

Feeding the Asian Dragon

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While Singapore is embarking on its sixth EfW project, in China there are as many as 30 projects every year, and Japan's lack of landfill space means incineration has been a necessity. Matt Clay looks at the varying Asian market ahead of this month's Energy from Waste Conference in London.

Between 2010 and 2015, Asia is expected to double its current share of global GDP, from 28% to 52%, according to the Asian Development Bank. Such rapid growth will also come hand in hand with a boom in population. And such an increase in population leads to additional strain not only on roads and hospitals, but also on energy supply and waste management.

As a result, Asian countries have progressively been including energy from waste (EfW) solutions in their waste management strategies as a way of dealing with increasing waste volumes.

Singapore sensation

One country that quadrupled its GDP per capita in the past 20 years alone is Singapore.

It was in September 2015 when the National Environment Agency released plans for a sixth EfW plant, to be located in the industrial area of Tuas. Costing S\$750 million (US\$532.4 million), the 120MW project will treat 3,600 tonnes per day of waste and will be built by a consortium including Mitsubishi Heavy Industries and water company Hyflux under a Design-Build-Own-Operate (DBOO) partnership over 25 years.

Lam Boon Kia, deputy director (operations) in the waste and resource management department of the National Environment Agency, says: "Even as Singapore continues to promote the three Rs – reduce, reuse and recycle – and works towards the targeted 70% recycling rate by 2030 under the Sustainable Singapore Blueprint, we project that Singapore's waste output will increase given the projected growth in population and the economy. The development of new EfW facilities is therefore required to meet our growing waste disposal needs. The new facilities would also replace the older ones when they reach the end of their economic life span of about 30 years."

The new plant will be Singapore's sixth EfW project and will bring the total number in operation to five, after the first in Ulu Pandan was decommissioned in 2009 after 30 years

in operation. The agency says the existing four plants meet up to three per cent of Singapore's electricity needs and generate an average of 450kWh per tonne of waste generated.

Kia adds: "Singapore uses WtE incineration in order to reduce the total volume of waste disposed and prolong the life span of Singapore's only landfill – Semakau Landfill. The EfW plants are designed to safely incinerate waste and are equipped with flue gas treatment systems to ensure that flue gas is treated to meet Singapore's air emission standards. The benefits of incineration include the reduction of waste volume by 90% and the recovery of energy in the form of electricity."

Lessons learned

So what has Singapore learned from its experience that could be shared across other Asian countries or even across Europe?

"Over the years, with the experience gained from the design and operation of EfW plants, significant improvements were made to each successive plant to increase their energy recovery efficiency and operational reliability," says Kia. "The sixth EfW plant will be able to produce more energy per tonne of waste incinerated (800kWh/tonne compared with 200kWh/tonne when Singapore's first plant was built). With improvements in flue gas treatment systems, the newer plants are also able to meet the increasingly stringent air emission standards. Modern digital control systems are also used in the new plants and these increase the productivity of manpower, with fewer staff needed to manage, monitor and control the complex plant."

While Mitsubishi Heavy Industries has delivered 180 EfW plants since 1964, it's the first venture into the area of solid waste for its partner, Hyflux.

Crucial issue

"With the growing importance of resource optimisation to urban cities and industries, the development of alternative sources of water as well as the recovery of energy from waste has become crucial. Our business is evolving in response to this global trend," group CEO and executive chairman Olivia Lum said in a statement.

The adage that necessity is the mother of invention rings true for Singapore.

A lack of physical space has meant that EfW was a viable option, as Professor Nickolas Themelis, chair of the Waste to Energy Research and Technology Council, says:

"Singapore government decided decades ago that they had no space for landfilling, but

they had the economic means to build the WtE plants needed for their post-recycling wastes. As the generation of MSW has increased over the years, they are now adding capacity."

He adds: "There has been no public opposition to WtE plants, in contrast to Hong Kong where WtE is badly needed and is supported by China but has been opposed by some, mainly for political reasons."

Positive attitude

A lack of public opposition to thermal treatment plants, a concept that will seem alien to the UK, is one that has helped Asian countries such as Singapore and Japan develop their infrastructure so efficiently, according to Paul Davison, MD of communications consultancy Proteus Environmental (Hong Kong). "Two countries which already have very positive attitude towards EfW are Japan and Singapore – both have had a historical need for energy and a lack of landfill capacity, resulting in the successful implementation of EfW," he says.

