Jurong Port

ENVIRONMENTAL SUSTAINABILITY REPORT 2022

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Introduction

This inaugural Environmental Sustainability Report covers Jurong Port (JP)'s decarbonisation commitment and strategy, and Greenhouse Gas (GHG) emissions for calendar year (CY) 2022 (1 January 2022 to 31 December 2022). JP is mindful of the impact we have on the environment and, through this report, we are reaffirming our commitment to accelerate decarbonisation efforts, help build leaner and greener supply chains that will contribute to the national and global sustainability agenda, and leverage innovation and technology to become a smarter and greener port.

About This Report

This report covers all of JP's Homeport and lighter terminals' operations in Singapore. It excludes operations from Jurong Port Tank Terminals (JPTT), Jurong Port Universal Terminal (JPUT), Offshore Marine Centres (OMC), and joint ventures where JP does not have full management and / or operational control.

This report brings focus to JP's main approach to environmental sustainability, targets and highlights some of the decarbonisation efforts we are embarking on. It is prepared in accordance with the Singapore Standards ISO 14064-3: 2021 to provide credibility to the GHG data and demonstrate our alignment with international best practices. All data in this report is provided for the year-ended 31 December, 2022 unless otherwise noted.

Management's Assertion

Management of JP is responsible for the accuracy, validity and completeness of the disclosures included in this report for the year-ended 31 December, 2022. Management is also responsible for the collection, quantification, and presentation of the information included in this report and for the selection of the criteria, which management believes provide an objective basis for measuring and reporting.

Important Notes & Limitations

This report includes non-financial information and / or data that is subject to uncertainties in measurement arising from limitations inherent in the nature and the methods used for determining such information and / or data. The selection of these varied but fair and reasonable measurement techniques (including estimation) can result in significantly different measurements. The accuracy of different measurement and estimation techniques may also vary. Certain information provided to JP for the compilation of this report is from third-party sources that JP believes to be reliable. This report was published in March 2023. JP reserves the right to update its methodologies, approach to measurement and estimation in the future.

About Jurong Port

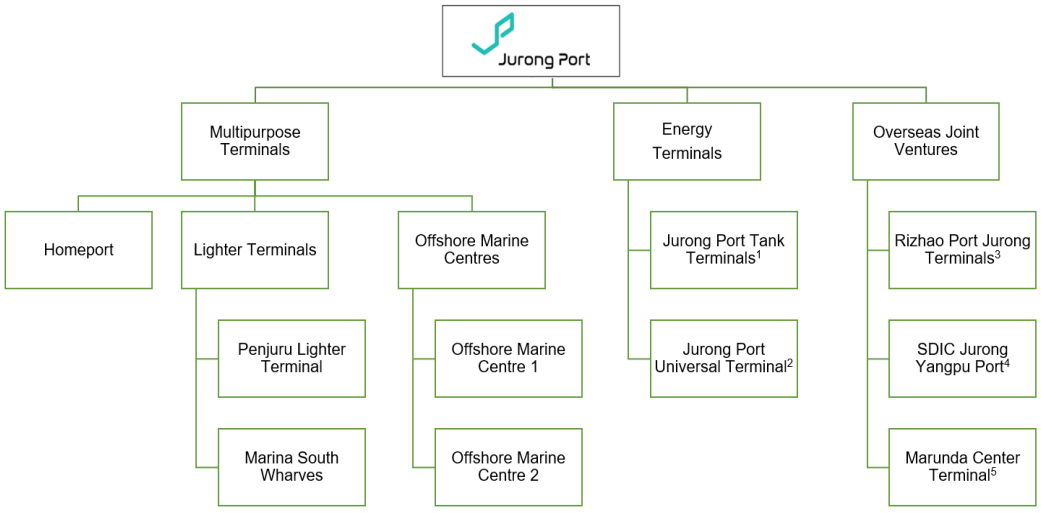
Headquartered in Singapore, JP prides itself as a leading international multipurpose port operator. The Homeport is Jurong Port's main multipurpose facility that handles approximately 14.5 million tonnes of general (including heavy-lift project cargo), bulk and containerised cargo per annum.

