Realizing a Waste-to-Energy Project – How to Start

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To realize a new Waste-to-Energy plant is a complex and long-lasting operation, with numerous obstacles which can, if not correctly approached, bring to a total failure of the project. The greatest errors are often done at the beginning. For this reason, it is very important to ensure a correct and well-planned start.

Aim of this article is to give some suggestions based on previous experiences, in order to help promoters have a higher chance of success in their initiatives.

1. The need of Waste-to-Energy

In this context we consider waste mainly as Municipal Solid Waste (MSW), hence excluding industrial, hazardous and other special waste.

The general objective in MSW-management is first of all the reduction of its production by avoiding waste producing products and reusing still valuable objects. The still produced waste is whenever technically and economically possible recycled, in order to recover materials which can be returned into production processes.

However, there is always a certain quantity of un-reusable waste which remains and must be disposed of. It is still usual in many countries, that this remaining waste is dumped in controlled (but also uncontrolled) landfills, leaving a heavy burden to the environment and to the future generations.
A much more responsible way of treating the remaining waste is to convert it into inert material by an oxidation process, the most common and reliable being the combustion. Used since decades in many countries, it has in the years reached a very high technological standard, being able to guarantee an extremely performing emission control, to convert into electricity and heat a large part of the energy contained in the waste and to recover useful material from the resulting inert residues, i.e. metals and minerals.

Waste-to-Energy is hence an indispensable part of a modern MSW-management system.

2. Boundary conditions

Before starting with the project, it must be verified that the necessary boundary conditions are given. The main conditions are:

- The construction of a WtE-plant must be legally possible. There are many regions where such plants are explicitly banned
- The regional planning of waste management should foresee the construction of a WtE-Plant, or at least it should not explicitly exclude it
- The ownership of MSW must be legally cleared. Generally, the collected waste is owned by the local authority, which has the duty to dispose it off. But there are situations where the MSW is owned by the collector, which can be a private company. In this case the public authority has no control on the destiny of the waste.

If above conditions are not given, it is not recommendable to start a WtE-Project.

3. How to start a project

3.1. Stakeholders

One should be conscious of all the bodies and entities which are touched by such a project, in order to consider them in the implementation strategy.

Figure 1 shows the usual stakeholders involved and the interactions with the promoter. As it appears, there are not only technical issues to be managed, but a plant must obtain the necessary authorization, the demanded financial funds must be found, and last but not least, the project must face the public opinion, which is often strongly opposed to such plants.

More details for each sector are given in the following chapters.
3.2. Technical approach

Being a WtE-plant a complex industrial facility, the technical issue is one of the first to be tackled.

Basic data

First of all, it is fundamental to have a clear view of the waste situation in the region where the promoter of the project is acting. Following questions must be answered:

- What is the actual total quantity of MSW produced, differentiated in type of waste (paper, glass, plastics, metals, organics, …) and how it has evolved in the past 5 to 10 years?
- Which portion of the said types of waste is recovered for material recycling?
- What are seasonal variations in waste production and its quality?
- How is the estimated evolution of these quantities in the next 10 to 20 years, considering population growth, increase of GDP, development of separate collection of waste?

To gather the actual data is not always easy, but with some efforts generally possible. It is much more difficult to estimate the future situation and therefore various scenarios must be put down. Typically, three scenarios are developed:
• Highest case scenario, considering the maximal evolution for all parameters
• Lowest case scenario, considering the minimal evolution for all parameters
• Middle way scenario, as an average of the above scenarios.

The following graphic shows an example of such scenarios.

Figure 2: Evolution of MSW production

Based on these data it is possible to evaluate the approximate quantity and quality of waste which has to be disposed of and hence to decide the capacity of the WtE plant.

