

January, 2023

JOBS-SKILLS QUARTERLY INSIGHTS

Skills for Engineers and Technicians
in the Green Economy



PUBLICATION BY

SKILLS *future* SG

IN PARTNERSHIP WITH



Executive Summary

In the second edition of the Skills Demand for the Future Economy Report¹ published by SkillsFuture Singapore (SSG) in November 2022, it was highlighted that engineers and technicians will need to pick up a bundle of Industry 4.0, green, and digital skills to support job roles that are emerging and in demand. Engineering will also become more important as it responds to global climate and sustainability challenges and goals under the United Nation's UN 2030 Agenda for Sustainable Development².

Coupled with many emerging and smart technologies and frontier digital innovations in the information technology space, engineers and technicians today have the tools at hand to be transformative and innovative in their practices through engineering solutions while addressing the aspirations of sustainable development and energy decarbonisation. As they take on greater roles in the development, design, manufacturing and implementation of green initiatives guided by sustainability standards and new regulations, this also means a demand for new skills to be layered onto existing ones.

This issue of Jobs-Skills Quarterly Insights looks at how the job content of engineering roles is changing, the new skills that are required, and skills-based pathways to help practicing engineers and technicians upskill. Specifically, two key trends are observable:

- 1. Cross-sector and cross-functional green skills are most highly sought after by employers for the engineering job roles in the transition towards a greener economy.** This is not surprising as more and more "brown" industries are taking steps to understand how to green their operations, products and services. Green skills such as *Energy Management and Audit, Sustainable Engineering, Environmental Sustainability Management, Environmental Management System Framework Development and Implementation* and *Renewables Energy System Management and Integration** are highly demanded and transferable across multiple engineering job roles.
- 2. The demand for the green skills reflects greening job content for existing engineers and technicians as well as the emergence of new and emerging green job roles.** Existing engineering roles are greening with more work functions and key tasks incorporating sustainability practices and climate mitigating features. New engineering job roles are also emerging. These roles require our engineers and technicians to be knowledgeable in emerging clean technologies, managing environmental sustainability, as well as possess digital skills such as *Internet of Things (IoT) Applications, Programming and Coding, and Big Data Analytics**.

¹ Skills Demand for Future Economy 2022, SkillsFuture Singapore. <https://www.skillsfuture.gov.sg/skillsreport>

² Engineering for Sustainable Development, UNESCO 2021.

* Please refer to the Annex for skill descriptions.

Introduction

The engineering workforce is a key bedrock of Singapore's economy. They are employed in multiple industries, from aerospace, precision engineering, electronics, and energy & chemicals, to air land, and sea transport, water & environmental, power, construction, and facilities management.

Today, with new decarbonisation and sustainability goals as well as the maturation of digital and Industry 4.0 technologies, engineering processes are increasingly more connected, smarter, and more sustainable. Besides domain skills in chemical, civil, electrical and mechanical engineering, engineers and technicians now need other skills in the Green Economy and Digital Economy to deal with greener and more digitalised work processes. At the same time, the technical nature of engineering jobs necessitates continuous learning and growth. Organisations play a key role in providing conducive workplace learning environments where their engineering workforce can pick up these emerging skills to drive new technological innovations and develop new sustainability solutions.

The Shift Towards Adopting Green Skills In The Engineering Sectors

Engineering is one of the main enablers for the five key pillars of the Singapore Green Plan 2030. The Institution of Engineers, Singapore (IES) has developed the IES Green Plan 2030 to outline engineering-centric action plans from 2023 to 2030 in support of the Singapore Green Plan 2030. Providing training related to sustainable development and sustainability is one of the focus areas of the IES Green Plan 2030, to equip engineering technicians, technologists and engineers with relevant skills to provide solutions to support Singapore's sustainability efforts.

Since the appointment by SSG as the Skills Development Partner for the engineering sector in August 2022, IES has been working with industry partners on the engineering skillsets for different job roles in each of the sub-sectors. Our goals are to articulate and validate priority skills, reach out to enterprises, and recognise engineering professionals through the IES Chartered Engineering Certification Scheme. This partnership will create multiple skills-based pathways for the engineering community to capitalise on opportunities in sustainability-related roles and upskilling the engineering community in the top skills required, including energy management and audit, sustainable engineering and environmental sustainability management.