Playing a pivotal role in the nation's ship supply industry are JP's two lighter terminals, Penjuru Lighter Terminal and Marina South Wharves, which are Singapore's primary gateways for the supply of ship provisions and spares. JP's lighter terminals handle more than 90% of ship supplies provided to vessels at anchorage in Singapore, with a combined total of more than 800,000 metric tonne of cargoes with 82,000 vessel calls by lighter fleet annually.

Besides our Homeport and lighter terminals, JP has been operating the Offshore Marine Centre (OMC) since 2012. The OMC is a purpose-built multi-user fabrication yard facility owned by JTC to serve the local offshore marine and fabrication industry.

JP is also Singapore's largest independent oil terminal operator, and has joint ventures in two energy terminals, namely Jurong Port Tank Terminals (JPTT) and Jurong Port Universal Terminal (JPUT).

In addition, JP has also invested in strategic assets across the region. We are currently operating two joint venture terminals in China – Rizhao in Shandong province, and Yangpu on Hainan island; and one in Indonesia – Marunda Center Terminal in Bekasi, West Java.



[1]Jurong Port Tank Terminals, located in Pulau Damar Laut in Jurong Port, is a 60:40 joint venture between Jurong Port Pte Ltd and Advario and has been operational since 2019.

[2]Jurong Port Universal Termina (JPUT)l, located on Jurong Island in Singapore, is a 41:34:25 joint venture between Jurong Port Pte Ltd, MAIF Investments Singapore Pte Ltd and PetroChina International (Singapore) Pte Ltd.

[3]Rizhao Port Jurong Terminals, located in Shandong Province, China, is owned and operated by Rizhao Port Jurong Co., Ltd (RPJC). RPJC is a joint venture company between Rizhao Port Group Co., Ltd and Jurong Port.

[4]SDIC Jurong Yangpu Port, located in Hainan, China, is owned and operated by SDIC Jurong Yangpu Port Co., Ltd (SJYP). SJYP is a joint venture company between State Development & Investment Corp., Ltd. (SDIC) and Jurong Port.

[5]Marunda Center Terminal, located in Bekasi, Indonesia, is owned and operated by PT Pelabuhan Tegar Indonesia (PTI). PTI is a joint venture company between Marunda Centre Industrial Estate and Jurong Port Pte Ltd.

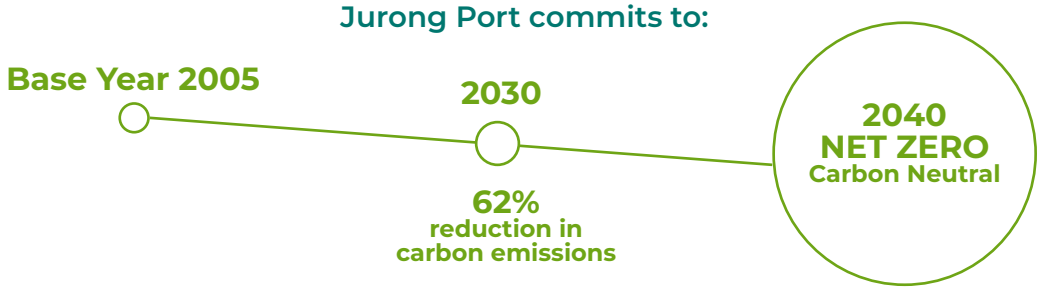
Diagram 1 – JP's Organisation Chart

Environmental Sustainability Commitment

Being environmentally sustainable is an integral part in Jurong Port's journey towards becoming a Next Generation Multi-Purpose Port. As the primary multipurpose port in Singapore, we are committed to accelerate decarbonisation efforts, help build leaner and greener supply chains that will contribute to the national and global sustainability agenda and continuously innovate to become a smart and green port.

Our Target

As part of our drive towards environmental sustainability, Jurong Port commits to:



Since 2021, JP has incorporated environmental sustainability as a key performance indicator (KPI) in our corporate score card. We will also integrate carbon emission considerations into all our investment decisions. All these are testament to our conviction in ensuring we keep sustainability at the heart of our business behaviour and mindset.

