jtc

BUILDING INDUSTRIES

SUSTAINABILITY REPORT

FY2021

Building a city of green possibilities — that is the vision of the Singapore Green Plan 2030. As the master planner and developer of Singapore's industrial landscape, JTC is doing our part to help the nation achieve its dream. As a statutory board under the Ministry of Trade and Industry (MTI), we are in a unique position to move the sustainability needle and rally industrialists to adopt a mindset of responsible consumption and production.

JTC's inaugural Sustainability Report reiterates our commitment to shaping a sustainable Singapore. It chronicles the strategies we have taken and initiatives we have rolled out to change the face of our industrial estates and to deepen our engagements with our esteemed stakeholders in our sustainability journey.

Front and back cover: Hampstead Wetlands Park

Right: one-north is designed to be a pedestrian-friendly estate

Contents

Below: Hampstead Wetlands Park

About This Report

Report Profile

This inaugural Sustainability Report covers JTC's sustainability commitments, material topics, management approach, and performance summary for the period of 1 April 2021 to 31 March 2022 (FY2021). Through this report, JTC is communicating our sustainability practices in a transparent and accountable manner, while also seeking feedback from our partners, stakeholders, and the community at large. The report has been prepared in accordance with the Global Reporting Initiative (GRI) Standards: Core Option.

Scope of the Report

This report covers all JTC's operations in Singapore excluding its subsidiaries. It touches on JTC's main approach to sustainability over the years and our achievements in the Environmental, Social and Governance (ESG) arena in FY2021. It also highlights some of the upcoming initiatives we are embarking on. Furthermore, it outlines the broader context of sustainability that JTC operates within and shows how our sustainability strategy aligns with Sustainable Development Goals as set out by the United Nations, Singapore's national sustainability commitments, and the Singapore Green Plan 2030.

As part of the reporting process, we have identified our key stakeholders' feedback when assessing ESG topics that are material to JTC. In doing so, we aim to address our stakeholders' feedback through our long-term strategy, risk management, and goals.

Assurance

No external assurance has been sought for this report.

Feedback

We welcome enquiries and feedback for improvement. For queries about the content of this report, please click **here**.

Right: Jurong Eco-Garden offers respite for the community

Best Practice for Sustainability Reporting

Guided by the GRI's reporting principles of stakeholder inclusiveness, materiality, completeness, and sustainability, we have identified a list of key material topics that the report will focus on.

Environmental	Social	Governance
› Land planning and urban design	› Occupational health and safety	› Sustainable and resilient supply chain/procurement practices
› Greenery and biodiversity	› Customer satisfaction and well-being	› Corporate governance
› Operations optimisation	› Community engagement	› Cybersecurity and information infrastructure resilience
› Renewable energy	› Infectious diseases	› Economic performance
› Waste avoidance and circularity	› Fair employment practices, labour relations, and talent retention	› Socioeconomic compliance
› Innovation	› Inclusion, diversity, and equal opportunity	
› Construction sustainability		
› Climate–change resilience and adaptation		

Figure 1: Key material topics identified for JTC's inaugural Sustainability Report

CEO's Message

We are delighted to present JTC's inaugural Sustainability Report.

JTC's sustainability journey did not begin overnight. Recognising that sustainability is evergreen and integral to everything we do, JTC has, since 2019, undertaken deliberate efforts to entrench sustainability as a key priority in our work. We acknowledge that for sustainability to be effective, it must permeate through our core roles and responsibilities, from the planning to the development of our estates, building operations to engagement with our industry clients.

Ultimately, we see sustainability as a core principle, value pillar and strategic differentiator that will guide how we build Singapore's industrial landscape while allowing us to support the Singapore Green Plan 2030, a nationwide movement to achieve net zero carbon emissions by 2050.

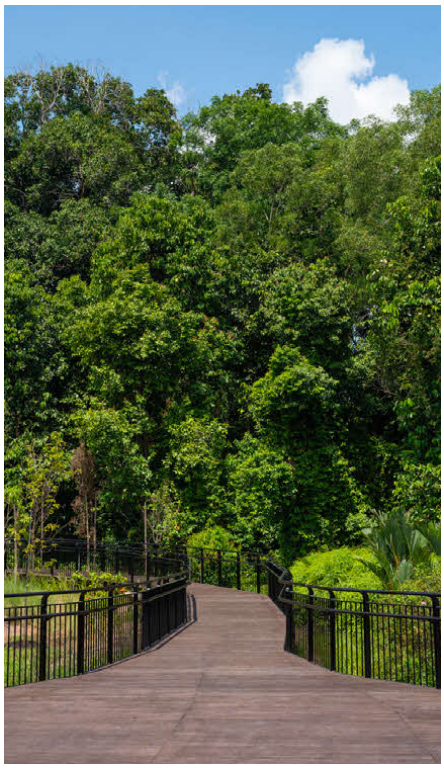
This report reflects our commitment and ambition to transform JTC and the industry towards a low-carbon and resilient future. The reports in the upcoming years will capture and document JTC's sustainability efforts and serve as a tracker of our initiatives in a transparent manner, as well as motivate us to do even better.

Sustainability is not a sprint, but a marathon. Results are often not immediate, but JTC is in it for the long run. We believe it is an exciting and fulfilling journey, but one not to be undertaken alone. As we chart our course forward, we invite you to join us in building a greener future for all.

Above: Tan Boon Khai, Chief Executive Officer, JTC

Tan Boon Khai
Chief Executive Officer

Our Key Achievements for FY2021



Planted **approximately 25,000 trees** across JTC properties as of the end of FY2021

Energised more than **51.5MWp** of solar panels as of the end of FY2021

55.5% of JTC total Gross Floor Area are Green Mark certified as of the end of FY2021

Certified **Eco-Office Plus Champion** in FY2021

0 major injuries in FY2021

Recycled **12,913 tonnes** of waste in FY2021

Reduced **approximately 80,000 sheets** of paper usage in FY2021 from FY2020

Commissioned **18 innovation projects** in FY2021

Reduced **approximately 168,000m³** of water usage from our buildings and estates in FY2021 from FY2020

Figure 2: Highlights of JTC's sustainability achievements for FY2021

Constructing Our Sustainable Development Framework

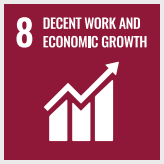
With the world becoming more and more competitive, our industrial estates too must modernise to meet the demanding needs of a new economy. Over the years, JTC has stepped up efforts to give our industrial estates a makeover. Sustainability is a factor we have given weight to when it comes to the planning, designing, construction and operations of our estates. The advent of sunrise industries such as additive manufacturing, biomedical and agri-food technology has also spurred the need for collaborative and vibrant spaces that can catalyse their growth. As we sail into the era of Industry 4.0, existing enterprises in traditional fields such as semiconductor will also benefit from such transformative spaces.

As a major developer of industrial estates, we recognise the urgency for our collective activities to lessen their impact on the environment. The onus is also on us to empower our ecosystem of businesses and partners so that they can operate more sustainably. To design an effective plan, we must first hold ourselves to global standards. In November 2020, we conducted a materiality assessment to align ourselves with eight of the 17 United Nations' Sustainable Development Goals (SDGs).

Our identified SDGs are as follows:

Ensure healthy lives and promote well-being for all at all ages.

Ensure access to affordable, reliable, sustainable, and modern energy for all.



Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.

Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation.

Make cities and human settlements inclusive, safe, resilient, and sustainable.

Ensure sustainable consumption and production patterns.

Take urgent action to combat climate change and its impacts.

Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development.

Figure 3: Eight SDGs that will anchor JTC's green strategy

Like pollinators that help flowers reproduce, our stakeholders will help to ensure that our sustainability efforts will thrive and go far. Figure 4 shows the key stakeholders pivotal to our business value chain.

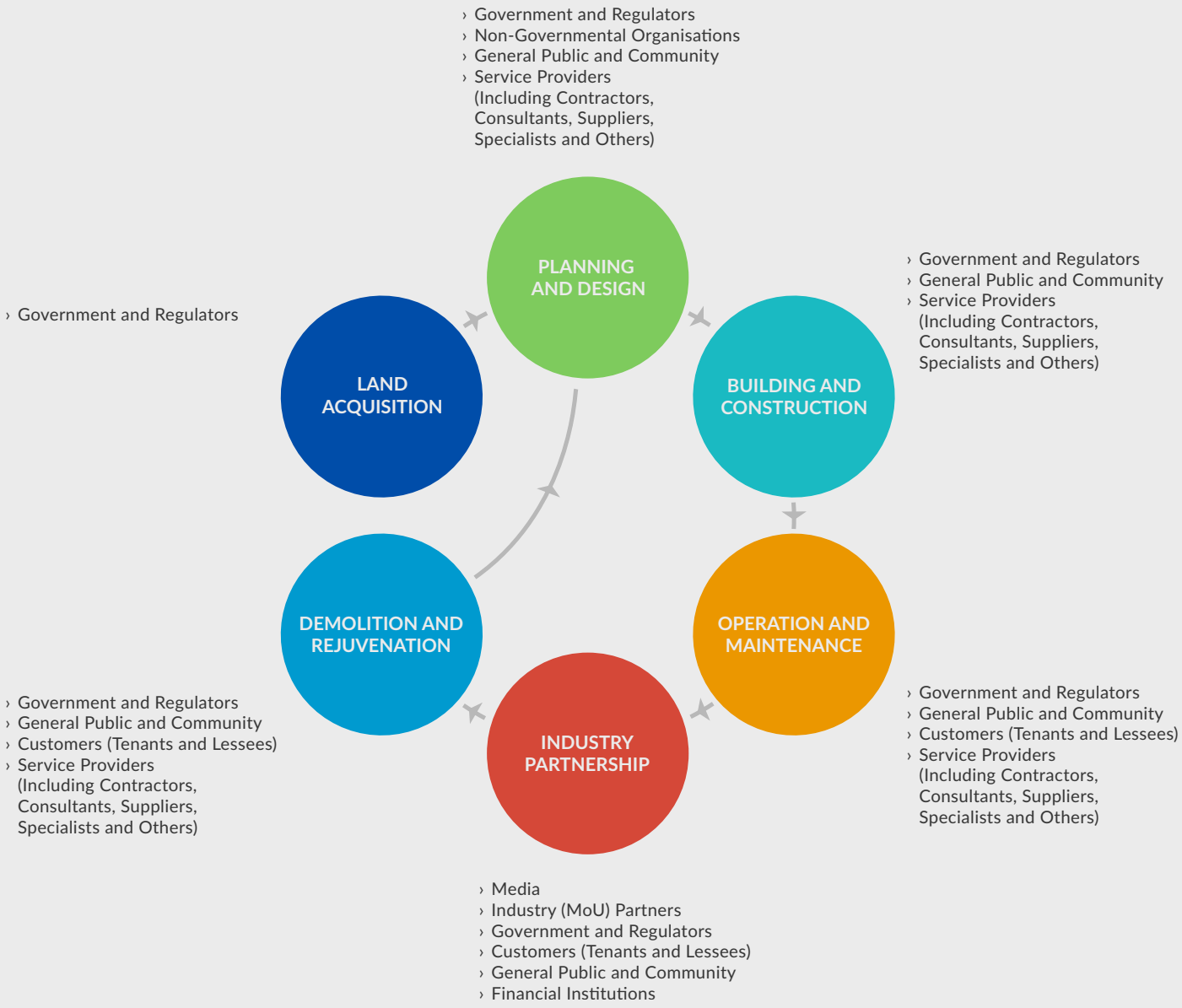


Figure 4:JTC's business value chain

Sowing the Seeds of Environmental Sustainability

For JTC, the Singapore Green Plan 2030 is a lodestar when it comes to planning our environmental sustainability roadmap. The whole-of-nation movement charts Singapore's green targets and initiatives towards achieving resource efficiency and a circular economy by the next decade. It aims to strengthen Singapore's commitments under the United Nations' 2030 Sustainable Development Agenda and the Paris Agreement through five pillars: Sustainable Living; Energy Reset; Resilient Future; City in Nature; and Green Economy.

Through our own initiatives, we are doing our part to make the key targets in the green plan a reality.

SG GREEN PLAN PILLARS	SUSTAINABLE LIVING	ENERGY RESET	RESILIENT FUTURE	CITY IN NATURE	GREEN ECONOMY
	› Zero waste nation powered by a circular economy › Turn waste treatment residue into NEWS and for construction	› Green 80% of all buildings by 2030 › Quadruple solar energy deployment from 2020 levels to 1.5 GWp by 2025 and at least 2GWp by 2030 › 60,000 electric vehicle charging points nationwide by 2030	› Urban heat island effect mitigation › Coastal protection against rising sea levels	› One million more trees across Singapore › Develop programmes for people and wildlife to live in harmony	› Promote homegrown innovation under the Research Innovation and Enterprise 2025 Plan › Create business and job opportunities in green sectors
JTC'S INITIATIVES	› In 2021, we rallied 51 companies to support the Jurong Island Circular Economy, which builds on the concept of resource optimisation. › Designed in partnership with the Waste Management Recycling Association of Singapore, Kranji Green is Singapore's first multi-storey recycling facility which will house recyclers handling waste streams like metals, paper and plastics.	› Many of our buildings have received the Green Mark award by the Building and Construction Authority over the years. In 2021, Punggol Digital District received the Green Mark Platinum Super Low Energy award. › Through installing solar photovoltaic panels, our SolarRoof and SolarLand programmes transform rooftops and unused land into functional spaces that generate clean energy. As the next phases continue, we aim to reduce 55,000 tonnes of carbon emissions and contribute 100 MWp to Energy Market Authority's (EMA) 2030 target.	› To cool our industrial estates, we are working with our partners to create 100ha of new green spaces by 2030.	› JTC is supporting National Parks Board's (NParks) OneMillionTrees movement that aims to introduce more greenery in our city. One of NParks' goals includes planting 170,000 more trees on industrial land by 2030. Jurong Island will see the addition of 34,000 new trees by 2022. › The 3.23ha Hampstead Wetlands is where workers in Seletar Aerospace Park as well as visitors can exercise amid nature and enjoy activities such as birdwatching.	› We unveiled the Jurong Island Innovation Challenge, where industry players can submit challenge statements on their circularity journeys. Start-ups as well as small and medium enterprises (SMEs) are then invited to propose concepts of their solutions. › Together with EMA, and supported by Enterprise Singapore (EnterpriseSG), we jointly launched the Jurong Island Renewable Energy Request-for-Proposals and pledged $6 million to fund research and test-bedding of new clean energy innovations on Jurong Island.

Figure 5: Aligning our initiatives with the pillars of the Singapore Green Plan 2030

Inspiring Others Through Our Actions

We are more than just landlords to our partners and stakeholders; we are partners of growth. The actions we take to safeguard the planet will encourage them to follow suit. As a champion of sustainability, we will lead by example and commit to the following:

› Decarbonise our own business value chain, including operations

› Help partner/stakeholder businesses decarbonise and catalyse industry transformation towards circular economy; and

› Seize economic opportunities by positioning our industrial estates to be attractive and enabling for business and customers.

