Collaborative Working Group

Solid Waste Management in Low- and Middle-income Countries

Waste to Energy Rapid Assessment Tool

March 2016

Acknowledgements

This Waste to Energy Rapid Assessment Tool is prepared by the Collaborative Working Group on Solid Waste Management in Low and Middle Income Countries (CWG) **www.cwgnet.net**

CWG is a global community of leading solid waste management professionals and institutions formed in the 1990s by four development cooperation organisations as an informal network of waste management practitioners working at the forefront of solid waste management and development, primarily in low and middle income countries that are not currently OECD members.

CWG strives to foster an open and honest exchange of perspectives, approaches and practices. It provides an open forum for exchange of professional experience, exploration of challenges, identification of current and emerging priorities, and dissemination of innovative approaches in the waste management sector.

The idea for this Rapid Assessment Tool emerged during a meeting in Cairo in 2014 where CWG experts met in order to discuss issues and potential synergies between the 'waste-to-energy' and 'circular economy' paradigms that are dominating policy attention around the world. CWG recognised the need for easy to read, informative, honest and impartial information on 'waste to energy' offers that could better inform decision-makers. This is not a scientific tool for the 'nitty gritty' of the technology itself but offers generic questions to understand the technology offer, ask critical financial, technical and contractual questions and the groundwork needed in order to take an informative decision.

This assessment tool has been prepared thanks to voluntary contributions of CWG members and is supported both financially and in terms of content by the advisory project 'Concepts for Sustainable Waste Management', implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).

The views expressed within this Rapid Assessment Tool are those of the authors, and do not represent or necessarily reflect GIZ policy.

Authors

The lead authors of Rapid Assessment Tool are Andrew Whiteman, Sanjay K Gupta, Cosmin Briciu and Stephen Bates. The initial draft of the checklists were prepared by Andrew Whiteman, Vaughan Levitzke, Johannes Frommann and Reka Soos.

The tool has been reviewed and commented on by: Johannes Frommann, Adam Read, Barbara Oelz, Ellen Gunsilius, Flaviu Pop, Reka Soos, Sonia Dias, Vaughan Levitzke and Anne Scheinberg, Graphic design and printing is courtesy of EnviroComms (**www.envirocomms.com**)

Collaborative Working Group
Solid Waste Management in Low- and Middle-income Countries

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Abbreviations

AD	Anaerobic Digestion
AISWM	Advanced Integrated Solid Waste Management
ATT	Advanced Thermal Treatment
AWT	Alternative Waste Treatment
CWG	Collaborative Working Group
EIA	Environmental Impact Assessment
EfW	Energy from Waste
GIZ GmbH	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
IRS	Informal Recycling Sector
ISWM	Integrated (Sustainable) Solid Waste Management
MBT	Mechanical Biological Treatment
MHT	Mechanical Heat Treatment
MSW	Municipal Solid Waste
MoU	Memorandum of Understanding
NDA	Non-Disclosure Agreement
RDF	Refused Derived Fuel
SIA	Social Impact Assessment
SRF	Solid/Specified Recovered Fuel
SWM	Solid Waste Management
WtE	Waste to Energy

CONTENTS

Who is this Assessment Tool for?

Good decision-making is of central importance in supporting sustainable improvement to waste management practices. Decisions taken in this sector impact on the ability to provide essential public services, improve the health and living conditions of citizens, protect the environment, limit emissions of greenhouse gases, and maintain the financial health of local, regional or national Government.

The past few years have seen Public Administrations worldwide being flooded with unsolicited offers from waste treatment technology suppliers and manufacturers of waste to energy plants and each promoting their own particular system or approach as better than the rest, claiming to offer seemingly magical/utopian solutions to municipal, regional and national waste management problems. These offers may promise to not only solve the waste management problem but also other pressing concerns.

There is a tendency to think that all Waste to Energy (WtE) technologies are thermal and burns waste for energy recovery, but there are also non thermal WtE technologies like anaerobic digestion. Amongst these increasingly numerous offers, many are fake, some even bordering on the fraudulent. That is not to say that all technology offers are dubious. Many remain genuine and credible and have the potential to deliver compelling outcomes which are worthy of serious consideration.

Technology is an essential part of any waste management system. Selecting between different technological options can be a very confusing task at the best of times and it has become increasingly difficult for Municipal Commissioners, Mayors and other national level decision makers to take a good decision and one which is right for their specific municipality. This tool has been created to help those responsible for the commissioning of waste management solutions to navigate the offers before them, enabling them to ask the right questions and carry out the research needed in choosing a technology solution.

Assessment of the functionality of a certain technology or approach depends on the waste generation and also composition and characterisation, but also on policy, legal, financial, social and cultural context. Availability of sufficient local know-how and skills to operate the technology are also of critical importance. Too many times, well-meaning technology projects have become 'white-elephants' or failed as a result of a lack of due diligence in planning and procurement of these projects.

This Rapid Assessment Tool provides a series of simple checklists to help decision makers ask the right questions and includes some simple guidance on how to uncover the authenticity and credibility of the companies behind the offer including questions on the technical, financial and contractual conditionalities and on the compatibility of the technology offer with the policy, legal, financial, environmental and social context. It offers guidance on how to screen technology offers for mixed or segregated municipal solid waste, and to be able to determine quickly which offers to discard and which ones to pay serious attention to and progress into a proper professional Feasibility Study.

The tool also provides a glossary of terms at the end to help you understand the terminology commonly used, and additional sources of reading that will help you explore more.

What is Waste to Energy?

Waste to Energy is a family of technologies used for, or prior to, the thermal or non-thermal treatment of waste and material by-products from waste processing. WtE technology comes in different forms and names such as mass burn incineration, fluidised bed incineration, co-incineration, anaerobic digestion or bio methanisation or bio-gas, refuse derived fuel/specified or solid recovered fuel, gasification, plasma gasification and pyrolysis. Variations and combinations of these terms are often also used.

