Waste to Energy Options in Developing Countries: The GIZ Perspective

Experts meeting ADB – GIZ

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Frankfurt/Manila

Content

1. Brief introduction to GIZ
2. Presentation of the forthcoming publication: “Waste to Energy Options for the Management of Municipal Solid Waste “
3. Brief insight into existing publication: „Waste to Energy Rapid Assessment Tool“ (in collaboration with CWG)
4. Discussion

Introduction to GIZ

(Trying to be brief…)

Our profile

A German federal enterprise

- **Owned by the Federal Republic of Germany**
- **A company under private law**
- **Supports the objectives of the German Government**

Our service package

Services to manage social change processes

- **Innovative and tried and tested methods**
- **At all levels of society**
- **On the ground – in Germany and around the globe**

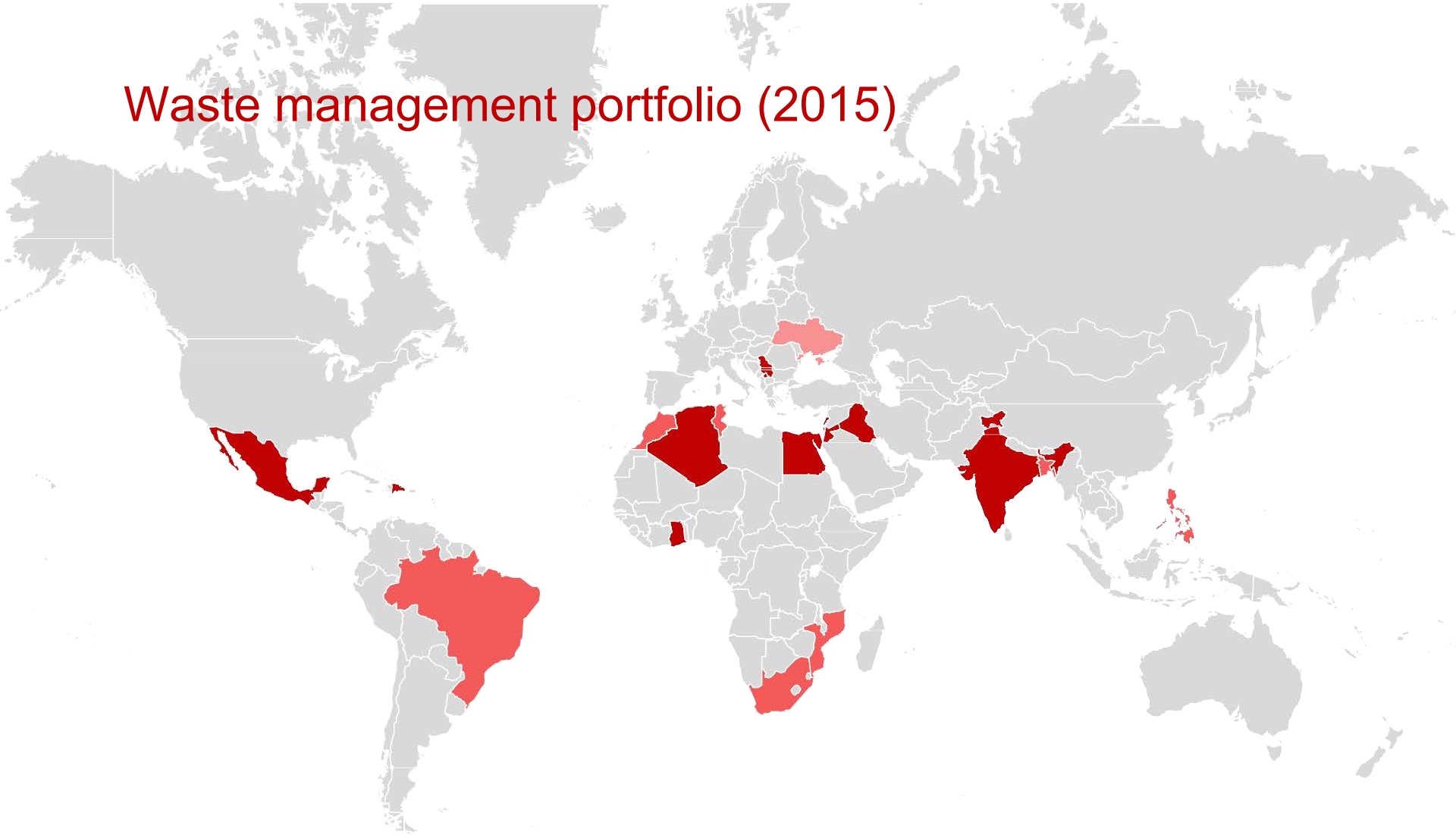
Facts and figures: business

- Operations in Germany and over 130 countries around the world
- Business volume of over EUR 2.14 billion in 2015
- Main commissioning party: the German Federal Ministry for Economic Cooperation and Development (BMZ), whose share of the total income from public-benefit business of almost EUR 1.7 billion in 2015
- Income from BMZ commissions included EUR 236 million of cofinancing from third-party donors
- Commissioned by well over 300 public and private-sector bodies in Germany and abroad

German Development Cooperation in the area of Waste Management

- Approx. 20 ongoing bilateral or regional programmes dedicated exclusively or partly to SWM
- Integrated experts programme (CIM)
- Regional training programmes
- Strategic alliances (PPP) and development partnerships with the private sector

Waste management portfolio (2015)



This geographical map is for informational purposes only and does not constitute recognition of international boundaries or regions; GIZ makes no claims concerning the validity, accuracy or completeness of the maps nor assumes any liability resulting from the use of the information therein.

Our approach in waste and resource management:

German development cooperation targets the establishment of integrated, closed-cycle waste management systems

This means:

- Improving urban waste disposal and setting up effective management structures
- Securing efficient disposal
- Utilising wastes as secondary raw materials
- Safeguarding employment opportunities in the waste sector
- Including climate change mitigation measures when choosing options in waste management.

Presentation of the forthcoming publication: "Waste to energy Options for the Management of Municipal Solid Waste"

Forthcoming Publication:

Waste-to-Energy Options for the Management of Municipal Solid Waste