Right: "Grow-a-Reef Garden" is a collaboration between JTC and NParks that has since garnered the support of various donors from JTC's estates and developments

In 2019, we established a JTC Environmental Sustainability Framework through our Environmental Sustainability Committee (ESC), which is chaired by our CEO, to weave sustainability into our business value chain. ESC oversees the sustainability work streams across five verticals, namely Sustainability by Planning & Design; Sustainable Construction; Operations Optimisation; Renewables for Green Energy; and Industry Partnership. The five verticals are underpinned by six enabling horizontals: Staff Learning; Flagship Estates; Procurement; Communication and Outreach; Policy; and Research & Development (R&D). Under this Environmental Sustainability Framework, specific targets and goals are formulated for each vertical, supported by the six enabling horizontals as shown in Figure 6.

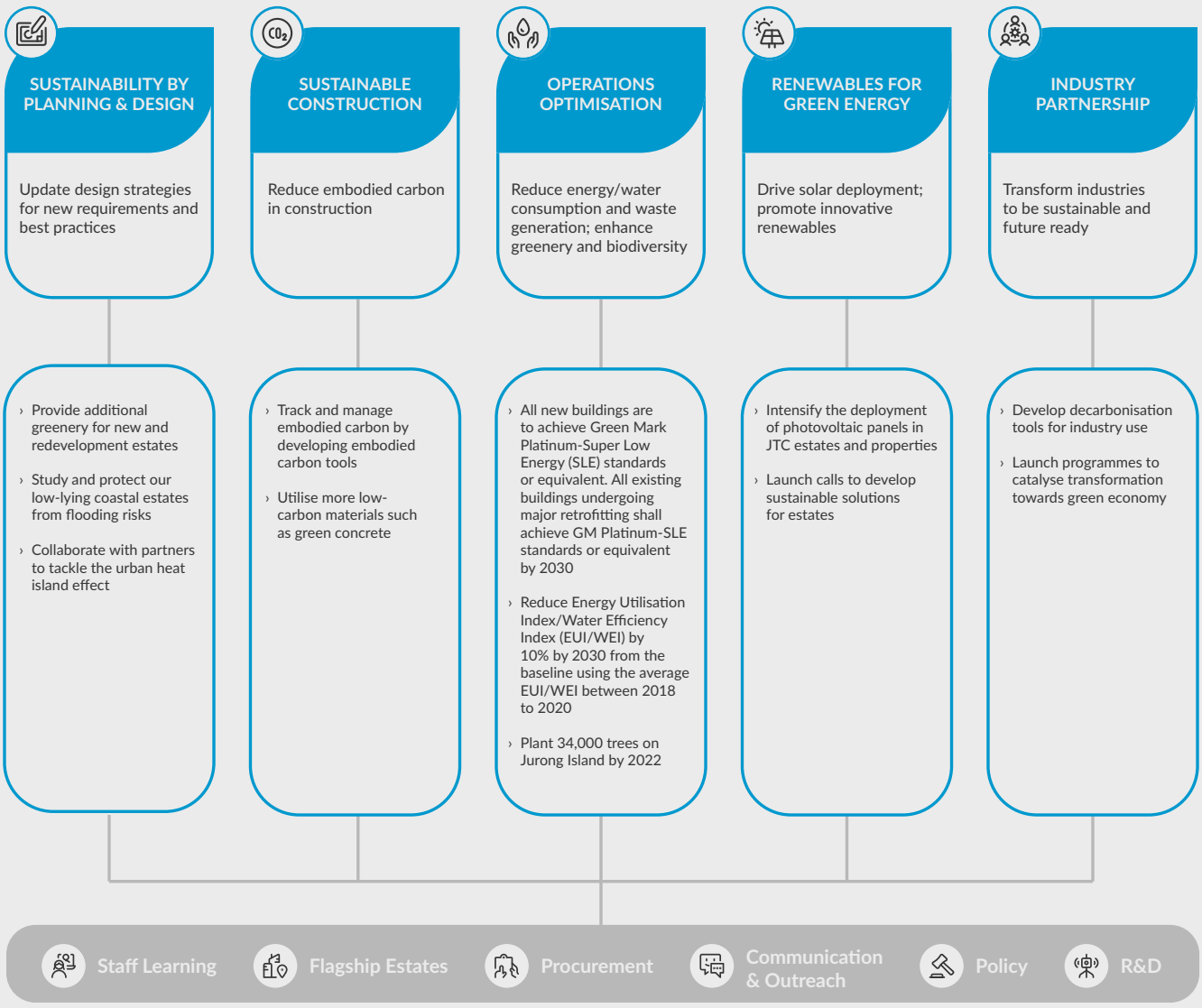


Figure 6: JTC's sustainability goals

Innovation as an Enabler for Environmental Sustainability

Advanced technological solutions are the key to resource optimisation, energy savings, waste recycling improvement and pollution minimisation. At JTC, we fully embrace collaborations that spin the wheels of innovation. In total, we commissioned 18 innovation projects in FY2021, which collectively cover the main themes of Smart Facility Operations and Maintenance (O&M), and Sustainability & Resilience. When proven successful, the solutions will be deployed and scaled across JTC estates or operations. Their respective sub-topics are as shown below:

Figure 7: Innovation framework for environmental sustainability

Through innovation calls such as Jurong Island Renewable Energy Request-for-Proposals, we invite start-ups and SMEs to brainstorm and share their novel ideas. From floating solar deployment to the development of a virtual ledger system to support green hydrogen production, these are examples of prototypes going to be test-bedded at Jurong Island. As innovation projects tend to be complex and intricate, to ensure we are on the same page as our partners, we employ three key principles to guide our R&D efforts.

Figure 8: JTC's three guiding principles for R&D

Start-ups Spearhead the Reimagining of the Built Environment Sector

With rising demand for cleaner, higher-quality construction and a shift towards a less labour-intensive workforce, Singapore's Built Environment sector teems with opportunities for disruptive innovations such as robotics and artificial intelligence (AI) to shine. Through the Built Environment Accelerate to Market Programme (BEAMP) and BE (Built Environment) Inspired platforms, JTC has built an ecosystem to facilitate R&D collaboration with start-ups, giving them the chance to incubate ideas as well as co-create and proliferate their solutions.

Under the BEAMP initiative, organisations such as City Developments Limited, Surbana Jurong, WeWork, Hong Leong Holdings and Housing Development Board issued challenge statements across seven categories: Advanced Construction Material; Advanced Design and Fabrication; Automation and Robotics for Construction; Building Inspection, Maintenance and Facility Management; Construction Site Safety; Digital Asset Delivery and Project Management; and Smart Estate Management. JTC also participated in the BEAMP as a joint National Innovation Challenge statement owner alongside private developers, asking the question: "How might we replace dangerous work-at-heights by adopting automation solutions for our building facades?'' We received strong response and interest from solution providers.

The BE Inspired platform takes a deep dive into the opportunities and challenges the Built Environment sector faces. Through illuminating webinars and panel discussions, the platform revs up interest and is a means for JTC to act as a demand driver and aggregator for solutions.

In June 2020, we launched the JTC Open Innovation Challenge 2020, where we solicited innovative solutions to address operational challenges over three phases. We eventually awarded 12 projects worth $2.93 million. Two start-ups had developed solutions capable of identifying estate defects such as potholes, faded road markings and damaged kerbs automatically and accurately. We have engaged them for further development and a pilot implementation in JTC estates. Also, JTC has facilitated network sessions with Facilities Management Companies (FMC) and other public agencies through a Technology Sharing Session. The FMCs have expressed a strong interest in the solutions offered by the start-ups.

Walking the Talk: Cultivating a Green Culture in JTC

Environmental sustainability is not only a business principle but also an integral element entrenched in our corporate culture. We are proud of the fact that we have been certified Eco-Office Plus Champion by the Singapore Environment Council since FY2020. The certification is awarded to organisations that adopt a low-carbon lifestyle as well as a mindset of "one less", and follow the practice of responsible consumption. As an organisation that employs more than a thousand employees, when all of us take small actions such as reducing our usage of paper, water and electricity, the impact we create is big and far reaching.

Above: The JTC Summit is also a testbed for solutions that will help us manage estates more efficiently and sustainably

Figure 9: JTC is a certified Eco-Office Plus Champion

Accountability as a Core Value

Ethics and integrity of our governance are the roots of our sustainability movement. Across areas such as compliance and risk management as well as resilient supply chains and procurement practices, we have put in place processes and systems to foster a culture of trust and build a strong foundation.

Furthermore, JTC's Sustainability Office was set up in Q3 of FY2020 and is backed by a dedicated, full-time team. This office focuses on driving high-impact sustainability initiatives, setting targets, tracking implementation, and measuring outcomes across JTC's entire value chain.

Right: Our construction projects utilise digital solutions that help achieve efficiency

Environmental Sustainability: Reducing Our Impact on Earth

Earth's resources are finite, and minimising our environmental impact is critical. To that end, JTC has integrated environmental sustainability principles throughout our five stages of business value chain: Sustainability by Planning and Design; Sustainable Construction; Operations Optimisation; Renewables for Green Energy; and Industry Partnership. Our initiatives run the gamut, from preserving the biodiversity of our estates to using sustainable construction materials and generating solar power.

JTC CleanTech Two @ Jurong Innovation District

Sustainability by Planning and Design

Through thoughtful design, we have turned our estates into vibrant spaces where one can work, live, play, and learn. It all begins at the planning and design stage, where we identify opportunities to embed sustainability throughout the life cycles of our developments.

Sustainability by Planning and Design is incorporated in these three areas:

- Estate design
- Infrastructure design
- Building design

Estate Design: Creating Green and Resource-efficient Spaces

Over the years, there has been a deliberate effort to weave greenery into our developments and increase our tenants' connectivity to nature. Inspired by the "City in Nature" vision as spelt out in the Singapore Green Plan 2030, we sought to infuse our estates with biophilic concepts, which have been found to support cognitive function, improve physical health, and promote psychological well-being, all while nourishing the environment.

In our Urban Design Guidelines (UDG), sustainability is achieved through the conscious introduction of eco-friendly features and biodiversity. Couple that with active design strategies, which include the optimisation of our mechanical and electrical operations, and passive ones such as optimising natural ventilation in our developments, we create green and resource-efficient estates.

One example of an active strategy is JTC's adoption of a District Cooling System (DCS) for estates with a mix of industrial, commercial, and residential units. An energy-saving and economical urban utility service, DCS utilises the centralised production and distribution of chilled water to provide air-conditioning to multiple commercial buildings in a district. The benefits are manifold, as follows:

- Decreased energy consumption
- Space reduction in chilled water plant rooms
- Shared redundancy of central air conditioning equipment
- Better reliability with specialists maintaining the DCS plants

We were the first to introduce DCS in Singapore, deploying it at our Changi Business Park back in 2007. Today, DCS powers our numerous estates such as Biopolis and Fusionopolis Phase 1 at one-north, Bulim Phase 1 at Jurong Innovation District (JID), and Punggol Digital District (PDD).

Winning the Best Car-Lite Advocate Award at the Land Transport Excellence Awards 2022

Singapore's car-lite vision benefits the environment and the community. Since the early 2000s, JTC has been embracing this car-lite vision and green mobility. one-north was planned as our pilot car-lite district. We have also adopted and advocated for car-lite measures across four aspects:

- **Planning and Policy:** Encourage higher public transport usage and active mobility
- **Provision of Infrastructure:** Ensure first- and last-mile connections to main transport nodes
- **Green Mobility Initiatives and Explorations:** Provision of shuttle bus services and deployment of AV buses
- **Research, Education and Outreach:** Provision of avenues to engage members of public on their visions for next-generation industrial estates

Today, our car-lite districts have expanded to include upcoming estates such as JID, PDD, Woodlands North Coast and Sungei Kadut Eco-District. Our push for car-lite districts has earned us recognition, such as the Best Car-Lite Advocate Award at the Land Transport Excellence Awards (LTEA) 2022.

Over the years, we have rolled out several initiatives such as the following:

- Holding a Car-Free Weekend, where 790 staff and tenants at one-north pledged to take public transport or carpool
- Providing first- and last-mile connectivity to one-north and Buona Vista MRT stations through shuttle bus services and building of fully sheltered walkways to the stations to encourage use of public transport
- Integrating cyclist- and pedestrian-friendly footpaths in existing and upcoming estates

From top: PDD and JID are designed with car-free thoroughfares

All Charged Up for a New Ride

As outlined in the Singapore Green Plan 2030, Singapore is aiming to gradually phase out Internal Combustion Engine (ICE) vehicles and have all vehicles powered by clean energy by 2040. JTC participated in the joint pilot tender launched by the Urban Redevelopment Authority (URA) and the Land Transport Authority (LTA) for the installation of 620 electric vehicle (EV) charging points in public carparks across Singapore. The tender was awarded on 3 September 2021. Specifically, 126 of them will be installed at various JTC industrial estates. At PDD, at least 14 out of the designated 80 EV charging points will be high-speed direct current chargers — the time needed to fully charge an EV is merely 30 minutes.

Infrastructure Design: Enhancing the Natural Habitat of Our Sites

JTC sets design standards that benefit the environment through intentional considerations regarding material selection, environmental design, technical and social-economic factors. Our sustainability criteria are enshrined in our Infrastructure Design Requirement (IDR) for a wide spectrum of infrastructure projects, covering land preparation as well as development of roads and flyover, drainage systems, sewage systems, substations, rock caverns and earth retaining systems.

As JTC's works also cover coastal and offshore areas, the preservation of marine biodiversity and ecosystems is of paramount importance to us. We have adopted a collaborative design process in engaging stakeholders for coastal development, with a vision to achieve better sustainability outcomes and aligned interests. The Reef Garden project is one fruit of this collaborative focus.

JTC's Collaborative Designs of Projects

Growing Singapore's Largest Purpose-built Reef Structures at Sister Islands Marine Park

Not only are coral reefs valuable habitats for the marine ecosystems, but they are also a defence against coastal erosion. To safeguard the marine biodiversity in Singapore, we partnered with NParks as well as marine research and interest groups such as Friends of Marine Park to co-develop and build eight ecosystem-enhancing reef structures at Sisters' Islands Marine Park.

Known as the "Grow-a-Reef-Garden Initiative", the artificial reef structures were pre-fabricated off-site and then sunk in the waters off Small Sister's Island. They currently house 1,636 coral colonies of various biological classes — otherwise known as genera — that are transplanted from various donor sites across the island. This initiative garnered the support of individual donors and 13 private-sector companies including ExxonMobil, NIPSEA, Vopak Terminals, and more.

Above: Each artificial reef structure is conceptualised to minimise impact to the existing marine environment, utilising materials that promote attachment and growth of corals, and recruitment of fish species

Building Design: Green as the Blueprint

Sustainable building design is key to helping business owners reduce resource use even as they maintain a higher-quality indoor environment for their employees. In particular, JTC's green building design aims to lower energy usage. Additional key elements, such as water conservation, materials usage, and facility maintainability are also incorporated in our Urban Design Guidelines (UDG) and Building Design Requirement (BDR).

Through Green Mark certification for our existing and new buildings, we have achieved a higher sustainability standard for our developments. Resource-saving features such as use of natural ventilation, optimised Mechanical and Electrical systems, and rainwater harvesting are implemented to improve the sustainability performance of JTC buildings.

Enhancing Our Estates' Greenery and Biodiversity

Besides buildings, we care for the landscapes and streetscapes of our estates too. Working with other agencies and organisations in the private sector, JTC is supporting NParks' OneMillionTrees movement and contributing to the goal of planting 170,000 more trees on industrial land by 2030. From FY2020 to FY2021, JTC has planted 24,952 trees across our properties.

