

Energy & Environment

We provide energy and environmental solutions that are essential for sustainable development.

Earnings Highlights (\$ million)

	2022	2021
Revenue ¹	4,230	3,560
EBITDA ¹	119	(261)
Operating Profit/(Loss) ¹	86	(291)
Profit/(Loss) before Tax ¹	215	(193)
Net Profit/(Loss) from continuing operations	172	(189)
Net Profit/(Loss) from discontinued operations	88	(225)

¹ Numbers are for continuing operations.

Progress in 2022

- Announced around \$2.6 billion of joint investments in solar, wind, energy and environmental assets and platforms with private funds and business trust managed by Keppel Capital.
- Opened intelligent Operations Nerve Centre, co-located in *Keppel Infrastructure @ Changi*, Singapore's first Green Mark Platinum Positive Energy building under the new and more stringent Green Mark scheme.
- Commenced import of hydroelectric renewable energy into Singapore via the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project.
- Developing Singapore's first hydrogen-ready advanced combined cycle power plant.
- Signed MOUs to explore several initiatives spanning carbon capture at WTE plants, R&D for hybrid floating renewable energy systems, and green hydrogen and green ammonia value chain with international partners.
- Keppel O&M secured charters for all available KFELS B Class legacy rigs.

Focus for 2023/2024

- OneInfra team will continue asset-light strategy and leverage third-party funds to pursue opportunities in power & renewables, new energy, and environmental solutions.
- Strengthen bundled rooftop solar, cooling, energy storage and electric vehicle charging through Energy-as-a-Service offerings.
- Continue to grow renewable energy portfolio to achieve 7 GW target by 2030.
- Expand environment solutions with value-added enhancements that improve circularity and reduce carbon intensity.



Keppel Corporation is expanding into the wind energy business, alongside Keppel Infrastructure Trust, through joint investments in offshore and onshore wind energy assets in Europe.

The global energy crisis presents strong tailwinds for the Group to leverage its deep capabilities and proven track record to help its customers expedite their energy transition.

The Energy & Environment segment provides technology-based solutions and services spanning power and renewables, new energy, environment, as well as offshore & marine (O&M). The segment comprises Keppel Infrastructure, Keppel Renewable Energy (which has been integrated under Keppel Infrastructure with effect from 1 March 2023) and Keppel O&M (which was merged with Sembcorp Marine on 28 February 2023). Over the course of 2022 and up to early 2023, Keppel streamlined its business, through the combination of Keppel O&M and Sembcorp Marine, as well as the resolution of its legacy rigs and associated receivables.

The Russia-Ukraine war has pushed energy security up the international agenda, with governments actively seeking to reduce their reliance on traditional energy sources and secure alternative energy supplies. Coupled with the higher energy prices and increasing global focus on climate change, recent developments have given new impetus to

the global shift to renewables and clean energy. Supported by the net zero carbon emission commitments of governments and businesses, the current market landscape presents strong tailwinds for the Group to leverage its deep capabilities and proven track record to help its customers expedite their energy transition.

Harnessing its asset-light model, the Group made around \$2.6 billion worth of energy & environment-related investments, jointly undertaken by Keppel together with the private funds and/or business trust managed by Keppel Capital. These include investments in offshore and onshore wind energy assets across Europe, as well as a solar energy platform in Asia. Reflecting the Group's continued integration efforts, a One Infrastructure (OneInfra) team, comprising senior members from Keppel Infrastructure and Keppel Capital, worked closely together to seize opportunities in decarbonisation and environmental solutions, investing in waste management businesses in Singapore and South Korea.

With its expertise in the development and operation of sustainable solutions as well as asset management capabilities, Keppel is well placed to leverage third-party funds to pursue inorganic opportunities such as acquiring assets, operating platforms and technologies. Looking ahead, the OneInfra team is actively exploring opportunities in power & renewables, new energy, and environmental solutions.

