

# FROM TRASH TO ASH

BY **KHAIRANI AFIFI NOORDIN**

**M**alaysia generates a lot of solid waste — a crippling problem, especially in light of recent revelations that the country has become the global dumping ground for plastic waste after China decided to forego the honour. Government statistics reveal that Malaysia generated 42,672 tonnes of waste daily in 2017, which is expected to rise to 44,888 tonnes per day as the population increases, especially in cities.

The build-up of solid waste is causing tremendous land and air pollution and no one seems to be able to come up with an ideal solution, but not for lack of trying. The favoured solution seems to be waste-to-energy (WTE) incinerators but previous incinerator projects have not been successful. To top it off, such projects have been very costly, says Roland C S Tee, Pyro Plasma Sdn Bhd executive director.

“In 2006, a government-linked company announced that it would be building mobile incinerators powered by alternative fuels to solve this problem. It never took off. Subsequently, in 2011, four incinerators worth RM188 million were built in Langkawi, Cameron Highlands, Pangkor and Tioman. Today, none of them are in working condition,” he points out wryly.

Tee, 73, is not a fan of incinerators as they require diesel, which is costly. He thinks it is a bad idea to use so much resources to collect the waste and spend even more to reduce it to something manageable. There had to be a better way.

He decided to take matters into his own hands and racked his brains day and night to figure out how to build an incinerator that could operate without using fuel. His peers thought he was spinning his wheels in mud and that there was no solution to the problem.



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**> Mohamed Razeek**

But Tee is nothing if not resolute. One day, he met with a few friends who were university professors and asked them if there was a way to burn garbage without using diesel. One of them suggested that he try pyrolysis — the process of chemically decomposing organic materials at elevated temperatures in the absence of oxygen. The irreversible process involves a change in the materials’ chemical composition and it is commonly used to convert organic materials into solid residue containing ash, carbon and small quantities of liquids and gases.

It was a eureka moment for Tee and sent him back to the drawing board. By 2011, he had designed the first prototype for Asher, a 6-metre-tall machine that can reduce most solid waste materials to ash. It uses integrated solar panels to operate continuously and is self-sustainable.

Asher is exclusively distributed by Pamarai Sdn Bhd. Executive director Pang Swee Lei tells *Enterprise* that in designing the Asher, Tee seems to have thought of everything from cost to sustainability. In fact, the capital expenditure required for Asher is not more than 20% of that required for a conventional incinerator on a tonne-for-tonne basis, he says.

“A conventional 1,000-tonne capacity incinerator requires a capex of around RM750 million. For the same capacity, the required capex for the Asher is only RM137 million. Additionally, the return on investment can be as high as 40% or within 2.5 years in certain cases,” says Pang.

## TRUE GRIT

When waste is put into the Asher, it ends up in the thermal degradation chamber where it will decompose via the pyrolysis process. The heat generated from the process is sustained only within the chamber. So, the longer the machine is in operation, the higher the internal temperature will be, Tee explains.

“Within the first hour, it can go up to 150°C. If it is used 24 hours continuously, it can go up to 1,000°C. This is why diesel is unnecessary.”

Although it does create toxic emissions such as dioxins (a highly toxic compound and serious environmental pollutant) and furans (a flammable, toxic liquid), Tee, who has spent most of his life working in the water industry, has created a filtration system to prevent these emissions from being discharged into the atmosphere.

“We wanted to come out with the formulation to filter the flue gas carbon (the gases produced by burning). Typically, incinerators use caustic soda but that is a chemical substance and I did not want to use anything chemical. So, I looked around and found that there is actually a lot of minerals that are similar to caustic soda,” he says.

His Japanese friends told him that he could use Nanogreen, a mixture of 13 types of metallic minerals. The pH value of the product is very high, almost 13.5, so it can suppress the acidic gases that come from the hot chamber. To do this, Tee designed the machine to



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**A trashy harvest: filtered and unfiltered water, ash and a sand brick.**

filter the smoke through Nanogreen-infused water, which resulted in emissions that were neutral and not harmful.