WtE technologies recover energy that can be in the form of heat or electricity or alternative fuel like biogas. Steam generated from thermal treatment can be fed into a generator or turbine to produce electricity, which can then be either used on site or fed into the electricity network. Steam can also be used to generate hot water that can be utilised in nearby industry or fed into a district-heating network to heat homes, greenhouses, hospitals and offices. Resulted biogas can be processed and fed into the natural gas grid, bottled or used to power a gas turbine; and SRF/RDF can be used to partialy replace fossil fuels.

Fundamentally WtE is a method of treating waste to recover energy from its components, can significantly reduce the volume of materials that require landfill disposal. The efficiency of energy conversion greatly depends on the composition of the input feedstock, and the specific type of WtE technology employed. In general this energy conversion efficiency is lower than for typical facilities generating energy from fossil fuels.

WtE processes invariably generate by-products, including fly ash (from gas cleaning), bottom ash, char and slag, digested materials from bio-gas in different quantities depending on the type of technology and feedstock. By products from WtE Bio-gas plants can be used as manure after proper testing. Some by-products from thermal treatment of WtE are hazardous in nature, such as dioxins, heavy metals, concentrated and contaminated ash that may require specialised disposal in hazardous waste landfill, or stabilisation and disposal in deep impermeable mines or other secure facilities.

New technology can often displace the livelihoods of local people, something that needs to be given due consideration. See section 8 (Environmental and Social Checklists) on page 19.

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.

	Actions and Questions	To consider
3	**Websearch: Premises** Enter the company address into Google Maps (or similar) to see if the address does physically exist. You can obtain added surety by checking the address on Google Streetview. You can also check the local paper or on-line telephone directory for the company landline and also the business registration offices where the company is located to see if this is registered.	It is easy for anybody to secure an impressive sounding address using serviced offices or PO Boxes; don't assume that simply because the address exists and that it's an impressive location, the company is permanently located there. A good way to double check both the premises and provide further confidence is to call the head office and note how the phone is answered, if indeed it is answered or goes to a voice mail. Is the number a landline or cell phone?
4	**Company website** Check if the the company has a website.	Have a look and consider if this is well designed, all pages contain relevant content and if it's original. Check this by copying random sections in to a search engine to see if it appears elsewhere on the web.
5	**Websearch: Consortiums** Where offers are made from consortiums, apply the same searches listed above (1,2 and 3) to each member company of the consortium.	
6	**Company stationery** Check the quality of the business card and business stationery. Also check the email addresses.	Credible companies are highly unlikely to use email addresses ending in @hotmail.com, yahoo.com or @gmail.com

The above should take no longer than half a day and following the checks and searches made, you should have established the following key information.

- The company (or member companies of a consortium) exist and are properly incorporated in their country of origin
- Key personnel are appropriately qualified and/or experienced.

Having established the above, the next priority is to consider the capabilities of the company or consortium:

Company Capabilities

	Actions and Questions	To consider
7	**References** Ask the company or consortium for a list of references (if not provided earlier) including its facilities and clients. Seek references and follow these up. Speak to clients in other municipalities where the technology has been applied and ask how long it is working and what were their experiences of working with the company. Did they delivered what they promised?	Don't rely only upon references provided by the company; contact others directly identified on the company website or other sales literature.
8	**Manufacture or supply** Find out if the company is offering to supply equipment that they manufacture themselves or if they're proposing to source equipment from other companies.	If they are manufacturing, consider whether they own the design or whether they manufacture under license from others. Try to find out if they will also operate the equipment and on what basis.
9	**Company financials** Obtain the financial records of the company or companies within the consortium to assess their financial capacity and origin of financing. Ask if the company is privately owned, listed on a stock exchange or funded through venture capital and if they have sufficient line of credit with suppliers. It is also worth checking the company's credit ranking.	It is important to ensure that a company has sufficient financial backing to remain in existence through the duration of a project. Remember though, that start-up companies still may not yet have amassed sound financial backing or good credit scores yet still offer a viable solution.
10	**Corruptive practices** It is important to check that the companies, consortium and the personnel in each have not been charged with bribery or other corruptive practices elsewhere.	In some countries, it is illegal for people to act as company Directors if they have broken local laws. Check via the local embassy of the country where the company is located.
11	**Verify the company's environmental, health, safety and labour past records.**	Check out for any past incidents recorded and measures taken through google search.

Following completion of the above, you should have amassed sufficient background information about the company to determine the following:

- The proposed offer uses a valid and demonstrable approach, evidenced from experiences elsewhere
- The supply chain is solid
- The company or consortium is sufficiently strong to oversee all aspects of project development through its duration.

2 POLICY AND PLANNING CHECKLIST

A checklist to determine if your municipality is ready for the proposal being made

Requirement for improved waste management may have emerged through carefully considered need analysis, studies and consultations with various stakeholders. This need analysis requires that it is set out in a properly managed and well-defined tender process which aligns with the national policies.

However, there are occasions when proposed solutions arrive unsolicited or open solution proposals sought on a 'blank-canvas' basis.

