste first to make it suitable for combustion, and they take this energy from other fossil sources.

Even in developed countries, with higher calorific value waste streams (less volume of organic waste in the overall mix), gasification plants are challenged to meet projected energy production targets.[xiv]
Even the GIZ acknowledges that a WTE plant is not capable of financing its costs through the sale of electricity.[xv]

Municipalities which are counting on revenues from electricity sales need to be wary about the promises of incinerator companies that they can profit from electricity sales.

**Question to ask the incinerator proponent:**

**Does the total cost of the facility include:**

- **Operations and maintenance? (how much will this cost annually?)**
- **The cost of the pollution control systems and its parts and replacement filters?**
- **Costs for the proper disposal of the ash and slag?**
- **Baseline soil, air and groundwater monitoring?**
- **Baseline human health monitoring for host communities?**

**What is the nature of the waste service contract? Is it a put-or-pay contract?**
**How many years is the lock-in?**

The usual contracts for incinerator facilities are long-term (up to 30 years) put-or-pay contracts. This means that the city or municipality will promise to deliver a minimum quantity of waste and pay the company tipping fees for this quantity, even when the waste the city or municipality produces is less than the minimum agreed.

Tipping fees for incinerators are drastically more expensive than tipping fees for landfills, particularly in developing countries so the amount is usually considerable. Many industry documents by incinerator companies confirm that these facilities earn money through tipping fees--not through energy production. In most cases these facilities rely on government energy subsidies (if there are any) to ensure better profit margins.

## Is electricity from WTE incineration renewable energy?

No. Energy from burning waste is not and should not be considered as renewable energy.

Renewable energy (RE) is defined as energy created from natural processes that do not get depleted, such as wind, wave or solar energy.

Municipal waste is non-renewable, consisting of discarded materials such as paper, plastic and glass that are derived from finite natural resources such as forests that are being cut down at unsustainable rates.

Plastic also comes from fossil fuels which is not renewable and is carbon intensive.

## Has incineration and WTE incineration solved the waste problem in Europe?

## By building an incinerator, will my city be emulating the examples of Sweden and Denmark?

Incineration has not solved the problem of waste in Europe.

Over the past years some EU countries have systematically over-invested in burning facilities while under-investing in recycling. As a result, they are now locked into expensive long-term contracts (40-50 years) with incineration plants that need a constant flow of waste on a 24-hour basis to keep operating.

In some EU states such as Germany, Denmark, Sweden, Holland and the UK there is already more incineration capacity than non-recyclable waste generated. Plans to increase incineration capacity pose an environmental and an economic threat.

Many of these countries, especially Sweden, even import massive amounts of waste from abroad to keep feeding the needs of their facilities.

Fortunately, Europe has taken the first step to phase out incinerators. The impetus for this change was the *EU Action Plan for the Circular Economy*. A circular economy is “one in which the value of products, materials and resources is maintained for as long as possible, minimizing waste and resource use.”

In January 2017, a European Commission communication on the role of "waste-to-energy" in the circular economy[xvi] has advised member states to issue a moratorium on new incinerators, decommission old facilities, and phase out public support and subsidies for incineration.

## Conclusion and recommendations

Cities and municipalities faced with mounting waste problems can be attracted to thermal waste-to-energy, or WTE incinerators, as a "magic bullet" that may seem to solve the problem once a facility is built.

In fact, in recent years, this is how many companies have peddled WTE incinerator facilities to local governments. However, decision makers need to be wary.

Waste incineration has been known to cause more problems than it purports to solve. It endangers human health and the environment, and has been known to put municipalities into debt due to staggering costs for both construction and maintenance, as well extorbitant tipping fees. In addition, cities and municipalities cannot rely on returns from energy generation as the output is very minimal when compared against investment costs and energy inputs. There are many cases around the world where cities and municipalities have lost money invested in such facilities, and have ended up with stranded assets that can't be used.

Waste is complex issue that can't be solved by the mere construction of a waste burning facility. It requires an integrated approach that values what we call waste as potential resources, and recognizes the toxic burden that waste incineration imposes on people and the environment.

Safer, simpler and more effective solutions are already at hand. The Zero Waste approach to resource management is the best place for municipalities to start. By implementing measures that are much higher up the waste hierarchy (reduction, reuse and recycling), cities and municipalities can drastically reduce the amount of residual waste the produce.

This paper recommends the following for cities and municipalities:

1. Implement a solid waste management plan that prioritizes actions higher up the waste hierarchy, namely reduction, reuse, recycling and composting, as these are recognized to be the preferred and sustainable actions for waste management;
2. Reject incinerator proposals (including WTE incineration facilities such as gasification and pyrolysis) as these will create more problems that they purport to solve. It will endanger the lives of communities with cancer-causing emissions, and will be a considerable economic burden for your city or municipality.
3. Adopt a Zero Waste approach and create a plan for its implementation.

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[i] https://zerowasteeurope.eu/2017/10/copenhagen-goes-all-in-on-incineration-and-its-a-costly-mistake/

[ii] *An Industry Blowing in Smoke*, GAIA, 2009

[iii] This section was taken and adopted from: Brenda Platt, Resources up in Flames: The Economic Pitfalls of Incineration versus a Zero Waste Approach in the Global South, GAIA, 2004. Some parts have been updated using Dr Jorge Emmanuel's presentation, Emerging Technologies in Solid Waste Management, given on September 28, 2017 at the Unversity of San Carlos-Recoletos, Cebu City, Philippines.

[iv] This section is based on the Powerpoint presentation of Dr Jorge Emmanuel, Emerging technologies in waste management, presented at a public forum in Cebu City in September 2017.

[v] Section also based on the above.

[vi] *An Industry Blowing in Smoke*, GAIA, 2009

[vii] Waste to Energy Options in Municipal Solid Waste Management, GIZ, 2017.

[viii] From GAIA and Greenaction brochure

[ix] Waste Incineration and Public Health (2000), Committee on Health Effects of Waste Incineration, Board on Environmental Studies and Toxicology, Commission on Life Sciences, National Research Council, National Academy Press, pp. 6-7.

[x] Waste to Energy Options in Municipal Solid Waste Management, GIZ, 2017.

[xi] Stringfellow, Thomas. An Independent Engineering Evaluation of Waste-to-Energy Technologies, Renewable Energy World. 1/13/2014.

[xii] http://www.eia.gov/oiaf/beck_plantcosts/pdf/updatedplantcosts.pdf

[xiii] U.S. Energy Information Administration (Department of Energy), Updated Capital Cost Estimates for Electricity Generation Plants, November 2010.

[xiv] Waste gasification and Pyrolysis, high risk, low yield processes for waste management, GAIA 2017.

[xv] Waste to Energy Options in Municipal Solid Waste Management, GIZ, 2017.

[xvi] http://ec.europa.eu/environment/waste/waste-to-energy.pdf