India's mountains of waste turned into electricity

In its efforts to manage waste sustainably, India is also using proven energy-from-waste technology, with three new plants being built in the southeast of the country. Local conditions and requirements are important, with low-cost-optimised solutions considerations in their construction.

By Hitachi Zosen Inova

Recycling and efficient, smoothly functioning waste management that encompasses the collection, processing and recovery of non-recyclable waste is taken for granted in many parts of Europe, Japan and other developed countries and is now increasingly gaining traction in India as well. In 2001, the Indian government launched the first version of its Solid Waste Management Rules (SWM Rules) and in 2016 an amended set of rules came into force. The 2016 SWM Rules stipulate that all municipal authorities must take responsibility for local waste handling, which includes the proper collection of segregated waste as well as transporting, storing, processing and recycling it. Composting, the production of substitute fuels, co-incineration in cement kilns, and thermal processes such as grate combustion all play a key role in these endeavours to minimise or completely eliminate landfills.

Even though India is struggling with the problem of generally uncontrolled growth in waste dumps and people have been aware of the waste management rules for almost 20 years now, only around 10% of communities have actually started implementing the requirements. The reasons for this hesitant adoption vary from financial considerations to geographic constraints.

India's metropolises, along with many smaller cities, stand at a turning point in terms of their waste problem – a problem they have to tackle now. In the past there were isolated attempts at projects aiming to build incineration plants, but in most cases there were technical shortcomings in the way they were implemented or the chosen technology was incompatible with the available waste.

In the wake of the new waste management policy and the onset of a new mindset among the public, in recent years there has been a growing number of projects in the sustainable waste management field. Modern energy from waste (EfW) technology based

Source: Hitachi Zosen Inova

The EfW plant in Jabalpur is in operation since 2016.

on grate combustion plays an important strategic role in this – not just because it reduces the volume of waste by up to 90% and uses state-of-the-art technology to purify the exhaust gases that result, but also because the process generates electricity that can be fed into the grid to power thousands of homes as well as local commerce and industry.

Following the construction of an EfW plant quite a few years ago, they faced a few failed examples due to wrong selection parties and mix-and-match technologies. The city authorities in Jabalpur executed a concession agreement to implement a waste management project in Jabalpur with Essel Infraprojects Ltd. (Essel), a company involved in the infrastructure business. Essel selected Hitachi Zosen Inova (HZI) as its partner to implement the Jabalpur project. The reason for the selection is as follows.

At the beginning of 2009, HZI decided to develop a low-cost product for developing nations. They selected India as the centre for such development, due to the availability of materials and manpower at low cost. Shortly after this, the local branch in Hyderabad, which was opened a few years before, launched the first joint project in close collaboration with the experts in Zurich, both subsidiaries of the Japanese company Hitachi Zosen Corporation. The idea behind this was to train local engineers in EfW with an eye to subsequently handing over the responsibility for engineering, procurement and construction.

The goal was to come up with a strategy geared to the Indian subcontinent, design a plant able to comply with the emission limits set out in the SWM Rules and respect concerns typical for India – including incorporating local industry standards and customs and involving regional subcontractors. In addition, the plan was for the future plant to operate in accordance with a model allowing as low a gate fee as possible; in other words, primarily financed through the sale of electricity. This required a functional design, i.e. a minimalist construction without architectural or technical embellishment. The installation was also designed to be adaptable to varying waste throughput volumes with minimal engineering work.

The result of the partnership, called LoCal 580, was presented in Chennai in October 2010. The name still says it all: LoCal describes various aspects of the plant, from low calculated costs and low calorific value to the local aspect of its construction. The "580" stands for a waste throughput of 580 metric tonnes a day. Alongside low investment costs, endeavours to align the approach with local conditions were geared to environmentally sustainable waste treatment and processing waste with a strikingly low calorific value. Despite many years of experience building EfW facilities all over the world, the latter in particular posed various challenges for the project team.

Fit the plant to local conditions and requirements

Unlike the practice in regions such as Central Europe, in India different kinds of waste are not collected separately. Instead, unsorted waste is put on the street where waste trucks literally pick it up. This means the waste contains a large proportion of moist material as well as earth and stones. A mixture of this sort has a massively reduced calorific value. For this reason the incinerator was developed on the assumption of 4-5 MJ/kg. By way of comparison, the EfW plant in Norway's capital Oslo processes waste with a calorific value of between 8 and 12 MJ/kg.

Several steps were taken to compensate for this low calorific value: At 97.5 m2, the reciprocating grate was made comparatively large. This allows the waste to be held there for a long period, enabling it to dry out more and assuring optimum burnout. Added to this, the primary air undergoes significant preheating in several stages to additionally facilitate the drying process and heating of the material. Features were also built into the construction to counter the low calorific value, including thick nogging around the lower part of the boiler to retain heat within the system.

The EfW plant in Jabalpur commenced regular operation in 2016. From a process point of view, the installation hardly differs from those previously built by HZI in other parts of the world. Besides an area for receiving and storing waste, the plant consists of a grate and a boiler where incineration and steam generation take place. The steam is passed into the turbine at a pressure of around 46 bar, with a downstream transformer generating around 11.5 MW (gross) of electrical energy that is fed into the grid. The exhaust gases produced are neutralised in a semi-dry process involving the injection of lime and active carbon. The particulate residue is then removed in a fabric filter. This way, all the emission limits specified in the 2000 SWM Rules are met. In this first version of the rules, the limits were slightly higher than those in Europe. They were adjusted in line with the European limits in the 2016 SWM Rules.

Since the commissioning of the facility there has been a drastic improvement in the waste situation in the region. With the volumes available in the city failing to stretch throughput capacity to its limits, waste is also collected from surrounding communities and processed in the EfW plant. Old landfills have been eliminated. Jabalpur has set an example for the whole country. A Ramky Group facility is currently under construction in the city of Hyderabad. In June this year, Essel won a contract to build another three plants based on Hitachi Zosen India's LoCal approach. The next few years will see the construction of EfW plants in Kadapa, Anantapur, and T.P. Gudem in the western province of Andhra Pradesh, each with a throughput of around 330 t/d and an electrical output of some 6 MW. Currently there are more than a dozen tenders under finalisation and a few are in the tendering phase. Even big metropolises are entering to improve their waste management situation using the combined combustion as well as segregation routes. Even if India still has a long way to go, the course has been set for a forward-looking, environmentally friendly waste management system.