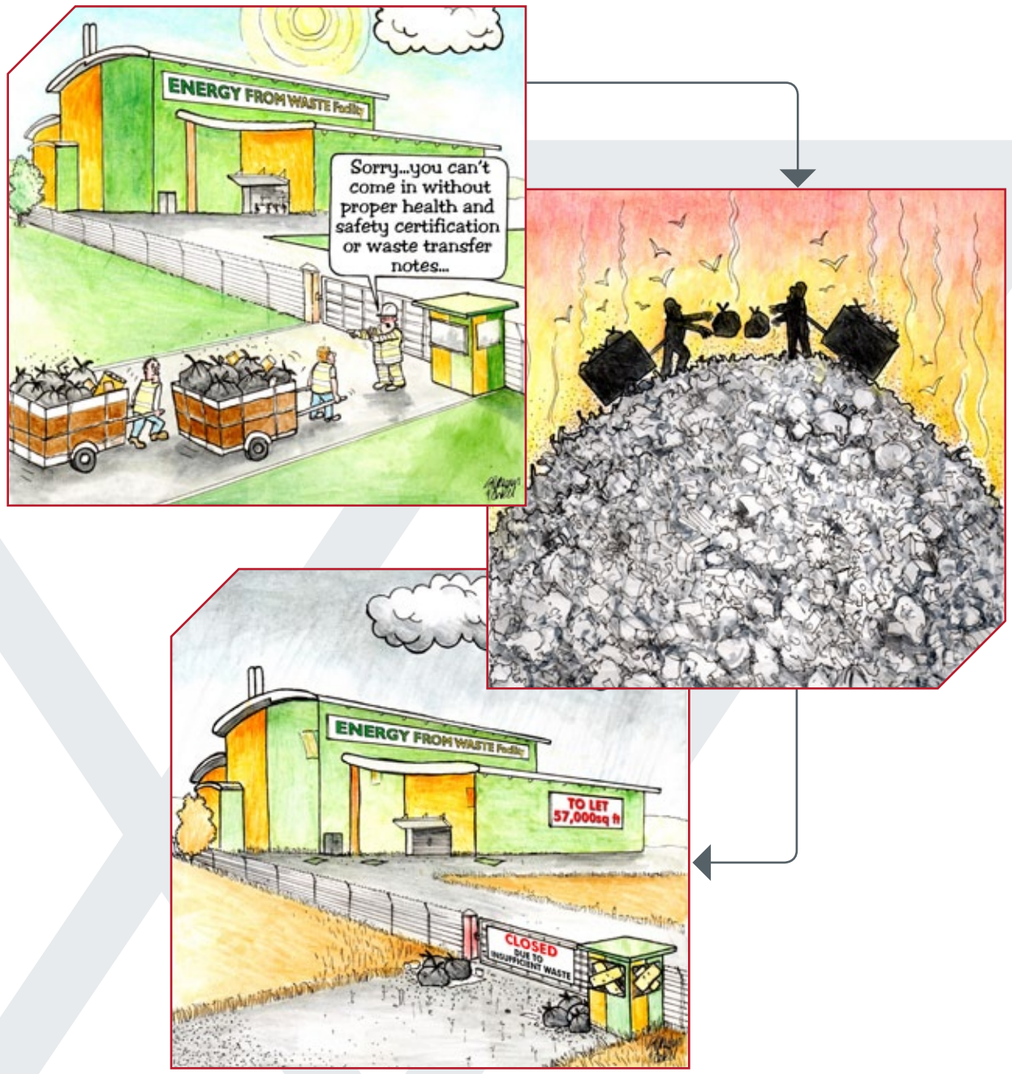
This checklist is designed to enable consideration of the policy factors that exists that will determine whether such proposals are suitable and where not, and whether policy can or should be adapted to accommodate them.

	Actions and Questions	To consider
1	**Policy Alignment** Is WtE catered for within national policy, if not WtE specifically; Renewable Energy? Are there financial or economic incentives in place to support such technology such as capital grants, preferential feed-in tariffs, etc?	Check if the proposal fits into existing policies surrounding planning consent and other related regulations. There exists the need to make sure that the municipality has enough financial resources and cash flow to operate a WtE plant for the promised period.
2	**City Development Plans** Has provision been made for WtE within city development plans? Have landfill facilities been secured as a mandatory requirement?	It is mandatory that a secured landfill is planned or under operation as a WtE plant of thermal technology will generate some by products which may be hazardous in nature and require safe and secure landfilling.
3	**Appropriate to need** Is the municipality ready for it? Do you have the required financial resources for the long term to operate and maintain the WtE plant?	Critical analysis of need is required to ensure that the proposal is appropriate to the local requirements in terms of waste composition, quantities, coverage and efficiency of collection services and availability of alternative facilities such as sanitary landfill sites.
4	**Alternatives** Is WtE the only option on the table or have other options been considered?	Even if a WtE proposal appears a credible and workable solution, alternatives should always be considered and the options compared for cost, efficiency and outcomes.
5	**Feasibility** Has the proposal been made upon generic assumptions, review of existing research. Has there been a detailed feasibility study done that has enabled the identification of the most appropriate solutions in terms of local needs, conditions and capacities?	Some proposals are made with the offer of a full feasibility study included as a primary activity that would then shape the final specification. In these cases, consider carefully the scope of such studies to ensure that all aspects like liabilities, access to land, contractual guarantess etc. are properly covered.
6	**Feedstock Guarantees** Who is responsible for guaranteeing feedstocks? Is a waste analysis available to estimate the feedstock in a credible way? Are you sure that you can guarantee the total feedstock requirement for the facility to operate uninterrupted and to the minimum efficiencies required?	Determine if a feedstock guarantee is legal and if there is a legal way out in case the waste stream shrinks. Check with the company the minimum requirements on feedstock and the financial ramifications if these requirements are not met. Does city or national policy cater for such scenarios? Carefully consider if the plant will remain suitable in case of decrease or increase of feedstock.
7	**Social Impacts** What are the expected impacts on livelihoods and employment of those currently involved with the informal and formal recycling sectors? Has a proper assessment been done?	Introduction of technology driven solutions may have a negative effect on local employment and livelihoods. Consideration needs to be given to the policies in place that support affected people and how these can be avoided or kept to a minimum.
8	**Future Proofing** Have projections been made of future waste composition and quantities and how this might affect the efficiency of the facility?	For example, as local economies grow, packaging waste tends to increase. How would this impact on technology that is focused upon treating waste that is currently high in organic materials? Does the facility have sufficient capacity to accept increasing quantities of waste?
9	**Regulation and Monitoring** Does the municipality have the institutional capacity to monitor and enforce regulatory compliance? What are the monitoring mechanisms available?	What local capacities are required for strict monitoring and compliance?