A Guide for Decision Makers

Commissioned by GIZ Sustainable Waste Management Advisory Project

Prepared by University of Applied Sciences and Arts Northwestern Switzerland (FHNW), lead author: Dieter Mutz

GIZ Advisory Project Financed by Federal Ministry for Economic Cooperation and Development (BMZ)

Independent WtE Guidelines for Decision Makers

- Target group: Decision makers and their advisors at Municipal scale in developing and emerging countries (cities of 100,000+ inhabitants)
- Understanding of WtE as integrated part of waste management system, role of the different actors
- Technology overview and options for specific contexts
- Financial, legal, ecological and institutional requirements which have to be met before WtE is applied
- Ecological costs and benefits of WtE

There are several existing guidelines, but these often assume unfulfillable preconditions will be met or do not clearly define the necessary preconditions required to successfully initiate WtE

Waste to Energy – A Silver Bullet?

- WtE means processing municipal solid waste to make energy, i.e. incineration, anaerobic digestion, co-processing with cement, landfill gas
- Local decision makers dream that WtE will **solve waste problems** and generate **enough energy** to satisfy the increasing power demand

IN

Waste Problem

Image: CWG WtE Rapid Assessment Tool

OUT?

Money? Energy?

Avoiding WtE Failure

- If a municipality is not able to manage its final disposal of the collected waste, how will they manage to operate a WtE facility?
- WtE technology exists and can be built, but plant won't work if pre-conditions and suitable framework not in place
  - Leads to wasted money/resources
  - Waste problem remains

Image: CWG WtE Rapid Assessment Tool

Waste to Energy **Myths**

"WtE is an easy solution to solve all the waste problems in your city"

"*WtE plant can finance its costs exclusively through energy sales*"

"A *WtE plant can cover a big fraction of the city's energy demand*"

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

Establishing a WtE plant requires

- Integration in existing waste management, following waste hierarchy
- Knowledge on waste quantities and characteristics
- Financial resources
- Additional financing instruments for operations and maintenance
- Qualified staff
- Fulfilment of high emission standards
- Legal security for WtE investors
- Technologies fit for developing & emergent countries

WtE Technology Options

- **Guidelines provide overview of 5 WtE technologies**:
  - Co-processing
  - Landfill gas collection
  - Incineration
  - Anaerobic digestion
  - Alternative technologies (pyrolysis/ gasification)

- Technology description, suitable waste, operational, environmental, legal, economic aspects and recommendations.