In line with Vision 2030, Keppel has been strengthening its recurring income sources from electricity sales, operations and maintenance of essential infrastructure and bolstering its Energy-as-a-Service (EaaS) portfolio with offerings such as energy optimisation and analytics, energy storage, cooling and electric vehicle (EV) charging. Such services offer customers tangible and realisable pathways to carbon neutrality, while also achieving cost savings for customers. Together, these solutions enable the Group to contribute towards efforts in achieving the world's energy transition and decarbonisation ambitions.

Operating & Market Review

Energy & Environment



Keppel MET Renewables, a joint venture between Keppel Infrastructure and Swiss-based MET Group, will pursue and invest in solar and onshore wind assets across Western Europe, starting with an initial portfolio of 213 MW of solar projects in Italy.

Power & Renewables

During the year, Keppel grew its renewables portfolio from 1.1 GW to 2.6 GW¹, as it gains ground on its 7 GW target by 2030.

Keppel Infrastructure formed Keppel MET Renewables, a joint venture with Swiss-based MET Group, to pursue and invest in both greenfield and brownfield solar and onshore wind assets across Western Europe. Keppel MET Renewables was seeded with an initial portfolio of 213 MW of solar projects in Italy, and has a target to scale up to at least 1 GW of operating and ready-to-build renewable energy projects.

As part of the 2.6 GW portfolio, Keppel co-invested approximately \$679 million in onshore and offshore wind energy assets across Germany, Norway, and Sweden, alongside Keppel Infrastructure Trust. The investments will provide Keppel not only with stable recurring income, but also a strong deal flow pipeline in well-established markets in the Nordics and the United Kingdom.

In Asia, Keppel, along with Keppel Asia Infrastructure Fund (KAIF) and KAIF's co-investor, increased their stake in Cleantech Solar Asia, the asset company of a leading solar energy platform from 25.5% to 75.5%. With solar assets located in India and ASEAN, the platform is

expected to benefit from the growing demand for renewable energy in the region.

Keppel is also pioneering cross-border power trade of renewable energy into Singapore, with the commencement of the nation's first import of hydropower under the Lao PDR-Thailand-Malaysia-Singapore Power Integration Project. As at end-2022, more than 180 GWh of electricity had been successfully transmitted into Singapore's power grid. In addition, Keppel Infrastructure is pursuing other renewable energy opportunities and cross-border interconnections with Cambodia, Lao PDR and Indonesia.

Other opportunities are in the pipeline for Keppel Infrastructure to scale up its offerings in the renewable energy sector. It was awarded a grant from the Energy Market Authority and JTC Corporation to pilot Singapore's first membrane-based nearshore floating solar photovoltaic system, which is designed to harness solar energy reliably amid rough sea conditions. Keppel Infrastructure is also collaborating with the National University of Singapore and Nanyang Technological University to develop a first-of-its-kind floating hybrid renewable energy system to harness solar, wind, and tidal energy for continuous power generation.

¹ On a gross basis, including projects under development.

Beyond renewables, the Group is at the forefront of efforts to decarbonise Singapore's power generation sector. Keppel Infrastructure is building the nation's first hydrogen-ready and most advanced combined cycle gas turbine power plant. When completed in 2026, the 600 MW Keppel Sakra Cogen plant will be the most energy-efficient power plant in Singapore, capable of saving up to 220,000 tonnes per year of CO₂ emissions, as compared to Singapore's average operating efficiency for equivalent power generated. In line with Keppel's asset-light business model, the Keppel Sakra Cogen Plant is intended to be owned by Keppel Energy and KAIF.

Keppel Infrastructure completed a high efficiency (HE) upgrade for a generating unit in Keppel Merlimau Cogen Plant, the first HE upgrade in Southeast Asia. Following the upgrade, the unit is delivering improved efficiency and flexibility, while reducing its fuel consumption, carbon footprint, and environmental impact.

In 2022, Keppel Renewable Energy entered into late-stage development for its flagship 500+ MW solar project in Queensland, Australia. Keppel Renewable Energy has also been collaborating with Keppel Data Centres to explore the import of renewable energy from Indonesia.