JP's 3-Prong Approach

JP will focus on three areas to support the decarbonisation of the maritime industry:

Singapore

JP Energy Terminals Support SG's Energy Transition

Leverage on JP's infrastructure to optimally serve maritime and national requirements in cost-effective way

Industry

Enhance Sustainability through Port-Centric Ecosystems

Reap supply chain carbon footprint savings

Collaborate with like-minded partners on POCs and trials

Spur coordinated industrial master-planning approach

Optimise sustainability through Digital Collaborative Platforms

Jurong Port

Environmental Stewardship & Building the Right Corporate Cultures

Build culture through engagement, education and communication

Green the port through energy efficient solutions & renewables

Implement relevant circular economy programmes

Decarbonising Port Operations

To achieve our decarbonisation goals, Jurong Port will pursue a strategy of electrification, solarisation and adoption of low-carbon fuels.

Electrification

to reduce Scope 1 (26%)

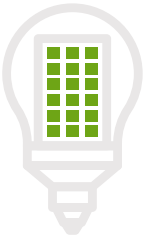
Solarisation & Facilitating Energy Transition

to reduce Scope 2 (74%)

Electrification

As a port operator handling many different types of cargo, JP operates a range of diesel-fuelled cargo handling equipment, such as Quay Cranes, Rubber Tyred Gantry Cranes, Mobile Harbour Crane, Side-loaders and forklifts, amongst others. Through the years, JP has actively sought to mechanise and electrify our operations, such as the installation of electric cement unloaders and conveyor belt systems for the handling of cement, as well as electric balance cranes for the handling of aggregates (sand and gravel).

JP will continue to transform our business operations and electrify our fleet of diesel equipment and vehicles. Whilst we actively look to electrify and convert our Scope 1 carbon emissions to Scope 2, JP recognises the importance of reducing our consumption of energy. We are actively optimising our business operations to improve energy efficiency, via energy saving technologies and improving work processes.



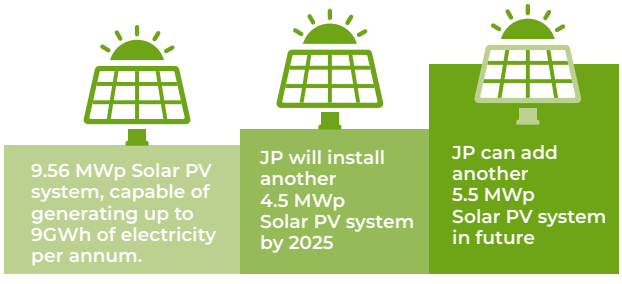
JP has embarked on a five-year planto convert all our port lightings to energy-efficient LED lights, which could **generate up to 1.5 gigawatt-hours (GWh) of annual savings in electricity consumption.**

Solarisation

Consumption of electricity accounts for Scope 2 carbon emissions and JP believes solar power will play an instrumental role in our decarbonisation efforts

In time to come, JP expects our port-based solar photovoltaic (PV) system to be able to meet up to 75% of JP's electricity needs. This will play an instrumental role in our Scope 2 emissions.

WORLD'S LARGEST PORT-BASED SOLAR PV SYSTEM



Year 2016

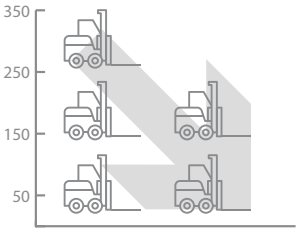
YEAR 2025 AND ONWARDS

Enabling Port Users to Reduce Carbon Emissions

JP seeks to influence and encourage port users to join us in the journey of being environmentally sustainable. JP has been working closely with all port ecosystem players to improve work operations and lower carbon emissions.

Forklift Pooling

Working closely with the stevedoring companies, JP completed the consolidation of stevedoring companies owned diesel-powered forklifts in 2022. By centrally managing this fleet of forklifts, JP has reduced the number of forklifts plying within the port and helped to reduce the diesel consumption. With the forklifts centrally managed, there will be economies of scale when JP embark on electrification efforts for the forklifts in the near future.



No. of forklifts reduced from 347 to 223 units and carbon emission reduced by 188 tCO_2e

Briefing stevedores on the functions of Forklift Pooling app.