- A **decision matrix** for different technologies indicating necessary requirements for each technology

Rough orientation on costs for WtE plants

	Initial Investment	Capital costs per ton & year of waste input	O&M costs per ton	Total cost per ton	Revenues* per ton	Cost ** per ton of waste input	Remark
Incineration (basic technical standard)	30 - 75 million EUR	22 - 55 EUR/t	20 - 35 EUR/t	42 - 90 EUR/t	2 - 10 EUR/t (electricity)	40 - 80 EUR/t	1 furnace line, LCV 7 MJ/kg, capacity 150'000 t/a, 15-20y operation, 6% p.a. interest rate
Co-processing	5 – 25 million EUR including pre-processing	10 – 25 EUR/t	10 – 20 EUR/t	20 – 45 EUR/t	1 – 5 EUR/t	19 – 40 EUR/t	LCV 10 MJ/kg, pre-sorted and capacity of 50,000 t/a, 20y operation , 6% p.a. IR
Biogas	12 - 20 million EUR	12 -19 EUR/t	10 - 15 EUR/t	22 - 34 EUR/t	8 - 16 EUR/t	14 - 18 EUR/t	Capacity 50 '000 - 150'000 t/a, 20y operation, 6% p.a. IR
Landfill gas	6 million EUR (CDM-Brazil) 5.3 million EUR (CDM-China)	0.8 EUR/t 1.4 EUR/t	0.8 EUR/t 0.3 EUR/t	6. EUR/t 7. EUR/t	2.4 EUR/t*** 3.4 EUR/t***	- 0.8 EUR/t - 1.7 EUR/t	Capacity about 390'000 - 850'000 t/a, 21y operation, 8% and 12% p.a. IR
Alternative Technologies	80 - 120 million EUR	35 - 45 EUR/t	30 - 40 EUR/t	65 – 85 EUR/t	2 - 5 EUR/t	63 - 80 EUR/t	Capacity 200'000 t/a, 20y operation, 6% p.a. IR.

* From the sale of end-products such as electricity, gas, compost, metal etc. In case of co-processing revenues are in form of substitution of fossil fuel. No subsidies

** Costs to be covered by gate fee, subsidies etc.

*** including CDM credits

Decision Matrix Pre-Condition Parameters

1. Overall level of waste management
2. Composition of waste
3. Calorific value of MSW for thermal processes
4. Suitable quantities of waste for WtE
5. Efficient operation of waste facilities
6. Additional transportation time and distance for MSW to WtE plant
7. Marketing and/or final disposal of process residues
8. Legal framework for WtE
9. Financing the management of MSW
10. Access to foreign currency
11. Access to energy end-users from WtE or RDF
12. Incentives for low carbon energy generation

