

P.b.b. 02Z030115 M, WEKA Industrie Medien GmbH, Dresdner Straße 45, 1200 Wien, Retouren an Postfach 100, 1350 Wien

Official Publication of:  
**ISWA**  
International Solid Waste Association



WASTE MANAGEMENT WORLD®

Euro 12,-

NOVEMBER-DECEMBER 2017

# Special Edition WASTE TO ENERGY

# TURKISH DELIGHT

## Europe's largest waste to energy plant to be built in Istanbul



## Cutting Down

Two-tier food waste prevention  
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# TURKISH DELIGHT FOR HZI



Every day, Istanbul's 39 municipalities produce some 17,500 tonnes of waste. Currently, nearly all of that is sent to landfill. Now, following a deal with Istanbul Metropolitan Municipality, Hitachi Zosen Inova is preparing to develop Europe's largest waste to energy plant.

By Ben Messenger

**O**ver millennia, the ancient city of Istanbul has reinvented itself many times. Known in previous incarnations as Byzantium and then Constantinople, it is the world's only city to straddle two continents, Europe and Asia, across the Bosphorus Strait. It may have lost its status as the capital of the Ottoman Empire

with the formation of the Turkish Republic in 1923, but with a growing population of 14 million, there is no doubting its importance to the country and its economy.

In common with most countries which experience years of strong economic growth, Turkey's waste generation has increased dramatically. Between 2008



and 2013, waste generation in Istanbul more than doubled from around 8000 tonnes per day to over 16,000 tonnes per day. Today, the Istanbul Environmental Management Industry and Trading Company (ISTAC) collects around 17,500 tonnes of MSW per day. Founded in 1994 as an affiliate company of the İstanbul Metropolitan Municipality, the firm is one of the largest waste management businesses in Turkey.

The city already plays host to one of the largest composting facilities in the world, also operated by ISTAC, and a bio-drying facility with a capacity of 2000 tonnes per day, where wastes are recycled through mechanical and biological processes and alternative fuel is derived. However, landfill still accounts for around 84% of waste disposal.

With a massive population to house and pressing environmental concerns, including landfill diversion targets, in 2010 the City and ISTAC began to contemplate an alternative to burying waste. By 2014, a plan to develop a huge waste to energy plant was taking shape.

#### WASTE COMPOSITION

During the initial investigation into the feasibility of the project, ISTAC carried out the waste characterisation study to compare the composition over a number of years in both summer and winter. The study followed the ASTM D5231 American Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste and European Commission Methodology for the Analysis of Solid Waste standards.

To ensure the waste characterisation was representative of the overall waste processed in Istanbul, ISTAC used samples from 24 counties with a mix of both affluent and less-affluent districts to ensure the study was reflective of the whole city's waste stream. It also used waste collected both during the week and on the weekend.

The moisture content was found to be between 45% and 55% while the calorific value of the different waste streams was between 6000 kJ/kg and 9000 kJ/kg. The density of the waste was also analysed to

**“THERE ARE ALSO PLANS BEING DRAWN UP TO DEVELOP A 45,000 TONNE-PER-YEAR ANAEROBIC DIGESTION PLANT FOR PROCESSING THE CITY'S ORGANIC WASTES.”**



**Fatih Hoşoğlu**  
operations manager ISTAC A.S.

calculate the correct size for the refuse pit and overhead cranes. It was estimated that the waste density was approximately 270 kg/m<sup>3</sup> when delivered by truck and around 400 to 500 kg/m<sup>3</sup> when delivered by trailer due to additional compaction of the waste.

However, according to Fatih Hoşoğlu, operations manager at ISTAC, it is anticipated that in the future Istanbul's waste composition could change as both population and wealth increase. He says that numerous studies have shown that the MSW heating value generally increases with people's living standard.

#### LOCATION LOCATION LOCATION

During the first stage of the project, 11 locations were identified, eight on the European side of the city and three on the Asian side. During the second stage, the number of potential sites was reduced through the use of evaluation criteria.

A number of factors were considered during this evaluation process, including: compliance with applicable laws and legal regulations; municipal approval - preferably for a location in a commercial area; public acceptance; land ownership; transportation distance from source to plant; grid connection for power customers; proximity to potential heat customers; and available local infrastructure.

The various locations were scored by using a weighted system, considering environmental factors, planning considerations, political and legal implications, and financial and economic criteria be-

#### REFUSE DERIVED FUEL

In an effort to recover unrecyclable, but high calorific-value waste at its Kemberburgaz Recycling and Composting Plant, back in 2008 ISTAC installed a 96 tonne-per-day Refuse Derived Fuel (RDF) facility. The plant processes wastes rich in organic content from vegetable markets and open bazaars as well as some wastes collected from towns. The compost produced is used in various parks and gardens of Istanbul. However, much of the non-compostable material is now also being used for energy recovery. The waste is first crushed down to a fraction size of around 250-300 mm. Metals and organics are then separated and the material is reduced to 0-30 mm in size in fine crusher. The resultant RDF has a calorific value in the range of 4000 kcal/kg and is sent to cement plants as an alternative fuel. —

## COVER STORY



### FACTS

**17,500**

**TONNES**

MSW collected in Istanbul every day

**51.71%**

Organic content of MSW in 2010

**3%**

Material recycled in Istanbul each day, or 500 tonnes

**2000**

**TONNES**

MSW sent for bio-drying with ISTAC each day

fore it was finally decided to locate the project in Eyüp.

### DECISIONS DECISIONS

Having considered various energy recovery technologies, the municipality and ISTAC, which will operate the facility, reached the conclusion that traditional mass burn incineration with energy recovery was the most prudent means forward.