The machine is also equipped with a wet scrubber that removes other possible internal pollutants. The water in the scrubber tank has to be removed and most would simply empty the water into a nearby drain. But Tee came up with a better solution — the Asher is connected to a water filtration device and the water is then reused.

“It’s a very simple operation, not rocket science. The Asher requires very simple training supervision for operations and maintenance. Additionally, the operation and maintenance protocols are documented and can be easily mastered,” he says.

The Asher is patented in Malaysia and 12 other countries, including Indonesia, Australia, Singapore, India and South Africa.

It has changed the lives of many communities around the world. For example, in the Philippines, an Asher unit is installed in a small village called Marikina. The government used to pay US\$100 (RM414) per tonne to a contractor to collect municipal solid waste to be sent to the landfill. Tee explains that this was very costly because the village does not have proper roads.

When the Asher team arrived, they suggested to the City Waste Management Office that residents be incentivised to bring their trash to the Asher to cut the cost of transporting it.

Tee was inspired by Wasted, a pilot project in Amsterdam’s Noord district, which provides incentives to households to recycle their plastics by rewarding them with discounts at local businesses.





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waste per day, they laughed.

“Here’s the thing — I deliberately did not want to create big versions of the Asher because if it is small, the waste treatment process can be decentralised. For example, let us say the Klang Valley produces 1,000 tonnes of trash every day. If the WTE incinerator they are planning to build is facing downtime or undergoing maintenance, will the trash wait? It will still be there tomorrow, and in fact, double in size.

“Mine is different — it can be decentralised. To process 1,000 tonne of trash, we need 500 units of the two-tonner Asher. This small machine can be distributed all over Kuala Lumpur. It will only take up the size of one parking lot, compared with a 1,000-tonner incinerator that will need 30 acres of land,” explains Tee.

That is not the only frustrating response, he says. It is discouraging to hear the authorities asking whether the Asher is a Japanese or Chinese invention. The Malaysian flag is proudly displayed on the side of each Asher unit.

Some companies have expressed their interest in buying the intellectual property rights to the Asher, but Tee is not selling. “A party from the Middle East came to me, offering a huge price for my technology and my existing customers. I declined. I want it to continue being known as a Malaysian invention. I want to champion Malaysia Boleh,” he says.

#### THE MALAYSIAN LIMITATION

One of the reasons why it is so hard to market the Asher in Malaysia is because the company has been asked to conduct an environmental impact assessment (EIA), says Pang. The EIA is a study to identify, predict, evaluate and communicate information about a proposed project’s impact on the environment and detail the mitigating measures before it can be approved and implemented.

Pang says it does not make sense to conduct an EIA for the Asher as it is technically not an incinerator and does not require a single litre of diesel to operate. “If I want to build an incinerator that processes 1,000 tonnes of waste per day, it makes sense that I will need to do an EIA. It is a very big infrastructure project and we have to thoroughly ensure that it does not cause air pollution, noise pollution and smell pollution.

“But the Asher is small, processing only two tonnes of waste per day. The cost to do the EIA is 10 times the cost of the Asher machine. How can we afford that?”

The country’s protocol and bureaucracy make it very difficult for the technology to be deployed, Pang says. This is in stark contrast to the distribution of the Asher beyond Malaysian shores, where it only needs to go through certain tests before being approved for use.

In Singapore, for example, the National Environment Agency visited a factory using an Asher unit to inspect possible secondary contamination. When no secondary contamination was found, the Asher was approved for use, says Tee.

“We have done all we can to prove that the Asher does not create secondary contamination. We got it tested by SIRIM, SGS and even China’s Pony Testing to make sure we complied with international environmental standards.