Decision Matrix Snapshot

1	Overall level of waste management	Advanced waste management system which is based on waste streams (e.g. biomass, hazardous waste, recyclables) exists.	Systematic waste collection is organized. Some waste fractions (e.g. tyres, recyclables, biomass) are directed towards recycling and composting.	Systematic waste collection and disposal on landfill exist. Recycling is not organized systematically.	A significant part of all waste is disposed of in uncontrolled or illegal dumpsites. Recycling is not organized systematically.
		Incineration	Incineration	Incineration	Incineration
		Co-processing	Co-processing	Co-processing	Co-processing
		Anaerobic digestion	Anaerobic digestion	Anaerobic digestion	Anaerobic digestion
		Landfill gas collection	Landfill gas collection	Landfill gas collection	Landfill gas collection
		Pyrolysis & Gasification	Pyrolysis & Gasification	Pyrolysis & Gasification	Pyrolysis & Gasification
2	Composition of waste	Organic and non-organic fractions are collected separately. Hazardous & bulky mineral waste is treated separately	MSW or separate collected waste fractions are sometimes mixed with small fractions of mineral and hazardous	MSW is regularly mixed with fractions of minerals or hazardous waste	MSW is mixed with large amounts of mineral and hazardous waste
		Incineration	Incineration	Incineration	Incineration
		Co-processing	Co-processing	Co-processing	Co-processing
		Anaerobic digestion	Anaerobic digestion	Anaerobic digestion	Anaerobic digestion
		Landfill gas collection	Landfill gas collection	Landfill gas collection	Landfill gas collection
		Pyrolysis & Gasification	Pyrolysis & Gasification	Pyrolysis & Gasification	Pyrolysis & Gasification
3	Calorific value of MSW for thermal processes	The calorific value of MSW is on average > 8 MJ/kg.	The calorific value of MSW is on average between 7 and 8 MJ/kg.	The calorific value of MSW is < 7 MJ/kg. High biomass content with high average humidity.	The calorific value of MSW is < 7 MJ/kg. The content of inorganic fractions (e.g. ash, dust, sand, glass, metals) is high.
		Incineration	Incineration	Incineration	Incineration
		Co-processing	Co-processing	Co-processing	Co-processing
		Anaerobic digestion	Anaerobic digestion	Anaerobic digestion	Anaerobic digestion
		Landfill gas collection	Landfill gas collection	Landfill gas collection	Landfill gas collection
		Pyrolysis & Gasification	Pyrolysis & Gasification	Pyrolysis & Gasification	Pyrolysis & Gasification
4	Suitable waste quantities for WtE	> 150'000 metric tonnes of suitable waste fractions are available per year	50'000 to 150'000 metric tonnes of suitable waste fractions per year	10'000 to 50'000 metric tonnes of suitable waste fractions per year	< 10'000 metric tonnes of suitable waste fractions per year
		Incineration	Incineration	Incineration	Incineration
		Co-processing	Co-processing	Co-processing	Co-processing
		Anaerobic digestion	Anaerobic digestion	Anaerobic digestion	Anaerobic digestion
		Landfill gas collection	Landfill gas collection	Landfill gas collection	Landfill gas collection
		Pyrolysis & Gasification	Pyrolysis & Gasification	Pyrolysis & Gasification	Pyrolysis & Gasification

GREEN: probably suitable conditions

YELLOW: investigate/improve

RED: knock-out criteria, improvement necessary

Using the Decision Matrix

Good

Bad

1. Overall Level of Waste Management	Incineration	Co-Processing	Anaerobic digestion	Landfill gas collection	Pyrolysis & Gasification
Advanced waste management system which is based on waste streams (e.g. biomass, hazardous waste, recyclables) exists.					
Systematic waste collection is organized. Some waste fractions (e.g. tyres, recyclables, biomass) are directed towards recycling and composting.					
Systematic waste collection and disposal on landfill exist. Recycling is not organized systematically.					
A significant part of all waste is disposed of in uncontrolled or illegal dumpsites. Recycling is not organized systematically.					

GREEN: probably suitable
YELLOW: investigate/improve
RED: critical, improvement necessary

Using the Decision Matrix

Good

Bad

9. Financing the Management of MSW	Incineration	Co-Processing	Anaerobic digestion	Landfill gas collection	Pyrolysis & Gasification
Collection and disposal costs of MSW are always fully covered. Financial means to cover additional costs of WtE are accessible.					
Collection and disposal costs of MSW are always fully covered. Additional costs for WtE might be difficult to cover.					
The costs for collection and disposal of MSW cannot be covered on a regular basis.					
There is frequently a lack of financial means to cover operating costs of SWM services.					

GREEN: probably suitable
YELLOW: investigate/improve
RED: critical, improvement necessary

Where can I find the guidelines?