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.

4 SENSE CHECKLIST

A quick checklist to review if everything is on the right track

You are now approaching the halfway point in the checklist process and should be beginning to either build confidence in the proposal or have some remaining doubt. In either case, it is important to pause and take stock and consider the following:

	Actions and Questions	To consider
1	**Have your questions been answered openly and promptly?**	
2	**Ask the company if they would be open to receiving a technical delegation to an operational site.**	A valid company will have no issue in accepting this and one would expect them to be enthusiastic at the prospect as the question posed at this stage will provide a very strong 'sales signal'. Requests that are less than enthusiastically received should again, give cause to question the company's validity.
3	**Are you still dealing with the same person?**	If the person you commenced discussions with is no longer in post and you have found yourself dealing with several new people, this should give cause for concern.

5 FINANCIAL CHECKLIST

A checklist to determine if the proposal is affordable and financially realistic

Next, it is of vital importance to carefully consider and evaluate the financial costs and economic benefits that might result from the implementation of the proposed WtE technology project. A full assessment will need to be carried out in a Feasibility Study, but the following checklist can be used for an initial financial assessment.

	Actions and Questions	To consider
1	**Cost Breakdown** Does the project proposal have a breakdown of capital, operating and maintenance, and replacement costs? What are the unit costs per tonne of waste feedstock to be treated?	Are the technical assumptions used in the proposal reasonable? Operational costs, wages, fuel, availability of maintenance services, spare parts and qualified personnel, etc. Many times calculations are designed to give a low price by always taking the most optimistic assumptions.
2	**Payment conditionalities** What payment/gate fee conditionalities are requested? WtE projects almost always require a gate fee to be paid to the facility operator for each tonne of waste delivered.	If the applicant does not indicate that a gate fee is required, ask them to confirm that in writing. If gate fee is required, can it be effectively covered by waste user charges or other municipal waste management funds?
3	**CapEx Origin** If the company making the WtE offer says that they will provide the capital investment, ask for financial statements and letters of credit from their banks, to substantiate their financial capacity to secure the necessary investment. If not, how will the company will get the CapEx?	Even if such letters of credit and documents exist, take care to determine their validity, as it is very easy to forge such documents. Contact the financial institutions directly if in doubt.
4	**Pre-treatment and disposal costs** Are the costs for pre-treatment and disposal included in the cost calculations?	

5 FINANCIAL CHECKLIST CONTINUED

	Actions and Questions	To consider
5	**Required fiscal facilities** Are any tax exemptions requested? Does the company require free or subsidised land, electricity, roads and water? Are sovereign or municipal guarantees required?	If so, can these be provided? What are the practical and political hurdles involved in accommodating these requirements? How much it will cost if such subsidies are added? Are requested guarantees available?
6	**Feed-in tariff** Is a preferential energy feed-in tariff (i.e. sale price of electricity from the WtE facility to the electricity grid) assumed?	Do your energy regulatory authorities/ utility companies offer a feed in tariff at the required level? If not, will they be willing to?
7	**Cost of energy generation** What is the cost per megawatt of energy production from this technology?	Compare the cost of WtE with that of energy generated from traditional fossil fuels or other renewable energy sources such as solar or wind.
8	**Other revenue sources** Are any other sources of revenue assumed? Check the estimated revenues carefully, and undertake a market survey including supporting letters from any end-users, such as recyclable traders, cement plants or industries (who may utilise extracted materials or refuse derived fuel).	Do not rely purely upon reports provided by the proposing company. Undertake your own research to verify the market conditions. Are the revenue sources sustainable?
9	**Allocation of risk** Are the potential social, financial, environmental and health risks properly considered and fairly allocated? Is potential informal recycling displacement considered?	Where risk falls with other ministries or institutions, do not assume this will be acceptable to them. Define all risks clearly at the begining.

6 CONSIDER EXTERNAL, INDEPENDENT EXPERT SUPPORT

By this stage, you should be satisfied that that the proposal sets out a proposition that is realistic, affordable and achievable and that the company or consortium is valid, capable and appropriate. Or, you will have determined that both the proposal and company are spurious or that the proposal does not meet your requirements.

On the assumption that the proposal is valid in your case, then progress from hereon will be focused upon very detailed legal, environmental, economic and social checklists, the components of which are described in the following chapters.

At this stage you may want to consider appointing external, independent experts to help further assess the proposal and provide impartial advice and assistance as you progress.

Even credible companies can sometimes skew proposals that favour them rather than you and having access to an external expert can help to ensure that the balance is appropriate.

Although this will require allocation of budget, compared to the overall project spend, it is proportionally very small yet could be a critical factor to ensure a successful outcome, saving the municipality millions of dollars in the long run.

WtE facilities often require major overhaul to how waste is contained and collected in order for the correct quantity and composition of waste to be made available.
See section 3 (Technical Checklist) on page 12.

7 CONTRACTUAL AND LEGAL DUE DILLIGENCE CHECKLIST

A checklist to determine the legalities and ability to fulfil contractual obligation

Below are nine key questions that you should ask but there may be more that are specific to your municipality, region or country and it is always wise to seek professional legal insight on such matters.

Some of these have been explored earlier but it is important to view them from the contractual and legal due diligence perspective. The process is not yet at a stage of detailed, complex contract negotiations but the following will form the basis of the contract, so it is important to ensure that the groundwork is done early.