“About 30 years ago, China was a very poor country. Its local companies continued to innovate so that improvements could be made, and the government was supportive. Today, China is the second largest economy in the world. The Malaysian government should also provide a better chance for local companies to do the same. We just want to help move the country forward,” Tee says.



SAM FONG/THE EDGE

“We said, ‘Why don’t you pay the residents US\$0.60 for every 30kg of waste they bring?’ The council said it could not reward the villagers with cash but could provide vouchers that could be exchanged for food and clothing at the local supermarkets. It was a hit! Not only did the residents keep and collect their garbage, the council also saved a lot of money as it no longer needed to pay contractors to collect the waste.”

The residents were happy with the vouchers, so much so that they took to stealing their neighbours’ garbage. “Before fights broke out, the council stepped in to suggest that they cleared up the drains instead to get more vouchers. In the next four-and-a-half months, all the drains in Marikina were cleared. You cannot find any rubbish there now,” Tee recounts gleefully.

One unique feature of the Asher is that the leftover ash, which is 4% of the weight of the original waste, can be reused, he says. In Marikina, Makati and Quezon City, the ash is mixed with sawdust and sold as fertiliser to farmers, allowing the council to generate further income.

“They are processing two tonnes of waste per day, which works out to 80kg of ash. The ash is very fine so they will need to mix it with 100kg of sawdust. The fertiliser is sold to farmers at a very low price of 15 pesos per kilogramme. This means that every day, the Asher is generating an income of RM234 for the council, which can be used to maintain the Asher,” Tee points out.

However, Pang notes that not all waste can be turned into fertiliser. The sources of the waste have to be carefully identified. If it is not suitable to be turned into fertiliser, the ash can still be used for multiple purposes such as general landscaping as it is odourless and non-hazardous.

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#### USE CASES IN MALAYSIA

Pamarai has distributed more than 50 Asher units outside Malaysia. But although the product was invented here, less than 10 units have been distributed within the country.

Pamarai executive chairman Datuk Mohamed Razeek Md Hussain says this is discouraging, especially as the Asher can definitely alleviate the problem of illegal plastic recycling plants in Malaysia.

Earlier this year, it was reported that Malaysian au-

thorities had shut down 139 plastic recycling premises, which had been operating illegally or had contravened provisions in the Environment Quality Act since July last year.

Energy, Science, Technology, Environment and Climate Change Minister Yeo Bee Yin was quoted as saying that the authorities had inspected 273 premises since then. Of these, 108 were found to be unlicensed.

“If we are able to install one of the 2.5-tonner Asher in all these factories, they can start loading two tonnes of plastic a day, cleaning up 100 tonnes of plastic within 50 days. The new government has done a very good job at closing down the illegal recycling plants, but what happens to all the plastic? It’s not going anywhere, it is not being treated. It is just being relocated.

“We have the solution and we want our voices to be heard. It is available, accessible and affordable! We are ready to talk to any government or private company to start treating their waste and solving problems,” says Mohamed Razeek.

Five of the units distributed in Malaysia are being used for the extraction of silica from padi husk. Previously, the purchasers were using diesel to extract the silica. When they found out about the Asher, they instantly switched. Two other units went to the local municipality in Semporna, which installed them at Taman Sempol and Bum Bum Island.

“Semporna recently came out with the law that household waste must be brought to the collection area — the municipality is no longer collecting the waste. If the waste had to be delivered by the residents themselves, it is more carefully handled, drier and well taken care of. Once it reaches the Asher centre, it will be more easily treated, removing the issue of bad odour, pests and bacteria,” says Pang.

It makes sense to install the Asher on islands because typically, waste has to be moved to the mainland — a costly and inefficient process, he explains. Last year, the Philippine resort island of Boracay was closed for a clean-up. Five Asher units were sent to the island as part of the waste-clearing exercise.

The Asher team is trying its best to meet more Malaysian authorities to talk about how it can help them cut costs and get rid of the increasing amount of solid waste. But the meetings have not been very productive so far.

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