IN FUTURE

Electrification of forklifts: reduce carbon emissions by up to 910 tCO_2e per annum

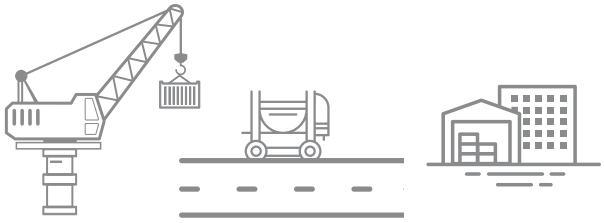
Ready-Mixed Concrete Ecosystem

In 2020, JP commenced the construction of the Ready-Mixed Concrete (RMC) Ecosystem, which:

- Brings aggregates imports and concrete batching plants closer together
- Forms part of the larger construction supply chain which includes cement and steel, both discharged and handled at JP

The co-location of aggregates, cement and steel handling will enable shorter, leaner, and greener supply chains for construction materials in Singapore.

An artist impression of RMC Ecosytem at JP.



With the use of electric balance cranes and conveyor systems to transfer aggregates, the no. of truck trips will be reduced by 624,000 per annum, equivalent to a reduction of 18,900 tCO_2e

IN FUTURE

Installation of solar PV panels on the roof of RMC facility: Generate 4.5 megawatt-peak of power or 5.8 GWh of electricity per annum

Lighter Terminals

As the operator of Singapore's two lighter terminals, JP works closely with both landward and seaward partners (e.g. ship chandlers, lighter boat operators, etc) to improve supply chain inefficiencies. In 2022, JP launched LT Connect, a digital platform, that helps our lighter terminal users by providing better matching of lighter boats and trucks.

JP also participates in the Goal Zero consortium, working with our industry partners to develop shore-based charging facility for electric harbour-crafts. JP is also a part of the Coastal Sustainability Alliance, where we work with our partners to electrify lighter-crafts, optimise lighter fleet solutions, improve supply chain efficiencies and reduce maritime congestion.

Coastal Sustainability Aliance's and MOU formalisation ceremony.

Save time, fuel and resources

Provides visibility of terminal availability

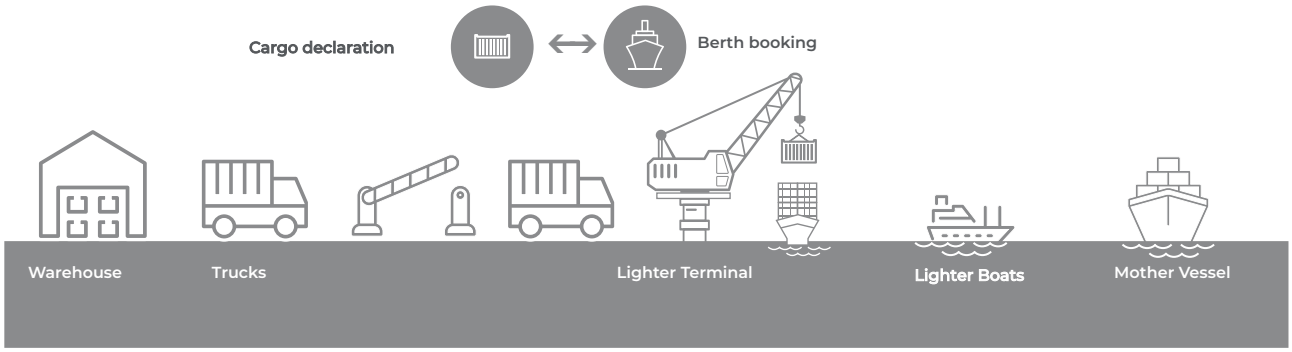
Enables more optimised operations by spreading loadings throughout the day

Jurong Port
LT Connect
Digital Platform

IN FUTURE

Support the electrification of harbour-craft and more efficient supply chain handling:

Reduce carbon emissions for the industry by up to 8,300 tCO_2e



Facilitating Singapore's Energy Transition

JP is collaborating with energy players to build capabilities that will help us play a vital role in the clean energy supply chain, and facilitate Singapore's future energy transition.

Preferred Port to Handle Future Fuels

For JP to meet our net-zero emissions target, low-carbon alternative fuels will be another important avenue to abate the remaining 25% of our electricity needs. Establishment of the low-carbon hydrogen value chain in Singapore will be critical in helping JP gain access to this fuel for localised power generation via fuel cell technology.

As a storage and terminal handling operator, we believed that our energy terminals are well positioned to facilitate Singapore's future energy transition by being the preferred port infrastructure to handle future fuels. JP is involved in a consortium along with Mitsubishi Corporation, Chiyoda, PSA, Sembcorp and others, with the aim of importing low-carbon hydrogen into Singapore via Liquid Organic Hydrogen Carriers (LOHCs).