	Actions and Questions	To consider
1	**Type of Contract** What kind of contract is proposed? Is it Built, Own and Operate (BOO), or Build, Operate and Transfer (BOT), or Build, Own, Operate and Transfer (BOOT)?	Are standards likely to change in the future? Is the facility designed to accommodate these changes?
2	**Period of Contract** What contract duration is proposed/ required for this project? Are you legally enabled to sign a contract for that duration?	
3	**Contractual Guarantees and Gate Fee payments** What contractual guarantees are required? Are you in a position to offer such guarantees for the agreed operational lifetime of the WtE facility?	These generally include guaranteed minimum tonnage to be delivered to the facility, feedstock quality and composition, and timely payment of gate fees. Are you in a position to offer such guarantees for the agreed operational lifetime of the WtE facility?
4	**Penalties in case of Default** Are there any contractual penalties (on the municipality) stipulated for failure to fulfil these obligations? Are there penalties stipulated (on the investor/operator) for failure to deliver the promised investment, performance, energy or other outputs?	Penalties should be for both parties in case of default of agreed deliverable outputs and obligations, and not just one sided.
5	**Availability of Waste Feed Stock** Are waste imports assumed from neighbouring municipalities or regions? If yes, do you have the commitment of these authorities to deliver the required feedstock for the period of contract?	Ensure that you have signed or taken commitments from other municipalities before you sign the contract with the WtE service provider.
6	**National and International laws and conventions** Are waste imports assumed from neighbouring countries? If yes, are these acceptable to the Environmental Ministry in your country, and will any trans boundary movement of waste be legally compliant with the Basel Convention?	Ensure that you are not in violation of any local/national laws or trans boundary conventions like the Basel Convention.
7	**Contingency Measures** Are there contingency measures in place in the event of facility breakdown or shut down for routine maintenance? Are alternative provisions or compensation arrangements included in the contract for these periods?	Must consider emergency preparedness as WtE initially may have operational hiccups.
8	**Contract scope and Variations** Are there clear procedures stipulated in the contract for variations to the contract conditions, obligations or scope?	Are contract variations or change of scope allowed? If yes, define those clearly upfront.
9	**Risk Allocation** Are project risks fully considered and fairly allocated?	

8 ENVIRONMENTAL AND SOCIAL CHECKLIST

A checklist to determine if environmental and social obligations can be met

Environmental and Social due diligence studies are generally required in most countries for such facilities. It is also worth noting that many funding bodies, particularly those supported through export credit schemes offered by other countries, demand that due consideration be given to these aspects and that suitable strategies are in place to mitigate against any negative impacts the project may have. The following are the key areas to consider.

	Actions and Questions	To consider
1	**Emission standards** What emissions standards have the facility been designed to meet? Are these national or international standards?	Are standards likely to change in the future? Is the facility designed to accommodate these changes? Make sure that hazardous substances thresholds (as set-up in the national legislation or international conventions) are taken into account.
2	**Compliance** Is there evidence of environmental compliance from environmental authorities in which such facilities are being operated by the consortium/ company?	Do not rely upon sight of certificates. Check with the issuing body.
3	**Testing** Do laboratory facilities that are equipped to carry out environmental emissions monitoring exist in your country? If not, how will emissions be measured?	Can local Universities/research institutes/ labs assist you with this? These may include testing capability for emissions of dioxin and furans, air pollution, leachate and any other rejects.
4	**Powers to remove** Does the regulatory body have powers to remove waste products (e.g. compost, fuel briquettes etc.) from the market, if found unsuitable?	Do defined specifications exist that would lead to this or is it arbitrary? Be wary of the latter as otherwise acceptable material can be rejected because the market value is low.
5	**Social Impacts** Are social impacts adequately considered? A key consideration is whether the potential displacement of informal recycling sector livelihoods has been considered?	Can the local municipality or government afford adequate or improved alternative livelihoods or compensation payments to affected families and individuals from the informal recycling sector? Do policies and procedures exist to facilitate this? Have organizations of informal recycling workers been involved in discussion of alternatives?
6	**Societal benefits** What are the potential social benefits, including job creation and life quality improvement?	When considering these, think about the time it will take for them to be realised, when will these improvements become visible?
7	**Environmental Health and Safety Implications** What are the potential environmental, health, labour and safety implications?	Prepare an environmental, public health and social scoping assessment with a local University or reputable consultant.
8	**Environmental mitigation** Are environmental mitigation measures factored into the project costs?	And who will bear these costs and when?
9	**Longer term liabilities** What are the long-term liabilities and are they sufficiently catered for?	This would include things such as decommissioning, land remediation, etc.
10	**Permits** What permits and licenses will be required and who will issue them?	Also consider any costs associated with these, validity and costs of renewal.

9 FIELD VISIT

Time to go and see for yourself

There remains one final check to do; go and see first hand a similar facility in operation and speak to your counterparts in that region. If the facility is working well, they will be proud and keen to share their success story with you. If it is not working well, they will be equally keen to tell you why.

Before you go, consider the following:

- If possible, ask the company for a list of locations from which you choose, rather than rely simply upon the suggestion of the company as to which one to visit.
- If possible, choose a location that most closely matches yours in terms of economy, population and waste generation.

- If language is going to be an issue, arrange a translator via the your country's Embassy in the country you are planning to visit. Do not rely upon any provided by the company.
- Be cautious on accepting lavish hospitality from the company (Business or First Class air travel, five-star hotels, escorts or guides for leisure time etc.).