The following collaborative development projects showcase JTC's further efforts in marrying our estates with a blend of greenery and biodiversity.

JTC's Collaborative Designs of Projects

A Rustic Sanctuary of Rich Biodiversity

Once a military base for the British Royal Air Force in the 1920s, Seletar Aerospace Park (SAP) is now a vibrant aerospace industry cluster of over 60 multinational companies and local aerospace enterprises. SAP's masterplan adopted a sensitive approach to balance the conservation of architectural heritage sites, preservation of the lush greenery and rich biodiversity, and the promotion of economic advancement. The 3.23-hectare Hampstead Wetlands Park, a green sanctuary home to various flora and fauna, is the result of a regenerative landscaping approach that ensured that the greenery of the park was replaced or enhanced.

Above: Hampstead Wetlands is an oasis of calm for both aerospace personnel as well as members of the public

JTC's Collaborative Designs of Projects

A Green and Resilient Jurong Island

As part of our "Greening Jurong Island" project, JTC is increasing the number of trees on Jurong Island. The initiative is a collaboration between JTC, NParks, companies on Jurong Island, as well as the Association of Process Industry (ASPRI) and its members. As of March 2021, we have planted 53 different tree species, 37 of which are native species serving as habitats to support native biodiversity. By 2022, 34,000 new trees will be planted on Jurong Island.

"By planting more trees, we create pockets of greenery and biodiversity on Jurong Island, making it an eco-friendly workplace environment that adds to the well-being of workers there."

Cindy Koh, JTC's Director of Energy and Chemicals

Besides greenery, JTC collaborated with the Public Utilities Board (PUB) to capture rainfall runoff from a large catchment area via a retention pond. The rainwater will then percolate into the existing underground freshwater lens. The pond will help with flood mitigation during extreme weather events, all while serving as a potential water source for industrial use. At the same time, JTC is also working with NParks to establish a habitat within the same space to introduce selected flora and fauna.

Above: Efforts to green Jurong Island are underway

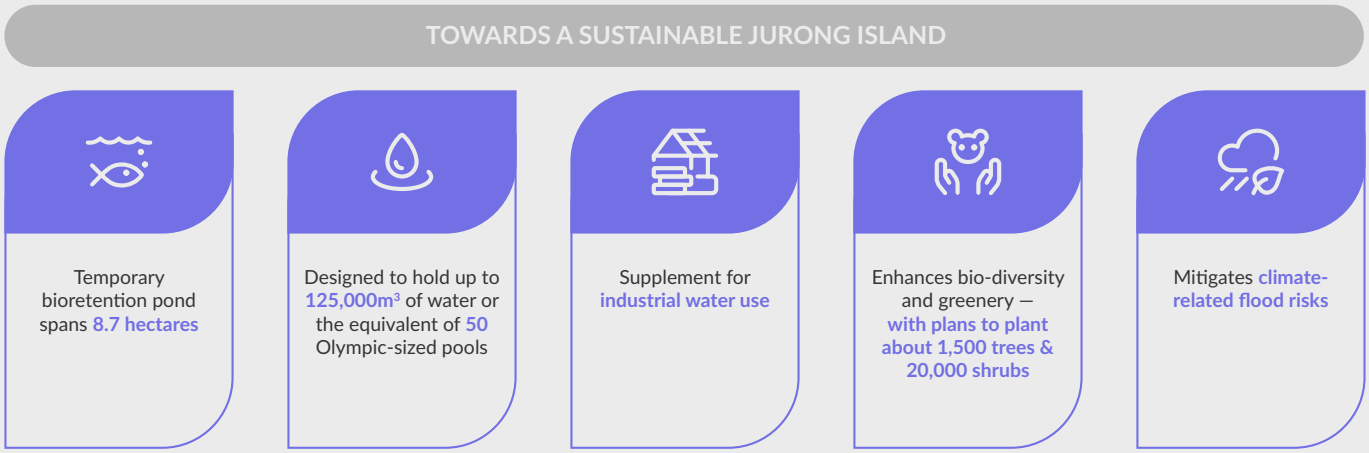


Figure 10: Nature-based solutions for Jurong island

A Thorough Evaluation Process to Mitigate Environmental Impact

JTC follows the national Environmental Impact Assessment framework to determine and mitigate the potential impact of new developments on the environment. For projects close to sensitive areas such as nature reserves, marine and coastal areas, we will carry out a detailed biodiversity impact assessment, which will accomplish the following:

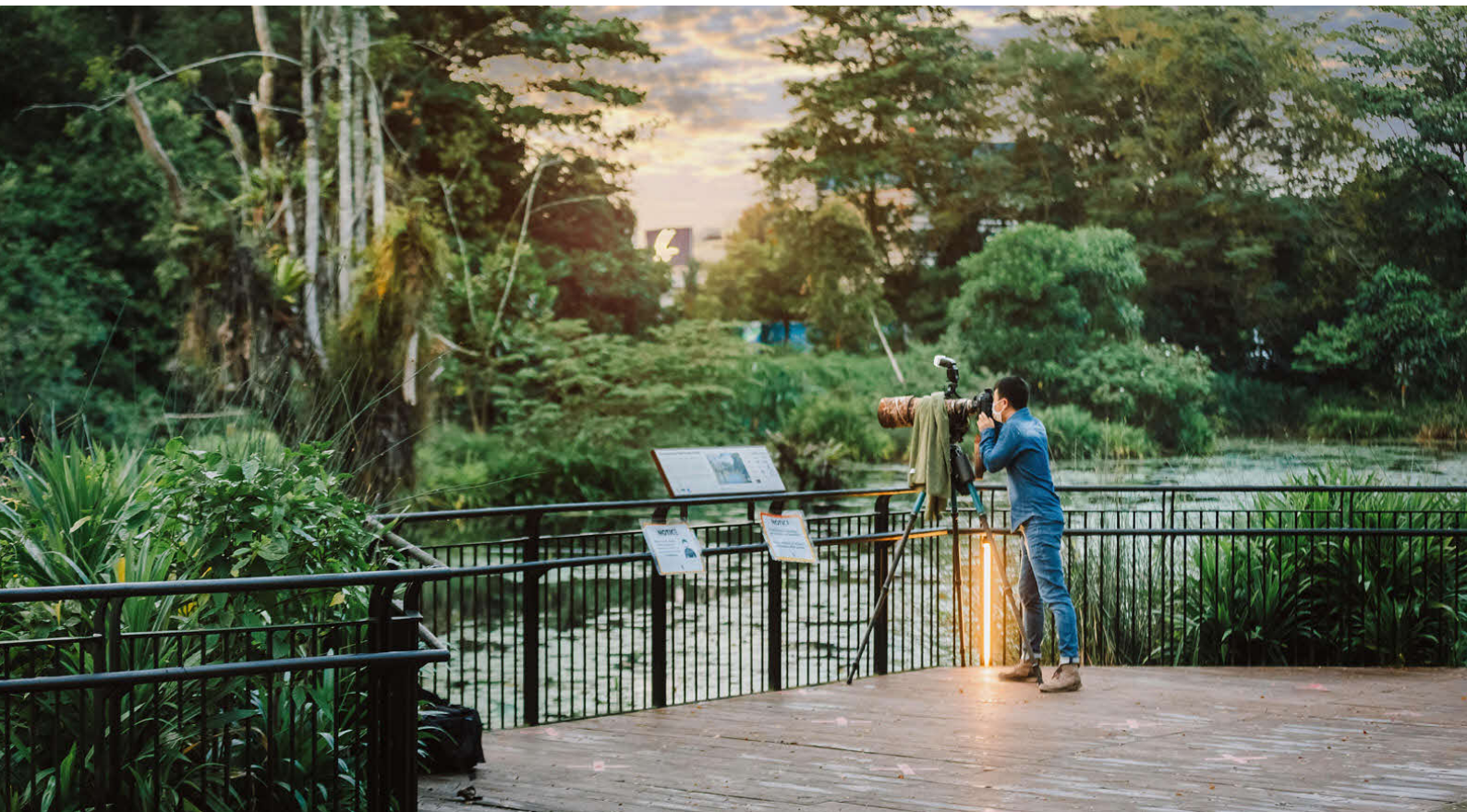
- Provide a baseline of the project site's flora and fauna
- Identify sensitive natural receptors
- Assess the potential impacts
- Recommend appropriate mitigation measures

We will consult technical agencies, nature groups and community stakeholders on the potential environmental impacts and publish the report online to seek public feedback.

Stepping Up Our Accountability

In February 2021, an incident occurred at a project site under development by JTC, where a section of Kranji Woodlands was cleared. We have taken steps to strengthen the governance of biodiversity and environmental issues in land planning and development projects. We have set up a new Biodiversity and Environmental Advisory Panel (BEAP) comprising industry experts, academics and nature expert representatives in FY2022. We will consult the BEAP prior to undertaking any projects that may have significant environmental impact to ensure that our projects achieve the best possible outcomes by balancing environmental sustainability and developmental needs.

Below: Hampstead Wetlands Park is a draw for avid bird watchers



Sustainable Construction: Reusing Materials and Reducing Waste

Worldwide, the construction industry accounts for 6% of energy usage and 11% of CO2 emissions[1]. With construction of new developments and infrastructures as a key part of our business, we have a responsibility to reduce our reliance on natural resources and mitigate environmental impact. To do this, we have turned our attention to sustainable construction.

Our three-pronged approach to sustainable construction is to:

› Reduce embodied carbon upfront

› Use sustainable materials that are reusable and recyclable

› Ensure a sustainable construction process

Reduce Embodied Carbon Upfront

Embodied carbon consists of all the greenhouse-gas (GHG) emissions associated with the construction process, including extracting, transporting, manufacturing, and installing materials on site as well as operational and end-of-life emissions. To measure embodied-carbon emissions, JTC is developing embodied-carbon tools for designers, planners, consultants, and contractors, so that they can make informed decisions on material selections and construction methodologies.

How Much Embodied Carbon Is There?

JTC has conducted a study to determine embodied carbon emissions in The JTC Summit, one-north, and Sin Ming Industrial Estate. This carbon-profiling exercise estimated that the total embodied emissions[2] were approximately 38 times the annual operational Scope 1 and 2 emissions for 2020.

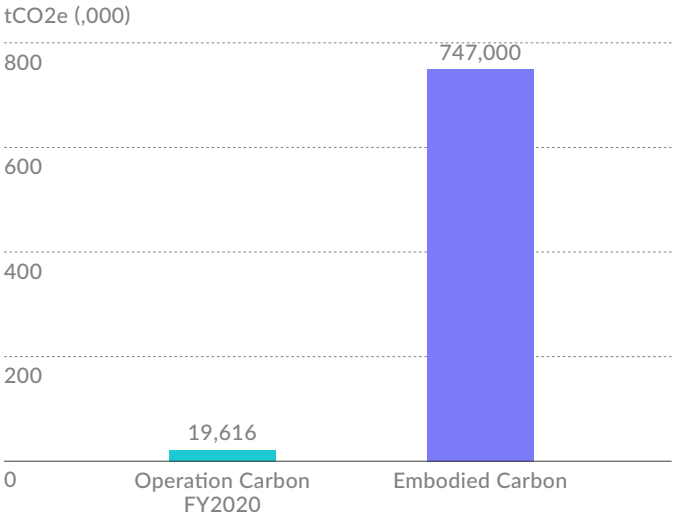


Figure 11: Embodied Carbon comparision with FY2020 Operation Carbon in The JTC Summit, one-north, and Sin Ming Industrial Estate

JTC has partnered with the National University of Singapore (NUS) to develop an embodied-carbon evaluation tool, and with Nanyang Technological University (NTU) to establish an embodied carbon baseline for JTC industrial buildings. These tools will help us create a measurement framework and set the benchmark for embodied carbon of typical industrial typologies in the local Built Environment industry.

Embodied Carbon Calculator

Embodied Carbon Baseline for Industrial Buildings

[1] 2019 Global Status Report for Buildings and Construction (United Nations Environment Programme, 2019)

[2] Embodied-carbon emissions were primarily calculated using the OECD International Office Benchmark 2010 (Commercial) from eTool – a life-cycle inventory-based approach that provides an embodied emissions inventory across the entire life cycle of a building. Production and transport of materials were included in these calculations.

Use of Sustainable Materials

As per requirements stipulated in our BDR, JTC utilised green concrete and Recycled Concrete Aggregates (RCA)/Recycled Aggregate (RA) for our construction projects. In addition, reinforcement steel was recycled during construction to reduce wastage on site.

JTC partners with players in the Built Environment industry such as the Singapore Green Building Council (SGBC) to push for greater synergy in sustainable development.

In addition, all projects must comply with strict requirements in the choice of building materials, as specified under our BDR.

Used approximately **295,951m³** of SGBC-certified green concrete in construction projects

Used approximately **27,239 tonnes** of RCA/RA

Recycled approximately **41,148 tonnes** of reinforcement steel

Figure 12: JTC's FY2021 Building Design Requirement successes

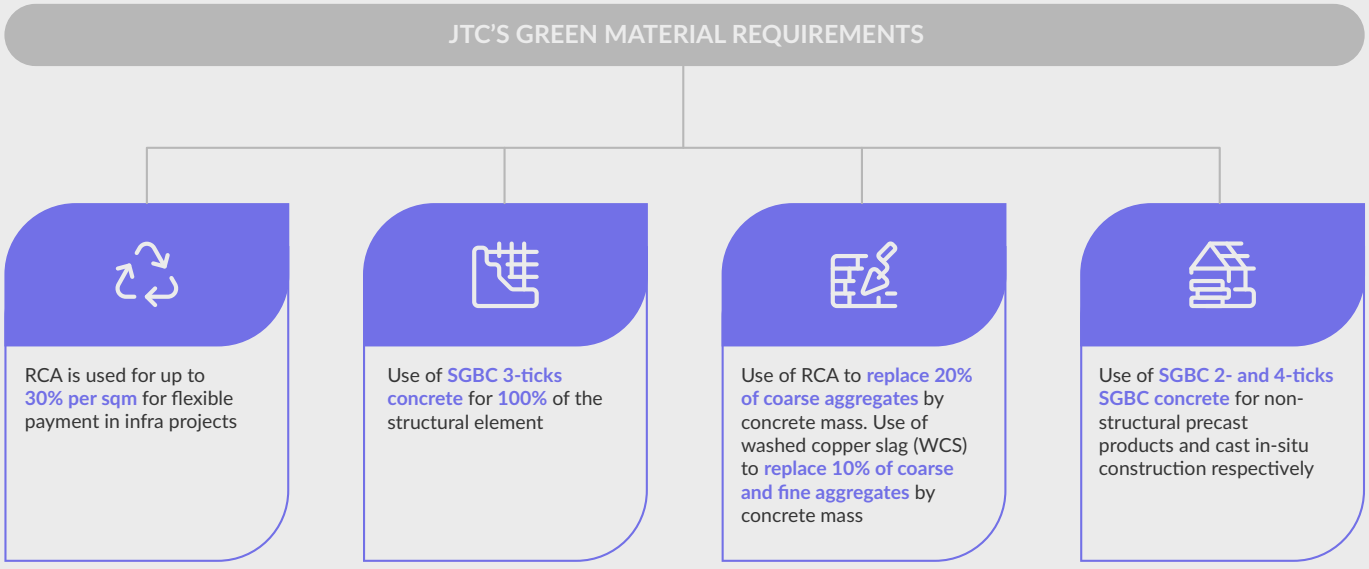


Figure 13: How JTC plans to increase compliance with the BDR

Finding a New Use for Waste

JTC is also collaborating with IHLs and Ready-Mix Concrete (RMC) suppliers to explore harnessing locally generated waste to replace conventional ingredients used in concrete production. In 2021, JTC partnered with NUS and Samwoh Corporation to embark on an R&D project to develop low-carbon concrete using waste glass powder. This collaborative research can potentially reduce the embodied carbon and cost of conventional concrete, enhance the concrete durability, and promote circularity by upcycling waste glass.

