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## Abstract

This research examines key aspects of the renewable energy skills landscape, with a focus on priority sectors identified as having high potential for inclusive renewable energy (RE) value chain localisation, and development, in the Western Cape. The analysis includes occupation and skill requirements, national and provincial employment trends, insights from Technical and Vocational Education and Training (TVET) colleges, and perspectives from industry. By integrating diverse sources of information, the study offers a comprehensive and nuanced analysis of the skills landscape underpinning these sectors. High levels of technical skills are needed within the sectors, with considerable overlap across sectors. Although the TVET colleges differ in their approaches to renewable energy training, all have demonstrated a commitment to providing this training. Most businesses identified deficiencies in soft skills as critical workforce challenges, as well as limited access to financing and unpredictable demand as core barriers to growth. Business insights highlight the importance of a versatile and agile workforce capable of responding effectively to changes in market demand. Embedding renewable energy content into existing TVET qualifications may assist in the development of such a workforce by producing graduates with the requisite agility and foundational expertise to meet changing demand dynamics.

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## 1. Introduction

This work investigates the occupations and skills required within key renewable energy sectors in the Western Cape to assist in informing policy development. The study builds on the concurrent National Business Initiative's work, which has identified priority sectors within the solar, wind and energy sector value chains, these being i) battery storage and renewable energy component recycling; ii) solar installation, repair and maintenance; and iii) battery assembly. It approaches the investigation from various angles to obtain a multi-faceted perspective on the status of the value chains in these priority areas. Both the labour demand and supply side perspectives are considered, with a focus on the identification of the required occupations and skills; estimates of employment in applicable occupations; skills training insights from Technical and Vocational Education and Training (TVET) colleges; and perspectives from businesses operating in the priority sectors. The diverse approaches bring together various sources of data and information to provide a detailed, and nuanced picture of the identified sectors within the key renewable energy value chains. These distinct perspectives complement each other to deepen the knowledge and understanding of the numerous aspects driving each sector.

From the labour supply perspective, the occupations and requisite skills for the relevant renewable energy value chains are identified first: solar, wind and energy storage. International literature is used to compile the required occupations and skills, which are then converted via a crosswalk to the South African occupation classification systems to be used within the South African data context. The next step is to estimate employment in renewable energy-related occupations in South Africa, using national labour market datasets, providing the big picture in terms of the trends in national and provincial-level labour supply. An additional output of the work is an extensive dataset on the skills and education requirements of each occupation.

The study then shifts to focus on the labour demand side, where the business aspect of the value chains is considered. While firm-level survey data is available, it does not provide sufficient information on the occupations of workers, which is required for this study (Statistics South Africa, 2024). As such, semi-structured interviews were conducted with local businesses to better understand their skill and occupation requirements, the related challenges they face, and the potential for growth within the priority sectors.

The third core component of the project examines the provision of skills. Information on skills delivery sits as a bridge between the supply and demand side of labour - a worker needs to acquire the necessary skills which are demanded by employers. Interviews were conducted with the three TVET colleges in the City of Cape Town to gain a better understanding of the current renewable energy-related training provided, as well as the potential for expanding this training.

Bringing together these various sources of information provides a rich depiction of the renewable energy priority sectors in the Western Cape to support evidence-based policy and decision making. While the research presents numerous sector-specific conclusions, certain overarching insights apply to all sectors: All sectors require a high degree of technical and theoretical skill, while most employment in the required occupations represents those in entry level positions with low educational attainment. The workforce in high-level occupations is smaller and dispersed across multiple industries. As a result,

new businesses within these sectors might face challenges in recruiting the highly skilled employees needed, or may need to offer increased remuneration initially to attract these workers. Secondly, the interviews with businesses revealed that a lack of soft skills, such as problem-solving and decision-making, presents challenges, suggesting a potentially broader lack of these skills in the labour market. Moreover, limited access to financing and unpredictable demand present significant challenges for businesses across the priority sectors. A versatile, multiskilled workforce is crucial, as it allows companies to adapt to fluctuating market conditions, and mitigate risks stemming from the uncertainty of national power provision. Finally, while opinions expressed by the three TVET colleges differed, all reported that they intend to provide renewable energy training, and the integration of renewable energy training into broader programmes was highlighted. This aligns with the business needs of a multiskilled, agile workforce, as such integration should produce graduates capable of adapting to evolving industry demands.

The study begins with a detailed overview of the project methodology, followed by general insights from the TVET colleges regarding renewable energy training, which are applicable across all the subsequent priority sector sections. The next three sections focus on battery storage and renewable energy component recycling; solar installation, repair and maintenance; and battery assembly. Each sector-specific section covers occupational requirements, estimated employment figures, business insights, and the relevant TVET college training. The subsequent section covers additional insights gathered from businesses that fall outside of the priority sectors, but which are related to the renewable energy sector more broadly. The study concludes with a summary and discussion.

## 2. Project Methodology

This section describes the approaches to collecting data on the occupation requirements within each priority sector, and subsequent alignment of these requirements with South African occupational classification systems for employment estimation. Following this is a description of the development of two interview instruments designed to obtain insights from TVET Colleges in the City of Cape Town and businesses operating within the identified priority sectors.

### 2.1 Occupations required in the renewable energy value chains

Each priority sector is linked to a specific renewable energy type and phase of the value chain. The comprehensive lists compiled in the following steps are restricted to only those occupations required in the renewable energy value chain phases linked to the priority sectors. Occupations are then matched to South African occupational codes, allowing for employment estimation. Each of these steps is discussed in detail below.

#### *Sources of occupational information*

##### I. Solar Occupations

Three resources form the basis of the list of occupations required in the solar PV value chain. The first is the International Renewable Energy Agency's (IRENA) *Renewable Energy Benefits: Leveraging Local Capacity for Solar PV*. This report outlines each stage of development of a utility scale solar PV project: project planning, manufacturing and procurement, transport, installation and grid connection,

operation and maintenance and decommissioning. For each stage of development, the report provides an overview of the occupations required (International Renewable Energy Agency, 2017b). IRENA is an intergovernmental organisation that promotes the widespread adoption and sustainable use of renewable energy globally. Established in 2011, they aim to support countries in their transition to renewable energy systems by providing knowledge, policy advice, and technical assistance. They have a long record of producing research concerning renewable energy around the world. Their reports, including those used in this project, have been used in various academic articles (Dominish *et al.*, 2019; Chellakhi, El Beid and Abouelmahjoub, 2022; Okika *et al.*, 2025).

The second resource is the *Solar Career Map*. This map was created by the United States' *Interstate Renewable Energy Council* (IREC), which is an independent nonprofit organisation seeking to increase the adoption of clean energy and energy efficiency, and has been referenced in academic literature (Interstate Renewable Energy Council, 2024; Zawaydeh, 2017; Saxe, Boman and Righetti, 2021).

These two resources are supplemented by the American Clean Power Association's (ACP) *Clean Energy Career Pathways Catalog: Solar Energy* (American Clean Power, 2023). ACP is an advocacy organisation for the United States clean energy industry, representing companies operating in the wind, solar, energy storage, clean hydrogen and transmission sectors. They aim to expand the market for clean energy by shaping federal and state policy, and providing market analyses and research (American Clean Power Association, 2025). While no academic articles that reference the ACP resources used in this project were found, other ACP research has been referenced in various academic articles (Bastasch, 2022; Hoen *et al.*, 2023; Ellenbogen, Kellam and Hankard, 2024; Douville *et al.*, 2025). The ACP's report and the Solar Career Map provide detailed information on education, skill and work experience requirements and a description for each occupation they identify. The occupations across all three resources are combined to create a comprehensive list of occupations required in the solar energy value chain.

## II. Energy Storage Occupations

Two resources are used to develop the list of occupations required for the energy storage value chain. The first is a career map developed by Environmental Careers Organisation Canada (ECO Canada) for occupations involved in the EV battery supply chain. ECO Canada is a national non-profit organisation that focuses on advancing the environmental workforce in Canada. The organisation's main mission is to connect people to environmental careers and support the development of a sustainable and skilled workforce for the environmental sector (Environmental Careers Organization of Canada, 2025). Although an academic article referencing the specific report used in this project has not been identified, other reports have been referenced in academic literature (Barbier, 2016; VanWynsberghe, 2016; OECD, 2024). The EV battery supply career map contains lists of occupations involved in four aspects of the value chain for batteries: Mining, Battery Production, EV Production and Battery storage recycling. This report focuses on energy storage applications of battery systems, therefore the occupations listed in the EV Production phase have been excluded from the final list (Environmental Career Organisation Canada, 2024). A second resource supplemented these occupations - *Energy Storage: Clean Energy Career Pathways Catalog*, which was produced by American Clean Power. It outlines occupations across four phases of the energy storage value chain: Project Development, Operations and Maintenance, Manufacturing and Construction/ Installation. The use of both of these

resources facilitates the compilation of a comprehensive list of occupations across the entire value chain from Mining to Recycling (American Clean Power, 2022a).

Due to the absence of pertinent South African resources, this project component utilises international data. While this introduces potential issues concerning local applicability, the essential competencies necessary for the establishment of renewable energy systems are largely uniform worldwide (International Renewable Energy Agency, 2017a, 2017b). Although the competencies may remain fairly consistent, their specific occupational representations can differ, necessitating the use of country-specific classification systems. Thus, in the following step, the occupations defined within the international context are aligned with local occupational classifications, thereby ensuring their relevance to the South African context.

#### *Priority sectors of renewable energy value chains in the Western Cape*

This research forms part of a National Business Initiative (NBI) project that is piloting a methodology for identifying inclusive renewable energy (RE) value chain localisation and development opportunities in the Western Cape and aligning these with the skills ecosystem. The project created a map of RE value chain components for wind, solar, and battery storage, and identified four priority opportunities for localisation: battery storage; renewable energy component recycling; solar installation, repair and maintenance; and battery assembly.<sup>1</sup>

To build on this work, this report identifies occupations required in each sector by matching each sector to its corresponding renewable energy type, and location, within the value chain (e.g. battery storage assembly is matched to the manufacturing phase of energy storage), and then restricting the initial comprehensive lists of occupations to focus on these specific value chain phases. Given the substantial overlap in occupations and skills, battery and component recycling are analysed jointly.

#### *Mapping estimated employment in occupations required in the priority sectors*

Estimates of employment in the priority area occupation lists are derived using South African labour market data. Several steps are required in applying international renewable energy occupation codes to South African data as the occupation classification systems differ. Occupation classification systems are frameworks of codes assigned to various occupations. The International Labour Organization defines occupations as "a set of jobs whose main tasks and duties are characterized by a high degree of similarity," in contrast to a job, which is described as "a set of tasks and duties performed, or meant to be performed, by one person, either for an employer or in self-employment" (International Labour Organisation (ILO), 2025). South Africa utilises two distinct systems for classifying occupations: the Organising Framework for Occupations (OFO), developed and maintained by the Department of Higher Education and Training (DHET), and the South African Standard Classification of Occupations (SASCO), created and maintained by Statistics South Africa. A series of crosswalks is required from the international classification system to the OFO and then to the SASCO, as detailed in Table 1 below. The methodology is an adaptation of that developed by Davidson et al (2024).<sup>2</sup>

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<sup>1</sup> This project is supported by Danish Industry in formal partnership with the Western Cape Government.