When you are there, run through the following checklist:

	Actions and Questions	To consider
1	**Read their contract** Ask the municipality and the company for details of the contract (excluding commercially sensitive information).	Look for things and make a checklist that are fundamental and that have yet to be included in your discussion with the company.
2	**Meetings with key people** Speak with several people at the municipality where the plant is operational including the Plant Manager, Commissioner, NGO officers, Environmental Engineer etc. Ask them about the plant, its functions and build an overall picture of the facilities' impacts.	When being escorted around the facility, try to speak with workers. These people can sometimes provide a more honest assessment than those at management levels.
3	**Data** Ask for data on the waste treated in last 6 months or preferably a year. Collect the data and get it analysed.	See if this shows a similar scenario to your own.
4	**Experience with the company** Ask the municipal authorities on their experience with the company.	Assess their views on the quality of service and the running of the facility and what would they change, if they had to do it again?
5	**Explanation of problems** If during your visit, the plant operator says either the complete plant or part of it is under maintenance, or repair or they are not getting enough feedstock, ask for how long it has been under maintenance, how often this happens, how long it takes to repair etc. Ask about the quality and quantity of the output such as energy, SRF/RDF, compost etc.	If the issue of feedstock is raised, question whether this was as a result of inaccurate measurement during the development phase or whether it is attributable to other, external influences. The delivery of promised quality and quantity if delivered, is a sign of a good plant.
6	**Check landfilling operations** Go and see the sanitary landfill available for residue disposal and ask if the landfill is also suitable for hazardous waste.	Ask the landfill operator, how much rejects come from the plant and if there are variations across different seasons? If it does not accept hazardous waste, this is a serious drawback as some WtE by-product may be hazardous.


Visiting a working example of the facility being proposed is vital.

10 ENGAGEMENT WITH LOCAL STAKEHOLDERS

The final process towards a 'yes'

When you return from the field visit, you will have amassed all you need to give you the confidence to proceed to contract mobilisation. You will be satisfied that the company or consortium is credible and what they are proposing is appropriate. If you have engaged external experts along the way, your confidence will be further boosted by their independent assessments.

So, you're good to go, right? Not quite!

WtE solutions often encounter opposition from social and environmental groups who will oppose certain technologies which have had a bad track record or reputation internationally, or projects that could displace jobs and livelihoods in the recycling sector. Sometimes, technology choices are opposed for no reason other than they do not align with a certain group's leading policies. In some cases, opposition can be strong enough to disrupt project development causing delays and added cost.

To enable this assessment to be carried out – and at the same time, seek to positively influence people's attitudes, early engagement is vital and the following approach will help you:

Stakeholder Analysis

As an initial step, the interest and impact mapping of various stakeholders has to be carried out. Some of these stakeholders will show exceptional interest and thus should be given more attention as a potential engine of change. Others, even if their interest is low, bring resources or risks of the implementation potential of the project over medium and longer term.

Segmentation of stakeholders

Consider those stakeholders you need to engage with and group them and engage with them as follows:

Regulatory Stakeholders

These are those that have direct control on whether the project proceeds or not. This group is likely to include Ministries and Regulators. Ensure that this group are properly briefed on the scope of the project, it's benefits and the virtues it will deliver, whilst also being honest and open about negative aspects. Seek to understand that it is not in contravention to national/state policies on environment or energy.

Community and other Influencing Stakeholders

These are those that may not directly control the progression of the project but can significantly influence it. Typically, this will include people living close by the proposed site, environmental lobby groups, workers in the informal recycling sectors and so on. The Press, local and national, also fall into this category. If the editorial slant leans towards opposition, it can be difficult to win hearts and minds of the wider population. Present the project proposal to this group as you did for the Controlling Stakeholders but be careful not to do so using technical or political jargon. Assess feedback and consider the level of support or otherwise.

11 SUMMARY

There is a saying that if something looks too good to be true, invariably; it is too good to be true. When pressure exists to deal with a challenge as big as improving municipal waste management, it can sometimes be difficult to apply this logic to the technology offers before you. It is for this reason that this document has been produced; to help you make informed choices based upon proper due process.

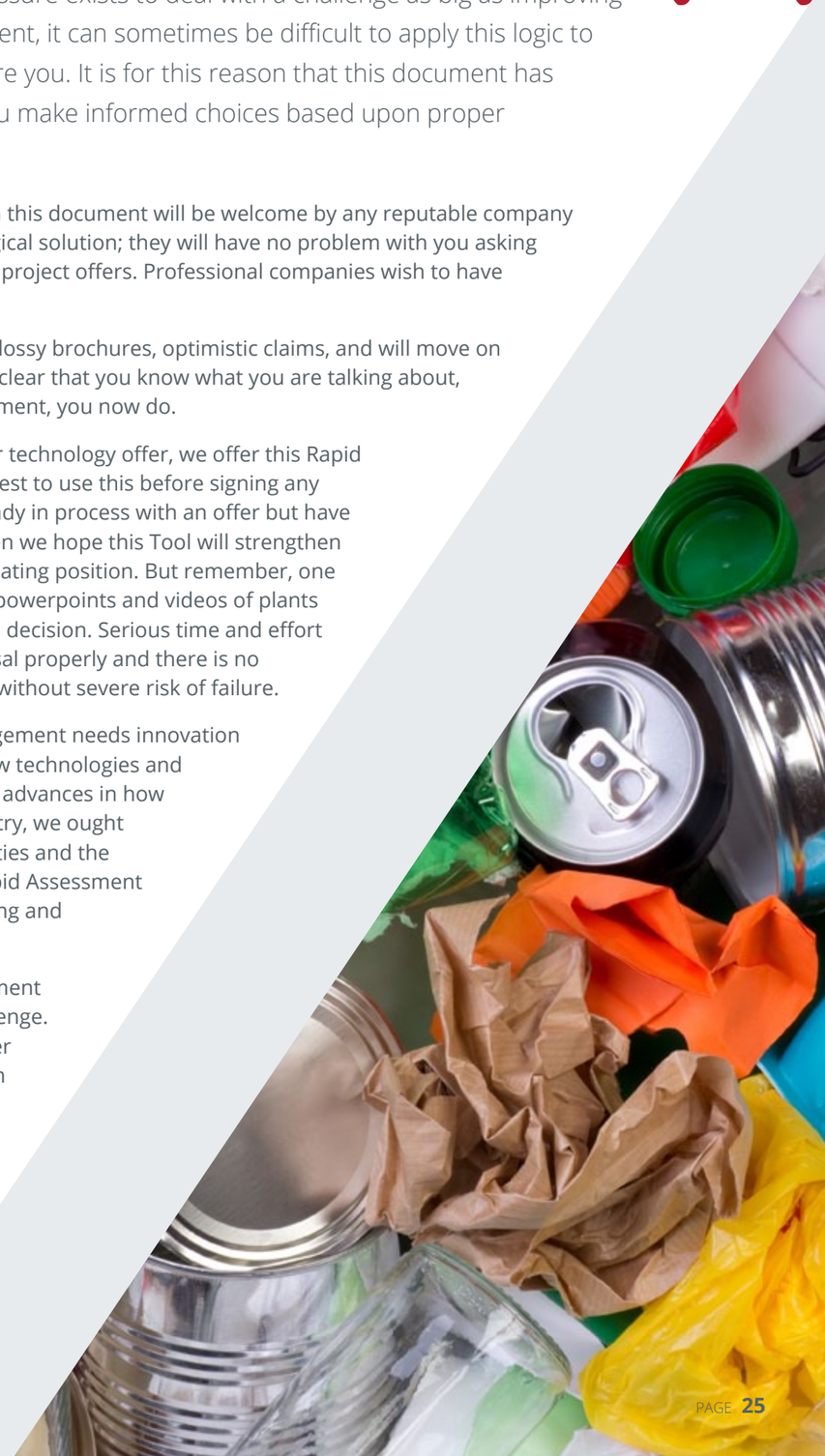
The steps we have described in this document will be welcome by any reputable company offering any credible technological solution; they will have no problem with you asking the right questions about their project offers. Professional companies wish to have well-informed clients.