Figure 14: How different types of waste can be used to produce green concrete

Partnerships with Companies and IHLs to Explore Use of Sustainable Materials

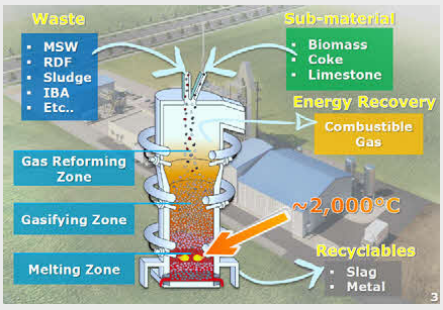
Partner	Details	
Samwoh Corporation: Recovering high value resource from construction by-products	The construction of Jurong Rock Caverns resulted in large quantities of excavated sedimentary rocks. With limited options for construction reuse, storage, or disposal in Singapore, JTC and Samwoh Corporation pioneered the reuse of sedimentary rocks to build the latter's new four-storey Samwoh Smart Hub, which is the company's headquarters, in 2020.	
Pan-United Corporation: semiconSpace with CarbonCure Concrete	JTC worked with both the main contractor and Pan-United to implement the use of CarbonCure concrete as an alternative to conventional concrete at JTC semiconSpace in Tampines Wafer Fab Park. This will help to reduce cement use and the concrete's carbon footprint.	**3 ways CarbonCure Reduces Concretes' Carbon Footprint** Utilises CO2 mineralised and stored in concrete structure Reduces cement use with its higher compressive strength Recycles blast furnace slag to further reduce carbon footprint
NTU: FasRap quick concrete repair solution	To repair spalling concrete more sustainably, we worked with NTU to develop a glass-fibre wrap that improves site productivity by 50%, with estimated manpower and cost savings of 30%. Furthermore, this uses less material than traditional repair of spalling concrete.	
NTU and JFE Engineering: Municipal Solid Waste (MSW) derived slag as a construction material	In this partnership involving JTC, NTU and JFE Engineering, the feasibility of using MSW slag as a construction material to replace up to 100% of natural sand in concrete was investigated. The use of MSW slag as a construction material could potentially reduce Singapore's reliance on imported natural sand and save Singapore's landfill space. JTC will test-bed MSW slag concrete for an upcoming footpath construction at the Tuas Western Coast (TWC) Infrastructure project.	 Image credit: NTU and JFE Engineering

Figure 15: Four of JTC's joint-partner projects that focus on creating sustainable materials

Ensuring a Sustainable Construction Process

To maximise productivity and resource efficiency for JTC projects — from design to construction and handover — JTC has set up a common data environment (CDE) called OPTIMUS. It leverages on Integrated Digital Delivery (IDD) and Building Information Modelling (BIM) to achieve better coordination amongst the various parties, thereby reducing abortive work and wastage. This was first rolled out for JTC Logistics Hub @ Gul, and has since been implemented for all projects from 2018 onwards.

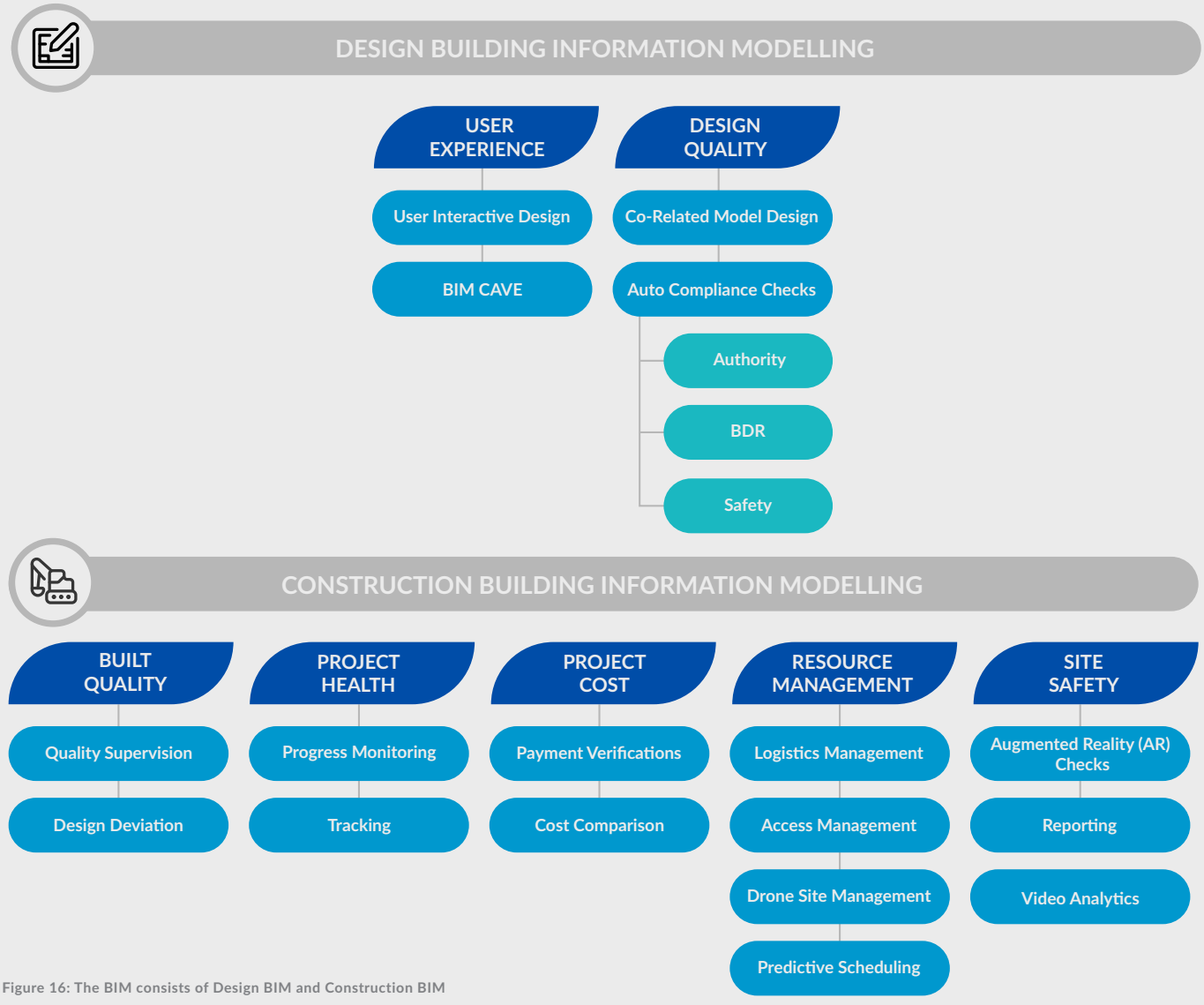


Figure 16: The BIM consists of Design BIM and Construction BIM

Operations Optimisation to Improve Resource Utilisation

According to the National Environment Agency (NEA), the industrial sector is the largest energy-consuming sector in Singapore. Here then lie significant opportunities for energy savings. JTC has identified sustainable building operations as one such opportunity. Through operations optimisation, we aim to manage and reduce energy and water consumption, as well as waste generation in our estates. We are also actively guiding our tenants towards the adoption of energy- and water-efficient equipment, and waste avoidance in their operations.

Right: JTC CleanTech One @ JID

Smart Estate Management System — Open Digital Platform

Together with fellow government agencies and industry partners, JTC has developed a smart estate management system known as the Open Digital Platform (ODP). The digital backbone of PDD, the ODP is akin to an operating system, integrating different facility and district management systems and enabling them to interoperate. As the systems utilise different communications technologies, the Open Standard Multiprotocol Middleware, a centralised data bus, translates and standardises the protocols. This allows the systems to understand one another.

One of the main functions of the ODP is to enable the optimisation of building management and resources, leading to enhanced cost savings and operational efficiency. Another key component of the ODP is the digital twin, a 3D environment of the PDD, which can be used for live monitoring, control as well as simulations.

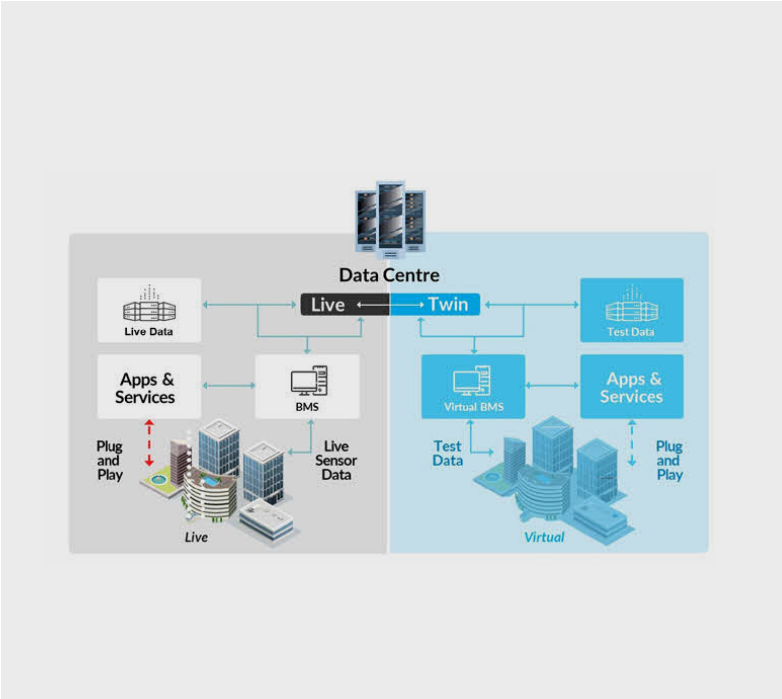


Figure 17a: The ODP's digital twin

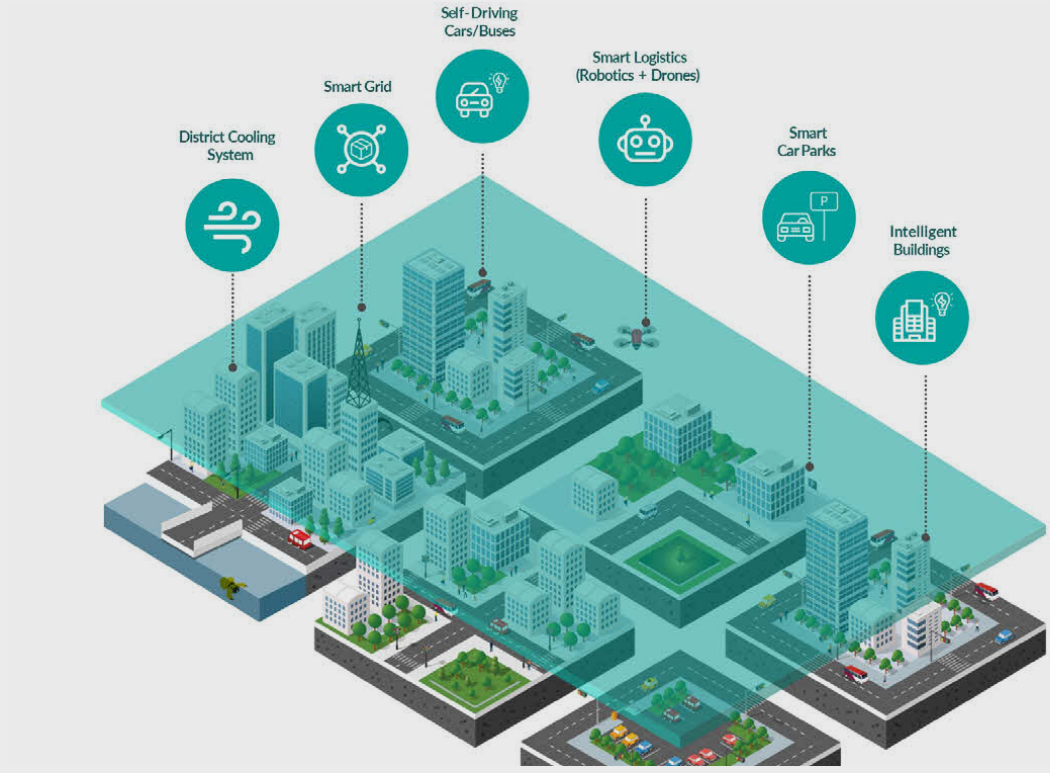


Figure 17b: Key features of the ODP

Using Data to Optimise the District Cooling System

When planning our industrial estates, we consider every single aspect, including infrastructure provisions such as power and chilled water supply. We have embraced the DCS to strike a balance between providing air-conditioning to ensure indoor comfort while remaining environmentally friendly. This energy-saving and economical cooling method facilitates the aggregation of chilled water demand at an estate level, which will help to drive better energy efficiency through economies of scale. Furthermore, the ODP enables DCS operators to identify synergies between systems by potentially providing data on the building heat load and occupant thermal comfort levels. The ODP can correlate data points from DCS and electricity prices to identify the best time to purchase or store energy for cooling. In turn, chiller performance and cooling energy production are optimised.

Conserving Energy

Being mindful of our energy usage is one way we can reduce our carbon footprint. JTC actively implements energy-saving solutions and monitors energy consumption every month. Using the average Energy Utilisation Index (EUI) between 2018 to 2020 as a benchmark, we aim to reduce our EUI in buildings under our management by 10% by 2030.

How JTC Reduces Our Energy Consumption

Office Lights

Switched off automatically during lunch and after office hours at The JTC Summit

Air-Conditioning

Operating temperatures are set at optimised levels

Chiller Plant

Efficient operation of chiller plants over and above BCA Green Mark requirement

Building Management System

Monitors building systems' performances, fault detections and diagnostics, resulting in energy and man-hour savings

Motion Sensors

Installed in toilets and carparks to reduce lighting and ventilation energy consumption

LED Lights

Transition towards higher efficiency luminaries targeting higher energy savings

Figure 18: Energy-saving solutions that JTC has implemented. The energy usage of FY2021 had slightly increased by 8,420 MWh compared with FY2020 as the occupancy rate of FY2020 was affected by COVID-19 situations. As of the end of FY2021, 55.5% of JTC total Gross Floor Area are GM-certified

Towards the Aspiration of a Super Low Energy Building

Our corporate headquarters, The JTC Summit, exemplifies our organisation's aspirations towards excellence in building sustainability performance. In 2020, we participated in the BCA-EnterpriseSG Challenge Call to solicit and pilot suitable technologies that will help us meet our goal of a Super Low Energy Building (SLEB). Our target was to reduce the energy intensity of The JTC Summit by more than 14% from Green Mark Platinum 2015 Standards.

