

[MUSIC PLAYING]

DR. HASLENDHA Industrial processes are highly energy intensive, and currently account for one third of global energy use. CO2 emissions from industries have increased about 0.6% from 2012 to 2013. **HASHIM:** This is equivalent to adding 27 million cars on the road. How can industry remain competitive and commercially viable without jeopardizing the environment?

One of the promising solutions is the implementation of industrial symbiosis. In this teaching module, I'll present an industrial symbiosis case study In Nusajaya, Iskandar Malaysia. What is industrial symbiosis? The concept of industrial symbiosis comes from natural ecosystems. Let's take a look at a simple example.

In nature, there is no such thing as garbage. Outputs becomes inputs for a different part of the ecosystem. A falling leaf decomposes into soil nutrients when then allows tree to grow. In other words, waste has become resource, and the process is repeated in a closed ecological system.

The same principle is applied in industrial symbiosis. Industrial symbiosis is an innovative concept where the byproduct, or output, of one company can become the raw material of another company by creating a closed cycle of waste resources between companies. It involves exchanges of byproduct and energy between companies.

More than 170 successful industrial symbioses can be found in the world, such as Kalundborg Symbiosis Park in Denmark, Kawasaki Eco Industrial Park in Japan, Smart Park in Texas, USA, Ulsan in Korea, [INAUDIBLE] Industrial Park in China, and Green Industrial Park in Nusajaya. In Malaysia, industrial symbiosis is put into practice in Iskandar Malaysia, located in southern peninsula Malaysia, in a complex known as the Southern Industrial and Logistics Cluster located in Nusajaya.

Industrial symbiosis in Nusajaya is built as a network of cooperation between four biotech companies. The companies exchange materials, byproduct, or energy with each other. For example, one utility company [INAUDIBLE] is using palm oil waste as fuel to give its steam steady supply to nearby industries. Industrial waste generated from other companies will also be sent to [INAUDIBLE] treatment facilities for further processing, to produce an alternative fuel called bio-gas.

The bio-gas generator can then be used as a renewable energy source to generate steam or electricity to supply back to the industrial area nearby. The waste left after this process is then sold as fertilizer. AS you can see, the visualization clearly shows the main concept of industrial symbiosis, which is utilization of one company byproduct, energy, or what is raw material for another company has been implemented in Nusajaya.

How can industrial symbiosis reduce emissions, and generate economic benefits? Or, in other words, what is the advantages of industrial symbiosis. There are multiple advantages industrial symbiosis. First, the practice significantly reduces the volume of waste being disposed in landfills. Second, the cost of raw material and waste treatment is reduced.

Third, raw material, energy, and water are conserved, because the byproduct always are turned into raw material, energy is recovered, and what there is used. Fourth, industrial symbiosis also leads to reduction in fuel consumption and transportation costs, due to shortened transportation distances for byproduct or waste to the industry. As a result, industrial symbiosis could produce fewer transportation-related emissions.

An sample of successful industrial symbiosis is Kalundborg It is the world's first industrial symbiosis site, and has been in operation for more than 30 years. It has achieved significant environmental and economic returns. Through integrating 30 companies, Kalundborg has reduced about 160,000 tons of CO2 emissions, and saved 3 million meters cubed of water. The process also saved more than \$1 million US dollar annually, all due to recycling and reuse of industrial byproducts.

in comparison, industrial symbiosis in Nusajaya has only been operating since 2009, and is still at its infant stage. However, given the benefit at Kalundborg, industrial symbiosis in Nusajaya in the long run could be a very promising strategy to help reduce carbon emissions by 50% in the Iskandar region by 2025. This is in line with the action plans in the low carbon society blueprint for Iskandar Malaysia.

As we all know, our prime minister was launched low carbons blueprints in 2012. So could you please explain, what is the insight low carbon society blueprint for Iskandar Malaysia.

SPEAKER:

I believe we are talking about this blueprint, the low carbon society blueprint, that actually give the 12 action framework for how Iskandar nation should drive. And it actually cover our three main core component, economy, [INAUDIBLE] and also environment. And this 12 actions plan

is actually looking at how each of us can actually working together to actually drive this initiative in Iskandar Malaysia.

DR. HASLEND

HASHIM:

Successful implementation of industrial symbiosis will not happen by accident. Several challenges need to be overcome for the development of industrial symbiosis in Nusajaya to become a successful model. First issue is related to logistic factor. There are four palm oil mills within 20 to 40 kilometers in Iskandar Malaysia. These mills are a potential supply of waste to the industrial park.

This long distance however will require large storage in industrial park to ensure the continuous supply of palm oil waste. Thus, it is recommended to site industrial symbiosis in an area adjacent or close to the source of waste, such as palm oil mills, to minimize the cost of transportation, as well as reduce the size of storage needed for palm oil waste.

Second, a major challenge concerns laws and regulations. The national green technology policy and feed-in tariffs were established in 2009 and 2011 to promote sustainable development for industry in Malaysia. However, there are no specific regulations or policies to encourage industry to form symbiotic linkages. In Japan, for example, the sound material cycle society was formed. It consists of various recycling and green purchasing laws to support the creating and selling of waste for industry inside and outside the industrial park.

This initiative will create sufficient and comparatively cheaper waste to use as raw material for industry. In addition to the lack of appropriate policy, lack of financial support is also one of the barriers that hinder the development of a more complex industrial symbiosis park in Nusajaya. In Japan, for example, 227 million US dollar were allocated by the government to build new recycling plants in Kawasaki Eco-Town in 1997.

In Malaysia, the sustainable energy development authority provides financial incentive in the form of feed-in tariffs. However, these incentive are only beneficial for palm oil industry park because they have no cost for waste or transportation. In addition to the factors that I have just highlighted, the concept of industrial symbiosis in Nusajaya can be extended to urban symbiosis similar to the system in Kalundborg. Special planning factor, which is the distance between industrial park and residential area, and strong linkages between state and local government, have contributed to this integrated effort.

The sustainable supply of waste could be generated from this effort, since municipal waste could also become a source of raw material for industry. In return, the municipality also

benefits from this initiative. Since the energy generated by industrial symbiosis will be supplied to the municipality, thus reducing the municipality heavy reliance on fossil fuel. What can be learned from industrial symbiosis in Nusajaya? And how can it be duplicated elsewhere?

The case of industrial symbiosis in Nusajaya provides a good lesson to accelerate the development of industrial symbiosis in developing countries. The primary elements that are necessary to support the successful implementation of industrial symbiosis in other countries are, first, availability of renewable energy source. Second, distance from the renewable energy source to the industrial park. Third, a strong regulatory and legal structure around climate change mitigations. Fourth, financial incentives. Fifth, strong linkages between national, state, and local development to encourage integrated industrial and urban symbiosis. Last but not least, this initiative would not be possible without strong commitment from industry and stakeholders to its sustainable development. As we come to the end, can industry save the environment while also remaining competitive? The answer is simple. Turning waste to resources by implementing industrial symbiosis.