Available early 2017:

"Waste-to-Energy Options for the Management of Municipal Solid Waste in Developing Countries and Emerging Economies - A Guide for Decision Makers and Advisors"

- Online early 2017 on GIZ Advisory project Website:
- https://www.giz.de/en/worldwide/15109.html

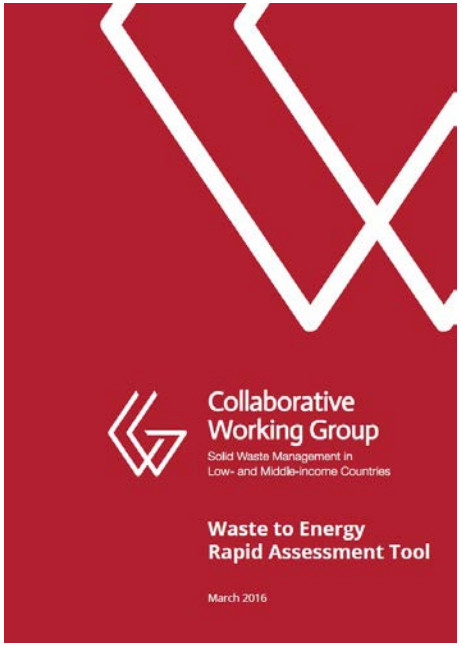
On behalf of
Federal Ministry for Economic Cooperation and Development

Brief insight into existing publication: „Waste to Energy Rapid Assessment Tool“

Waste to Energy Rapid Assessment Tool

Publication Already Available:

- A guide for city planners to help assess companies and project proposals
- Easy to understand checklists
- Collaborative Working Group (CWG)
- March 2016
- https://www.giz.de/en/downloads/giz2016-en-cwg_Rapid-Assessment-Tool_Waste-to-Energy.pdf



Waste to Energy Rapid Assessment Tool

Is Waste to Energy right for you?

Before assessing proposals, you must first ask if a Waste to Energy solution is the right choice for your municipality or area. Sometimes this emerges as you proceed through the assessment stages but a lot of time, effort and money can be saved by considering first, the following three points:

A If the municipal solid waste composition in your city has in excess of 50% of organic waste (i.e. food, vegetation, or other putrescible), and greater than 15% of inert waste (construction waste, debris, sand, silt, etc.), then thermal waste treatment will probably not be the right choice. Ask the company making the offer to pay for an independent analysis of waste generation and composition, and request your local technical University or reputable Consultant to do this work under your supervision.

B Check whether your municipality has sufficient financial resources for this project. Even if the project applicant is promising to finance the capital costs of the project, there will be operating, maintenance and capital re-payment costs to be covered. In 99% of cases, waste to energy facilities require a gate fee to be paid by the municipality to the operator in order for these facilities to operate.

C Does such a solution fit within national and local policy?

If you are confident that these conditions are met, next consider the following questions:

- Are you looking for a technological solution to your waste management problems?
- Have you received a waste to energy technology offer?
- Are you unsure of the credibility of the companies making the offer?
- Are you unsure whether the offer is technically, socially, economically and financially sound?

If so – we invite you to use the following checklists that can help you understand the offered technology and aspects of this to be looked at in detail.

1 COMPANY AND PRODUCT CHECKLIST

Preliminary Screening to check the general credibility of the company and what is being offered

A priority action is to assess the viability of the company (or consortium of companies) and undertake an initial assessment of the viability of what is being proposed. Time spent here will save precious time and money and ensure that as you progress, you are engaging with credible companies focusing on appropriate solutions.

Below you will find two checklists. The first is to assess the corporate credentials of the proposing company or consortium and gain confidence that they are genuine. The second focuses upon corporate capabilities and is designed to provide confidence that what is being proposed is deliverable in the broadest sense.