<sup>2</sup> Davidson, K., De Lannoy, A., Grotte, J., Jana, A., David, A., Leibbrandt, (2024). An Analytical Framework to Assess Green Transition Jobs in South Africa. Cape Town: Southern Africa Labour and Development Research Unit, University of Cape Town. (SALDRU Working Paper Number 309)

**Table 1: Steps in estimating employment in renewable energy related occupations in South Africa**

Steps	Worked Example
<p>1 Crosswalk or match the occupation required in the priority area to the 6-digit Organising Framework for Occupations (OFO) system. Matching is done manually, with some straight matches and other less straightforward matches. The descriptions of the occupations, their location within their respective classification systems (where provided), and the alternative occupation titles provided by both classification systems, are used to match the renewable energy related occupations with the OFO codes.</p>	<p>Several resources including the <i>Wind Energy Career Map</i> identify Crane operators as being required in the end-of-life or recycling phase of the wind value chain. This can be matched to <i>Crane or Hoist Operator</i>, code 734301, in the OFO.</p>
<p>2 Calculate a 'renewable energy occupation' measure, which is the proportion of the 6-digit OFO renewable energy occupations in the 4-digit OFO occupations.</p>	<p>734301 <i>Crane or Hoist Operator</i> is part of the 7343 <i>Crane, Hoist and Related Plant Operators</i> minor group OFO occupation code. This minor group occupation code has three 6-digit occupation codes in total, including 734301 <i>Crane or Hoist Operator</i>. The proportion of 'renewable energy occupations' assigned to 7343 <i>Crane, Hoist and Related Plant Operators</i> is 0.333 (1/3). It is assumed that employment is uniformly distributed among the 6-digit occupations.</p>
<p>3 Match 4-digit OFO occupation codes to 4-digit South African Standard Classification of Occupations (SASCO) codes using the crosswalk developed by the Department of Higher Education and Training (DHET).</p>	<p>The DHET crosswalk matches 7343 <i>Crane, Hoist and Related Plant Operators</i> OFO occupation code to 8333 <i>Crane, hoist and related plant operators</i> 4-digit SASCO occupation code. The proportion of 'renewable energy occupations' in SASCO 4-digit occupation code 8333 <i>Crane, hoist &amp; related plant operators</i> is thus 0.333 as calculated in Step 2. This represents the 'renewable energy measure' for that occupation code.</p>
<p>4 Calculate an average 'renewable energy measure' for the relevant 3-digit SASCO codes. Repeat this process until the 2-digit level is reached.<sup>3</sup></p>	<p>The SASCO 4-digit occupation code, 8333 <i>Crane, hoist and related plant operators</i>, is part of the 3-digit occupation code 833 <i>Agricultural and other mobile plant operators</i>. There are two 4-digit codes identified as containing 'renewable energy occupations' under this 3-digit code, including 8333, and four 4-digit occupations in total under this 3-digit code.</p> <p>The same assumption of uniform employment is applied here. Thus, an average of the 'renewable energy measures' under this 3-digit code is calculated i.e. the 'renewable energy measures' of the two 4-digit codes are added together and divided by four.</p> <p>Both 8333 <i>Crane hoist &amp; related plant operators</i> and 8334 <i>Lifting-truck operators</i> occupation codes have a 'renewable energy' measure of 0.333. These are added together and then divided by four to produce a 'renewable energy' measure of 0.667 <math>((0.333+0.333)/4)</math> for 833. <i>Agricultural and other mobile plant operators</i>.</p> <p>This step is repeated to calculate the 'renewable energy measures' at the 2-digit level.</p>
<p>4 Multiply the 'renewable energy measure' of the 2-digit SASCO code by the number of workers in that occupation to estimate the number of workers in occupations required in the priority area within that occupation code.</p>	<p>If there are 23 000 workers employed in the 83 <i>Drivers and mobile plant operators</i> SASCO occupation code, we estimate that there are 851 (23 000 x 0.037) workers within that occupation code that are in occupations required in the priority area.</p>

### Data

The employment estimates rely on data from Statistics South Africa's Labour Market Dynamics and Quarterly Labour Force Survey covering the period from 2012 to 2024 to estimate employment in the occupations required within the priority sectors for the Western Cape (Statistics South Africa, 2012-

<sup>3</sup> Although the Labour Market Dynamics and Quarterly Labour Force Survey data classify occupations at the 4-digit level, the sample sizes at that level for the Western Cape are insufficient to reliably estimate employment at this level of granularity. Consequently, estimates are derived at the 2-digit occupation level to improve the reliability of the estimates.

2024). Data collection methods used for the 2020 and 2021 data differ from those employed for the other years of data due to the Covid pandemic. This led to small samples which may impact the employment estimations; however, Statistics South Africa did introduce an additional weighting procedure to account for this. Further information can be found in the metadata documents for the data.

## **2.2 Interviews with businesses**

To understand the skill and occupation requirements, and related challenges within the priority sectors, semi-structured interviews were conducted with businesses in the Western Cape. The development of the interview instruments started with a review of several existing survey tools. The United Kingdom Office for National Statistics administers the Low Carbon and Renewable Energy Economy Survey to gather insights from businesses and enhance understanding of the renewable energy sector (Office for National Statistics United Kingdom, 2025). The World Bank conducts a broad-based business survey to compile data on various aspects, including infrastructure and service availability, management practices, market competition, financial conditions and workforce skill requirements (World Bank, 2023). Additionally, the European Training Foundation, as well as the European Centre for the Development of Vocational Training and the International Labour Office on conducting skills surveys provided further guidance (European Training Foundation, International Labour Office, and European Centre for the Development of Vocational Training, 2017). Drawing from these resources, questions were compiled focusing on the following key themes: current skill requirements for employees, current supply of required skills and demand for labour, and skills development.

In addition, to obtain more granular occupational information within these firms, a comprehensive spreadsheet was constructed, detailing occupations required for the sector. Respondents completed this spreadsheet by indicating whether they employ the listed occupations and providing additional details about each role - including required qualifications, levels of technical expertise required, and degree of renewable energy knowledge needed for the role.

## **2.3 Interviews with TVET Colleges**

Semi-structured interviews were conducted with TVET colleges in the City of Cape Town to gain a better understanding of the current renewable energy-related training provided, as well as the potential for expanding this training. Comparable approaches to surveys specifically focused on TVET colleges, or educational institutions, regarding their renewable energy training programmes were not identified. Although several surveys have been conducted with TVET colleges for other purposes, none provided guidance relevant to the aims of this component of the study. As a result, the interview material was based on a detailed examination of existing renewable energy qualifications in South Africa, as well as national curriculum documents and subject guidelines related to renewable energy qualifications offered at TVET colleges. A spreadsheet was produced containing information relating to the renewable energy qualifications offered by the college, and the interview questions covered various topics including work experience assistance, plans for expansion of renewable energy training and collaborations with industry.

### 3. The role of TVET colleges in the provision of renewable energy training

Technical and Vocational Education and Training (TVET) colleges play a central role in renewable energy skills development across the priority sectors. Considering the overarching perspectives and insights from the colleges provides important context before turning to the individual priority sectors. This section brings together insights on existing renewable energy training programmes and the colleges' plans for the future provision of this type of training. The respondents hold academic leadership positions within their respective colleges, with direct knowledge of, and involvement in, the various programmes discussed.

#### 3.1. Current provision of renewable energy training

Table 2 presents eight TVET qualifications covering renewable energy topics, and indicates which colleges offer, or intend to offer, the qualification. This list of qualifications was drawn from searches of national guidelines for TVET college programmes for those explicitly covering renewable energy.

**Table 2: TVET College Renewable Energy Programmes<sup>4</sup>**

Type	Programme	Colleges offering programme	Colleges that plan to offer programme
Skills Programme	Renewable Energy Workshop Assistant		False Bay TVET College
Occupational Certificate	Solar Photovoltaic Standalone System Mounter	Northlink TVET College	False Bay TVET College
National Occupational Certificate	Solar Photovoltaic Standalone Systems Installer		False Bay TVET College; Northlink TVET College
Higher Occupational Certificate	Solar Photovoltaic Standalone Service Technician	False Bay TVET College	Northlink TVET College
Higher Occupational Certificate	Solar Photovoltaic Service Technician		False Bay TVET College; Northlink TVET College
Occupational Certificate	Wind Turbine Service Technician		
Advanced Occupational Diploma	Renewable Energy Technologist		False Bay TVET College
National Certificate: Vocational	Renewable Energy Technologies (elective subject)	False Bay TVET College	

The eight programmes predominantly focus on solar energy, with four dedicated to this area of study, whereas wind energy is represented by only one programme, which is neither currently offered by any of the TVET colleges nor planned for future implementation. Three programmes cover content relating to multiple types of renewable energy, and are only offered by False Bay TVET College.

The solar focused programmes aim to equip students with skills in solar installation, repair and maintenance – an identified priority sector. A review of the curricula for these programmes reveals

<sup>4</sup> Initially, this project included two further TVET college programmes in this list of renewable energy programmes: Energy Performance Certificate Practitioner and Energy Efficiency Technician (Energy Audit Technician). However, upon further review, it was determined that these programmes should be excluded, as they do not explicitly cover renewable energy material. False Bay TVET College plans to introduce both programmes, while the College of Cape Town currently offers the Energy Performance Certificate Practitioner programme.

that, among the NQF level 4 qualifications, both Solar Photovoltaic Standalone Systems Installer and Mounter programmes are included, with the Installer programme being more comprehensive, encompassing electrical components of solar energy systems. At NQF level 5, the Solar Photovoltaic Service Technician and the Solar Photovoltaic Standalone Service Technician programmes also differ in scope, with the former including training on inverters, transformers and interconnections, while the latter primarily focuses on the mechanical elements of solar energy system installation (South African Qualifications Authority, 2025e, 2025c, 2025d, 2025b).

At the entry-level in the general renewable energy programmes, the Renewable Energy Workshop Assistant, an NQF level 4 Skills Programme, offers a one-month introduction to basic skills needed to work in the renewable energy industry, including the identification, selection and use of hand and power tools. It requires a Grade 9 (NQF level 1) equivalent qualification (Quality Council for Trades and Occupations, 2025). At the advanced level, the Renewable Energy Technologist, an NQF level 7 Advanced Occupational Diploma, covers a range of renewable energy topics from contract management in the renewable energy environment, to applied physics and energy conversions, to financial modelling for renewable energy projects. The programme requires entrants to have completed an NQF level 6 qualification in power generation, electrical engineering or mechanical engineering. NQF Level 6 qualifications are those at the level of Diplomas or Advanced Certificates (South African Qualifications Authority, 2025a). The Renewable Energy Technologies elective subject is offered as part of the National Certificate: Vocational Electrical Infrastructure Construction programme. This three-year programme is designed to equip graduates with the skills required to pursue careers in various sectors related to electrical systems. The elective subject provides foundational knowledge on multiple forms of renewable energy, including hydrogen and fuel cell technology, as well as e-mobility (Department of Higher Education and Training, 2015).