JP is also in a consortium with JERA and MHI, seeking to establish an ammonia value chain for the generation of low-carbon electricity to the Singapore grid. Working with like-minded industry partners is critical to realising the establishment of the value chain for future fuels. JP will continue to keep track of the technological progresses of these low-carbon fuels and associated fuel cell technologies, so as to be able to deploy them when they are readily available.

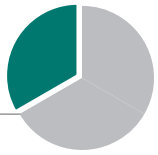
Low-Carbon Energy Research RCA Signing Ceremony *(Credit: NTU Singapore)*

Energy Terminals

JP's energy terminals, comprising of Jurong Port Tank Terminals (JPTT) and Jurong Port Universal Terminal (JPUT), form a critical part of the maritime bunkering ecosystem. JP actively pursues opportunities to pivot our energy terminals to handle future low-carbon alternative fuels, and this can be seen in our participation in the Castor Initiative, which is a global partnership that is committed to make zero emission shipping a reality via the use of ammonia as a marine fuel. JP is also a study member of the GCMD Ammonia Bunkering Safety Study, providing our expertise and knowledge as a port and terminal operator to help GCMD study the safety implications for ammonia bunkering.

Singapore remains as the world's largest bunkering hub with a volume of 47.9 million mt (in Year 2022)
Source: S&P Global

JPUT serves approximately one-third of the marine bunker volume in Singapore.



IN FUTURE

Singapore's future fuel needs will have to be imported by sea and stored in suitable tank terminals. JP's storage/wharf assets are well positioned to play a vital role in Singapore's energy transition.

Greenhouse Gas (GHG) Emissions Report 2022

Organisational Boundary

JP operates the Homeport and lighter terminals (Penjuru Lighter Terminal and Marina South Wharves) which are fully owned, and regulated by the Maritime and Port Authority (MPA) under the Public Port Licence (PPL) scheme.

JP utilises an operational control boundary for the purposes of GHG emissions reporting. GHG emissions associated with the facilities over which we have determined we have full operational control are included in this GHG Emissions Report. This includes owned and leased facilities and company-owned vehicles in Singapore.

This GHG Emissions Report excludes emissions data from the Offshore Marine Centres (OMC), energy terminals (JPTT and JPUT) and overseas joint ventures (Rizhao, Yangpu and Marunda) as we do not have full operational control and ownership in these business entities and that they do not fall under the regulatory purview of the PPL scheme.

As such, this report will include Scope 1 and Scope 2 GHG emissions arising from activities within JP's Homeport and lighter terminals only.

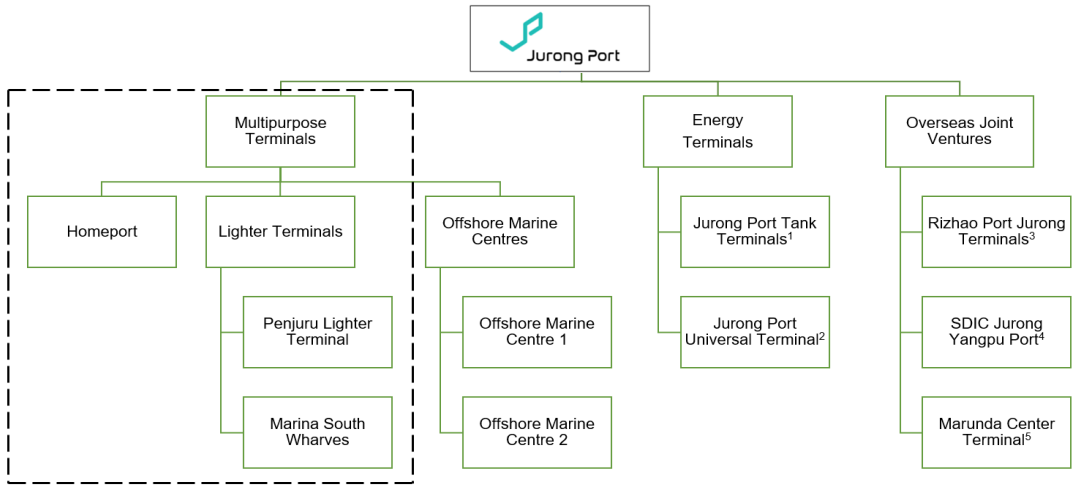


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Diagram 2: Organisational Boundary for GHG Emissions Report 2022.