Below: JTC relocated our operations from Jurong Town Hall to The JTC Summit in 2000

BCA-EnterpriseSG Challenge Call — Shortlisted Solutions from the Industry

- Passive Displacement Cooling
- Smart Lighting Arrays and Sensors
- Solar Films
- Electronically Commutated (EC) and Blameless Fan Systems
- IoT Controller for System Integration

Figure 19: Five industrial solutions shortlisted in the BCA-EnterpriseSG Challenge Call to reduce JTC Summit's energy intensity

Protecting Our Precious Water Resources

Water is a scarce resource whose supply is something we should not take for granted. We have set a target to reduce our Water Efficiency Index (WEI) by 10% by 2030 from a baseline averaged between 2018 and 2020. To do this, we are diligently tracking the ways we use water, and implementing initiatives to reduce water usage.

Water-Efficient Fittings

Using water-efficient fittings to reduce water consumption

Drought-Tolerant Plant

Choosing resilient plants for landscaping wherever possible

Monitoring & Analysis

Installing metering system to obtain real-time information to detect leaks and defects, and optimise water usage

Water-Efficient Irrigation

Installing irrigation timers and soil moisture sensors to minimise water wastage

Use of Non-Potable Water

Recycling non-potable water for irrigation, general washing and cooling towers

Use of Condensate Water

Initiating the use of water condensate at JTC CleanTech Two and LaunchPad @ one-north for non-potable uses

Harvesting Rainwater

Implementing large-scale rainwater systems for landscape irrigation at Fusionopolis One @ one-north

App for Quick Repair

Implementing Report-A-Fault mobile app and hotline feedback channels to allow quick repairs on leakage and faulty fittings to reduce wastages

Figure 20: The water-saving measures that JTC has implemented have resulted in a reduction of 167,992m³ of water consumption in FY2021 for our buildings and estates

Testbed of Water Recycling System at JTC CleanTech One @ JID

In collaboration with Ecosoftt, JTC conducted the test-bedding of a decentralised blackwater recycling system. The system is coupled with smart remote monitoring and controls to treat domestic wastewater, which will be used to produce non-potable water and reduce the load on centralised treatment systems. The non-potable water is then used for toilet flushing as well as landscaping. The solution revealed an important market need in land-scarce Singapore: treated water remains highly in demand and is most advantageous when obtained with lower energy, space, and cost requirements. This wastewater treatment technology also helps to address the needs arising from the pandemic. It was subsequently deployed at Changi Exhibition Centre, which had been transformed into a COVID-19 community isolation facility.

This solution has since made forays into other countries such as India, Hong Kong, Malaysia, and Indonesia.

Above: Test-bedding of a decentralised blackwater recycling system for non-potable usage at JTC CleanTech One

Sustainable Water Treatment and Irrigations system

Marking a partnership with NParks and Ecosoftt, this project sought to develop a cooling tower blowdown water treatment system to generate non-potable water for the irrigation of façade and rooftop greenery. The system is deployed at LaunchPad @ one-north, and its goal is water conservation. Thanks to the improved thermal mitigation, which is achieved by the shading and evapotranspiration cooling effect of the newly installed green roof and vertical green wall, a reduction in the building cooling load and ambient temperature can be achieved. The project not only brings about economic benefits, but also improves biodiversity and enhances the aesthetics of the public space.

Above: The cooling water recovery system for rooftop and vertical greenery at Block 79, LaunchPad @ one-north

Waste Avoidance and Circularity

Singapore has envisioned a Zero Waste future, and has laid out strategies to minimise food, packaging, electrical and electronic waste. We have aligned ourselves with this vision. JTC has started to expand recycling efforts, promote research into circularity, and reduce the amount of waste sent to the landfill by exploring new ways to recycle or upcycle waste back into the supply chain.

Tracking the amount of waste generated in our estates and properties helps us to identify where we can begin to reduce our environmental footprint. For JTC, the total amount of non-hazardous waste generated in FY2021 was 45,204 tonnes, of which 12,913 tonnes of waste were recycled.

In FY2021, JTC set up food waste digestors at food factories such as 15 Woodlands Loop and Gourmet East Kitchen. These food waste digestors convert food waste into compost, which is a valuable soil enhancer that helps plants thrive. The compost is then used in landscaping. We have also phased out the use of Styrofoam cups, which are non-biodegradable and non-recyclable, in our premises since 2017.

To reduce paper use, we have implemented a Digital Management System (DMS) to digitise physical documents, making them readily accessible in softcopy. As a result, we have moved towards a paperless system for the majority of our tenders, contracts, and meeting documentations, with JTC's senior management taking the lead in phasing out hardcopy printouts. We reduced 79,563 sheets of paper usage in FY2021 from FY2020.*

*Partly due to lowered occupancy rates during the COVID-19 period.

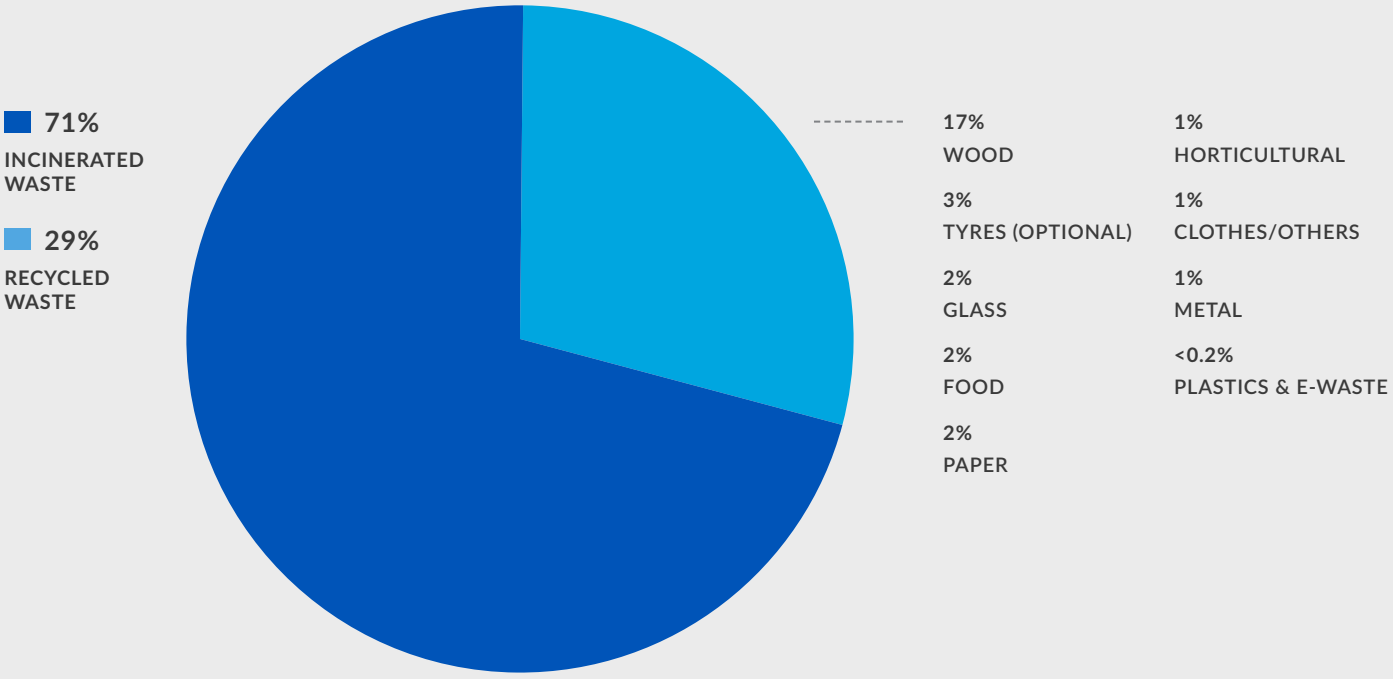


Figure 21: JTC's disposal of non-hazardous waste
Numbers may not add up due to rounding

Renewable Energy: Enhancing Our Energy Security

In line with Singapore's goal to quadruple solar energy deployment to 2GWp by 2030, JTC has intensified the deployment of solar photovoltaic (PV) panels in our estates and properties through our SolarRoof and SolarLand programme. As of the end of FY2021, we have successfully deployed 51.5MWp of solar arrays to generate clean energy, which will be supplied to Singapore's grid, through SolarLand Phase 2 and 3.

In FY2020 and FY2021, various solar contracts with an estimated solar installation capacity of 100MWp were awarded to private solar developers such as Terrenus Energy, Sunseap and Sembcorp. Under SolarLand Phase 2, which was awarded to Terrenus Energy in 2020, a total of 19.17MWp of PV capacity spanning across 11.6 hectares of JTC's vacant land within Changi Business Park was commissioned on 25 November 2021.

Below: Solar farms are deployed on vacant land to generate renewable energy

SolarLand Phase 3 has been awarded through a two-package contract to Sembcorp and Sunseap. Under the SolarLand Phase 3 Package 1, Sembcorp has managed to energise a total of 18.1MWp across 9.88 hectares of JTC's vacant land at Tuas West and Tuas Bay Lane on 17 November 2021 and 4 January 2022 respectively.

SolarLand Phase 3 Package 2 has been awarded to Sunseap and several plots are expected to be energised in 2022.

Taking into consideration the business feasibility of installing and operating the solar panels, this scheme requires any company with a new or renewed land lease to deploy solar panels on its roof if the site has at least 800sqm of available contiguous rooftop area with a remaining lease period of 15 years or more. This scheme ensures that lessees, as owners of the buildings, solarise their rooftops in line with national efforts to increase solar energy deployment.

On the other hand, tenant-occupied buildings owned by JTC are solarised under the SolarRoof programme. JTC called the SolarRoof Phase 3 tender in November 2021, and with the evolving technologies and higher efficiency solar panels, we are able to solicit shorter contract period rates from new solar vendors without jeopardising business viability. This way, customers with shorter balance tenures will also be able to benefit from the new contract options.

Below: Tuas will also welcome a solar farm as part of Phase Three of the SolarLand Programme

Our Solar Programmes – What's the Difference?

SolarRoof: Making Solar Adoption Easier and More Accessible for Firms

In June 2017, we launched our pilot solar programme, SolarRoof, to support the generation and adoption of solar energy at JTC's buildings. In 2020, we solarised the rooftops of more than 40 buildings and actively encouraged our customers to be a part of the programme through the two leasing models highlighted on the right.

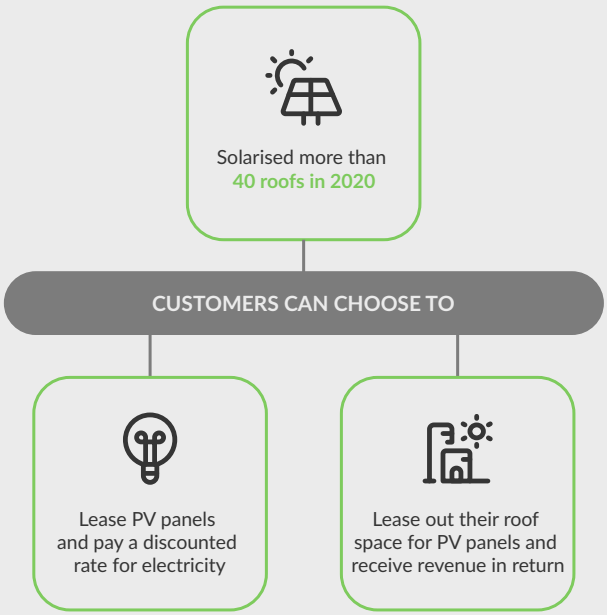


Figure 22a: JTC's SolarRoof Leasing Model

SolarLand: Better Utilisation of Vacant Land

JTC's SolarLand programme makes use of interim vacant land to generate renewable energy, which is then exported to the national grid. In FY2020, JTC launched our latest phase of SolarLand tender, which was awarded to two partners: Sunseap and Sembcorp. This phase of the programme aims to add over 80MWp of PV panels and use 506,000m^2 of temporarily vacant land.

To learn more about our solar efforts, please click **here**.

Figure 22b: Targets of the latest phase of SolarLand Tender

Innovation as a Catalyst for Solarisation

JTC also embarked on a slew of solar-related innovation efforts aimed at improving the solar yield, increasing flexibility of deployment, and maximising the use of limited land and roof space.

INTEGRATED SOLAR GENERATION WITH FARMING

Partnering with Terrenus Energy to test-bed multi-functional use of PV spaces

MOBILE SUBSTATION WITH PORTABLE SOLAR PANELS

Piloting mobile PV systems to improve deployment speed and versatility

AUTONOMOUS PV CLEANING ROBOTS

Automating labour intensive tasks that boost productivity and power generation

SOLAR PV INSPECTION WITH DRONES & AI

Achieving quick and reliable solar fault detection using drones and smart vision

Figure 22c: JTC's solar-power innovations

Breakthrough in the Field of Energy Storage

JTC has collaborated with local start-up VFlowTech (VFT) to demonstrate the PowerCube — a vanadium redox flow battery developed by VFT — at JTC CleanTech One @ JID. VFT's battery solution has an expected lifespan of 25 years and is proven to be one of the safest and most environmentally friendly battery technologies. It is a dependable and long-lasting energy storage solution that can guarantee reliable power supply. It stores energy from renewable power sources and even off-grid diesel generators, and performs at an optimal level regardless of weather conditions, temperatures, or grid instability.

The pilot's success has enabled a game-changing technology for renewable energy transition, in collaboration with other cleantech organisations both in Singapore and countries such as South Korea, Africa, India, Japan and Australia.

Figure 22d: Demonstration of the PowerCube, a vanadium redox flow battery

JTC-Shell Memorandum of Understanding: Exploration of a Solar Farm

On 17 June 2021, JTC and Shell signed a non-binding Memorandum of Understanding (MoU), supported by NEA and EMA, to jointly explore developing a solar farm on Semakau Landfill. The solar farm is expected to take up an area of 60 hectares and have a capacity of at least 72MWp — sufficient to reduce CO2 emissions by 37,000 tonnes a year. This is also equivalent to powering up to 17,500 households for a year. After the MOU signing, JTC and Shell jointly conducted the Request for Information (RFI) for innovative solutions on the solar farm and are planning the next steps of Request of Proposal (RFP).

Below: An aerial view of Semakau landfill

Industry Partnership: Rallying Like-minded Sustainability Champions

Because of the roles we play, JTC is uniquely positioned to drive sustainability in different industrial ecosystems. We have accelerated and proliferated our sustainability efforts since 2018, going beyond the role of an infrastructure provider to empower enterprises so they can bolster their sustainability performances. We are also actively partnering with our business partners and stakeholders to co-create value and explore new opportunities. An example birthed from meaningful industry partnerships is the Jurong Island Circular Economy (JICE) study.