False Bay and Northlink TVET colleges have begun offering some of these renewable energy programmes and are actively planning further expansions. False Bay TVET College currently offer the Solar Photovoltaic Standalone Service Technician and the Renewable Energy Technologies elective subject as part of the National Certificate: Vocational Electrical Infrastructure Construction. In contrast, Northlink TVET College presently provides only the Solar Photovoltaic Standalone System Mounter, which forms part of their Electrician Occupational Certificate. Both colleges are seeking to offer more of these programmes in the future. In contrast, the College of Cape Town does not offer, nor do they currently plan to offer, any of these renewable energy programmes.

### **3.2. Barriers and motivations**

The College of Cape Town cited two concerns leading to their decision not to offer any of the renewable energy programmes: long term employment prospects for graduates, and funding to develop and provide these programmes. According to the respondents, renewable energy projects are unlikely to generate significant long term employment opportunities. They argue that while these projects typically require substantial numbers of workers during the initial stages, the demand for workers decreases once installations are completed, as only a limited number of personnel are needed for ongoing maintenance. Given these dynamics, they contend that employment sustainability should be a key consideration before implementing any programme.

Moreover, the College of Cape Town identified sectors that may provide more sustainable career opportunities for graduates. The identification of these sectors is based on their experience when engaging with employers and other partners on the best way forward concerning renewable energy training. One such area is the electric vehicle sector, where mechanics could either specialise or expand their existing expertise through training in electric vehicle maintenance and production. Another example provided is the demand for electricians skilled in electric vehicle charging point installation and maintenance, which is expected to increase with the growing adoption of electric vehicles. Furthermore, the College works on the understanding that programmes focused on electrical systems training are particularly relevant to renewable energy projects, which require workers with extensive electrical expertise. Thus, the Pinelands campus of the College of Cape Town specialises in electrical training and has partnered with Schneider Electric to offer students advanced electrical education.

Another key challenge cited is the funding of such programmes, particularly in the absence of ministerial approval. Since these programmes have yet to receive this approval, they are ineligible for government funding through the annual grant, necessitating financial support from external sources or through increased tuition fees. Under the current funding structure, TVET colleges receive an annual grant that covers 80% of the programme costs for students who meet the entry qualifications, with the remaining 20% financed through tuition fees (Department of Higher Education and Training, 2019). However, this grant applies only to those programmes approved by the Department of Higher Education and Training. As none of these renewable energy programmes have received this approval, they do not qualify for this funding allocation.

While Northlink TVET College acknowledged that funding would be a determining factor in the expansion of renewable energy programmes, they expressed confidence in their ability to secure the necessary financial resources. False Bay also did not reflect any concerns over accessing funding; however, they noted that the funding opportunities offered by the Sector Education and Training Authorities (SETA) are not always aligned with the college's academic year, which posed challenges. Furthermore, the Northlink and False Bay TVET colleges both reported high demand for graduates with the skills garnered in the renewable energy training programmes. Northlink noted that students who had completed their Solar Photovoltaic Standalone System Mounter programmes have a 100% placement rate in work experience opportunities within renewable energy businesses, and that many of these students had received full time employment offers before completing their qualification. False Bay revealed that they had received many requests from businesses for their staff to receive renewable energy training, and for graduates with these skills to be placed with them for work experience. These reports do not necessarily contradict the concerns of the College of Cape Town, as their concerns are around the sustainability of these positions. They agree that many workers with these skills may be required initially, but the question they raise is how long-term these positions will be.

Northlink and False Bay TVET College highlighted a lack of trained educators to adequately staff these programmes as a significant barrier to implementing additional renewable energy programmes. Both colleges acknowledged ongoing difficulties in retaining qualified staff, noting that instructors who received training often leave for higher paying opportunities elsewhere. Northlink College further indicated that the strong emphasis on training electricians exacerbates the issue, as it reduces the availability of trainers for renewable energy programmes, adding further strain on staffing resources.

In sum, the three colleges approach the provision of renewable energy differently. The College of Cape Town has taken a more cautious approach which is led by a concern over the sustainability of work in the solar installation, repair and maintenance sector. They argue that while there may be many job opportunities initially, the longevity of these positions is uncertain. The other colleges did not report this same concern and rather focused on the fact that students with solar installation, repair and maintenance training are in demand, as well as there being students who want to pursue this type of training. In addition, the College of Cape Town differs on the matter of funding, as they reported this as a key barrier to implementing the programmes listed in Table 8, while the Northlink and False Bay TVET colleges were more positive about their prospects for generating funding for these programmes. Moreover, these colleges both reported a lack of trained educators and difficulties retaining trainers as key barriers to implementing renewable energy programmes. These barriers and motivations apply to both the colleges' current provision of training, as well as future provision.

### **3.3. Plans for future provision of renewable energy training**

This section outlines the plans that each college has for the expansion of their renewable energy training provision.

#### *The College of Cape Town:*

While the college reports concern over the sustainability of the job opportunities for students completing the programmes listed in Table 2, they are interested in implementing opportunities for students to be trained on renewable energy topics. The college is collaborating with multiple partners to develop a comprehensive strategy for renewable energy related training. A key aspect of this initiative involves integrating more specialised renewable energy related content into existing training programmes linked to the renewable energy value chain.

For instance, in partnership with the University of Johannesburg and the National Business Initiative, the college is in the process of establishing a certified technician programme. A five-year analysis conducted by the college revealed that only approximately 25% of Bachelor of Engineering students complete their degrees. Recognising this trend, the college aims to provide an alternative pathway for students who have not completed the degree or those considering a Bachelor of Engineering, as well as incorporating renewable energy training into this programme. The proposed course will span one to three years and graduates will have the opportunity to progress to further educational prospects, including progression to a Bachelor of Technology degree at Cape Peninsula University of Technology.

#### *Northlink TVET College:*

The college holds accreditation and possesses the necessary equipment for three programmes, in addition to the one they already offer: Solar Photovoltaic Standalone Systems Installer; Solar Photovoltaic Standalone Service Technician and Solar Photovoltaic Service Technician. The implementation of these programmes remains contingent upon both available funding and demand. Furthermore, in alignment with the College of Cape Town, Northlink College stresses the significance of this training being integrated into existing broader qualifications.

Initially, the college planned to focus exclusively on programmes relating to Solar Photovoltaic (PV) systems, however they are now exploring expanding their scope to encompass additional technologies,

including heat pumps. In addition to this, they are in the process of collaborating with the University of the Western Cape (UWC) on the manufacturing of an “energy cart” which features a lithium-ion battery and is designed to provide electricity to individuals lacking access, either due to loadshedding or living in a poorly electrified rural area. The college intends to construct the complete cart on-site to provide students in relevant training programmes with much needed experience working with this type of energy storage system. As part of the collaboration with UWC, PhD candidates will contribute to specific aspects of the project, such as the lithium-ion battery, while TVET college students will engage in competencies best suited to their technical training. This hands-on experience will enable students to develop practical skills related to energy storage systems and foster teamwork with multi-skilled teams.

#### *False Bay TVET College:*

Of the eight programmes, False Bay TVET College plans to implement an additional five programmes. The College plans to increase their intake of students taking the Solar Photovoltaic Standalone Service Technician programme from 20 for the 2025 intake to 120 students over the next three years. Moreover, the college intends to launch a five-day programme allowing graduates to be eligible to provide PV GreenCards, accommodating twenty learners per month. A PV GreenCard is issued by certified solar PV installers upon completion of the system’s installation (PV GreenCard, 2025). To support students in gaining industry experience, the college is actively collaborating with various renewable energy companies. These partnerships aim to facilitate work placement opportunities for students pursuing these renewable energy training qualifications.

## **4. Priority Sector: Renewable energy recycling**

The renewable energy recycling sector includes both renewable energy component and battery storage recycling, and this section discusses the occupations and skills required, as well as the information gathered through semi-structured interviews with TVET colleges and businesses specific to this sector.

### **4.1. Occupations required in this priority sector**

Table A1 in Appendix A lists twenty-two occupations required in the recycling of battery storage systems, categorised into entry-level, mid-level and advanced roles, based on education and experience requirements. The process for compiling these lists is outlined in Section 2.1. Entry-level occupations typically require no formal education or only the completion of secondary school, while mid-level roles usually necessitate technical or vocational training. Advanced occupations generally require a university degree. These levels are based on the skills level descriptions used in the World Bank’s Enterprise Survey<sup>5</sup>, as well as the education and experience descriptions available in the resources on relevant occupations (American Clean Power, 2022a; World Bank, 2023; Environmental Career Organisation Canada, 2024). Occupations are assigned a level based on the information contained in the original resources outlined in Section 2.1. Each occupation is briefly described; however, it is important to clarify that these descriptions pertain to the role in general, rather than to specific tasks undertaken within battery storage recycling businesses.

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<sup>5</sup>Highly skilled jobs: “Professionals or technicians whose tasks require extensive theoretical and technical knowledge”; Semi-skilled jobs: “Workers whose tasks require some level of mechanical or technical knowledge”; low-skilled jobs: “Workers whose tasks involve no specialised knowledge.”

Table A1 reveals that mid-level and entry-level occupations are equally represented within this sector, collectively comprising the majority of roles. Mid-level positions are predominantly occupied by technicians and technologists, while advanced-level roles are filled by engineer occupation groups. Entry-level occupations are largely associated with manual labour, though some require specialised skills, such as the operation of machinery, including cranes and trucks. The business interviewed currently employs workers in the following occupations: Electrical engineering technician, Chemical engineer, Electrical engineer, Chemical production machine operator, Forklift driver, Truck driver, Manufacturing labourers, Materials recycler, Waste materials plant operator, Mechanical engineer, Health and safety manager and General administrative staff.