Others will come and go with glossy brochures, optimistic claims, and will move on quite quickly once you make it clear that you know what you are talking about, which with the aid of this document, you now do.

If you are exploring a particular technology offer, we offer this Rapid Assessment Tool. Ideally it is best to use this before signing any documents, but if you are already in process with an offer but have not yet signed the contract, then we hope this Tool will strengthen your understanding and negotiating position. But remember, one meeting, one brochure or few powerpoints and videos of plants are not enough to make such a decision. Serious time and effort is needed to assess any proposal properly and there is no quick way for decision making without severe risk of failure.

Like any industry, waste management needs innovation and there may well emerge new technologies and processes that offer significant advances in how waste is managed. As an industry, we ought not be blind to such opportunities and the principles contained in this Rapid Assessment Tool are relevant to both existing and new technology.

The pursuit of any waste treatment technology is not without challenge. For WtE, the task is even greater and the aim of CWG is that with the help of this Tool, you will be able to progress with confidence and that your endeavours lead to success.



Annex A: Glossary of Terms

This Annex provides definitions for some of the terms used in waste management that may also be used in waste to energy technology offers.

Advanced Integrated Solid Waste Management: The coherent and sustainable application of approaches and solutions that have the effect of reducing the amount of waste that needs to be landfilled.

Advanced Thermal Treatment: Processes involving heat to degrade the waste, recovering some value from its energy content to derive energy from the waste and to reduce both volume and its biodegradability. It includes gasification, pyrolysis and plasma gasification.

Alternative (or Advanced) Waste Treatment: A specific technology or facility that alters the characteristics of waste through physical, thermal, chemical, and / or biological processes either prior to, or in place of, landfill. AWT broadly includes the recycling and / or recovery elements of the waste hierarchy.

Anaerobic digestion: A series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen to produce a methane-rich biogas, which may be combusted to generate electricity and heat, or can be processed into natural gas or transportation fuel.

Biogas/Biofuel: By-product from anaerobic digestion use to generate heat and electricity in a generator, injected into the national gas network, or used as a vehicle fuel.

Biomass: Products consisting of any whole or part of organic matter from agriculture or forestry, which can be used for the purpose of recovering its energy content.

By-product: A secondary product produced in a process.

Char: A carbon-rich by-product from pyrolysis and gasification.

Co-incineration: Means any stationary or mobile plant whose main purpose is the generation of energy or production of material products which uses wastes as a regular or additional fuel; or in which waste is thermally treated for the purpose of disposal.

Collection: The collation, loading and subsequent movement of materials considered by the generator as waste, from the point of generation to the point of recycling, treatment or disposal.

Competent Authority: Any person or organization that has the legally delegated or invested authority, capacity, or power to perform (or delegate the performance of) a designated function.

Contract: An agreement between two or more parties regarding the delivery of works, supplies or services related to SWM that is written and enforceable by law.

Digestate: A liquid slurry by-product from anaerobic digestion.

Emission: the direct or indirect release of substances, including heat, gas, noise and vibration, from individual or diffuse sources into the air, water or soil.

Extended Producer Responsibility: Producers or manufacturers of products, which subsequently become waste having a responsibility to put measures in place for the collection and management of such waste materials for the post-consumer stage.

Feasibility Study: A study designed to determine the practicability of a plan, system or technological application.

Gasification: a process that converts organic or fossil fuel based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide. This is achieved by reacting the material at high temperatures (>700 °C), without combustion, with a controlled amount of oxygen and/or steam.

Guideline: A document or set of materials that provides direction or advice as to a decision or course of action in improving solid waste management systems.

Hazardous Waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

Integrated (Sustainable) Solid Waste Management: The coordinated use of a set of waste management approaches and solutions, each of which has a functional role in an overall solid waste management system, and combine together as a recognisably coherent whole.

Incineration: A treatment process that involves combustion of waste, reducing the volume and biodegradability, and potentially also deriving energy in the form of electricity and/ or heat.