Since 1 March 2023, Keppel Renewable Energy has been integrated under Keppel Infrastructure to optimise synergies.

New Energy

Keppel Infrastructure positioned itself to capture the demand for decarbonisation in Singapore and around the region through its sustainable EaaS offerings. In 2022, it secured multi-year contracts with a total value of over \$250 million. Moving forward, the EaaS business model is expected to add to the sources of quality recurring income for the Group.

The effectiveness of the sustainable EaaS concept is demonstrated in the retrofitted *Keppel Infrastructure @ Changi*,

which showcases Keppel's ability to blend innovation and sustainability into a value-added energy service. *Keppel Infrastructure @ Changi* houses Keppel Infrastructure's intelligent operations nerve centre, which harnesses smart technologies, such as artificial intelligence and IoT to streamline processes, improve productivity, and enhance the reliability of Keppel's assets and operations.

The building is expected to yield about 600,000 kWh/year of renewable energy, more than double of the building's consumption, earning it the highest accolade of Green Mark Platinum Positive Energy by the Building and Construction Authority.

Keppel Infrastructure continued to expand its energy-efficient district cooling services. The construction of the district cooling systems in Bulim Phase 1 of the Jurong Innovation District in Singapore and in the Sam Yan commercial area in Bangkok are progressing well.

The Group leveraged its asset-light model to invest about \$2.6 billion in energy & environment-related assets and platforms in 2022, alongside the private funds and/or business trust managed by Keppel Capital.



Mr Koichi Watanabe, CEO of Jurong Engineering; Ms Cindy Lim, CEO of Keppel Infrastructure; Mr Loh Chin Hua, CEO of Keppel Corporation; Dr Tan See Leng, Minister for Manpower & Second Minister for Trade and Industry; Mr Ngiam Shih Chun, Chief Executive of Energy Market Authority; and Mr Osamu Ono, CEO of Mitsubishi Power Asia Pacific were present at the signing of the engineering, procurement and construction contract for the construction of the Keppel Sakra Cogen Plant.

Operating & Market Review Energy & Environment

Gearing up for the low-carbon economy, Keppel Infrastructure explored partnerships in the low-carbon ammonia/hydrogen, carbon capture utilisation and sequestration (CCUS) and decarbonisation spaces. It signed a Memorandum of Understanding with Greenko, one of India's leading renewable energy companies, to explore green ammonia and renewable opportunities to meet the growing demand for low-carbon energy in India, Singapore and globally. It also entered into a joint study with Pertamina Power Indonesia and Chevron New Energies to explore the development of selected green hydrogen and green ammonia projects using geothermal energy located primarily in Sumatera, Indonesia. During the year, Keppel Infrastructure formed a consortium with Air Liquide, Chevron and PetroChina to advance the development of large-scale CCUS solutions and integrated infrastructure in Singapore.

Environment

In 2022, the OneInfra team leveraged third-party capital for the acquisition of South Korean waste management company, Eco Management Korea, and Singaporean environmental services company, 800 Super. The transactions complement and broaden the range of environmental services that

In line with Keppel's Vision 2030, Keppel Infrastructure has been strengthening its recurring income sources from electricity sales, operations and maintenance of essential infrastructure and bolstering its EaaS portfolio.

Keppel Infrastructure offers, and create opportunities to synergise operations.

Notwithstanding the impact of the COVID-19 pandemic on construction and development, Keppel Infrastructure forged ahead with the construction of the Hong Kong Integrated Waste Management Facility and Tuas Nexus Integrated Waste Management Facility, achieving good progress in 2022. In Australia, Keppel Seghers is supporting the client in the final commissioning works of the Kwinana Waste-to-Energy (WTE) project, Australia's first thermal WTE facility.

Carbon capture for WTE is a key target on Keppel's decarbonisation roadmap, as it

spearheads the decarbonisation of Singapore's waste infrastructure through a joint study with the National Environment Agency on the feasibility of carbon capture for selected WTE plants in Singapore as well as the potential development of a pilot carbon capture facility integrated with these plants. In Europe, Keppel Seghers is an active member of the European Supplier of Waste-to-Energy and the chair of its CCUS taskforce.