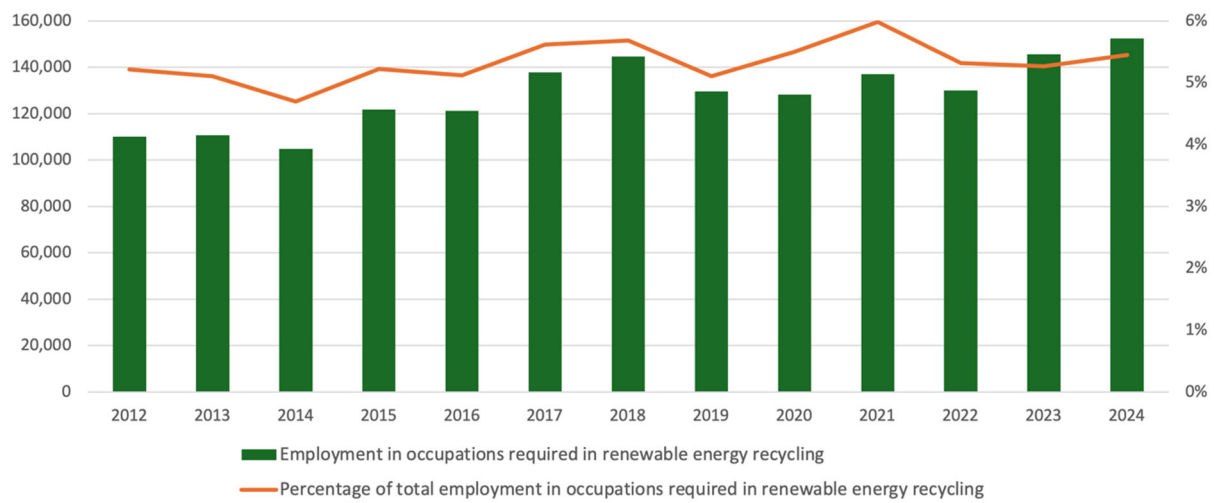
Sixteen of the twenty-one occupations listed in Table A1 in the appendix are found on the 2024 Western Cape List of Occupations in High Demand. Logistics manager (Supervisors, supply chain, tracking and scheduling coordination occupations), Health and safety manager, Truck and forklift drivers (Material handler (equipment operators)), Electrical and electronics engineering technician, Industrial engineering and manufacturing technologists, Mechanical engineering technician, Industrial electrician, Millwright, Solar installer (Solar O&M technician (commercial/utility); Solar service technician (residential); Solar technician), Industrial and manufacturing engineers, Chemical engineers, Electrical and electronics engineers, Data scientist, Environmental engineer (Hazardous substances engineer, Regulatory compliance manager), Mechanical engineer (Design engineer, Product engineer, Equipment engineer). These occupations are majority advanced and mid-level occupations, comprising seven mid-level, six advanced and only three entry level occupations (DNA Economics, 2024).

#### **4.2. Employment in the occupations required in this priority sector**

This section presents employment statistics for the renewable energy recycling sector. It is important to note that workers in these occupations may not necessarily be working in the priority sector, but rather they have the ability to perform occupational tasks required within this sector. Thus, growth in these employment numbers may not necessarily reflect or correlate to growth in the sector specifically, but rather to growth within the broader occupations.

Figure 1 presents employment trends in the Western Cape in occupations required for the renewable energy recycling sector from 2012 to 2024, along with the percentage of total provincial employment. Although employment in these occupations has largely grown over time, their share of total employment has remained stable at approximately 5%. There is a small increase in the percentage in 2020 and 2021, however this is largely due to overall employment falling, while employment in these occupations remained consistent, with a minor increase in 2021. As discussed in the Data section (2.1), caution is advised when interpreting estimates for these years.

**Figure 1: Employment in occupations required in renewable energy recycling per year in the Western Cape**



Source: Own calculations using Labour Market Dynamics 2012-2019; Quarterly Labour Force 2023, 2024

Note: Sampling weights are applied and in the case of the Quarterly Labour Force Data, sampling weights are divided by four to get year-level estimates (Wittenberg, 2017; Borat *et al.*, 2023).

Table 3 provides an overview of the workforce distribution in the Western Cape in occupations required in the renewable energy recycling sector, by 2-digit occupation group and year. It also indicates the percentage of total employment represented by each occupation group. Throughout the period, most of the employment in these occupations is concentrated in entry level positions requiring manual labour. The two largest groups are identified as *Labourers in mining, construction, manufacturing and transport* and *Extraction and building trades workers*. The *Labourers in mining, construction, manufacturing and transport* group contains the following occupations required in the sector: *Labourers in mineral and metal processing, other labourers in processing, manufacturing and utilities* and *material handlers (manual)*. Similarly, the *Extraction and building trades workers* includes Electricians and Solar construction workers. By contrast, the smallest workforce is observed within the *Stationary-plant and related operator* group, which comprises the Machine operators in the electrical apparatus manufacturing occupation.

**Table 3: Employment in occupations required in renewable energy recycling in the Western Cape by 2-digit occupation group and year**

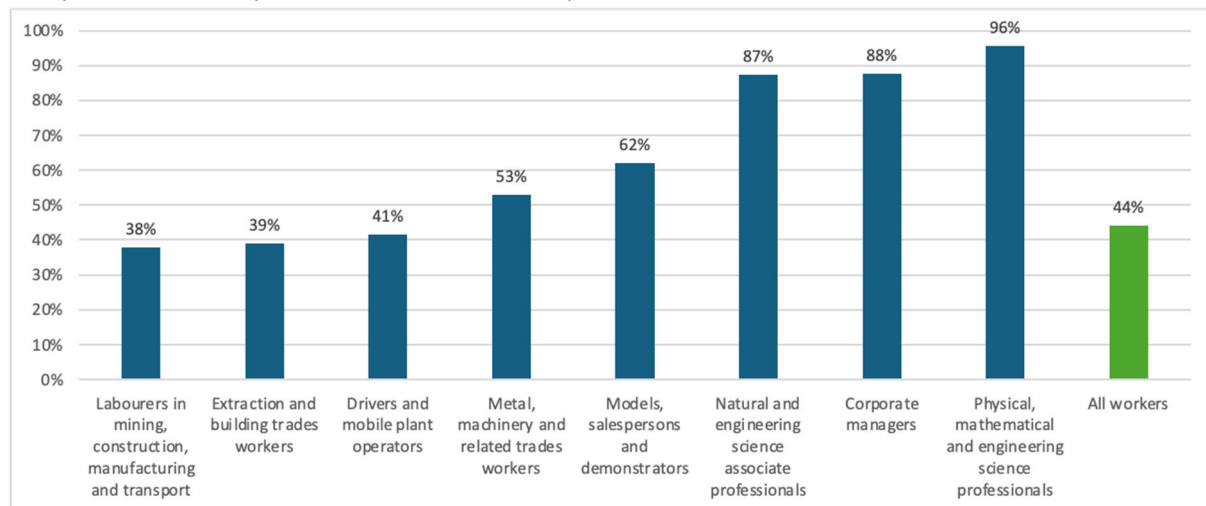
Occupations	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Stationary-plant and related operators	116 (0.1%)	129 (0.1%)	102 (0.1%)	126 (0.1%)	163 (0.1%)	164 (0.1%)	143 (0.1%)	228 (0.2%)	80 (0.1%)	131 (0.1%)	131 (0.1%)	154 (0.1%)	170 (0.1%)
Metal, machinery and related trades workers	358 (0.3%)	368 (0.3%)	410 (0.3%)	467 (0.45)	474 (0.4%)	499 (0.4%)	562 (0.4%)	502 (0.4%)	440 (0.4%)	389 (0.3%)	389 (0.3%)	413 (0.3%)	482 (0.3%)
Corporate Managers	1 093 (1%)	1 141 (1%)	1 218 (1%)	1 196 (1%)	1 223 (1%)	1 234 (1%)	1 317 (1%)	1 320 (1%)	1389 (1%)	1560 (1%)	1 560 (1%)	1 345 (1%)	1 401 (1%)
Drivers and mobile plant operators	2 903 (3%)	3 295 (3%)	3 222 (3%)	3 632 (3%)	3 639 (3%)	4 288 (3%)	4 081 (3%)	4 126 (3%)	3761 (3%)	3874 (3%)	3 874 (3%)	4 728 (3%)	5 503 (4%)
Physical, mathematical and engineering science professionals	3 721 (3%)	4 040 (4%)	3 930 (4%)	2 175 (45)	2 975 (2%)	3 126 (2%)	3 131 (2%)	2 327 (2%)	6463 (3%)	6278 (5%)	6 278 (5%)	6 414 (4%)	4 781 (3%)
Models, salespersons and demonstrators	5 935 (5%)	5 320 (5%)	5 347 (5%)	4 911 (5%)	4 849 (4%)	5 105 (4%)	5 949 (4%)	6 040 (5%)	4916 (5%)	4751 (4%)	4 751 (4%)	6 623 (5%)	5 486 (4%)
Natural and engineering science associate professionals	7 123 (6%)	6 703 (6%)	6 247 (6%)	6 198 (6%)	5 892 (5%)	6 725 (5%)	5 872 (4%)	6 410 (5%)	5799 (4%)	6472 (5%)	6 472 (5%)	6 056 (4%)	7 703 (5%)
Extraction and building trades workers	27 727 (25%)	28 654 (26%)	31 425 (26%)	33 812 (30%)	36 523 (28%)	37 835 (27%)	37 841 (26%)	37 024 (29%)	29512 (23%)	26133 (20%)	26 133 (20%)	34 437 (24%)	35 147 (23%)
Labourers in mining, construction, manufacturing and transport	61 070 (55%)	61 091 (55%)	52 875 (55%)	69 324 (50%)	65 476 (57%)	78 761 (59%)	85 653 (59%)	71 547 (55%)	84708 (59%)	80379 (62%)	80 379 (62%)	85 371 (59%)	91 786 (60%)

Source: Own calculations using Labour Market Dynamics 2012-2019; Quarterly Labour Force 2023, 2024

Note: Sampling weights are applied and in the case of the Quarterly Labour Force Data, sampling weights are divided by four to get year-level estimates (Wittenberg, 2017; Bhorat *et al.*, 2023). The OFO places materials recyclers in the salesperson unit group which is the reason that the 2-digit *Models, salespersons and demonstrators* occupation groups. In the 2020 and 2021 data, fewer than 25 Stationary-plant and related operators were interviewed which does not meet the benchmark of 25 observations as per the Department of Higher Education and Training's Occupations in High Demand for the Western Cape Methodological Report. This report identified *Occupations in High Demand* at the provincial level and as part of their process to establish a list of the Provincial Occupations in High Demand, they use occupation data from the QLFS to estimate measures of occupational employment pressure. They remove all occupations with fewer than 25 observations (Labour Market Intelligence, 2022). Thus, those estimates should be approached with caution.

This report examines the skills landscape in which these priority sectors operate, and as direct data on skills is not available, the educational attainment of these workers can provide a picture of their potential abilities. As a result, Figure 2 depicts the percentage of workers in renewable energy recycling occupations who have completed secondary school, categorised by their respective 2-digit occupation group. There is variation in educational attainment across these groups; however, when considering all workers within renewable energy recycling occupations, only 44% have completed secondary education by 2024.

**Figure 2: Percentage of workers in occupations required in renewable energy recycling who have completed secondary school in the Western Cape in 2024**



Source: Own calculations using Quarterly Labour Force 2024 Q1-Q4

Note: Sampling weights are applied and divided by four to get year-level estimates (Wittenberg, 2017; Bhorat *et al.*, 2023). Stationary-plant and related operators 2-digit occupation was excluded due to sample sizes for that occupation, when disaggregated further, did not meet the 25-observation benchmark. See Table 4 notes for further explanation.