Hoşoğlu explains that to ensure that the project was based on proven technology with a good track record, which allows it secure financing as well as staying in operation for the minimum operating term of 20 years, the moving grate mass-burn technology was chosen.

A competitive tender process followed and in September this year, Swiss waste to energy firm Hitachi Zosen Innova (HZI) was selected as the technology partner.

The plant will process 1 million tonnes of waste per annum, generate around 70 MW of electricity, and cost approximately 2.6 billion Lire (\$690 million). Located close to Istanbul's new airport in the northwest of the city, from 2021 its three



The architectural design of the facility was selected to correspond with the natural environment in which it will sit.

incineration lines will process around 15% of the city's municipal solid waste. The plant is also being designed to exceed EU emission regulations.

Under the turnkey contract, HZI will oversee the design and build of the Eyüp Kemberburgaz Domestic Waste Incineration and Power Generation Facility, together with its Turkish construction partner Makyol. Beside the design and construction, the contract covers also the operation and maintenance of the turnkey plant for at least one year.

Speaking at the signing of the agreement, Istanbul's Mayor, Kadir Topbas, said that when he came to office in 2004, the priority was to focus on regular collections and sanitary disposal. However, if the city continues to landfill waste at the current scale a considerable amount of additional land will be required in the future. "For this reason, we are signing for the establishment of a state-of-the-art facility," he said. "We are proud to be a model for Turkey and the world."

### ADDING VALUE

As well as supplying electricity and disposing of waste, the new plant will also deliver added value for the region economically. Over 20% of all the components for the plant will be produced by local businesses, while all of the work connected to the construction will be carried out exclusively by local workers.

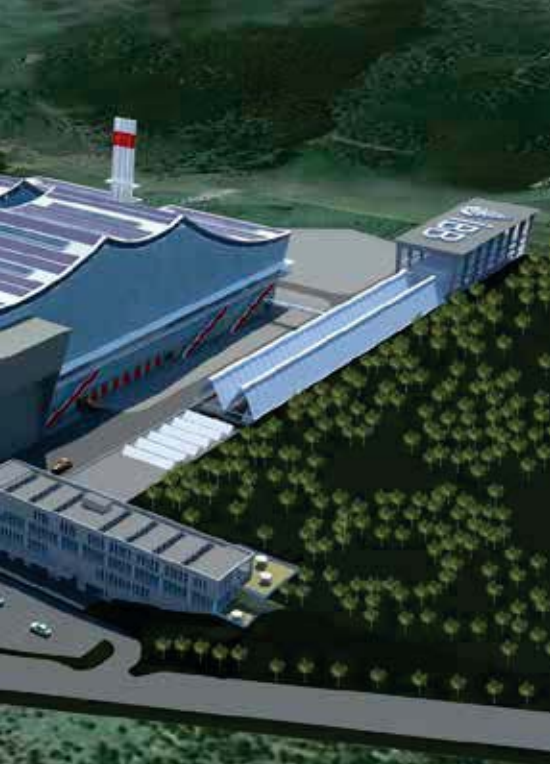
"We will have eliminated 25% of the daily garbage from the European side," says Mayor Topbas. "There are solar panels on the roof of the plant that will reduce greenhouse gases. It is a terrific en-

### LANDFILL GAS



At ITC's existing landfill gas site in Ankara it uses the heat from the engines in a greenhouse to grow tomatoes and strawberries.

With so much waste already deposited in landfill, recovering energy from landfill gas is also seen as a major opportunity in Turkey. While Istanbul already generates around 50MW of electricity in this fashion, elsewhere in Turkey other major projects are underway. In August this year, plans to install 16 new GE Jenbacher gas engines with a combined generating capacity of 22 MW across three landfill sites owned by ITC-Ka Enerji Uretim Sanayi Ve Ticaret AS (ITC) were unveiled. In total, the three facilities will process 1,387,000 tonnes of municipal solid waste annually from the surrounding households, vegetables, fruit and garden waste and comprise more than 50% of the household waste of the cities of Antalya, Eskisehir and Alanya. With much of that waste being landfilled, gas generation is high. Four of GE's Ecomagination certified, Jenbacher J420 biogas engines will be installed at Eskisehir, nine at Antalya and three at the Alanya landfill site. —



environmental project that produces electrical energy while disposing of waste.”

**MORE TO COME?**

Istanbul already generates more waste than many European countries, and with its population set to grow both in numbers and wealth, the problem will not be

going away on its own. According to the European Environment Agency, across Turkey the share of MSW going to landfill increased by 5% between 2001 and 2010. The number of sanitary landfill sites increased from 15 in 2003 to 68 in 2012.

However, with Turkey eyeing potential membership of the European Union at some point in the future, it is adopting a number of EU environmental regulations. While there is clearly room to improve material recycling rates in both Istanbul and the country as a whole, there is also clear potential for additional waste to energy infrastructure. Hitachi Zosen Inova chief executive officer Franz-Josef Mengede agrees that “the region has enormous potential in the area of energy from waste,” and concludes by saying that the development is “paving the way for further EfW projects going forward”. —

**COVER STORY**



**“BECAUSE ISTANBUL'S POPULATION AND GARBAGE ARE CONSTANTLY INCREASING, WE WILL BUILD THIS HUGE FACILITY.”**



**Kadir Topbas**  
Mayor of Istanbul

**Doosan Lentjes**  
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At Doosan Lentjes, we help our customers get the maximum from their residual waste: Latest technologies across combustion, steam generation and flue gas cleaning allow maximum energy and material recoveries while securing compliance with strict emissions standards.

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