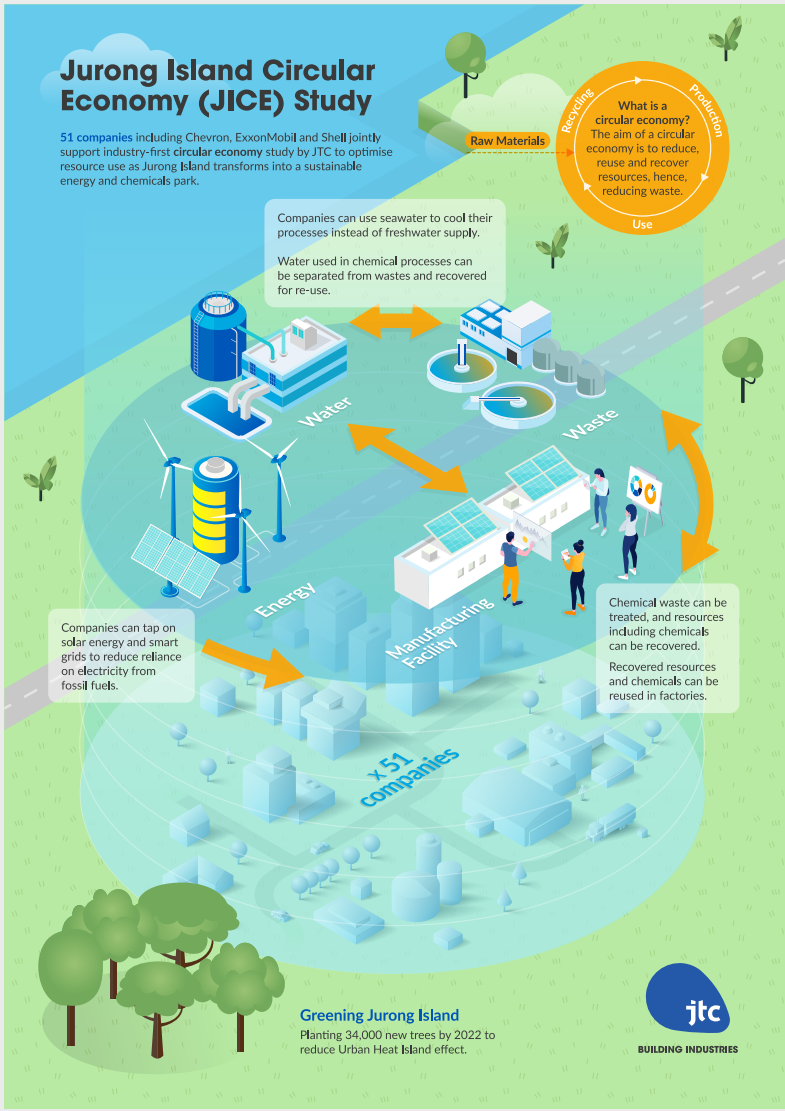
Below: Jurong Island is making its transition to a sustainable energy and chemicals hub

JICE: A Collaborative Approach to Designing a Circular Economy

Jurong Island is one of the world's largest chemical parks and the key anchor for Singapore's energy and chemicals industry. Companies on the island are linked via pipelines for exchange of petrochemical resources, shared infrastructure, and third-party utilities (such as industrial-water storage facilities), thereby optimising resource use.

With support from 51 resident companies and other government agencies, JTC commissioned the JICE study to deep-dive and map out the energy, water, and chemical waste flows on Jurong Island between January 2019 to August 2021. While the JICE study has identified opportunities in the areas of clean energy use, water recycling and recovery, as well as the sustainable recovery and treatment of chemical waste, it also sheds light on challenges faced in implementing the circularity solutions.

To explore further sustainability possibilities for solar integration, carbon capture and storage solutions on the island, we carried out a Jurong Island RFI study in 2020. We also launched the Jurong Island Innovation Challenge (JIIC) and Jurong Island Renewable Energy RFP in 2021 to solicit sustainable solutions for test-bedding, which will address the circularity challenges.



Above: A snapshot of the JICE study

JIIC 2021 – Tackling Resource Use Challenges Through Innovation

Through the JICE study, opportunities were identified to reduce resource use at the system level. In August 2021, we followed up with the inaugural JIIC, which was co-organised with EnterpriseSG and supported by NEA and PUB.

Eight Jurong Island companies subsequently stepped forward with 10 challenge statements to act on some of the opportunities. These spanned the areas of energy management, emissions reduction, and water and waste management.

This initiative allowed innovators to collaborate, co-develop, and pilot novel solutions with Jurong Island companies, which can be deployed to solve real-world issues. We saw a total of 45 proposal submissions, seven of which were selected as winners in March 2022 to proceed with solution development, pilot trials and procurement.

Jurong Island Renewable Energy RFP: Advancing Clean Energy Innovations

EMA and JTC jointly launched the Jurong Island Renewable Energy RFP to accelerate the development of clean energy innovations. The energy and chemicals hub will serve as a living testbed for these solutions. If shown to be commercially viable, they will then be scaled up.

EMA and JTC, with support from EnterpriseSG, pledged a joint commitment of $6 million to fund projects. The RFP was opened to the industry, including SMEs and the research community. We received 34 proposal submissions in February 2022, and some examples are:

- An innovative floating solar deployment
- Development of a virtual ledger system to support green hydrogen production
- Use of existing infrastructure to deploy energy storage systems, with the electrolytes for energy storage to be produced from recycled industrial waste

EMA and JTC are currently assessing the proposals and will award in the second half of 2022.

Above: Jurong Island Innovation Challenge 2021

Above: Jurong Island Renewable Energy Request-For-Proposal

Turning the Agri-Food Innovation Park into a Circular Estate

To make circular estates a reality, we have tapped innovation and modelling to augment the design and planning of our estates. The use of ENGIE's BeCircle software at the Agri-Food Innovation Park (AFIP) is one example. Located in the upcoming Sungei Kadut Eco-District, AFIP is where high-tech urban indoor farming and associated R&D activities converge. AFIP will also be established as a pilot cluster to catalyse innovation in the agri-tech ecosystem.

To enable the co-location of activities across the urban agriculture value chain and increase opportunities for circular economy practices, JTC partnered ENGIE Southeast Asia to enhance and pilot BeCircle for the planning and design of the AFIP. The software comprises a geodata-based web platform that models ecosystems based on resource flows, from water to materials and energy, without any need for requiring confidential data. By advancing and adopting BeCircle, we hope to achieve a circular design of the AFIP with both economic and environmental benefits, and to develop a model of sustainable urban food production that can be exported to the region.

Below: High-tech urban indoor farming technologies will be explored at the AFIP

Green Compass:
A Sustainability Transformation Guide for Businesses

JTC has stepped up the engagement with our tenants and lessees to promote industry decarbonisation. To support this effort, the development of appropriate frameworks, assessment tools and incentive schemes is necessary. At the Energy Innovation event held on 23 July 2021, JTC signed a Research Collaboration Agreement with A*STAR's Singapore Institute of Manufacturing Technology (SIMTech) and TÜV SÜD PSB to jointly develop a Green Compass assessment framework that helps businesses pivot towards sustainability.

The Green Compass offers a set of assessment tools, methodologies, and training workshops that enables companies to measure their sustainability maturity, identify gaps, and formulate improvement pathways in alignment with their business strategies. The evaluation methodology of Green Compass cuts across the environmental impact of the company's operations, supply chains, and product life cycle. It then prioritises areas for improvement while considering financial impact.

For more information on Green Compass, please click here.

Above: The signing ceremony of Green Compass

Transform your Business:
Environmental Sustainability through Green Compass

A sustainability assessment and strategic roadmapping tool for businesses

Figure 23: JTC's tripartite collaboration with A*STAR SIMTech and TÜV SÜD PSB to map out the Green Compass framework

A tripartite collaboration of

Fortifying Our Governance Framework

As a government agency, stakeholder trust is of utmost importance to us. At JTC, we believe in acting in the best interests of not just our business, but also our partners'. We place a strong emphasis on the ethics and integrity of our governance to provide a strong foundation for our sustainability strategy. We constantly review our risk management systems to ensure that dishonest or illegal practices are not condoned.

JTC CleanTech Three @ Jurong Innovation District

Putting in Place Stringent Compliance and Risk Management Practices

Robust Cybersecurity and IT Infrastructure Resilience

As a government agency, JTC is subject to strict cybersecurity compliance rules. We ensure that our cybersecurity controls and processes are constantly reviewed and improved, so that we can stay ahead of evolving security threats. We actively enforce data privacy laws as mandated by the government. Alongside our investment in technology, JTC staff are required to attend cybersecurity awareness training to ensure adherence to strict protocols when handling sensitive data. If data is compromised, there are immediate response procedures in place to contain and minimise the impact.

In FY2021, there were no substantiated complaints concerning breaches of customer privacy or loss of customer data.

Cultivating Trust Through Corporate Governance and Socio-Economic Compliance

Upholding the highest standards of governance is crucial to maintaining stakeholder trust and delivering sustainable returns to our shareholders. There is zero tolerance for wrongful practices related to the breach of laws or policies, such as those involving fraudulent acts, corruption (bribery) and collusion.

JTC has established procedures that mitigate and monitor the risks of non-compliance to all applicable laws and regulations. We articulate norms clearly to employees via our Code of Conduct and Ethics. All staff are required to comply with JTC's Financial Manual for procurement matters, undergo fraud-risk training, and complete an annual declaration on core values and conflicts of interest.

JTC's whistleblowing policy is communicated to all employees at the start of their employments. Thorough investigation is carried out on a case basis, even as every reasonable effort is made to protect the whistleblower's identity.

In FY2021, JTC did not receive any whistle-blower reports concerning corruption. There were no instances of employees being disciplined or dismissed due to corruption, nor were there terminations or renewal refusals of contracts with business partners for this reason. No legal case regarding corruption was brought against JTC or our employees during this period.

For more information on JTC's financial performance in FY2021, please refer to our Annual Report **here**.

Building Resilient Supply Chains and Implementing Procurement Best Practices

JTC adheres to procurement guidelines as stipulated by the Ministry of Finance (MOF) and is subject to audits by our internal audit team and the Auditor-General's Office (AGO). We are guided by the government's three key procurement principles: transparency, value for money, and fair and open competition.

Our departments carry out contracting and procurement in line with our in-house frameworks and policies. We regularly conduct internal performance reviews of our procurement processes to ensure that they are up to date.

In FY2020 and FY2021, over 200 and over 50 contracts respectively were awarded to consultants, contractors, service providers, and suppliers to support our construction and corporate functions. We actively conduct performance reviews of consultants and contractors based on commissioned systems such as the BCA Consultants' Performance Appraisal System (CPAS) and C41.

Despite challenges arising from COVID-19, JTC did not experience significant impact on our supply chain, other than project delays during the Circuit Breaker period caused by the implementation of safe distancing measures. We also continued to pay contractors and consultants in a timely manner.

Right: JTC engineers at work maintaining The JTC Summit's systems

A Renewed Commitment to Social Responsibility

Touted as a crisis of a generation, the COVID-19 pandemic has upturned the workplace, the economy, and ultimately our lives. Even as we navigated our own challenges, we listened and supported our business partners through various communication channels. We take greater care to ensure the well-being and personal development of our employees. Our workplace policies are structured to create an inclusive work environment, offer fair employment practices, maintain strong labour relations, and provide equal opportunities for all.

Jurong Town Hall

Enriching Our Strategic Direction Through Active Stakeholder Engagement

Meaningful Conversations With Our Stakeholders

JTC hosted engagement sessions with our varied groups of stakeholders to understand how our operations can better meet their needs. For FY2021, we identified key stakeholders based on their impact on JTC's operations and compiled a list of topics and concerns that have been raised by them.

Stakeholder Group	Forms of Engagement	Frequency	Key topics and concerns raised by stakeholder group	JTC's Responses
Staff	› Half-yearly regular employee dialogue sessions with Reporting Officers › Environmental, health, and workplace-safety awareness activities › Periodic series of leadership development programmes catered to the specific needs of different employee groups, aimed at nurturing skills in critical thinking, innovation, and team spirit › Regular appraisals for staff to identify training opportunities for career development › Team building and recreational activities	As required	› Upskilling and training › Remunerations and benefits › Employee welfare › Safe and healthy working environment	JTC has a bi-annual review on upskilling and training. The HR Division ensures regular reviews of remunerations, benefits and staff welfare policies.

Stakeholder Group	Forms of Engagement	Frequency	Key topics and concerns raised by stakeholder group	JTC's Responses
Customers (tenants and lessees)	› Regular discussion and feedback channels provided	As required	› Quality of facility and space used › Customer satisfaction › Health and safety concerns › Revenue and cost of space	JTC sets and monitors key performance indicators (KPIs) for our facilities management company. One of the main KPIs is the resolution time and number of cases (of feedback) from our building users.
Service Providers and Vendors (including contractors, consultants, suppliers, agents, and others)	› Procurement guidelines review › Discussions and feedback channels provided	Monthly/ quarterly meetings, or as required	› Quality of facility and space used › Customer satisfaction › Health and safety concerns › Revenue and cost of space	Periodic system reviews to address concerns as required, such as when safety-related incidents occur.
Industry (MoU) Partners Government Agencies Academic/ Research Institutes Non-Governmental Organisations (NGOs)	› Senior management representation within industrial associations and national programmes › Active participation in external conferences, dialogues, and events across different industries › JTC Innovation Challenge	Regular meetings depending on collaboration frameworks	› Development of sustainability innovations and collaborations › Sharing of industry best practices › Inculcating responsible and green workplace practices › Regulatory development towards a low-carbon economy › Promoting ESG integration into financial reporting	Regular meetings, discussion forums, and periodic reviews of collaboration frameworks with stakeholders, as necessary.

Stakeholder Group	Forms of Engagement	Frequency	Key topics and concerns raised by stakeholder group	JTC's responses
Media	› Participation in and organising of conferences, meetings, and site visits › Media releases and interviews › Milestone reports › Feedback channels › Staff involvement in community volunteering events › Community development initiatives	As required	› Business impact on environment and society › Corporate governance › Efficient use of public funds › Future roadmaps	Regular press releases as per communication plan.
General Public & Community				Public engagement sessions, as required.

Figure 24: Table summary of JTC Key Stakeholders' main topics and concerns, and JTC's responses to them

Placing an Emphasis on Customer Engagement

Close to 14,000 businesses call our industrial estates home. Therefore, customer satisfaction is an important metric for us. Our customer service portal provides a comprehensive suite of services that allows customers to manage their leases and tenancies, make payments, as well as search and apply for properties. Apart from partnering our customers and stakeholders in industry transformation, we aim to create well-designed, affordable, and functional estates and buildings with a high level of customer engagement, quality, and sustainability.

Unifying Like-minded People for Good Causes

JTC believes in giving back to society. Our adopted charities include Movement for the Intellectually Disabled of Singapore (MINDS) Fernvale Garden and Singapore Asian Women's Welfare Association (AWWA) Senior Community Home. Apart from events where our staff volunteered their services, JTC also conducted several fundraisers for other beneficiaries. Our Corporate Social Responsibility Core Principles are anchored on four prongs, as detailed in Figure 25.

Figure 25: JTC's Corporate Social Responsibility Core Principles

A Labour of Love: The Community Garden at one-north

At one-north, a small plot of land was converted into a community garden to allow those with green fingers to pursue their interest. People from all walks of life can come together, recharge as they work the soil, and interact with fellow gardeners. Community gardens like this serve as a reminder that industrial spaces can be meaningfully transformed to facilitate social interactions and connections.

Celebrating Christmas With Our Migrant Workers

To bring the holiday cheer to our migrant workers, JTC conducted a Christmas Fundraiser in tandem with Migrant Workers' Centre (MWC). Our staff made monetary donations as well as wrote heartfelt messages to them. Many were also involved in putting together 505 care packs. In total, JTC raised $6,695.88, of which $3,942 were spent on the care packs. The balance was donated to MWC's Migrant Workers Assistance Fund, which provides funding for the humanitarian and emergency assistance it renders to its clients.