In sum, overall employment in the occupations in the Western Cape required for renewable energy recycling has grown, however their share as a percentage of total employment has remained consistent over time. The analysis highlights the prevalence of employment in entry-level manual labour positions, while higher level roles represent comparatively lower employment. This trend is consistent with the findings of the Occupations in High Demand for the Western Cape, which predominantly identifies the high and mid-level occupations required for renewable energy recycling as those in high demand (DNA Economics, 2024). Furthermore, while educational attainment varies significantly across the 2-digit occupational groups, most workers in these occupations have not completed matric.

#### 4.3. Perspectives from a business operating in the sector

Having considered the big picture of provincial employment, this section narrows the focus to a business operating in the renewable energy and energy storage recycling sector, and examines their experiences around employment, skills, challenges and potential growth in the sector. The business recycles a vast array of solar and energy storage components from the module to cabling to battery management systems. Additionally, it possesses the capability to recycle wind components, such as the wind turbine and nacelle, though it has not yet received requests to do so.

The findings highlight three key insights: first, the sector is expected to grow, potentially resulting in increased demand for specific occupations; second, the primary skills gap among newly hired

employees for this business pertains to difficulties in applying acquired technical skills; and third, retention challenges and inadequate enforcement of existing regulations are identified as significant obstacles. The business anticipates substantial growth in the sector, which they expect will result in them expanding their workforce, with a particular need for additional machine operators, electrical engineers and electrical technicians as the company scales its operations.

Regarding skills gaps, deficiencies in problem-solving, decision-making and organisational abilities are identified as the most common challenges, with no direct concerns raised about technical skills. Additionally, they report that while TVET college graduates possess adequate technical competencies, they often struggle to effectively apply these skills in professional settings.

Although recruitment does not present a significant challenge for the business, retention issues are cited as a major concern, resulting in operational delays and business losses. The business invests substantial time and resources in recruiting and training employees, only for staff to leave, necessitating repeated recruitment and hiring efforts. In some cases, retention difficulties have forced the outsourcing of specific roles. The inability to enforce notice periods exacerbates the problem, as employees leave without sufficient time for proper handover procedures or recruitment of suitable replacements. Positions requiring advanced technical skills are identified as the most challenging to retain, likely due to high demand for these skills and competitors being able to offer higher salaries. To address these concerns, the business has implemented strategies such as funding training costs for newly hired staff, contingent upon a contractual agreement to remain with the organisation for a defined period.

Additionally, the business highlighted that the ineffective enforcement of existing regulations<sup>6</sup> poses a challenge for businesses operating in the sector. Companies that comply with regulatory requirements incur higher operational costs, while competitors who disregard these rules benefit from reduced expenses. The Extended Producer Responsibility represents recent legislation that mandates producers to take responsibility for the entire lifecycle of their products, including end-of-life management and recycling (Department of Forestry, Fisheries and the Environment, 2024). This legislation has led to an increased demand for recycling services. The business posited that companies seeking recycling services to comply with the new Extended Producer Responsibility legislation should be required to use the services of those who adhere to existing legislation.

#### **4.4. TVET college provision of relevant training**

As far as could be ascertained, there are no national guidelines for TVET College programmes dedicated to the recycling of energy storage or renewable energy components. However, several existing qualifications focus on the installation of solar PV systems, including the Solar Photovoltaic Standalone System Moulder, Solar Photovoltaic Standalone Systems Installer, Solar Photovoltaic Standalone Service Technician and Solar Photovoltaic Standalone Service Technician. These programmes likely offer essential knowledge relevant to individuals working in the recycling of solar PV components. Northlink TVET College offers Solar Photovoltaic Standalone System Moulder and False Bay TVET College offers Solar Photovoltaic Standalone Service Technician, both of which cover solar installation content, with

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<sup>6</sup> Relevant legislation would include National Environmental Management Act and National Waste Management Strategy 2020 (Department of the Environment, Forestry and Fisheries, 2020; South African Government, 2022).

both colleges planning to offer additional qualifications on this topic in the future. In addition, False Bay TVET College plans to introduce the Renewable Energy Technologist qualification which covers energy storage topics. This programme would likely be applicable to those seeking to work in the recycling of energy storage systems (South African Qualifications Authority, 2025a).

Beyond renewable energy specific courses, additional TVET college programmes may apply to the battery storage and renewable energy component recycling sector. The three colleges each offer training in electrical systems through programmes in electrical engineering and electrician vocational training as well as mechanical engineering programmes. Additionally, False Bay offers training on crane operation (College of Cape Town, 2025b; False Bay TVET College, 2025b; Northlink TVET College, 2025b). Northlink TVET College has already incorporated training on Solar PV installation into their Electrician Occupational Certificate, while the College of Cape Town indicated plans to develop a technician programme that integrates renewable energy topics. Collectively, these educational offerings will likely provide students with valuable renewable energy training, as well as more foundational training on a trade applicable to a wide variety of sectors, including the renewable energy recycling sector.

#### **4.5. Conclusion**

Twenty-two occupations are identified as relevant to the renewable energy recycling sector, mainly comprising mid-level and advanced roles. Approximately 77% of these occupations can be found on the Western Cape Occupations in High Demand list. Employment in these occupations has grown between 2012 and 2024, which may suggest that there is a growing number of workers able to take up opportunities in the priority sector. This employment is concentrated in entry level positions, which is further highlighted in the low educational attainment among these workers. Although no national guidelines appear to exist covering renewable energy recycling specifically, there are several programmes - including those on renewable energy more broadly - that may be relevant to those seeking work in the sector. Moreover, the three TVET colleges all offer programmes on electrical systems and crane operation, which are identified as relevant skills by the occupational information. The interview with a business operating in the sector revealed that they expect the sector to grow, however there are challenges faced in the sector, namely retention of staff and lack of adequate enforcement of existing regulations. There is potentially scope for increasing regulatory enforcement in the sector, which may assist compliant businesses to operate more efficiently and effectively. The issue around the retention of staff is not clear: it may be a case of limited supply of employees who are in high demand, particularly those with on-the-job experience.

## 5. Priority Sector: Solar installation, repair and maintenance

The occupations and skills required in the solar installation, repair and maintenance sector are discussed in this section. Findings from key informant interviews with TVET colleges and businesses are reported to provide a deeper understanding of skills provision and the business perspectives within the sector.

### 5.1. Occupations required in this priority sector

Table A2 in Appendix A outlines fifty-one occupations required in the solar installation, repair and maintenance sector, grouped into entry-level, mid-level and advanced positions, based on education and experience requirements. More information on the source of this occupational information can be found in Section 2.1. The criteria for each group are discussed in Section 4.1. In addition, a general description is provided of each occupation. Just under half of these occupations are classified as advanced, totalling twenty-one occupations, followed by seventeen mid-level occupations, and twelve entry-level occupations. The three businesses interviewed currently employ workers in the following occupations: Civil engineer, PV system designer, Surveyor, Financial analyst, Project manager, Concrete worker, Solar installer, Solar PV crew chief, Energy storage installer, Store person, Construction manager, Electrical engineer, Purchasing officer, Truck driver, Electrician, Logistics manager and General accountant.

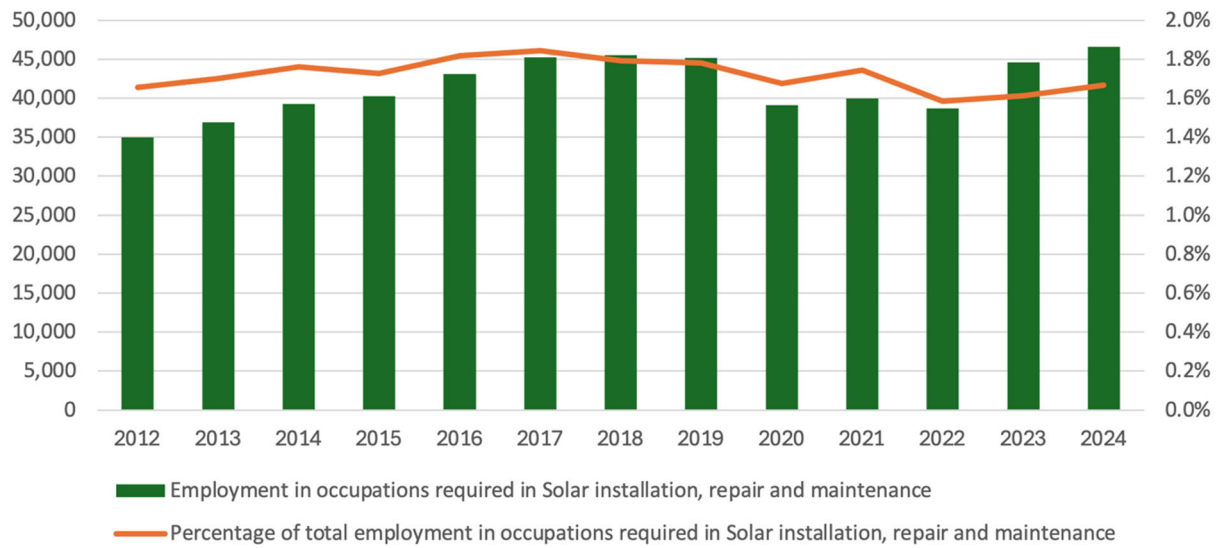
Twenty one of the fifty one occupations listed in Table A2 in the appendix are found on the 2024 Western Cape List of Occupations in High Demand: Health and safety manager, Solar installer (Solar PV installer, Solar assembler/ Basic (entry) installer), Truck driver, Logistics manager, Cable joiner, Electrician, Engineering manager, Project manager, Air conditioning and refrigeration mechanic, Electrical engineering technician, Mechanical engineering technician, Construction project manager, Industrial engineer, Fleet manager, Electrical engineer, Environmental engineer, Mechanical engineer, Meteorologist, Purchasing officer, Civil engineer, General accountant, Physical asset manager, Attorney. More than half of these are advanced occupations (DNA Economics, 2024).

### 5.2. Employment in the occupations required in this priority sector

This section contains employment statistics for the occupations required in the solar installation, repair and maintenance sector. As discussed in Section 4.2, workers represented by these statistics are employed across various sectors.

Figure 3 presents employment in the Western Cape in occupations required for the solar installation, repair and maintenance sector between 2012 and 2024. In addition, it shows this employment as a percentage of total employment in the province. Employment in these occupations has grown, while their share of total employment has remained between 1.6% and 1.8% over the twelve-year period. There is a small drop in employment in these occupations in 2020 and 2021 which may have been caused by the Covid pandemic. As with the employment statistics for the previous priority sector, changes in employment in these occupations may not necessarily indicate the same changes in the sector.

Figure 3: Number and percentage of workers in occupations required in the Solar installation, repair and maintenance sector in the Western Cape between 2012 and 2024



Source: Own calculations using Labour Market Dynamics 2012-2019; Quarterly Labour Force 2022, 2023, 2024

Note: Sampling weights are applied and in the case of the Quarterly Labour Force Data, sampling weights are divided by four to get year-level estimates (Wittenberg, 2017; Borat *et al.*, 2023).