Informal Recycling Sector: individuals, families or small private sector entities whose activities are neither organised, sponsored, financed, contracted, recognised, managed, taxed nor reported upon by the formal solid waste authorities.

Integrated Waste Management Plan: A plan, which outlines how competent authorities are going to deal with waste that also identifies facilities and required resources.

Legislation: The act or process of law making, and the SWM-relevant laws that are so made.

Materials Recovery Facility: A place where recyclable materials are separated into fractions through manual and mechanical methods.

Mechanical Biological Treatment: Waste treatment processes combining mechanical and biological elements in a range of different configurations.

Mechanical Heat Treatment: Processes combining mechanical and thermal elements in a range of different configurations.

Municipal Solid Waste: Waste generated by households or by legal entities of a similar nature to household waste.

Plasma gasification: A process which converts organic matter into synthetic gas, electricity and slag using a plasma torch powered by an electric arc to ionize gas and catalyse organic matter into synthetic gas and solid waste (slag).

Policy: A plan or course of action set by government intended to influence and determine decisions, actions, and practices in the waste management sector.

Pyrolysis: Thermal degradation either in the complete absence of oxygen or oxidizing agent. Relatively low temperature is employed of 500 to 800 °C. By-products produced include: gas, pyrolysis oil and charcoal.

Recycling: The process of collecting, separating, classifying, transforming (through physical, mechanical or chemical processes), and returning to productive use, materials originally discarded by the generator as waste.

Refuse-derived fuel (RDF): A type of fuel containing combustible components of municipal solid waste with variable calorific value depending on composition.

Regulation: A governmental order having the force of law.

Sanitary Landfill: Sites where waste is isolated from the environment and its subsequent in situ degradation is managed under a controlled physical, biological and chemical process until it is rendered safe.

Slag: A vitreous material with low leaching properties generated as a by-product from pyrolysis and gasification.

Specification: A detailed, exact statement of particulars, especially a statement prescribing materials, dimensions, and quality of work for something to be built, installed, or manufactured.

Standard: An acknowledged measure of comparison of quantitative or qualitative value; a criterion against which to enforce and/or benchmark the performance of SWM systems.

Strategy: The art and science of developing and employing instruments in a synchronized and integrated way to overcome challenges and achieve defined objectives.

Syngas: A by-product from pyrolysis and gasification processes used to generate electricity and / or heat through combustion in a gas engine or through a steam circuit.

Thermal Treatment: The degradation of waste by heat.

Treatment: Any method, technique or process that is designed to: a) Change the physical, biological or chemical character or composition of a waste; b) Remove, separate, concentrate or recover a hazardous or toxic component of a waste; or c) Destroy or reduce the toxicity of a waste, in order to minimise the impact of the waste on the environment prior to further use or disposal

Waste: Any substance irrespective whether it has a potential to be reduced, re-used, recycled or recovered; that is surplus or the owner or generator does not need it any more.

Waste Management Hierarchy: an order of preference for actions to reduce and manage waste.

Waste to Energy: the process of generating energy in the form of electricity and/or heat from thermal or non-thermal treatment of waste. Waste to energy technology comes in different forms and names such as incineration; mass burn incineration, co-incineration, fluidised bed incineration, anaerobic digestion, refused derived fuel, gasification, plasma gasification, pyrolysis etc.

Annex B: Suggested Further Reading

This Annex provides some suggestions for further on waste management in general, and waste to energy technologies in particular.

Application of the Sustainability Assessment of Technologies Methodology: Guidance Manual, Nov 2012
http://www.unep.org/ietc/InformationResources/Publications/SustainabilityAssessmentofTechnologyManual/tabid/106701/Default.aspx

An Independent Engineering Evaluation of Waste-to-Energy Technologies
http://www.renewableenergyworld.com/articles/2014/01/an-independent-engineering-evaluation-of-waste-to-energy-technologies.html

Solid Waste Management – UNEP – Vol I – Chapter X to XIII
http://www.unep.org/ietc/Portals/136/SWM-Vol1-Part1-Chapters1to3.pdf

Waste Gasification Impact on the Environment and Public Health
http://www.bredl.org/pdf/wastegasification.pdf

Process and technological aspects of municipal solid waste gasification – A review by Umberto Arena
http://www.ncbi.nlm.nih.gov/pubmed/22035903

Advanced Thermal Treatment of Waste
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/221035/pb13888-thermal-treatment-waste.pdf

EU Waste Incineration Directive:
http://europa.eu/legislation_summaries/environment/waste_management/l28072_en.htm

US Environnemental Protection Agency:
http://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol26/pdf/CFR-2011-title40-vol26-chapI.pdf

By Products and Residues of Incineration Technologies
http://web.mit.edu/urbanupgrading/urbanenvironment/resources/references/pdfs/MunicipalSWIncin.pdf

Waste Materials and By-Products in Concrete
Springer Science & Business Media, Nov 13, 2007 – *Technology & Engineering*, **Chapter 8**

Waste Incineration – A Potential Danger? Bidding Farewell to Dioxin Spouting
http://www.seas.columbia.edu/earth/wtert/sofos/Waste_Incineration_A_Potential_Danger.pdf

Food waste-to-energy conversion technologies: Current status and future directions
http://www.sciencedirect.com/science/article/pii/S0956053X14005819

For detailed information on anaerobic digestion, see
https://www.americanbiogascouncil.org/biogas_what.asp **and**
http://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/publikationen/SWM/Anaerobic_Digestion/biowaste.pdf

Notes

Collaborative Working Group

Solid Waste Management in
Low- and Middle-income Countries

c/o Skat, Swiss Resource Center and
Consultancies for Development
Vadianstrasse 42
CH-9000 St.Gallen
Switzerland

Tel: +41 71 228 54 54
Fax: +41 71 228 54 55