Industry Connect: Connect, Collaborate, Consult

The Fourth Industrial Revolution is set to unlock opportunities like never before. But for its full impact to materialise, every business — in particular small and homegrown companies — must be able to harness its potential. With this in mind, we launched Industry Connect in January 2020, which is aimed at enhancing access to Industry 4.0, talent development and environmental sustainability initiatives in JTC estates. The initiative connects SMEs to our vast network of businesses, solution providers, talent and training partners, and sister government agencies. To date, over 300 businesses in our estates have been engaged for technology adoption.

As part of Industry Connect, we also matchmake a wide pool of talents from IHLs to the companies in our ecosystems. Over 3,000 students have benefited from learning journeys. Through project and internship opportunities, they get to experience the inner workings of various manufacturing sectors.

From top: JTC encourages community engagement within the premises of its properties, such as with this community garden at one-north; JTC staff working hand in hand to assemble the 505 care packs for migrant workers during the Christmas Fundraiser in December 2020

Our Occupational Health and Safety Roadmap: Improving the Welfare of Workers

Formed in 2006, JTC's Workplace Safety and Health (WSH) Committee oversees our Occupational Health and Safety (OHS) management system and policies. Our Workplace Safety Department (WSD), incepted in 2017, continuously upholds and enhances the safety standards at JTC worksites as well as updates our OHS management system.

Migrant workers leave their homes to help build ours. We partner with contractors and NGOs such as the MWC to take care of the physical and mental health of migrant workers on our work sites. We evaluate the safety records of all vendors and contractors prior to the award of tenders. Contractors are also required to implement safety management systems at their work sites. Near misses, incidents and accidents must be duly reported to JTC.

All incidents are investigated with mitigation measures implemented in accordance with the Incident Investigation Process as set out in the Safety Specifications for all construction projects. Regular safety audits are carried out for all projects and safety lapses. Contractors are to submit details on the workplace accidents.

In FY2021, there was no incidence of fatality. In FY2022, JTC will measure safety performance for Construction Projects based on the Workplace Injury Rate (WIR), which is the number of workplace accidents per 100,000 workers.

WORK-RELATED INJURIES REPORTED BY CONTRACTORS IN FY2021*

Number of work-related injuries	49
Number of major injuries[3] (excluding fatalities)	0
Total number of hours worked:	24,420,481 hours

Figure 26: JTC's workplace injuries in FY2021

* This information has been obtained from our contractors and is dependent on the contractors' reporting accuracy.

[3] Major Injury refer to Non-Fatal but Severe Injuries – For example: Amputation; blindness; deafness; paralysis; crushing, fractures and dislocations; head, back, chest and abdomen, neck, hip, and pelvis; exposure to electric current; asphyxia or drowning; burns with more than 20 days of medical leave; concussion with more than 20 days of medical leave; mosquito borne diseases with more than 20 days of medical leave; virus outbreak with more than 20 days of medical leave.

Inculcating a Health- and Safety-Oriented Mindset in Our Workers

"A Healthy Workforce in Safe Workplaces; A Country Renowned for Best Practices in Workplace Safety and Health" — this is the national WSH 2028 vison. One strategy under the WSH 2028 is to strengthen WSH ownership, where every company becomes motivated to care for their workers' safety and health, and in so doing breeds a culture of mutual trust. Aligning ourselves with this strategy, JTC collaborated with the Singapore Contractors Association Limited (SCAL) to establish the Construction Safety School (CSS) in June 2019.

At the CSS, state-of-the-art technologies such as simulations and Virtual and Augmented Reality are employed to facilitate experiential learning for workers involved in JTC's construction projects. As the construction industry in Singapore comprises workers from different cultures and nationalities, such training helps workers to learn the dangers of construction-related activities and protect themselves at work. All supervisors and workers are required to complete this safety programme before they can commence actual onsite work. A total of 7,477 participants have been trained to date.

Caring for Our Migrant Workers

JTC also collaborated with MWC on various fronts to take better care of our migrant workers. For instance, we distributed 7,700 care packs, consisting of daily necessities and food packs, to help them through the COVID-19 period. Workers were also introduced to a 24-hour hotline where they can receive emotional support and assistance from MWC.

From top: A donation drive for our migrant workers; care packs assembled and ready for distribution

Together as One, Against COVID-19

As part of the Singapore government's COVID-19 pandemic response, JTC was heavily involved in several work streams. JTC rapidly re-configured existing industrial spaces to produce critical products needed to stem the COVID-19 outbreak. Examples include face mask manufacturing at JTC Space @ Tuas; respirator production at LaunchPad @ one-north; and vaccine testing and production at MedTech Hub. JTC also assisted other agencies to set up a significant number of testing and vaccination facilities in suitable industrial facilities throughout Singapore.

To reduce the spread of COVID-19 within migrant worker dormitories, JTC constructed and operated 12 Temporary Dormitories as well as Community Care Facilities (CCFs) with a capacity of more than 8,500 beds at short notice. We also built four Quick Build Dormitories (QBDs), with a total of over 6,000 beds, to provide greater housing choices for businesses and employers.

Another challenge JTC undertook was the conversion of selected factory buildings into CCFs that can house COVID-positive but asymptomatic migrant workers. Today, JTC continues to operate two CCFs with our medical partners. One of which is Tuas South Street 5 (TSS5). At the peak of its operation, the 1,000 beds at this facility were nearly fully occupied. Currently, it houses both male migrant workers as well as Foreign Domestic Workers (FDWs) who have tested positive for COVID-19.

Being the operator of the only CCF in Singapore to accommodate female work permit holders, JTC worked with sister government agencies and NGOs to conduct various welfare initiatives such as befriending programmes and art workshops to boost their morale. Some FDWs later conveyed their appreciation by producing a thank you video, expressing their gratitude for their comfortable stays at the CCF.

From top: Art lessons were conducted for the FDWs; staying active while quarantining at the CCF

Taking Care of the Needs of Our Elderly Through Food Deliveries

As part of MTI's mandate to strengthen food resilience during the Circuit Breaker period, JTC partnered with the Agency for Integrated Care (AIC) to ensure that the nutritional needs of some of the vulnerable groups, in particular the elderly living alone without support, were taken care of when enhanced safe distancing measures were implemented.

During the Circuit Breaker period, it was essential for the vulnerable elderly to minimise exposure by reducing travel beyond the confines of their homes. However, this put them at risk of falling through the cracks of societal support. To ensure their continued physical and mental well-being, JTC and AIC organised a one-time dry-grocery supply as well as rallied volunteers to check in on them.

The initiative targeted the following desired outcomes:

- Ensure that the needs of Singapore's vulnerable elderly group are heard and addressed
- Foster stronger community ties between the vulnerable elderly and our Silver Generation Office (SGO)
- Garner the trust of the elderly folks so they will be receptive to receiving government support schemes and assistance
- Boost the morale of the community during rough times
- Nurture civic capacity and volunteerism within the public service sector

The entire food distribution exercise happened over 12 days, where we reached out to 30,957 seniors through 44,592 house visits. More than 80,000 supplementary food packs were delivered on some 500 buses. 218 JTC staff members volunteered for the exercise, committing more than 404 man-days in total, with each person volunteering an average of two days.

From top: Rallying around a good cause during the COVID-19 pandemic; volunteers from JTC and AIC after a successful run delivering food to elderly folks living alone

Assisting Our Stakeholders Through COVID-19

The early days of COVID-19 were filled with uncertainty. To help our partners cope with the sudden onset of financial challenges, JTC provided the following extensive rental waivers to our tenants and licensees:

› Two months for industrial and office tenants

› Four months for F&B and retail tenants

› Five months for hawker tenants

11,000 industrial and office tenants, as well as 300 commercial tenants and hawker stallholders, benefitted from the rental waivers.

To help our construction and consultancy companies, JTC provided various forms of assistance such as ex-gratia extension of time, advance payments, co-sharing of prolongation costs, contract adjustments for foreign manpower cost increases in accordance with COVID-19 (Temporary Measures) Act (COTMA) and BCA/MOF guidelines.

As the pandemic crisis progressed, working from home became the default modus operandi for JTC staff. Although JTC staff were already equipped with portable laptops prior to the pandemic, additional Virtual Private Network (VPN) accounts and iPads were issued to help with the transition. A one-off payment of $150 was disbursed to staff in September 2020 to offset purchases of telecommuting equipment, and expenditure of mobile and broadband services.

JTC also took utmost care to ensure the safety and health of our visitors and tenants of our industrial estates and buildings. For instance, the infrastructure at The JTC Summit underwent upgrades such as the following:

› UV sterilisation of escalator handrails

› Replacement of push-button door releases with contactless door release buttons

› Application of self-disinfecting coatings at high-contact points such as lift call buttons

Below: Promoting a safe and welcoming work environment is important at JTC

Becoming an Employer of Choice Through Fair Employment Practices

Fair employment, labour relations and talent retention

In any organisation, the talents are the greatest assets. At JTC, we practise fair employment and support our employees' professional growth.

Since 2017, JTC has been a signatory of the Employers' Pledge of Fair Employment Practices as established by the Tripartite Alliance for Fair & Progressive Employment Practices (TAFEP). We conform to the government's Instruction Manual on Employment and abide by legislation such as the Employment Act, Workplace Safety and Health Act, the Retirement and Re-employment Act.

Employees are represented by the Amalgamated Union of Public Employees (AUPE), which is the largest public-sector union in Singapore. We have enjoyed a collaborative relationship with the union based on trust and open communication.

Members of the senior management team conduct regular engagement sessions with employees across all levels to understand their issues and concerns. At the organisational level, an employee satisfaction survey is carried out every three years to solicit feedback, with the latest of such surveys completed in 2021.

JTC remunerates employees fairly, taking into consideration factors such as ability, performance, and experience. In developing our staff, we provide fair and equal opportunities to all staff to develop themselves professionally through initiatives such as training, job rotations, attachments, professional accreditations, and study awards.

Our human resource practices have been recognised, receiving accolades such as the 2014 NTUC May Day Model Partnership Awards and the 2018 Tripartite Alliance Awards' Plaque of Commendation (Gold).

Professional training for employees is monitored closely to ensure that staff are equipped with the relevant skillsets to meet the needs of their current jobs and remain relevant. To improve the training experiences and provide employees with continued access to training while working from home, JTC introduced more digital content (e-learning and otherwise) and enhanced training with blended learning experiences. Such initiatives gave JTC staff the flexibility to plan for training and access online training at their convenience.

In FY2021, JTC achieved an average of 37.2 training hours per officer, and 32.1% of JTC officers met designated training hours. This is an improvement from FY2020 (average of 22.2 training hours per officer and 16.7% of officers meeting designated training hours), and appears to be a reversal of the two-year decline of training hours observed over FY2019 and FY2020.

Inclusivity, Diversity, and Equal Opportunity

NUMBER OF EMPLOYEES IN JTC (TOTAL: 1159)

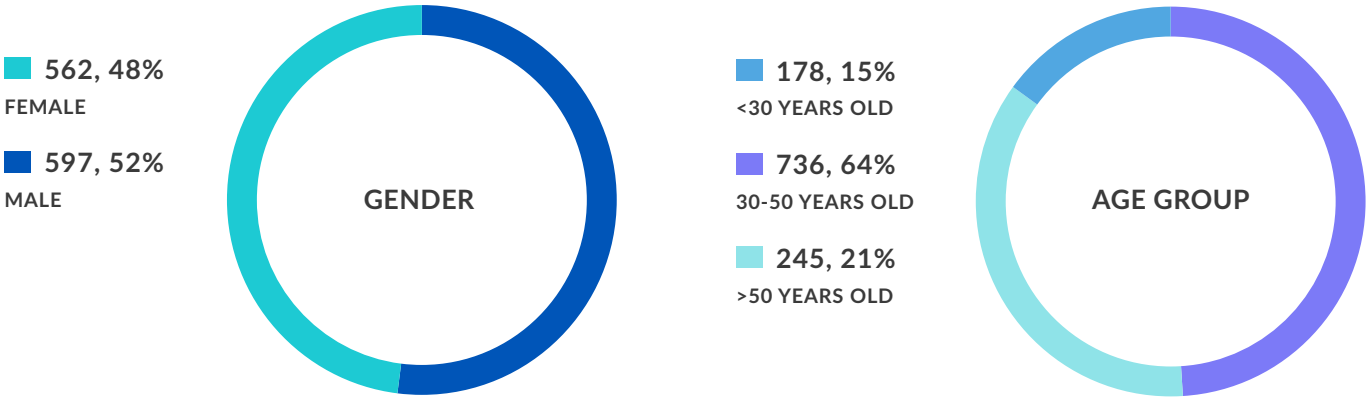


Figure 27: Breakdown of JTC staff demographics

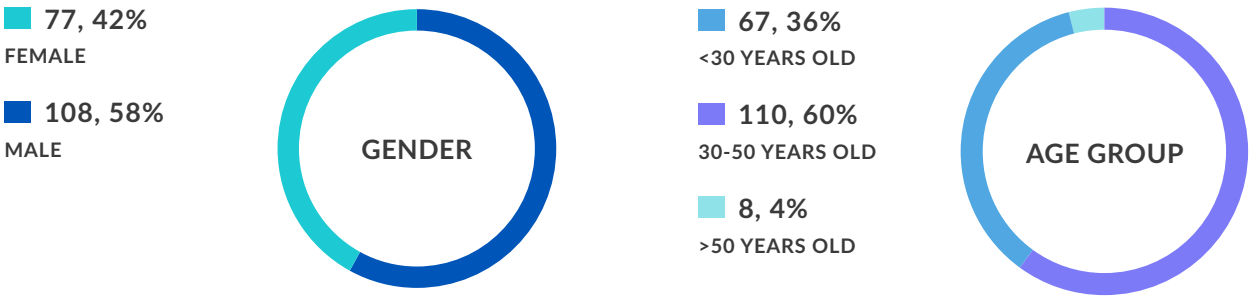
TOTAL NUMBER OF EMPLOYEES BY EMPLOYMENT CONTRACT AND EMPLOYMENT TYPE AND GENDER AS OF 31 MARCH 2022

EMPLOYMENT TYPE	MALE	FEMALE
Permanent employees	483	477
Fixed term/ temporary employees	114	80
Full-time employees	597	577
Part-time employees	0	5

Figure 28: JTC's employee demographics by employment contract/ type and gender

Employee Data

NUMBER OF EMPLOYEES RECRUITED (TOTAL: 185)



NUMBER OF EMPLOYEES WHO LEFT JTC (TOTAL: 192)