To fortify institutional and national efforts in our sustainable development journey, we call for the engineering community to join us to broaden their skills for the digital and green economy. We also invite those with knowledge and experience to join and share their insights for the betterment of Singapore's growth.

Dalson Chung, President, The Institution of Engineers, Singapore

Trend 1: Cross-sector and cross-functional green skills are highly sought after by employers for the engineering job roles in Singapore’s transition towards a greener economy

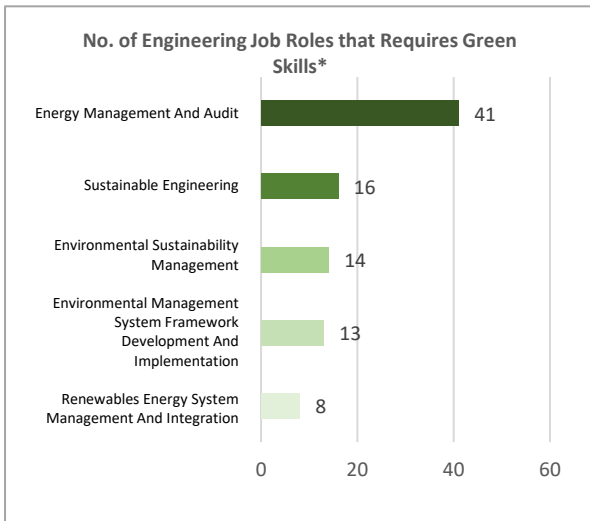
Based on SSG’s analysis of job posting data between 2018 to 2021, cross-sector and cross-functional green skills are highly sought after by engineering job roles in this transitional stage of Singapore’s green economy. Some of the top green skills with highest transferability are *Energy Management and Audit*, *Sustainable Engineering*, *Environmental Sustainability Management*, *Environmental Management System Framework Development and Implementation*, and *Renewables Energy System Management and Integration**.

company caused by operating the things that it owns or controls. Skills such as *Renewables Energy System Management and Integration* and *Energy Management and Audit** also support the control of Scope 2 emissions, which are “indirect” emissions created by the production of the energy that a company buys³. Finally, skills in *Environmental Sustainability Management* and *Environmental Management System Framework Development and Implementation**, amongst others, can help mitigate Scope 3 emissions across a company’s upstream and downstream value chain³.

Trend 2: The demand for the green skills reflects greening job content for existing engineers and technicians as well as the emergence of new and emerging green job roles

On further analysis, engineering job roles that most require the above green skills include both existing engineering roles which are greening with more work functions and key tasks focusing on environmental compliance, energy management, and climate mitigation, as well as new job roles that require our engineers to be knowledgeable in emerging low carbon and clean technologies and possess digital skills such as *Internet of Things Application*, *Programming and Coding*, and *Big Data Analytics**.

Between 2018-2021, these engineering roles with the highest hiring demand are **Energy Engineer**, **Solar PV Project Development Engineer**, **Health, Safety and Environment (HSE) Manager**, **Power Technician**, and **Facilities Engineer**.

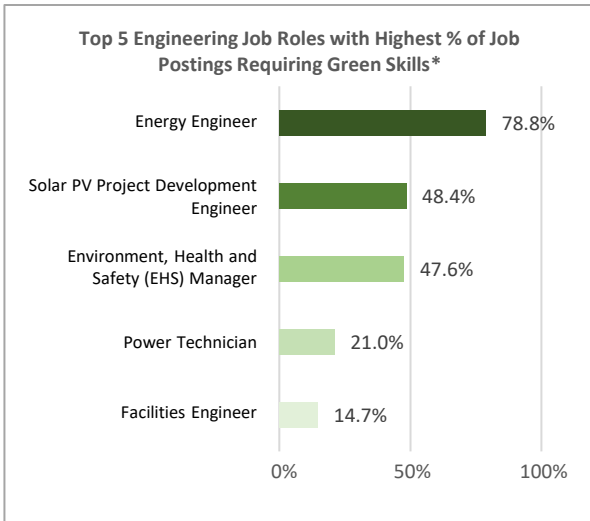


Source: JobTech and SkillsFuture Singapore

Specifically, skills such as *Energy Management and Audit*, *Sustainable Engineering*, and *Environment Sustainability Management** support the mitigation and management of Scope 1 emissions that are related to the “direct” emissions of a

³ Weforum.org

* Please refer to the Annex for skill descriptions.