Corporate Credentials

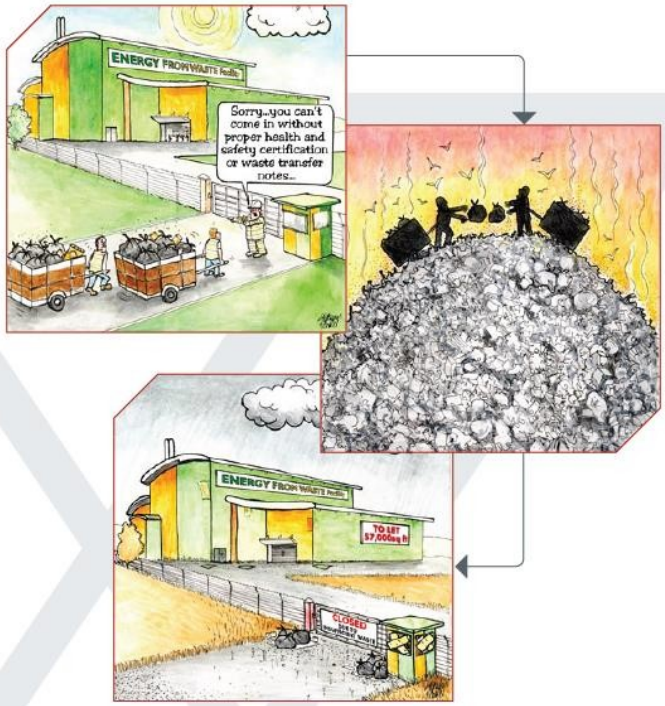
	Actions and Questions	To consider
1	**Websearch: Company** Run the company or consortium through a search engine (i.e. Google) and check that a) they exist, b) what their ownership structure is, c) what their management structure is as well as their size, locations and look for any published references.	Credible companies will also be registered with the incorporation body of the country in which they are primarily based. Look for the existence of Company Numbers and VAT Numbers or local equivalents.
2	**Websearch: Personnel** Find out the names of the company or consortium directors and undertake a search on their credentials and background. Social media is particularly useful for this and your search should include LinkedIn, Facebook and Twitter.	Assessing the capabilities, experiences and credentials of those involved can provide insight on this in the absence of corporate credentials or bolster confidence if that information does exist.

Waste to Energy Rapid Assessment Tool

3 TECHNICAL CHECKLIST

A checklist to determine if the technical aspects are appropriate for your needs

At this point, you should have confidence that the company is credible and that there exists the institutional capacity to accommodate the policy requirements needed. The next step is to initiate a technical investigation. Contact the company representative to arrange a meeting for an initial presentation, to seek more clarity on other aspects of the technology offer. In this first formal interaction you can ask the questions set out here.



	Actions and Questions	To consider
1	**Feedstock Quantity** What quantity of feedstock supply is required for the facility to operate effectively and for the project offer to work? **1a** Does this correspond to the quantity of the specific type of waste currently being collected across your existing operations, or does it require extension of collection services or import of feedstock from elsewhere? **1b** Have seasonal fluctuations of waste generation and composition been adequately considered?	Consider whether the quantity and composition of waste is likely to change in the future. It's reasonable to expect waste quantity to rise but think about the impact something like an economic downturn would have on this; would waste quantity fall below requirement? A new recycling policy can also reduce access to good quality waste for WtE plant. Both quantity and type of collection – segregated or mixed will have different impact on the energy recovery. Take into account waste composition from possible import areas.
2	**Feedstock Composition** Is the assumed feedstock composition supported by waste composition and characterization surveys? Is the survey conducted in your municipality or assumed from your region or national data? **2a** Are external (hazardous waste, tyres, agricultural waste etc) and not just municipal feedstocks also planned to be used as well? What are the legal and technical implications?	Whilst for an initial outline proposal, it is acceptable to make some broad assumptions, based upon existing data from similar or neighbouring regions, it is important to verify the viability specific to your needs as you move towards a decision.
3	**Treatment** Will collected feedstock require pre-treatment for the WtE facility? Has this been taken into account within the project design, scaling and costing?	This can add significant cost to the project and also raise questions regarding land availability and acquisition. It is important to verify this at this stage.
4	**Disposal of by-products** Has sufficient consideration been given for the safe treatment and disposal of by-products from the technology process and do facilities already exist within your municipal area?	If consideration has been given, also check their compliance to relevant environmental regulations.

Thanks for listening.

Discussion?

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