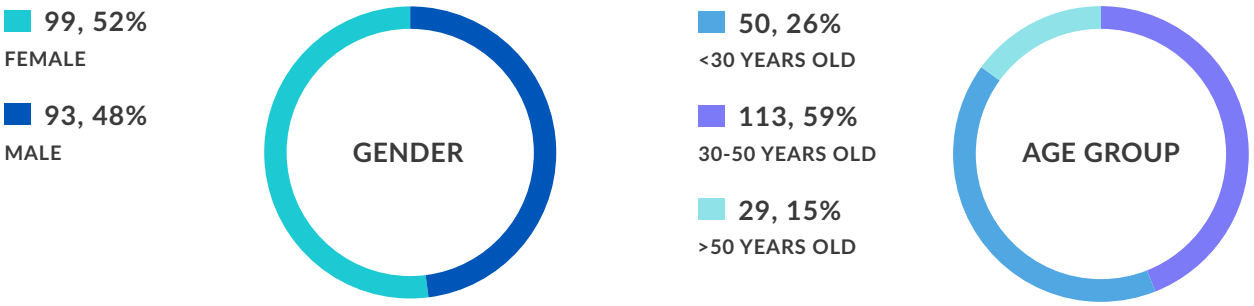
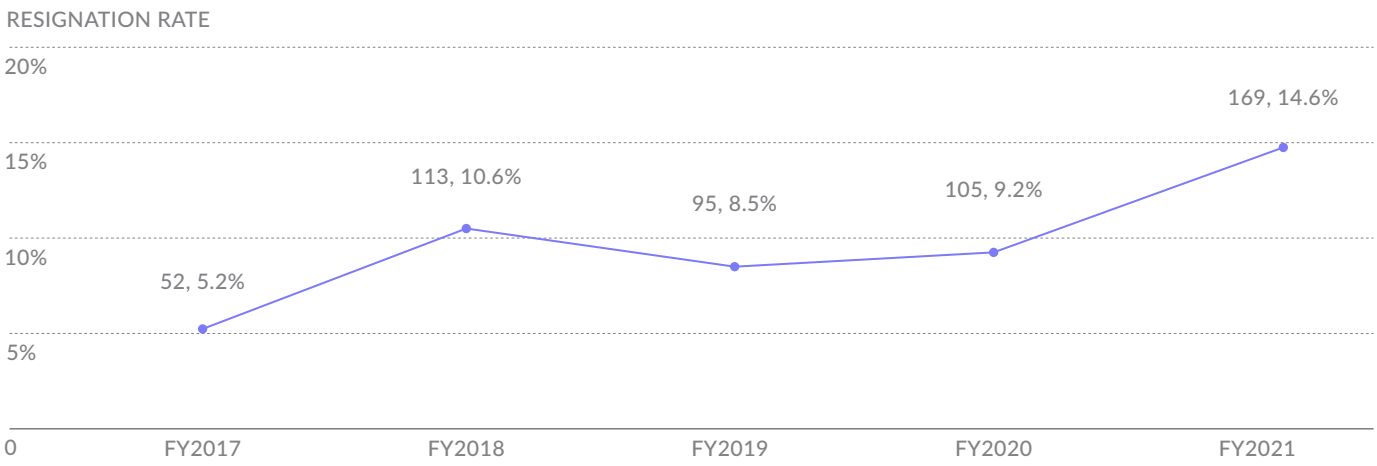


Figure 29: JTC's employment rate in FY2021

Involuntary exits (such as employees leaving upon contract expiry), those who have retired, and those who passed away in service were included in the number of employees who left JTC.



FY2021's resignation rate was 14.6%, almost 60% higher than FY2020's rate.

Figure 30: JTC's five-year resignation rate

Appendix

Eclipse @ one-north

GRI Content Index

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
GRI 101: Foundation 2016			
General Disclosures			
GRI 102: General Disclosures 2016	102-1	Name of the organisation	JTC Corporation
	102-2	Activities, brands, products, and services	At JTC, our mission is to develop industrial infrastructure that supports the growth of new industries and transforms enterprises in Singapore. Find out more on our website here.
	102-3	Location of headquarters	Singapore
	102-4	Location of operations	Singapore only
	102-5	Ownership and legal form	JTC is a statutory board under the Ministry of Trade and Industry of Singapore.
	102-6	Markets served	Singapore only. JTC looks after industrialists, working with them to build vibrant, innovative developments where they can grow and thrive. Our direct beneficiaries are corporations looking to use industrial spaces in Singapore. Our customers are from various sectors including but not limited to advanced manufacturing, aerospace, biomedical, construction, and logistics.
	102-7	Scale of the organisation	Page 59-61. As of June 2021, JTC has developed approximately 7,000ha of industrial land in Singapore with approximately 13,000 customers across various sectors.
	102-8	Information on employees and other workers	Page 59-61. A significant proportion of the work done in our construction projects is done by contractors.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
	102-9	Supply chain	Page 7, 47.
	102-10	Significant changes to the organisation and its supply chain	Page 47.
	102-11	Precautionary principle or approach	Our strategy includes taking preventive actions early to mitigate known risks and taking a precautionary approach to tackle the unknown risks of our operations.
	102-12	External initiatives	Page 6, 59.
	102-13	Membership of associations	JTC is a member of Singapore Green Building Council (SGBC).
	102-14	Statement from senior decision-maker	Page 4.
	102-16	Values, principles, standards, and norms of behaviour	Find out more on our website **here**.
	102-18	Governance structure	JTC Annual Report FY2021: page 4-7. Page 10.
	102-40	List of stakeholder groups	Page 49-51.
	102-41	Collective bargaining agreements	Page 59-61. All staff are eligible to join our designated Union – the Amalgamated Union of Public Employees (AUPE). As of March 2022, 263 (22.7%) staff of all grades are union members.
	102-42	Identifying and selecting stakeholders	Page 49-51.
	102-43	Approach to stakeholder engagement	Page 49-51.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
	102-44	Key topics and concerns raised	Page 49-51.
	102-45	Entities included in the consolidated financial statements	JTC Annual Report FY2021: page 57-90. Page 2.
	102-46	Defining report content and topic boundaries	Page 2-3. Beyond engaging our stakeholders to understand their sustainability concerns, we also conducted an internal Materiality Assessment to determine the scope of this Report
	102-47	List of material topics	Page 3.
	102-48	Restatements of information	Not applicable as this is JTC's inaugural Sustainability Report.
	102-49	Changes in reporting	Not applicable as this is JTC's inaugural Sustainability Report.
	102-50	Reporting period	Page 2.
	102-51	Date of most recent report	Not applicable as this is JTC's inaugural Sustainability Report.
	102-52	Reporting cycle	Page 2.
	102-53	Contact point for questions regarding the report	Page 2.
	102-54	Claims of reporting in accordance with the GRI Standards	Page 2.
	102-55	GRI content index	Appendix: GRI Content Index
	102-56	External assurance	Page 2.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
Material Topics: Economic Performance			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	JTC Annual Report FY2021: page 39-45.
	103-2	The management approach and its components	JTC Annual Report FY2021: page 39-45.
	103-3	Evaluation of the management approach	JTC Annual Report FY2021: page 39-45.
GRI 201: Economic Performance 2016	201-1	Direct economic value generated and distributed	JTC Annual Report FY2021: page 39-45.
	201-2	Financial implications and other risks and opportunities due to climate change	The information is not available at the moment.
Material Topics: Indirect Economic Impacts			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 11-13.
	103-2	The management approach and its components	Page 11-13.
	103-3	Evaluation of the management approach	Page 11-13.
GRI 203: Economic Performance 2016	203-2	Significant indirect economic impacts	Page 11-13.
Material Topics: Anti-corruption			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 46.
	103-2	The management approach and its components	Page 46.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
Material Topics: Anti-corruption			
	103-3	Evaluation of the management approach	Page 46.
GRI 205: Anti-corruption 2016	205-3	Confirmed incidents of corruption and actions taken	Page 46.
Material Topics: Materials			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 23-27.
	103-2	The management approach and its components	Page 23-27.
	103-3	Evaluation of the management approach	Page 23-27.
GRI 301: Materials 2016	301-1	Materials used by weight or volume	Page 23-27.
Material Topics: Energy			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 30-31, 35-39.
	103-2	The management approach and its components	Page 30-31, 35-39.
	103-3	Evaluation of the management approach	Page 30-31, 35-39.
GRI 302: Energy 2016	302-1	Energy consumption within the organisation	Page 30-31, 35-39. In FY2021, the total energy usage for JTC's buildings and estates is 121,709.3MWh
	302-3	Energy intensity	The information is not available at the moment.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
Material Topics: Water and Effluents			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 32-33.
	103-2	The management approach and its components	Page 20, 32-33.
	103-3	Evaluation of the management approach	Page 32-33.
GRI 303: Water and Effluents 2018	303-1	Interactions with water as a shared resource	Page 32-33.
	303-2	Management of water discharge-related impacts	All wastewater discharged to sewers in accordance with NEA and PUB's regulations and standards. JTC does not directly operate any industrial processes. There was no industrial discharge of water in FY2021.
	303-3	Water withdrawal	In FY2021, the total water usage for JTC's buildings and estates is 975,367.6m^3.
	303-4	Water discharge	All wastewater discharged to sewers in accordance with NEA and PUB's regulations and standards. JTC does not directly operate any industrial processes. There was no industrial discharge of water in FY2021.
Material Topics: Biodiversity			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 17, 19-22.
	103-2	The management approach and its components	Page 17, 19-22.
	103-3	Evaluation of the management approach	Page 17, 19-22.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
GRI 304: Biodiversity 2016	304-2	Significant impacts of activities, products, and services in biodiversity	Page 17, 19-22.
Material Topics: Emissions			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 18, 21-31, 35-39.
	103-2	The management approach and its components	Page 18, 21-31, 35-39.
	103-3	Evaluation of the management approach	Page 18, 21-31, 35-39.
GRI 305: Emissions 2016	305-1	Direct (Scope 1) GHG emissions	The information is not available at the moment.
Material Topics: Waste			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 25-26, 34, 41-43.
	103-2	The management approach and its components	Page 25-26, 32, 41-43.
	103-3	Evaluation of the management approach	Page 25-26, 32, 41-43. In line with the national target to reduce the per capita amount of waste sent to the landfill by 30% by 2030, JTC targets to achieve a 30% reduction in waste intensity from 2022 levels by 2030 as a part of the GreenGov.SG initiative.
GRI 306: Waste 2016	306-1	Waste generation and significant waste-related impacts	Page 25-26, 32, 41-43.
	306-2	Management of significant waste-related impacts	Page 34. Waste data collection and monitoring is done by our property and estate management teams, supervised by the Environmental Sustainability Committee.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
	306-3	Waste generated	Page 34.
	306-4	Waste diverted from disposal	Page 34. Hazardous waste data is not available for FY2021.
Material Topics: Supplier Environmental Assessment			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 47.
	103-2	The management approach and its components	Page 47.
	103-3	Evaluation of the management approach	Page 47.
GRI 308: Supplier Environmental Assessment 2016	308-2	Negative environmental impacts in the supply chain and actions taken	We are working towards including environmental criteria in supplier assessments.
Material Topics: Employment			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 59-61.
	103-2	The management approach and its components	Page 59-61.
	103-3	Evaluation of the management approach	Page 59-61.
GRI 401: Employment 2016	401-1	New employee hires and employee turnover	Page 59-61.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
Material Topics: Labour-Management Relations			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 59-61.
	103-2	The management approach and its components	Page 59-61.
	103-3	Evaluation of the management approach	Page 59-61.
GRI 402: Labour-Management Relations 2016	402-1	Minimum notice periods regarding operational changes	JTC follows Public Service Division's directives and effective dates on minimum notice periods regarding operational changes. For collective agreements, there is no notice period and JTC will work towards renewing expiry dates.
Material Topics: Occupational Health & Safety			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 54-58.
	103-2	The management approach and its components	Page 54-58.
	103-3	Evaluation of the management approach	Page 54-58.
GRI 403: Occupational Health and Safety 2018	403-1	Occupational health and safety management system	Page 54-58. Our OHS management system has been implemented in accordance with national legislations for workplace health and safety, such as the Workplace Safety & Health (WSH) Act. The system covers both our employees and contractors.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
	403-2	Hazard identification, risk assessment, and incident investigation	Page 54-58. JTC has in place an Incident Investigation Process to investigate work-related incidents: 1. Upon the occurrence of an incident, the contractor is required to immediately inform the safety officer and JTC. 2. Immediate action is to be taken by the contractor to close off the incident area and station security personnel to prevent the public from entering the area. 3. Depending on the nature and extent of the accident, a total or partial stoppage of works may be ordered to allow investigation and/or carry out remedial measures.
	403-4	Worker participation, consultation, and communication on occupational health and safety	The information is not available at the moment.
	403-5	Worker training on occupational health and safety	Page 54-58. JTC requires our contractors to send workers to the JTC Safety Induction Course, run by the Construction Safety School (worker level). Similarly, for the project team level, JTC requires the team to attend a Project Onboarding Workshop that covers safety topics. The JTC Safety Induction Course is a full-day training requirement for every construction worker and supervisor assigned to JTC construction projects. The objectives of the course are as follows: › Reinforce JTC's safety requirements at the construction projects › To provide an experiential learning to the participants in the following areas: - Human equipment interaction, - Working at height, - No gap policy, - Powered tools safety, - Work positioning and ergonomics, - Traffic management, and - Electrical safety

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
	403-6	Promotion of worker health	Page 54-58.
	403-7	Prevention and mitigation of occupational health and safety impacts directly linked by business relationships	Page 54-58.
	403-9	Work-related injuries	Page 54-58. The work-related hazards that pose a risk of high-consequence injury include: working at height, housekeeping, human equipment interaction, and temporary structural system activities.
Material Topics: Training and Education			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 59-61.
	103-2	The management approach and its components	Page 59-61.
	103-3	Evaluation of the management approach	Page 59-61.
GRI 404: Training and Education 2016	404-1	Average hours of training per year per employee	Page 59-61. In FY2021, the average training hour for male staff is 42.19hrs, and for female staff is 32.04 hrs. The average training hour for contract staff is 30.82hrs.
	404-3	Programmes for upgrading employee skills and transition assistance programmes	Page 59-61. 100% of JTC employees received performance reviews during FY2021.
Material Topics: Diversity and Equal Opportunity			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 59-61.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
	103-2	The management approach and its components	Page 59-61.
	103-3	Evaluation of the management approach	Page 59-61.
GRI 404: Training and Education 2016	405-1	Diversity of governance bodies and employees	Page 59-61. JTC Annual Report FY2021: page 4-7. Breakdown by employee category and breakdown by age group for governance bodies are not available.
Material Topics: Local Communities			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 52-58.
	103-2	The management approach and its components	Page 52-58.
	103-3	Evaluation of the management approach	Page 52-58.
GRI 413: Local Communities 2016	413-1	Operations with local community engagement, impact assessments, and development programmes	Page 52-58.
Material Topics: Customer Health and Safety			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 49-51.
	103-2	The management approach and its components	Page 49-51.
	103-3	Evaluation of the management approach	Page 49-51.

GRI Standard	Disclosure Number	Disclosure Title	Page Reference, direct responses and reasons for omissions, if applicable
GRI 416: Customer Health and Safety	416-2	Incidents of non-compliance concerning the health and safety impacts of products and services	There was 0 case incident of non-compliance concerning the health and safety impacts of services for JTC in FY21.
Material Topics: Customer Privacy			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 46.
	103-2	The management approach and its components	Page 46.
	103-3	Evaluation of the management approach	Page 46.
GRI 418: Customer Privacy 2016	418-1	Substantiated complaints concerning breaches of customer privacy and losses of customer data	Page 46.
Material Topics: Socio-economic Compliance			
GRI 103: Management Approach 2016	103-1	Explanation of the material topic and its boundary	Page 46.
	103-2	The management approach and its components	Page 46.
	103-3	Evaluation of the management approach	Page 46.
GRI 419: Socio-economic Compliance 2016	419-1	Non-compliance with laws and regulations in the social and economic area	Page 46.

JTC SUSTAINABILITY REPORT FY2021

THE JTC SUMMIT
8 JURONG TOWN HALL ROAD
SINGAPORE 609434