Source: JobTech, Indeed.com, LinkedIn, and SkillsFuture Singapore

Trend 2A. Greening of Existing Engineering Job Roles

Existing engineering roles with greening job content include **Environment, Health and Safety (EHS) Manager** and **Facilities Engineer**. Traditionally, an **EHS Manager** assesses work environment for work hazards caused by environment or work processes. However, in today’s context, work functions also encompass the protection and sustainability of the physical work environment and work processes as well as compliance to new regulations related to environmental sustainability.

By analysing the job descriptions of the greening work functions, it is observed that a combination of green skills are required by employers. In the case of **EHS Manager**, new skills that are required include *Environmental Sustainability Management*, *Impact Indicators Measurement and Reporting*, and *Sustainability Risk Management**, on top of the regular workplace safety and health requirements and domain skills.

* Please refer to the Annex for skill descriptions.

Example of Greening Tasks	Green Skills Needed*
<ul style="list-style-type: none"> Lead and facilitate compliance, EHS and sustainability internal/external audits/surveys 	<i>Environmental Sustainability Management</i>
	<i>Impact Indicators Measurement and Reporting</i>
<ul style="list-style-type: none"> Review any statutory updates, identify relevant EHS requirements, prepare procedures towards achieving compliance to the new statutory requirement(s) 	<i>Sustainability Risk Management</i>
	<i>Environmental Management System Framework Development and Implementation</i>
<ul style="list-style-type: none"> Well versed with ISO 14001 compliance process and requirement 	

Source: Indeed.com

Similarly, today’s **Facilities Engineer** not only ensure operational efficiency of facilities services, he/she also supports sustainability efforts both in their day-to-day work and in interaction with clients such as building tenants.

Example of Greening Tasks	Green Skills Needed*
<ul style="list-style-type: none"> Promote to clients/tenants related sustainability initiatives by proposing and participating in recycling, energy, waste reduction, sustainability program 	<i>Environmental Sustainability Management</i>
	<i>Green Facilities Management</i>
<ul style="list-style-type: none"> Ensure compliance with client policies and procedures, government regulations and internal SOP pertaining to environment, health and safety, procurement, financial policies 	<i>Sustainability Risk Management</i>
	<i>Environmental Management System Framework Development and Implementation</i>
<ul style="list-style-type: none"> Knowledge of Energy Reduction and Sustainability Programs 	

Source: LinkedIn

Trend 2B. New/Emerging Green Job Roles

New/emerging green job roles, such as roles in solar PV development and deployment and energy sustainability engineering, are also growing. Besides functional domain skills such as in



What are the frontier green skills which engineers should be equipped with to capitalise on the opportunities in the growing green economy?

As Singapore positions herself to be a premier in green, digital and financial hub, engineers have an enabling role in nurturing the growth of these symbiotic hubs. To participate, contribute and benefit from the ongoing transformation of Singapore, both young as well as senior engineers need to acquire relevant knowledge and skills. As part of the IES Green Plan 2030, one of our key goals is to guide our engineers in re-skilling and up-skilling in areas that matter most in the unfolding green economy - with a sharp focus on digital technologies.

Every sector in the green economy revolves around digital technologies. In the energy sector, digital technologies are used to monitor energy supply and use, enhance energy efficiency, interface renewable energies with energy grids and its management, and generate carbon footprint and sustainability reports. In the water sector, digital technologies are harnessed to monitor water supply and leakages, so as to enhance water circularity and reduce water footprint per capita.

The same goes for data centres, where digital technologies are utilised to lower the energy consumption of data centres. Green engineering digital solutions, including personal and mass mobility, also drive the transformation of land, sea and air transportation. Furthermore, digitalised engineering technologies are key in improving the delivery of nutrients and water in urban farming, as well as circular economy of key waste streams of Singapore including electronic, food and packaging waste.

Similar, digital technologies are at the core of life cycle assessment of products and services to assess their carbon footprint and to generate digital product passports. Life cycle engineering can enhance those credentials via manufacturing and supply chain optimisation and predictive maintenance. Annual ESG reporting or sustainability reporting expected of various companies and organisations leverage digitalised engineering solutions for data collection, monitoring, automated reporting, efficiency and transparency.

