



On July 14, Singapore unveiled one of the world's largest inland floating solar farms at Tengoh Reservoir, which can power the country's water treatment plants, in its move to green its energy mix. ST PHOTO: LIM YAOHUI

Primer

Singapore taps green tech to feed, water and power its people

This is the 11th of 12 primers on current affairs issues under the news outreach programme by The Straits Times and the Ministry of Education



Shabana Begum

For Ms Lim Fengru, 33, what started out as a hobby in cheese-making has turned into a career.

As co-founder of biotech start-up TurtleTree, she is on a mission to find a cleaner way to produce milk – not from cows but from mammary cells in a lab.

The story began in Vermont in the United States, where she learnt to make cheese. On her return to Asia, she travelled to many dairy farms in Indonesia and Thailand to source for milk for the high-quality cheese she hoped to produce.

What she found instead were farms where cows were injected with hormones, animal hygiene was poor and the water contaminated – resulting in poor-quality milk. So she turned to technology.

Today, her start-up can produce milk from mammary cells. These are immersed in a lactation solution TurtleTree produces in-house which simulates the environment inside mammals' bodies, thus causing the cells to convert the solution into milk.

The technology behind cell-based milk is similar to that of cell-cultured meat, where chicken or beef cells are multiplied into tissue in bioreactors before they are harvested as minced meat. Most start-ups here and abroad are currently in their research and development (R&D) phase to transform cultured meat into textured cuts such as steak, using edible scaffolds.

With the world's population expected to reach close to 10 billion by 2050, the demand for food and water will soar. The push is also on to switch from fossil fuels, still the world's main energy source, to renewables in a bid to reach net zero carbon emissions by 2050, so as to prevent the worst effects of climate change.

As an island nation facing the threat of both sea-level rise and food insecurity, Singapore is geared to innovate and tap the latest in green and biotechnology,

to feed and water its population and power their activities.

BEEFING UP NEW FOOD

A city-state that imports over 90 per cent of its food is wise to invest in research and development of novel food.

Singapore is on its way to becoming a hub for innovative proteins. There are start-ups here working on growing cell-cultured seafood and meat. Production facilities and R&D centres are sprouting, and there is even an upcoming university course on meat alternatives.

A report this year commissioned by the Good Food Institute Asia Pacific found that cultured beef produced via renewable energy can slash the industry's global warming impact by up to 92 per cent, while slashing the amount of land needed by up to 95 per cent. Rearing livestock for meat and dairy contributes to about 15 per cent of global greenhouse gases, and two-thirds of the planet's agricultural land is used for livestock, according to the United Nations Food and Agriculture Organisation.

To eventually feed the country, alternative protein start-ups here need a platform to manufacture their food products affordably, especially for firms that do not have pilot plants.

That is why despite the Covid-19 pandemic, Singapore has not dialled back on its ambition to mass produce and refine technology and equipment to develop new products.

Local biotech company Eseo Aster is seeking a Singapore Food Agency licence for one of its facilities to produce novel food ingredients such as cell-based meat.

While the novel food space is gaining steam here, the public's receptivity to cell-based meat and milk is still uncertain. Food is core to people's culture and sense of identity, and start-ups also need to figure out how to overcome the "ick factor" of meat grown from cells. Will there come a day when people eat their own cell-cultured chicken rice?

Professor William Chen, director of Nanyang Technological University's (NTU) Food Science and Technology programme, hopes public outreach and school buy-in. In April, a hub was launched in NTU to study the safety of novel foods and work

About The Straits Times-Ministry of Education News Outreach Programme

For 12 Mondays until Aug 2, in the Opinion section, this paper's journalists will address burning questions, offering Singaporean perspectives on complex issues.

The primer articles are part of The Straits Times-Ministry of Education News Outreach Programme which aims to promote an understanding of local and global issues among pre-university students.

The primers will broach contemporary topics, such as the future of work and evolving global supply chains. Other issues include the economics of modern cities and Singapore's blueprint for green development.

Each primer topic will give a local perspective to help students draw links to the issues' implications for Singaporeans.

This programme is jointly organised by The Straits Times and the Ministry of Education.

dry spell in 2016, Malaysia's Linggiu Reservoir, from which Singapore draws a big share of its water, plunged to 20 per cent of its capacity – a historic low.

The team hopes that the "desalination battery" can eventually be used in desalination plants.

Meanwhile, over the next five years, national water agency PUB is aiming to reduce the amount of energy used in desalination by more than 40 per cent.

One of its solutions is to scale up the development of membranes that mimic the ability of plants and animals to extract fresh water from seawater.

Although Singapore is on track to becoming water-resilient, the same cannot be said for some other parts of the world.

The United Nations (UN) says that by 2025, two-thirds of the world's population could be living under water-stressed conditions.

Ensuring clean water and sanitation is one of the UN's 17 Sustainable Development Goals.

Whether it is a village-level water filtering machine or a regional-scale water technology company, innovations at every scale are crucial to overcome the water crisis and make a difference.

A small Kenyan company is converting air into water through a process that involves filtering, massing moisture from the air,

and condensation. The firm, Majik Water, started out by providing a children's home in a water-scarce area with 50 litres of water a day.

Since 2017, numerous Majik Water units have provided thousands of litres of water to people in water-stressed regions, including parts of South Africa and India.

PUSHING THE FRONTIERS IN GREEN ENERGY

Although natural gas – the cleanest fossil fuel – will remain Singapore's dominant fuel for the next 50 years, the country has started to green its energy mix.

Currently, about 95 per cent of Singapore's electricity is generated from natural gas.

The public sector will do the heavy lifting by taking care of three-quarters of that target by 2030, as part of its bigger goal to reach maximum carbon emissions around 2025.

And yet, just a few decades ago, it seemed unlikely that solar energy would be the most viable form of renewable energy for Singapore, given the country's small size and intermittent sunshine due to cloud cover.

What has made it possible for the city-state to soak up sunshine for electricity is a plug-in in the cost of solar cells, which have also become more efficient, and creative space use.

Between 2010 and 2018, the cost of the most widely used type of solar panels fell by more than 80 per cent, according to last year's Update of the Solar Photovoltaic Roadmap for Singapore.

On July 14, Singapore unveiled one of the world's largest inland floating solar farms at Tengoh Reservoir, which can power the country's water treatment plants.

Two more solar farms at Bedok and Seletar in the country are expected to be completed later this year, while Sunseek Group has announced a solar farm at sea in the Straits of Johor.

As other forms of renewables like wind and hydropower are not suitable to the country, the hunt for more novel forms of renewable energy.

Low-carbon hydrogen has set aside \$49 million to fund low-carbon energy research and test-bedding efforts in hydrogen and carbon capture utilisation and storage.

The authorities recently commissioned a study to find out if Singapore's rich reserves of natural gas can be used as a fuel. For hydrogen to be considered a fully green fuel, the gas has to be extracted via "renewable" energy.

Singapore's limited renewable energy resources mean it is a regional-scale water technology company, innovations at every scale are crucial to overcome the water crisis and make a difference.

A small Kenyan company is converting air into water through a process that involves filtering, massing moisture from the air,