Reporting Period

The reporting period for this report is Calendar Year 2022 (CY2022), from 01 January 2022 to 31 December 2022. This approach is aligned with JP's annual reporting of GHG data for our Homeport and lighter terminals to MPA, and the National Environmental Agency (NEA) using the Emissions Report User-Interface (UI) provided by them in the Emissions Data Monitoring and Analysis (EDMA) system.

Methodology

Scope 1 – Direct Emissions

JP's Scope 1 emissions include direct emissions arising from stationary and mobile combustion of fuels which would emit Carbon Dioxide (CO_2), Methane (CH_4) and Nitrous Oxide (N_2O).

Computation of Scope 1 emissions is based on NEA's Calculation Approach for Scope 1 emissions which uses the following formula that was derived from the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories:

$$E_g = [Q_f \times NCV_f] \times \frac{\Sigma(EF_{f,g} \times GWP_g)}{1000}$$

Parameter ID	Parameter description	Units	Reporting status
E_g	Emissions for GHG (g) i.e. CO_2, CH_4 and N_2O	tCO_2e	Calculated using above formula
Q_f	Quantity of fuel (including lubricant) combusted i.e. total quantity of fuel (Diesel, Motor Gasoline & Lubricants) consumed for purposes of producing or providing energy	tonne	Calculated based on JP's annual consumption Diesel, Motor Gasoline & Lubricants
NCV_f	Net caloric value of fuel (f)	GJ/tonne	Derived from 2006 IPCC Guidelines for National Greenhouse Gas Inventories
$EF_{f,g}$	Emission factor for CO_2, CH_4 and N_2O for fuel (f) on a net calorific basis	Tonne GHG/GJ	Derived from 2006 IPCC Guidelines for National Greenhouse Gas Inventories
f	Fuel type (f) being combusted i.e. Diesel, Motor Gasoline & Lubricants	Nil	Reported from the fuels consumed by JP annually
GWP_g	Global warming potential values for GHG (g)	Nil	Derived from the IPCC Fifth Assessment Report (AR5)

Table 1: Formula to Compute Scope 1 Emissions.

For diesel and motor gasoline (e.g. petrol), the quantity of fuel consumed was derived from the monthly invoices that JP received in CY2022. For lubricants, the quantity consumed was derived from the volume of lubricants drawn down from JP's inventory in CY2022.

JP measured the associated GHG emissions based on the emissions factors of CO_2, CH_4, and N_2O that were extracted from the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories.

Source	Net Caloric Value	CO_2 Emission Factor	CH_4 Emission Factor	N_2O Emission Factor
	Gigajoule (GJ) /tonne	$kgCO_2/GJ$	$kgCH_4/GJ$	kgN_2O/GJ
Lubricants	40.2	73.3	0.0006	0.003
Diesel	43.0	74.1	0.0006	0.003
Motor Gasoline	44.3	69.3	0.0006	0.003

Table 2: Emission Factors of GHG.

JP used the GHG Protocol's Global Warming Potential (GWP) Values which were obtained from the IPCC Fifth Assessment Report (AR5) to convert GHG emissions - CH_4 and N_2O into CO_2e.

GHG	GWP
Carbon Dioxide, CO_2	1
Methane, CH_4	28
Nitrous Oxide, N_2O	265

Table 3: GHG Protocol's GWP Values.

Scope 2 – Indirect Emissions

JP's Scope 2 emissions include indirect emissions arising from purchased electricity from grid to power our business activities in Homeport and lighter terminals. Presently, we draw electricity from the electricity grid and our on-site Solar PV system.