Table 4 shows the number of workers in occupations required in the solar installation, repair and maintenance sector in the Western Cape by 2-digit occupation group and year, alongside the percentage of the total employment that the employment in each 2-digit occupation group represents in these groups. Over the period, the majority of employment in these occupations is in entry-level positions involving manual labour, with over half of all employment in these occupations found in the *Extraction and building trades workers* occupation group. The *Extraction and building trades workers* occupation group includes Electricians, Solar construction workers, Carpenters, Roofers, Concrete workers and Solar Installers. The fewest workers are found in the *Natural and engineering science associate professionals* 2-digit occupation group which contains the Electrical Engineering Technician and Safety Inspector occupations.

**Table 4: Employment in occupations required in solar installation, repair and maintenance in the Western Cape by 2-digit occupation group and year**

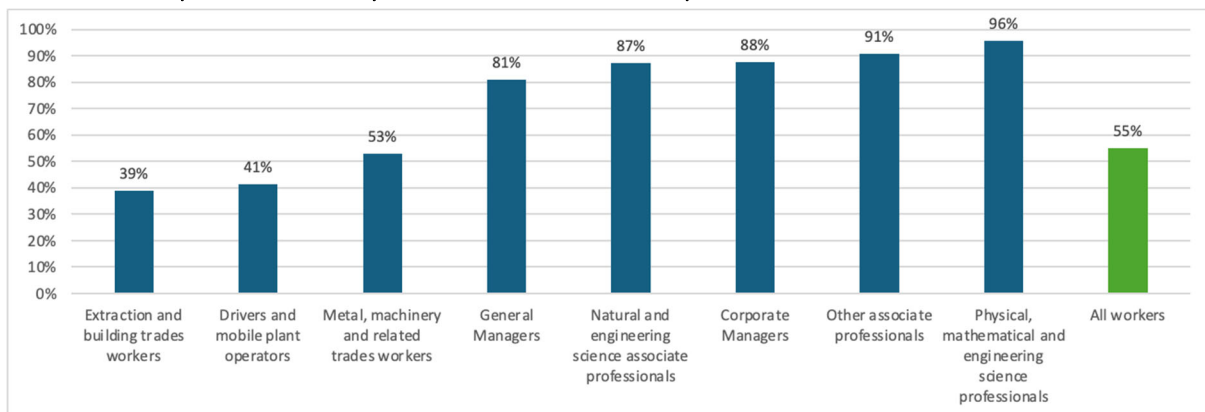
Occupations	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Corporate Managers	1 665 (5%)	1 737 (5%)	1 855 (5%)	1 821 (5%)	1 862 (4%)	1 879 (4%)	2 006 (4%)	2 010 (4%)	829 (2%)	853 (2%)	2 375 (6%)	2 048 (5%)	2 133 (5%)
Physical, mathematical and engineering science professionals	1 731 (5%)	1 879 (5%)	1 828 (5%)	1 011 (5%)	1 383 (3%)	1 454 (3%)	1 456 (3%)	1 082 (2%)	1462 (4%)	1886 (5%)	2 920 (8%)	2 983 (7%)	2 223 (5%)
Natural and engineering science associate professionals	1 048 (3%)	986 (3%)	919 (2%)	912 (2%)	867 (2%)	989 (2%)	864 (2%)	943 (2%)	1926 (5%)	2116 (5%)	952 (2%)	891 (2%)	1 133 (2%)
Other associate professionals	2 025 (6%)	2 133 (6%)	1 964 (5%)	2 000 (9%)	2 119 (5%)	2 222 (5%)	1 827 (4%)	1 987 (5%)	2037 (5%)	3006 (8%)	2 118 (5%)	2 299 (5%)	2 314 (5%)
Metal, machinery and related trades workers	2 828 (8%)	2 906 (8%)	3 234 (8%)	3 685 (7%)	3 743 (9%)	3 941 (9%)	4 436 (10%)	3 961 (8%)	3814 (10%)	3477 (9%)	3 069 (8%)	3 260 (7%)	3 810 (8%)
Drivers and mobile plant operators	2 155 (6%)	2 446 (7%)	2 392 (6%)	2 697 (7%)	2 702 (6%)	3 184 (7%)	3 030 (7%)	3 063 (7%)	2978 (8%)	2792 (7%)	2 876 (7%)	3 510 (8%)	4 085 (9%)
General Managers	4 071 (12%)	4 724 (13%)	5 058 (13%)	4 444 (11%)	4 809 (11%)	5 023 (11%)	5 407 (12%)	6 176 (14%)	5104 (13%)	5124 (13%)	6 073 (16%)	5 448 (12%)	6 291 (13%)
Extraction and building trades workers	19 437 (56%)	20 087 (54%)	22 029 (56%)	23 703 (59%)	25 603 (59%)	26 522 (59%)	26 527 (58%)	25 954 (57%)	20987 (54%)	20688 (52%)	18 320 (47%)	24 141 (54%)	24 638 (53%)

Source: Own calculations using Labour Market Dynamics 2012-2019; Quarterly Labour Force 2023, 2024

Note: Sampling weights are applied and in the case of the Quarterly Labour Force Data, sampling weights are divided by four to get year-level estimates (Wittenberg, 2017; Borat *et al.*, 2023).

As discussed in the preceding analysis of employment patterns, educational achievement can proxy skills potential. Figure 4 shows the percentage of workers in solar installation, repair and maintenance occupations who have completed secondary school, by their respective 2-digit occupation group. While over half of the workers in these occupations have completed high school (55%), this figure shows that this varies substantially by 2-digit occupation group.

**Figure 4: Percentage of workers in occupations required in solar installation, repair and maintenance who have completed secondary school in the Western Cape in 2024**



Source: Own calculations using Quarterly Labour Force 2024 Q1-Q4

Note: Sampling weights are applied and divided by four to get year-level estimates (Wittenberg, 2017; Borat *et al.*, 2023).

In conclusion, although total employment in the Western Cape in the occupations required in the solar installation, repair and maintenance sector has grown between 2012 and 2024, its percentage of total provincial employment has remained the same. Employment is concentrated in entry-level occupations with only small percentages of workers in the more advanced occupation groups. In addition, this report found that although the majority of those employed in these occupations have completed matric, large differences exist in the level of educational attainment among the 2-digit occupation groups.

### 5.3. Perspectives from businesses operating in the sector

Building on the provincial labour market findings, this section turns to the insights from three businesses operating in the sector. These include the occupations and skills they require, as well as the sectoral challenges and growth potential. While there is some alignment, the businesses report differing perspectives on the growth potential of the sector, recruitment and retention problems, and barriers to growth.

These businesses represent small businesses<sup>7</sup> at different stages of operation in the sector. One has been operating in the sector for nearly two decades. The second is relatively new to the sector and is seeking to focus more of their business on solar installation, repair, and maintenance, having previously been more heavily involved in the other related sectors. The final business has yet to begin installing solar panels in South Africa, however they have done so in other African countries and see potential opportunities in the South African market, especially given the resumption of loadshedding – see the loadshedding discussion below. They are also involved in other phases of the solar value chain from project development to manufacturing.

<sup>7</sup> This is based on the definition of small businesses within the South African context provided by the Department of Small Business Development (Department of Small Business Development, 2023).

All three businesses provided different perspectives on the growth potential of the sector. Two of the three businesses reported that there was a high probability that the sector would grow in the short term<sup>8</sup>. However, each of these businesses reflected a different opinion on the potential opportunities in the sector, with one reporting that they felt that the South African market is saturated and as such opportunities for those moving into the sector may be limited and the others reporting that they saw much potential in the sector and were planning to pivot their business to more heavily focus on this sector. These align with the perspectives of the False Bay and Northlink TVET colleges, who see a large demand for students with solar installation, repair and maintenance skills. The final business felt there is a relatively low probability that the sector would grow, and further reported that the largest barrier leading to this is a lack of demand needed to grow their business. Moreover, they described regulation, access to finance, and access to qualified electrical engineers with construction and installation experience as additional barriers. In terms of regulation, they conveyed that this added fixed costs on users who are seeking to invest in renewable energy. Examples of the regulation issues include the complexity of permit procurement from local municipalities, and that the requirements vary depending on location, both of which add significant delays to projects. Moreover, wheeling charges are high, further deterring investment, especially from the private sector. Wheeling charges are fees payable by the Independent Power Producers as well as electricity customers. The Independent Power Producers are paying for the use of the grid delivering electricity to their customers (Eskom, 2025). In addition, the business reported that in the case of larger systems, accessing the grid can also be a major problem and that additional regulation is needed to speed up the broadening of grid access.

The timing of the interviews is important to note here. The business foreseeing a limited probability of growth in the sector was interviewed prior to the resumption of loadshedding, whereas the other two interviews were conducted once loadshedding had resumed. The period of uninterrupted power represents the longest time without loadshedding since 2018, with 300 consecutive days of consistent power supply (van Diemen, 2025). This raises the possibility that the resumption of power outages influenced the opinions expressed by these businesses. Supporting this, the interviewee who predicted a low probability of growth also noted that the unexpected cessation of loadshedding has profoundly impacted the sector with many businesses closing down entirely. They argued that loadshedding has artificially inflated the industry and led to unsustainably high salaries, which subsequently fell as power outages stopped, and workers returned to lower-paying positions. For their business, this resulted in a shift towards smaller projects and underscored the critical need for a multiskilled workforce to navigate the sector's demand volatility.

Despite their different perspectives on the likelihood of growth in the sector, each business was asked about the action they would take if the sector experienced large growth. All three stated that they would increase staff, and two businesses reported that this is the only action they would take. The third business indicated that they would seek out collaboration opportunities with other businesses in the South African and African markets to enhance their market access.

Only one of the businesses conveyed facing both recruitment and retention issues, while another relayed no problems, and the third business recounted that they outsource much of their installation, repair and maintenance work and as such, could not accurately reflect on this issue. The business that

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<sup>8</sup> Short term was defined in this context as the next one or two years.

reported both recruitment and retention issues reflected that the source of their recruitment problems is insufficient applicants, and applicants who lack the required technical skills. They stated that qualified technicians are difficult to find, especially those who commission sites. These technicians are those with electrical and electronic trade expertise and experience who perform system tests and verify that all wiring specifications are adhered to prior to switching the system on. Moreover, while skilled engineers and electricians can be found, this is often at salaries higher than what the business can afford, as they provide their services to the highest bidder. In the case of retention difficulties, they conveyed that technicians and wiremen electricians are difficult to retain, primarily due to larger businesses being able to offer much larger salaries. The business's difficulties in recruiting and retaining staff had led to losses of business, delays in the expansion of business activities, the need to outsource work, and increased operating costs.

All businesses feel that newly hired staff lack problem-solving and decision-making skills, whereas only two businesses find that they also lack technical skills. An additional skill which one business found lacking was communication skills, specifically when an issue has occurred, as a lack of prompt problem reporting can lead to many challenges at later stages of the work.

None of the three businesses engage with TVET colleges regarding hiring or providing work experience opportunities to graduates. Only two of the three businesses provide training to their employees. Most of this training is specific to the different positions held by their employees, however health and safety-related training was provided by both businesses to most of their employees. One business has provided relevant employees with basic installation training from Green Solar Academy.

