

# Technology and Innovation

We are harnessing technology and innovation to drive transformation and achieve Keppel's Vision 2030 plans.

Keppel has a strong track record in innovation and transformation.

During the year, the Group's innovation efforts were centred around Keppel's Vision 2030 strategy, from assessing the impact of mid- to long-term technological and business model shifts on the Group, to accelerating the development of new growth engines and strengthening the resilience of its businesses through differentiation.

Technology and innovation efforts are driven both at the Group and business unit (BU) levels. BUs focus on the key growth areas identified as part of Vision 2030, leveraging their technical and operational expertise and network of partners and in-country presence. At the Group level, Keppel Technology & Innovation drives technology foresight, identifies long-gestation opportunities in collaboration with BUs, and cross-fertilises ideas among BUs, leveraging their distinct capabilities to create unique competitive advantages for the Group.

In addition, the Group Digital Office (GDO) was established in March 2022 to catalyse digital transformation. Headed by the Chief Digital Officer, the GDO drives digitalisation and automation to improve efficiency across the Group's assets and operations.

Beyond in-house capabilities, the Group also taps the insights of the Keppel Technology Advisory Panel (KTAP), comprising eminent business leaders and industry experts from across the world, which guides the Group's innovation journey and provides technology foresight. This includes monitoring of early-stage industry developments, and new technologies as well as future scenario mapping. Through the KTAP members, Keppel is also able to access their networks so as to stay updated on emerging megatrends, the latest technologies and the changing global landscape.

To address complex and interrelated issues that may be difficult for the Group to solve alone, Keppel adopts a robust ecosystem and value chain approach, working in close partnership with the industry stakeholders including institutes of higher learning, government agencies, global and local corporates, as well as venture funds and start-ups. Our close collaboration with strategic partners helps us to develop innovative, differentiated and integrated solutions. An example is Keppel Infrastructure's collaboration with Mitsubishi Heavy Industries to carry out a feasibility study on the development of a 100% ammonia-fuelled power plant in Singapore, which can contribute to building a more resilient and sustainable energy sector in Singapore and the region.

As part of Vision 2030, we are embedding sustainability and customer centricity in our innovation efforts. We help our customers in their decarbonisation efforts through our suite of energy-efficient solutions, clean energy and digital solutions.

**Innovation Across Time Horizons**  
Keppel views its technology and innovation efforts across three time horizons.

**Engine 1:** We focus on enhancing and defending our current revenue streams through efficiency improvements enabled by technology and digital strategies, such as developing more energy-efficient data centres in our Connectivity segment.

**Engine 2:** We seek to accelerate the development and commercialisation of our prioritised new engines of growth, through business model and technology innovation. Working with partners, we build new adjacent solutions that have strong scalability and growth potential, and strengthen the Keppel differentiation in the marketplace. Such developments include our sustainable urban renewal solutions.

**Engine 3:** Further out in the horizon, we maintain strong technology foresight on emerging, disruptive or game-changing technology, assessing their potential mid- to long-term impact on our businesses, and looking to capture new and disruptive revenue streams or future-proof our existing business.

## Innovation Across Our Business Segments

**Asset Management:** We are delivering to investors in our funds, REITs and business trust, access to Keppel's proprietary-developed assets with unique technologies. For instance, Keppel Infrastructure Trust signed a non-binding term sheet in 2022 to acquire Keppel's interest in the entity that owns the Keppel Marina East Desalination Plant, which was developed by, and will continue to be operated and maintained by Keppel Infrastructure.

**Energy & Environment:** We are focused on developing decarbonisation and integrated environmental solutions. In the area of low-carbon power, together with our partners, we have advanced the development of clean energy value chains, such as renewables imports, ammonia and hydrogen. In the environmental space, we have partnered with the National Environment Agency to study the feasibility of carbon capture for waste-to-energy plants in Singapore.

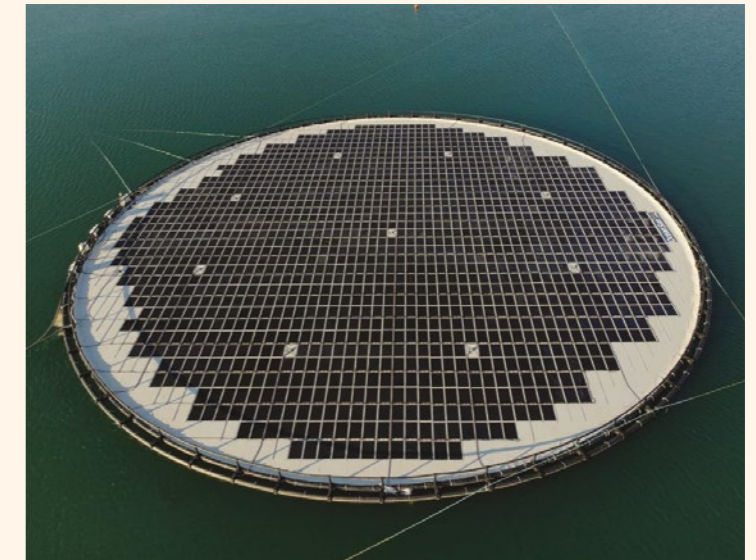
**Urban Development:** We are developing new living and working concepts, seizing opportunities in up-and-coming real estate segments, such as sustainable urban renewal and senior living, with a strong focus on improving the customer experience. We look to develop Real Estate-as-a-Service solutions to grow our recurring income.

**Connectivity:** We are enhancing the sustainability of our data centres through the development of power-efficient solutions, such as data centre-grade infrastructure solutions. M1 is transforming itself from a traditional telco to a cloud native connectivity platform, and is leveraging its 5G network to develop innovative 5G use cases jointly with partners, such as Gardens by the Bay and Electronic Sports to enable metaverse experiences.

Keppel has also invested directly into high-growth companies and start-ups, as well as in venture funds, which help us accelerate our learning and value-add to our ecosystem. This includes our investment in Envision AESC – one of the world's leading electric vehicle battery companies. We are also collaborating with the wider Envision Group, a leading green technology partner and net zero tech partner, to explore the development and supply of low-carbon electricity solutions.

## Case Study

### Piloting Singapore's First Membrane-based Nearshore Floating PV System



Keppel Infrastructure was awarded a grant from the Energy Market Authority (EMA) and JTC to pilot Singapore's first membrane-based nearshore floating solar photovoltaic (PV) system at Jurong Island. The pilot PV system consists of three circular platforms, which will have an installed capacity of 1.5 MWp.

Compared to conventional floating PV systems used in calmer water bodies such as reservoirs, this membrane-based PV system is designed based on floating PV specialist Ocean Sun's technology to harness solar energy reliably amid sea conditions, including strong waves and wind. This is achieved through the flexible circular surface membranes which undulate with the waves, providing a favourable distribution of loads and forces, thereby reducing stress to the PV system.

The reinforced membranes for the PV panels also ensure the lowest material usage of any floating PV system, enabling resource conservation. The system is also easy to deploy and install, with increased efficiency from direct water cooling.

When completed, Keppel Infrastructure's pilot membrane-based nearshore floating PV system can serve as a model for future scaling and replication in nearshore waterbodies in Singapore as well as overseas.

With limited land space in Singapore, this robust and innovative system can help to catalyse the deployment of renewable energy using unutilised sea space.

The award was part of EMA and JTC's Jurong Island Renewable Energy Request for Proposals to accelerate the development of clean energy innovations for implementation on the island. Projects will be funded by a \$6 million joint commitment by EMA and JTC, with support from Enterprise Singapore.