Computation of Scope 2 emissions is based on market-based method that reflects emissions from electricity specific to each supply/contract, and the formula is as follows:

$$S_2 = \Sigma(Q_{EGS} \times GEF)$$

Parameter ID	Parameter description	Units	Reporting status
S_2	Scope 2 (S_2) emissions arising from purchased electricity from grid to power business activities	tCO_2e	Calculated using above formula
Q_{EG}	Quantity of electricity consumed (Q_{EGS}) that was supplied via electricity grids and from renewable source(s)	Gigawatt hour (GWh)	Calculated based on JP's annual consumption of electricity provided by its contracted grid-based power generation company and solar PV system supplier
GEF	Grid Emission Factor (GEF)	kg CO_2/Kilowatt hours (KWh)	Derived from EMA's published GEF values. Where electricity supplies are known to be from a renewable source (e.g. Solar Power), a ZERO GEF is used.

Table 4: Formula to Compute Scope 2 Emissions.

The quantity of electricity consumed in CY2022 was derived from the monthly invoices that JP received from our contracted grid-based power generation company and solar PV system supplier.

JP used EMA's published Grid Emission Factor (GEF) to measure the average CO_2 emissions emitted per unit of net electricity generation in the system by all grid-connected power units. For the calculation of Scope 2 emissions in CY2022, the GEF of 0.4057 kgCO_2/kWh was used.

In previous years, JP would only account for and report Scope 1 and Scope 2 carbon dioxide emissions as there was negligible emission of other GHGs arising from our business activities. However, starting from CY2022, we will align with MPA and amend our emissions accounting methodology to include all GHGs. Therefore, we will report our annual Scope 1 and Scope 2 emissions in tCO_2e.

While the GHG emissions for CY2022 falls within our commitment to achieve the target of 9,000 tCO_2e by 2030, JP expects emission numbers to rise due to launch of new projects such as the new Ready-Mix Concrete Ecosystem which will commence in 2024.

Base Year

After consultation with the MPA, it was agreed that JP's base year for Scope 1 and Scope 2 net GHG emissions is CY2005. Subsequent years' net GHG emissions will be measured relative to the CY2005 baseline.

CY2022 GHG Emissions Data

In CY2022, JP's total Scope 1 and Scope 2 net GHG emissions are as follows:

	CY2005 tCO_2e (Baseline)	CY2022 tCO_2e	% Change from 2005
Scope 1	14,723	2,357	-84%
Scope 2	9,329	5,332	-43%
Total	**24,051**	**7,689**	**-68%**

Table 5: JP's Total Scope 1 and Scope 2 Net GHG Emissions in CY2022.

JP's Scope 1 emissions include direct emissions arising from stationary and mobile combustion of fuels which would emit CO_2, CH_4 and N_2O.

Scope 1	CO_2 (tonnes)	CH_4 (tonnes)	N_2O (tonnes)	Total (tCO_2e)
Diesel	2,205	2.5	4.7	2,212
Petrol	59	0.1	0.1	59
Lubricant	85	0.1	0.2	86
Total	**2,349**	**2.7**	**5**	**2,357**

Table 6: Breakdown of JP's Scope 1 GHG Emissions in CY2022.

JP's Scope 2 emissions include indirect emissions arising from purchased electricity to power our business activities in Homeport and lighter terminals. Presently, we draw electricity from the electricity grid and our on-site Solar PV system.

Scope 2	Electricity /GWh	tCO_2e
From Solar	1,760,961	N.A.
From Grid	13,141,526	5,332
Total	**14,902,486**	**5,332**

Table 7: Breakdown of JP's Scope 2 GHG Emissions in CY2022.

Awards

In January 2022, Jurong Port receives the Global Compact Network Singapore's LowCarbonSG logo, awarded to companies that demonstrate progress in monitoring their carbon emissions, supported by the National Environment Agency and Enterprise Singapore.

At SUSTAINABILITY@SMW, Maritime and Port Authority of Singapore (MPA), Singapore Shipping Association and Global Compact Network Singapore presented the inaugural Maritime SG Carbon50 Award 2022 to three companies. JP was recognised for our carbon accounting and emission reduction efforts.

JP joined ten other ports in the Asia Pacific to receive the Green Port Award 2022 from APEC Port Services Network (APSN) at the APSN 2022 Forum in Manila. This award aims to encourage ports to implement green programmes to improve the environmental sustainability of their operations.

Conclusion

JP is committed to decarbonise our port operations and achieve our GHG emissions target of 9,000 tCO_2e by 2030, a 62% reduction from 2005 levels. Although the national target is to achieve net-zero emissions by 2050, we are accelerating our plans by aiming to achieve net-zero earlier by 2040.