"There's no doubt that Asia represents the biggest commercial opportunity for EfW technology for the next 20 years," Davison adds. "But, before all the EfW salesmen pack their bags and head over, it's important to recognise the need for a very disciplined approach to the way the technology is delivered to this market.

"Attitudes towards EfW vary considerably, so, despite the perfect storm of rapidly increasing economic wealth, subsequent increase in waste generation and an insatiable appetite for energy, any wrong approach to the public can generate significant delays and dramatically increase costs," warns Davison.

Environmental education, together with trust between the government and its public (again, a second alien concept in the UK), are key to the success of EfW, says the MD.

"However, there are two other factors that make EfW development easier than in other countries in Asia," he adds. "Firstly, there are high degrees of trust between the public, business and government. Secondly, both countries have an extremely well-educated population with a high degree of environmental literacy.

"In essence, these potential host communities understand the need, the technology and the environmental benefits that EfW has to offer. So it's hardly surprising that new plants can get built and old plants replaced faster and more cheaply than in many other countries."

Big land demand in small Japan

The Tuas project is anticipated to be Singapore's most energy-efficient EfW plant, as well as its most "land efficient", calculated by how many tonnes are processed per day on the space taken up by the facility.

To give an idea of the improvement, the new Tuas plant will consume 750 tonnes/day per hectare, compared with the existing Keppel Seghers plant in the same location, which handles 500 tonnes/day per hectare.

Developing infrastructure with land restrictions was also a key part of Japan's successful EfW roll-out.

"Japan has been very conscious of land use and phased out landfilling well before any other country," says Professor Themelis. "They have tried multiple streams of recyclables (up to nine), various types of composting, and all of their post-recycling MSW is sent to plants based on more thermal processing technologies than in all other nations put together. In order to avoid transporting MSW long distances, Japan requires each city to have their own WtE or RDF plants."

Nobuhiro Tanigaki of Nippon Steel & Simikin Engineering believes there are several reasons for EfW's success in Japan, but it's important to note many of the plants are for disposal, rather than energy generation.

"Firstly, in Japan, the priority of the EfW facility is to treat waste properly, not the power generation from waste. This is because of the lack of land," he tells *RWW*. "Some EfW facilities have no power generation and heat utilisation – they only treat the waste. This means that the plants are sanitation facilities. Secondly, the EfW plants also have education areas for citizens. Sometimes, the heat from the plant is used to heat a swimming pool, installed next to the plant.

"These could be the reasons why EfW plants are implemented successfully in Japan. At the moment, 75-80% of household waste is combusted and almost no waste is landfilled."

The company has over 40 reference plants in Japan. In 2014, it acquired German grate incineration firm Fisia Babcock Environment, demonstrating its interest in moving from East to West. Despite Japan's proliferation of plants, Tanigaki believes the market is still "active" with "the new order" estimated to be at "4,000 tonnes per day capacity level every year".

Not everyone's cup of tea?

Japan and Singapore to one side, China has its own set of challenges, despite historically completing up to 30 projects a year.

“The mega cities of China are literally besieged by landfills and the national government is fully supporting EfW,” says the Waste to Energy Research and Technology Council’s Themelis.

“For example, they have designated EfW as a renewable energy source, spent millions of dollars for R&D on circulating fluid bed technologies, and provide a \$30/MWh credit for EfW electricity. As a result, in recent years there have been nearly 30 new WtE plants per year. However, there is still some public opposition based on the presumption that although these EfWs are equipped with modern air pollution control systems, they may not be monitored adequately for environmental performance. Columbia University is investigating this issue.”

Proteus Environmental’s Davison adds: “China – where an estimated 150 new plants could be built in the next 15 years – has suffered from increasing public opposition and protests that have resulted in projects being substantially delayed or cancelled.”

It’s clear that with Asia’s continued growth, despite recent signs of a slowdown in China, there will be opportunities for energy from waste, yet each country comes with its own unique set of challenges.

- Lam Boon Kia, deputy director (operations) in the waste and resource management department at Singapore’s National Environment Agency, will be speaking at the Energy from Waste Conference taking place on 24-25 February 2016 at the Royal College of Surgeons, London. For more information, visit www.efwconference.com

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