#### **5.4. TVET college provision of relevant training**

While the interviews with businesses touched upon the general skills of their employees, this section addresses the provision of relevant skills within the TVET college system. Half of all the TVET college level qualifications covering renewable energy topics are focused on equipping students to install, repair and maintain solar PV systems. They have yet to all be implemented by the three TVET colleges, however the Solar Photovoltaic Standalone System Mounter qualification is currently being offered by Northlink TVET college as part of its Electrician Occupational Certificate, and both Northlink and False Bay intend to offer more of these programmes in the future.

There are additional TVET college programmes which do not explicitly cover renewable energy topics but may also be applicable to this sector. All three of the TVET colleges offer training in electrical systems, such as electrical engineering and electrician vocational programmes, as well as mechanical engineering programmes (College of Cape Town, 2025a, 2025c; False Bay TVET College, 2025a, 2025c; Northlink TVET College, 2025a). In addition, False Bay offers training on crane operation, and the College of Cape Town offers training on machining (College of Cape Town, 2025b; False Bay TVET College, 2025b; Northlink TVET College, 2025b).

## 5.5. Conclusion

Fifty-five occupations have been identified as required in the solar installation, repair and maintenance sector, with twenty-two of these occupations found on the Western Cape Occupations in High Demand list. Employment in these occupations has grown moderately, and mainly represents those working in entry level positions with low educational attainment. While half of all the TVET college level renewable energy qualifications are focused on students seeking to pursue opportunities in this sector, the three colleges each currently offer only one of these programmes. There are additional programmes offered by the colleges, such as mechanical engineering, which could be applicable to those seeking work in this sector. The business interviews revealed different perspectives on the sector, including divergent views on growth outlook and barriers. However, they all report that if there were to be a large increase in demand for renewable energy, they would increase their staff complement. Loadshedding appears to have played a large role in determining the growth outlook: one of the interviewees indicated that they predicted a low probability of growth in the sector, while another indicated that they thought that growth was likely, but that new entrants to the sector would struggle as the market is saturated. The business predicting a low probability of growth relayed key challenges to the sector, including regulation, access to finance and access to qualified electrical engineers with construction and installation experience. Moreover, this business highlighted the importance of multiskilled staff in order to be resilient to the demand uncertainty facing the sector. The reflections of the TVET colleges on the need to integrate renewable energy training into broader programmes would likely benefit the sector greatly by providing a pool of multiskilled workers.

## 6. Priority Sector: Battery storage assembly

This section examines the occupations and skills required for the final priority area of battery storage assembly, as well as insights from the TVET colleges and businesses in the sector.

### 6.1. Occupations required in this priority sector

Table A3 in Appendix A outlines thirty-six occupations required in the battery storage assembly sector. Each occupation is assigned either an entry-level, mid-level or advanced designation, based on the education and experience requirements, and a general description is provided for each occupation. The criteria for each level are discussed in Section 4.1, and the methodology utilised to identify these occupations is in Section 2.1. This sector requires a balance of mid-level and advanced occupations, with significantly fewer entry level occupations. Insights from an interview conducted with a business operating in this sector indicate that technician positions generally require specialised knowledge and experience in renewable energy, whereas engineering roles can predominantly rely on broader professional experience and formal education. This business employs workers in the following occupations: Electrical engineer, Electrical engineering technician, Electrical engineering technologist, Electrician, Electronics engineering technician, Electronics engineer, Electronics engineering technologist, Forklift driver, Industrial products sales representative, Manufacturing labourer, Mechanical engineer, Metal fabricator, Metal machinist, Manufacturing Supervisor, Project manager, Purchasing officer, Quality controller, Store person and Supervisors, electronics and electrical products manufacturing.

Sixteen of the thirty six occupations listed in Table A3 in the appendix are included in the 2024 Western Cape List of Occupations in High Demand: Electrical and electronics engineering technician, Mechanical engineering technician, Industrial engineering and manufacturing technologists, Industrial electrician Millwright (Construction millwrights and industrial mechanics), Logistics manager (Supply chain, tracking and scheduling coordination occupations), Stock clerk/officer, Welder, Chemical engineer, Industrial engineer, Electronic and electrical engineer, Data scientist, Mechanical engineer, Purchasing officer, General accountant, Engineer manager. One half of these occupations are mid-level and the other half are advanced (DNA Economics, 2024).

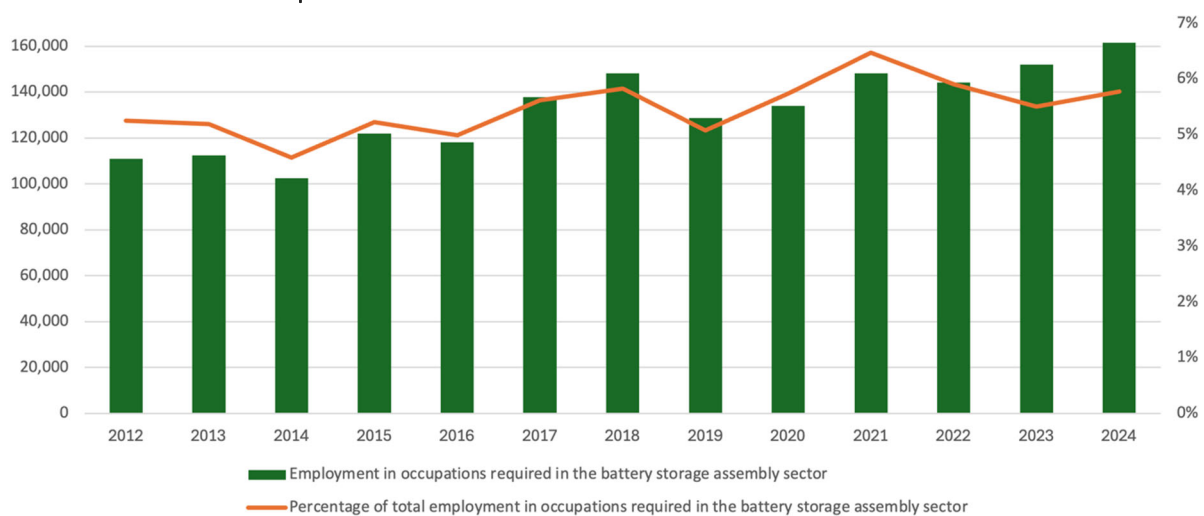
## 6.2. Employment in the occupations required in this priority sector

This section presents statistics on employment in the occupations required in the renewable energy recycling sector. Employment in these occupations reflects those working across a variety of sectors, as outlined in Section 4.2.

Figure 5 shows the estimated employment in the Western Cape for occupations required by the battery storage assembly sector between 2012 and 2024. Additionally, the figure includes this employment as a percentage of total employment within the province. As with the employment statistics for the previous priority areas, and explained in section 4.2, changes in employment in these occupations may not necessarily signify expansion of the sector.

While total employment in these occupations has increased, as a percentage of total employment, it has remained relatively stable between 5% and 6%. There is a slight increase in the percentage observed in 2020 and 2021. However, this is primarily attributable to a decline in overall employment, while employment in these occupations remained relatively stable, apart from a modest rise in 2021. As noted in the Data section of this report (2.1), it is crucial to interpret the 2020 and 2021 estimates with caution due to smaller sample sizes.

**Figure 5: Number and percentage of workers in occupations required in the battery storage assembly sector in the Western Cape between 2012 and 2024**



Source: Own calculations using Labour Market Dynamics 2012-2019; Quarterly Labour Force 2022, 2023, 2024

Note: Sampling weights are applied and in the case of the Quarterly Labour Force Data, sampling weights are divided by four to get year-level estimates (Wittenberg, 2017; Borat *et al.*, 2023)

Table 5 shows the number of workers in the Western Cape in occupations required in the battery storage assembly sector by 2-digit occupation group and year, alongside the percentage that the employment in each 2-digit occupation group represents of the total employment in these groups. The vast majority of employment in these occupations is found in the *Labourers in mining, construction, manufacturing and transport* occupation group, with over 70% of employment found in this group. This occupation group includes Labourers in mineral and metal processing, Other labourers in processing, manufacturing and utilities, Contractors and supervisors in machining, metal forming, shaping and erecting trades and Material handler (manual).

**Table 5: Employment in the Western Cape occupations required in battery storage assembly by 2-digit occupation group and year**