Digitalisation of engineering for green economy leverages several technologies such as internet of things (IoT), industrial internet of things (IIOT), big data analytics, cloud computing, machine learning, artificial intelligence, smart sensors and embedded software, 5G networks, drones, satellites, additive manufacturing, remanufacturing, biomanufacturing, cyber security, block chain, digital labelling, automation, robotics, digital twins, modelling and simulation. Acquiring these skills would certainly enhance the competitiveness and relevance of our engineers.

Dr Seeram Ramakrishna, Professor of Materials Engineering; Chairman of Circular Economy Taskforce, NUS; Advisor to the IES Green Plan 2030

engineering maintenance and operations, these roles also require our engineers to be knowledgeable in emerging clean technologies, managing environmental sustainability, as well as possess skills such as *Internet of Things (IoT) Applications, Programming and Coding, and Big Data Analytics**.

For example, looking at the job responsibilities of a **Battery Energy Storage Systems (BESS) Solar Engineer**, he/she is also required to pick up skills in clean energy systems such as Battery Systems Design Management, Smart Grid Implementation and Integration, and digital skills such as *Internet of Things (IoT) Applications and Big Data Analytics**.

as *Green Building Strategy Implementation and Smart Facilities Management** are required.

Example of Green Job Responsibilities	Green and Digital Skills Needed*
<ul style="list-style-type: none"> Monitor the energy usage and performance of facilities, productions, including planning for necessary improvement toward carbon footprint reduction 	<i>Energy Management and Audit</i>
	<i>Carbon Footprint Management</i>
<ul style="list-style-type: none"> Lead in the reporting towards various statutory requirement and equivalent. Examples are Energy Use Report, Carbon Pricing Act, Energy Efficient Opportunities Assessment and Energy Management System. 	<i>Sustainability Reporting</i>
	<i>Environmental Sustainability Management</i>
<ul style="list-style-type: none"> Reporting of carbon footprint, sustainability goals & targets 	<i>Green Building Strategy Implementation</i>
	<i>Green Facilities Management</i>
<ul style="list-style-type: none"> Strong background in operations, maintenance, engineering of Heat, Ventilation, Air-Condition (HVAC), lighting, Mechanical and Electrical (M&E) systems and project management of energy and carbon efficiency programs 	<i>Big Data Analytics</i>
	<i>Programming and Coding</i>

Source: LinkedIn

Example of Green Job Responsibilities	Green and Digital Skills Needed*
<ul style="list-style-type: none"> Provide engineering review and support for engineering design, energy modelling and data performance for renewable energy projects such as BESS and solar projects 	<i>Energy Management and Audit</i>
	<i>Carbon Footprint Management</i>
<ul style="list-style-type: none"> Implement engineering and design using software of grid-connected BESS power generation and distribution systems, including standalone or integrated renewable technologies 	<i>Smart Grid Implementation and Integration</i>
	<i>Battery Systems Design Management</i>
	<i>Internet of Things (IoT) Applications</i>
	<i>Big Data Analytics</i>

Source: Jobstreet

Emerging job roles in the facilities operations and maintenance (O&M) space are also observed. For instance, an **Energy Sustainability Engineer** requires cross-functional green skills in *Energy Management and Audit, Carbon Footprint Management, and Sustainability Reporting**. This is in addition to function-specific green skills such

Call to Action

Engineers and technicians will increasingly play a greater role in the actual development, design, manufacturing and implementation of green and sustainable initiatives guided by sustainability standards and new regulations. Our engineers and technicians need to be empowered through continuous skills development related to the green and digital economy and be given opportunities to sandbox creative engineering approaches to solve sustainability challenges. Existing engineers as well as new entrants can look forward to a series of professional certification programmes and courses offered by both industry bodies and Institutes of Higher Learning (IHLs).

* Please refer to the Annex for skill descriptions.

IES Chartered Engineering Certification Schemes

To stay relevant amidst the world's pivot towards a more sustainable future, engineers and engineering professionals should upskill themselves to capitalise on opportunities in green or greening roles.

The recognition of skills mastery in technical competencies will provide engineering professionals with a career progression pathway that ultimately can see them take on leading roles as the subject matter experts in their practicing domains.

The Chartered Engineering Certification Scheme, mooted and administered by The Institution of Engineers, Singapore (IES), is one such pathway. It enables engineers, technologists and technicians, who have demonstrated sufficient work experience and are assessed to be competent, to be certified and able to progress from Chartered Technician to Chartered Technologist and then to Chartered Engineer.