In line with the Group's plans to advance the circular economy, Keppel Seghers, together with its partners, is exploring the treatment and use of Incineration Bottom Ash (IBA) as an alternative construction material for WTE plants. In Qatar, plans for plastic recycling and use of IBA are already underway to improve the circularity of the Domestic Solid Waste Management Center (DSWMC). This will reduce the volume of IBA going to the landfill, thus improving the circularity of waste streams and prolonging the lifespans of existing landfills.

During the 2022 FIFA World Cup, Keppel Seghers supported the Government of Qatar in managing the higher volumes of waste through treatment at the DSWMC. Leveraging its strong track record in Qatar, Keppel Seghers will continue to widen its presence in the Gulf Cooperation Council countries, many of which have embarked on WTE projects as a means of diverting waste from conventional landfills.

At the same time, there continues to be strong demand for energy-efficient WTE plants in other regions where Keppel Seghers is present. Europe is facing the need to replace ageing WTE plants with more energy-efficient technology, in order to maximise energy recovery from waste. Meanwhile, in Southeast Asia, where most waste is still being landfilled, there has been burgeoning demand to explore WTE as a sustainable waste management alternative. Keppel Seghers, with its broad international experience and strong execution track records, is well poised to meet the growing interest from governments.



Keppel continues to expand its customer base for EaaS offerings, such as district cooling, solar panels and EV chargers.



Carbon capture for WTE is a key target in Keppel's decarbonisation roadmap. (In picture: Keppel Seghers' Beijing Fangshan District Circular Economy Industrial Park.)

Offshore & Marine

In 2022, amid improving conditions in the offshore and marine sector, Keppel O&M secured about \$8.1 billion of new orders, bringing its net orderbook to \$11.0 billion, the highest level since 2007. This includes two floating production storage and offloading units for Petrobras.

During the year, Keppel O&M continued to strengthen its foothold across the value chain of offshore renewables. Keppel O&M completed a wind turbine installation vessel crane upgrade project and secured a contract to build its sixth offshore substation. Its first two offshore wind substations for Ørsted, which were for the Greater Changhua 1 & 2a wind farms in Taiwan, have successfully generated their first power.

In specialised shipbuilding, Keppel O&M achieved several industry 'firsts' with the successful completion of its maiden autonomous vessel project. Capable of autonomous vessel navigation as well as collision detection and avoidance, the Maju 510 tug, owned and operated by Keppel Smit Towage, is the first vessel in the world to receive the Autonomous and Remote-Control Navigation Notations from ABS classification society. Keppel O&M also delivered to Dutch maritime company Van Oord the Vox Ariane and Vox Apolonia, high-specification dual-fuel dredgers with several features that reduce fuel

consumption and carbon emissions, including the ability to run on liquefied natural gas.

The offshore drilling market has seen continued fixture activity, predominantly in the Middle East, resulting in a steady upward trajectory of utilisation and day rates for jackup rigs. As at end-2022, all of Keppel O&M's available KFELS B Class legacy jackup rigs had secured bareboat charters. It successfully bareboat-chartered four of its legacy B Class rigs and redeployed another two B Class rigs to drilling contractors in the Middle East, securing stable recurring charter income over the next three to five years.

With effect from 28 February 2023, Keppel O&M has been merged with Sembcorp Marine to create a premier global player offering solutions in offshore renewables, new energy and cleaner solutions in the O&M sector. Keppel's legacy rig assets and associated receivables have also been transferred to Asset Co, the majority of which is owned by external investors. Amidst the improving offshore rig market, Keppel is hopeful that the monetisation of the legacy rigs can take place sooner, leading to earlier repayment of the vendor notes issued by Asset Co. Keppel has received \$4.25 billion in vendor notes, which come with a coupon rate of 4% that translates into approximately \$170 million of interest income per annum.