Feasibility study/Siting

Once defined the waste quantity and quality which should be treated by the future facility, it is advisable to finalize a feasibility study. The main aims of such a study are:

• Determine the nominal capacity of the plant, considering seasonal variations (i.e. touristic locations) and some reserves
• Determine the thermal power of the plant, which depends from quantity and low calorific heat of incinerated waste
• Decide number of combustion lines: one big line is less costly; two smaller lines are more flexible
• Define concept of plant:
  – type of combustor: grate boiler, fluidized bed boiler
  – steam parameters
  – steam boiler type
- fluegas treatment system
- energy recovery system: only electricity, electricity and district heating/industrial steam

- Determine layout of plant and hence required land surface
- Find a suitable site where to build the plant, considering:
  - land surface required
  - suitable land use regulation
  - availability of infrastructure (access roads, electricity grid, water, sewage, …)
  - nearby presence of industrial facilities which could be interested in buying energy from the plant (steam, heat, electricity). This can improve substantially the economical result of the plant
- List all the necessary permits and authorizations and required procedures for each of them
- Draw an estimated timetable from start decision till commissioning of plant
- Estimate construction, financial and operating costs, and hence determine the required gate fee.

With the results of the above study, the promoter has the basis to evaluate chances and risks of the project and to decide whether to continue or to stop it.

To invest into a feasibility study is of high interest for the promoter. Try to economize on it is not very long-sighted. In fact, such a study can have a great influence on the success of the project. As shown in Figure 3, in the very first phases of a project, good ideas as well as errors have the highest impact on the final result.

![Figure 3: Influenceability of the project phases](image-url)
Engineering
Once decided to pursue with the project, further engineering activities can be put ahead for permitting purpose and later on for procurement procedures. However, there are other issues to face first.

3.3. Financing
Private promoters must create a financing structure comprising proprietary capital, external capital through for instance capital stock or equity funds, as well as bank loans and insurance policies. Often promoters request the contractors who supply and build the plant, to participate with capital stock.

Often the building up of a financing structure is very time and money consuming, since all the involved parties want to have enough guaranties that the project has a positive issue, hence asking for technical and non-technical due diligences. Adequate time must be considered for this task.

In case of public promoters, the required credits must first be approved by the deciding entity (legislative body) and sometimes even through a public referendum. After this approval, usually bank loans are searched, which in this case are less difficult since the public authority offers enough guarantees being usually always solvent.

3.4. Permitting
To obtain all necessary permits and authorizations is often a long-lasting procedure, on one side because of the complexity of the object to be authorized, but moreover because objections and administrative appeals against a WtE-Plant are practically unavoidable. Therefore, the timetable of permitting is very uncertain.

In order to possibly reduce this uncertainty, it is advisable to:

- Meet the authorizing authorities in advance and clear with them the correct procedures to be followed and the required documents and studies to be supplied. This can minimize losses of time. Furthermore, the personal contact with the officers in charge of the authorization request can facilitate the whole procedure.
- Include the public (neighborhood, NGOs, other interested entities) in the procedure (see following chapter).

3.5. Communication/Stakeholders involvement
WtE-Plants are notoriously not very favored objects, often ideologically demonized. Furthermore, they can be in conflict with other actors of the waste management system or influence the political arena. Typical opponents to such projects are:

- Neighbors of the future plant: the nimby (not in my backyard) syndrome is everywhere present.
- NGOs and environmental activists: WtEs are favored opposition objects, since they have a strong mediatic impact and give the opportunity of a high visibility.
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Policies/Strategies

- Owners of landfills: the waste which goes to a WtE-Plant doesn’t bring them any revenue
- Politicians: favoring this type of infrastructure does not usually increase the number of votes at the next elections.

Therefore, it is advisable to promote a good and professional communication since the beginning of the project, involve and understand the worries and concerns of the opponents and try to accommodate them as far as possible.

Investment in these activities is well placed money.

3.6. Organization of the promoting entity

To face all the issues described in the precedent chapters requires a solid and professional organization of the promoter.

At least following competences should be foreseen:

- Consulting engineer: to produce the feasibility studies, to provide all the engineering services to prepare technical documents for permitting and procurement
- Legal advisor: to prepare contracts, solve legal issues, organize complaint management
- Financial advisor: helping set up of financing structure
- PR-consultant: to organize communication and involvement of stakeholders.

Very important is the project management, which can be internal of the promoter or external. The project manager must be an experienced person, knowing what it means to realize a WtE-Plant. He must guarantee a constant overview of the project and the coordination of all the subjects directly involved in the project team.

4. Conclusions

The realization of a Waste-to-Energy plant is a complex task. Bring it successfully to the end is not obvious. The first phases of such a project are crucial and enough time and money should be allocated to them in order to guarantee a well-organized and thoroughly planned start.

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