This is one of the key pillars in IES to build an inclusive engineering community where a practising engineering technologist or technician can aspire to become a Chartered Engineer, progressing through the academic and/or the non-academic pathway, and continuously upskill and reskill themselves to take on the growing opportunities.

The Institution of Engineers, Singapore

Examples of courses for the Green Economy

- [Energy Measurement and Audit \(IES Academy\)](#)
- [Improve Manufacturing Productivity through Energy Usage Pattern Monitoring and Analysis \(SIMTECH\)](#)
- [Environment, Social and Governance \(ESG\) and Materiality Reporting \(SMU\)](#)
- [Greenhouse Gas \(GHG\) Emission, Carbon Tax and Energy Efficiency \(Temasek Polytechnic\)](#)
- [Design of Clean Energy Systems \(NTU\)](#)

Please visit this link for information on suggested courses for the Green Economy.

<https://go.gov.sg/green-econ-courses>



Examples of courses for the Digital Economy

- [Data Analytics Essentials \(in PDC in Smart Technology in Specialist Diploma in Industrial Informatics\) \(Temasek Polytechnic\)](#)
- [IoT for Engineers \(Ngee Ann Polytechnic\)](#)
- [Feature Engineering & Analytics using IOT Data \(NUS\)](#)
- [Programming Methodology \(NUS\)](#)
- [Sensor and Communication for AIoT Solutions \(Singapore Polytechnic\)](#)

Please visit this link for information on suggested courses for the Digital Economy.

<https://go.gov.sg/digital-econ-courses>



For more information on the job-skills insights and priority skills highlighted in the Green Economy, Digital Economy and Industry 4.0 in the Skills Demand for the Future Economy 2022, you can download our skills report and full list of skills from this link

<https://go.gov.sg/sdfe>



Let us know how this report has helped you. You can also share with us other insights that you would like to find out more from us.

<https://go.gov.sg/jan2023jsi-greeneconomy-feedback>



Skills Title	Skills Description
<i>Carbon Footprint Management</i>	Quantify and reduce the organisational carbon footprint
<i>Big Data Analytics</i>	Apply data analytics techniques and tools to analyse significant volumes of data and draw patterns and trends for investigating business problems
<i>Battery Systems Design Management</i>	Design and review battery systems according to capacity requirements and site constraints
<i>Energy Management and Audit</i>	Perform energy audits to optimise the energy performance of energy consuming systems and manage energy consumption
<i>Environmental Management System Framework Development and Implementation</i>	Develop Environmental Management System (EMS) frameworks and implement procedures and practices to ensure compliance with legal and organisational requirements as well as commitment to environment protection
<i>Environmental Sustainability Management</i>	Integrate environmental sustainability through the development, implementation and review of sustainability strategies and programmes against industry best practices
<i>Green Building Strategy Implementation</i>	Develop environmental sustainability plans throughout the building lifecycle through the development, implementation and review of sustainability strategies to enhance environmental performance
<i>Green Facilities Management</i>	Manage facility operations and maintenance to minimise environmental impact and operational costs efficiently
<i>Impact Indicators Measurement and Reporting</i>	Analyse, monitor and report impact of sustainability actions and lead the organisation in setting impact mission and targets for the organisation or customers
<i>Internet of Things (IoT) Applications</i>	Implement Internet of Things (IoT) technologies to drive efficiency and effectiveness of operations
<i>Programming and Coding</i>	Develop technical capabilities to understand, design and write instructions to be processed by computers as software programmes to achieve desired outcomes
<i>Renewable Energy System Management and Integration</i>	Analyse impact of renewable energy system integration on energy grid in steady state and during dynamic operation.
<i>Smart Grid Implementation and Integration</i>	Develop and implement an integrated smart grid system using various distributed energy sources and energy management systems.
<i>Sustainable Engineering</i>	Design, construct and operate engineering systems and assets to optimise energy management and enhance environmental performance
<i>Sustainable Manufacturing</i>	Manage efficient use of energy and other utility resources to promote sustainable manufacturing operations
<i>Sustainable Reporting</i>	Lead development of organisation's sustainability reporting and accounting policies and processes in line with regulatory requirements and international best practices
<i>Sustainability Risk Management</i>	Develop frameworks, strategies and policies for managing sustainability risks for the organisation to minimise and mitigate risks and impact to the organisation

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