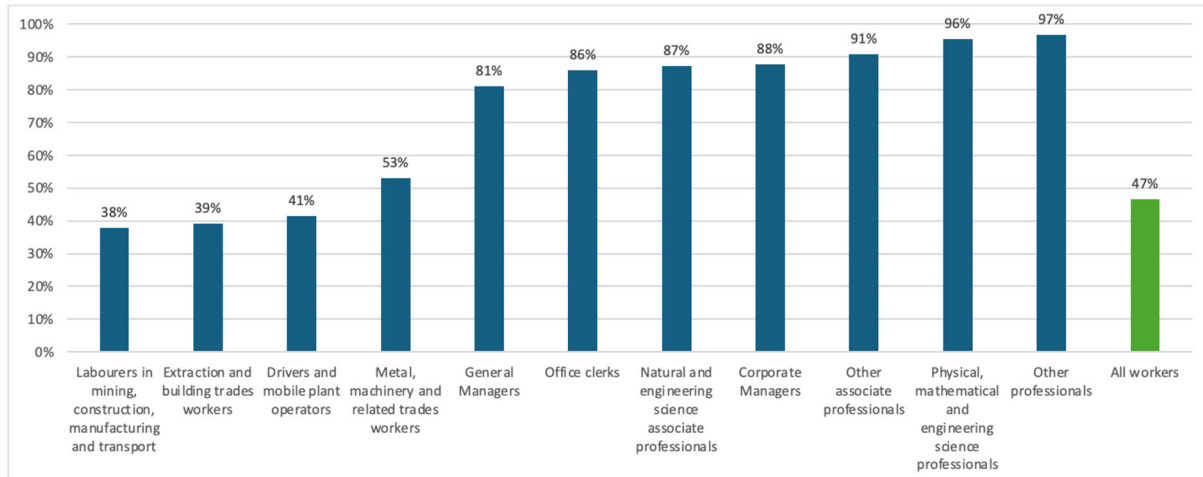
Occupations	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Stationary-plant and related operators	116 (0.1%)	129 (0.1%)	102 (0.1%)	126 (0.1%)	163 (0.1%)	164 (0.1%)	143 (0.1%)	228 (0.1%)	84 (0.1%)	80 (0.1%)	131 (0.1%)	154 (0.1%)	170 (0.1%)
Other associate professionals	675 (1%)	711 (1%)	655 (1%)	667 (1%)	706 (1%)	741 (1%)	609 (0.4%)	662 (1%)	487 (0.4%)	629 (0.4%)	706 (0.5%)	766 (1%)	771 (0.5%)
Corporate Managers	2 879 (3%)	3 004 (3%)	3 208 (3%)	3 149 (3%)	3 220 (3%)	3 251 (2%)	3 470 (2%)	3 476 (3%)	3 332 (2%)	3 659 (2%)	4 108 (3%)	3 541 (2%)	3 690 (2%)
Other professionals	3 175 (3%)	3 393 (3%)	3 646 (4%)	2 461 (2%)	2 608 (2%)	2 534 (2%)	2 927 (2%)	2 914 (2%)	2 848 (2%)	3 554 (2%)	4 390 (3%)	4 449 (3%)	4 020 (2%)
Natural and engineering science associate professionals	3 422 (3%)	3 220 (3%)	3 002 (3%)	2 978 (2%)	2 831 (2%)	3 231 (2%)	2 821 (2%)	3 080 (2%)	2 707 (2%)	2 786 (2%)	3 110 (2%)	2 910 (2%)	3 701 (2%)
Office clerks	2 492 (2%)	2 511 (2%)	2 525 (2%)	2 397 (2%)	2 224 (2%)	2 405 (2%)	2 512 (2%)	2 395 (2%)	2 213 (2%)	2 212 (1%)	2 348 (2%)	2 941 (2%)	2 994 (2%)
Extraction and building trades workers	2 950 (3%)	3 048 (3%)	3 343 (3%)	3 597 (3%)	3 885 (3%)	4 025 (3%)	4 026 (3%)	3 939 (3%)	3 185 (2%)	3 140 (2%)	2 780 (2%)	3 663 (2%)	3 739 (2%)
Drivers and mobile plant operators	1 594 (1%)	1 810 (1%)	1 769 (2%)	1 995 (2%)	1 999 (2%)	2 355 (2%)	2 241 (2%)	2 266 (2%)	2 203 (2%)	2 065 (1%)	2 128 (1%)	2 597 (2%)	3 022 (2%)
Physical, mathematical and engineering science professionals	3 721 (3%)	4 040 (3%)	3 930 (4%)	2 175 (2%)	2 975 (3%)	3 126 (2%)	3 131 (2%)	2 327 (2%)	4 381 (3%)	6 463 (4%)	6 278 (4%)	6 414 (4%)	4 781 (3%)
Metal, machinery and related trades workers	3 327 (3%)	3 419 (3%)	3 805 (4%)	4 335 (4%)	4 404 (4%)	4 637 (3%)	5 219 (4%)	4 660 (4%)	4 487 (3%)	4 091 (3%)	3 611 (3%)	3 835 (3%)	4 483 (3%)
General Managers	4 071 (4%)	4 724 (4%)	5 058 (5%)	4 444 (4%)	4 809 (4%)	5 023 (4%)	5 407 (4%)	6 176 (5%)	5 104 (4%)	5 124 (3%)	6 073 (4%)	5 448 (4%)	6 291 (4%)
Labourers in mining, construction, manufacturing and transport	82 438 (74%)	82 467 (73%)	71 375 (70%)	93 579 (77%)	88 385 (75%)	106 320 (77%)	115 622 (78%)	96 581 (75%)	102 948 (77%)	114 347 (77%)	108 503 (75%)	115 241 (76%)	123 901 (77%)

Source: Own calculations using Labour Market Dynamics 2012-2019; Quarterly Labour Force 2022, 2023, 2024

Note: Sampling weights are applied and in the case of the Quarterly Labour Force Data, sampling weights are divided by four to get year-level estimates (Wittenberg, 2017; Borat et al., 2023). In the 2020 and 2021 data, fewer than 25 Stationary-plant and related operators were interviewed, which does not meet the benchmark of 25 observations as per the Department of Higher Education and Training's Occupations in High Demand for the Western Cape Methodological Report. This report identified Occupations in High Demand at the provincial level and as part of their process to establish a list of the Provincial Occupations in High Demand. they use occupation data from the QLFS to estimate measures of occupational employment pressure. They remove all occupations with fewer than 25 observations

The key role of education as an indicator of skills and potential ability has been discussed in the previous sections on employment trends. Figure 6 shows the percentage of workers in battery storage assembly occupations who have completed secondary school by their respective 2-digit occupation group. While this figure shows much variation in the percentage of workers who have completed high school by 2-digit occupation group, just under half of all workers in battery storage assembly occupations have attained this education level (47%).

**Figure 6: Percentage of workers in occupations required in battery storage assembly who have completed secondary school in the Western Cape in 2024**



Source: Own calculations using Quarterly Labour Force 2024 Q1-Q4

Note: Sampling weights are applied and divided by four to get year-level estimates (Wittenberg, 2017; Bhorat *et al.*, 2023). Stationary-plant and related operators 2-digit occupation was excluded due to sample sizes for that occupation, when disaggregated further, did not meet the 25-observation benchmark. See Table 8 notes for further information.

In conclusion, employment in these occupations in the Western Cape has grown marginally between 2012 and 2024, while as a percentage of total provincial employment, it has remained stable over the same period. Much of this employment is in entry level roles, and only 47% of the workers in these occupations have completed matric.

### 6.3. Perspectives from a business operating in the sector

Shifting the focus from the overall provincial employment figures, this section delves into the experiences of a battery storage assembly business, with a particular emphasis on the occupations required, challenges faced, and growth prospects. The section outlines the insights gathered from a medium sized business<sup>9</sup> operating in battery storage assembly.

This business reflected that they expected to experience a great deal of growth both internationally and locally. They have already increased their office footprint internationally and expanded their production and workforce, and they expect to continue this expansion. In terms of growing their workforce, they expect to require additional software developers to support their production and after sale support for their battery management systems; qualified electricians to act as commissioning specialists; electronic and electrical engineers; and production staff with special skills such as welder,

<sup>9</sup> This is based on the definition of small businesses within the South African context provided by the Department of Small Business Development (Department of Small Business Development, 2023).

computer operated industrial machinery technicians to support the production of their battery storage systems.

While the business reported no recruitment or retention problems, they stated that newly recruited staff most often lacked technical skills as well as problem-solving and decision-making skills. Moreover, the business identified some challenges facing the sector more broadly. The first is limited finance for end users of energy storage systems due to the large upfront costs of investing in renewable energy systems, leading to delays in getting returns on investment, leading to declines in the demand for energy storage systems. The second is the unexpected stop in loadshedding for 300 consecutive days, leading to steep declines in demand, which may have led to many businesses closing their doors (van Diemen, 2025). Despite the resumption of loadshedding since this interview was conducted, the uncertainty over demand caused by the unpredictability of loadshedding continues.

#### **6.4. TVET college provision of relevant training**

While the interview with a business in the sector offers insights into the general skills of their workforce, this section examines the provision of relevant skills by the TVET college system. Table 2 identifies the Advanced Occupational Diploma: Renewable Energy Technologist, which covers a range of energy storage topics, as one of the eight renewable energy-related TVET college qualifications. However, this is a very advanced programme which is at NQF level 7 and requires a NQF level 6 qualification in power generation, electrical engineering or mechanical engineering (South African Qualifications Authority, 2025a). Most other training programmes explicitly covering energy storage topics are typically offered at the postgraduate level. Examples include Stellenbosch University's Centre for Renewable and Sustainable Energy Studies offers an Energy Storage Systems short course at a postgraduate level, and the University of the Western Cape's Energy Storage Innovation Lab offers a one year Energy Storage Programme for electrical and mechanical engineering graduates (Heystek, 2023; Centre for Renewable and Sustainable Energy Studies, 2025).

While there are not many programmes at the TVET college level directly covering energy storage topics, there are other training programmes at the three TVET colleges that relate to the occupations identified as required for this sector. College of Cape Town, Northlink and False Bay TVET College all offer welding, electrical systems and mechanical engineering training. The College of Cape Town includes machining (College of Cape Town, 2025c; False Bay TVET College, 2025c; Northlink TVET College, 2025a).

#### **6.5. Conclusion**

There are thirty-six occupations required in the battery storage assembly sector with sixteen of them on the Western Cape Occupations in High Demand list, all sixteen of which represent mid-level and advanced roles. The sector requires workers in both technician and engineering roles, with a business operating in the sector revealing that while the technicians need high levels of knowledge of renewable energy systems, the engineering roles typically do not require that kind of specialised knowledge. Between 2012 and 2024, employment in these occupations has grown somewhat, however, their percentage of provincial employment has changed little. Most of the workers in these occupations have not completed secondary school and are employed in what have been identified by the occupational information as entry level roles. Energy storage education appears to be an advanced topic with the only TVET level qualification explicitly covering energy storage topics, Advanced Occupational Diploma: Renewable Energy Technologist, being an advanced programme requiring an NQF level 6 qualification

in power generation, electrical engineering or mechanical engineering for entry into the programme. Moreover, programmes dedicated solely to energy storage topics are mainly at the postgraduate level. TVET colleges do however offer other programmes which are likely applicable to those seeking work in the sector, such as welding, electrical systems and mechanical engineering programmes. All three of these programmes are offered at the Northlink, College of Cape Town and False Bay TVET colleges. An interview with a business operating in the sector found that growth is expected despite the lack of financing facing the end users of battery storage systems. In addition, the business indicated that while it faced neither recruitment nor retention issues, new staff often lack technical skills.

## **7. Insights from businesses operating in the broader renewable energy sector**

The preceding sections covered insights and information specific to the identified priority areas. This section provides insights gathered from outside of these priority areas to provide some understanding of the broader renewable energy landscape. Many of the businesses interviewed operate within more than one renewable energy sector, thus it is important to reflect on the broader renewable energy sector and linkages between the sub-sectors.

Two of the businesses involved in the solar panel installation, repair and maintenance priority area also engage in local assembly. Both anticipate growth in South Africa's solar panel assembly industry, which they expect will drive increased demand within their businesses for technicians, engineers, logistics specialists and quality control professionals. One of the businesses discussed the introduction of a layup technician role within its production line. This position was established to enhance production quality and efficiency while minimising job displacement. Layup technicians are entry level roles responsible for assembling all panel components, including glass and encapsulant sheets. These positions do not require formal qualifications and employees receive on the job training. Introducing this position more broadly in businesses in the solar panel assembly sector, and potentially beyond in other renewable energy manufacturing sectors, may present a potential opportunity for employees with lower skill levels.

Both businesses indicated that limited access to financing for large scale projects diminishes the competitiveness of local firms. Other barriers they identified include hesitancy toward domestically manufactured solar products and regulations imposing higher costs on renewable energy investors. One business noted that local consumers often assume imported solar products are of superior quality, which negatively impacts the adoption of locally produced alternatives. The indication from the business is that the regulatory environment may not be geared toward promoting the growth of local businesses. Examples of specific regulations contributing to increased costs for investors are discussed in Section 4.4.

An additional interview was conducted with a medium-sized business operating in the installation, operation and maintenance of wind turbines within the South African market. This business anticipates substantial sectoral growth, which is expected to increase their demand for service technicians capable of maintaining wind farms. However, they face challenges in recruiting and retaining workers with the necessary technical skills and qualifications. The interviews with TVET colleges that formed part of this project revealed a limited focus on skills development related to wind energy, which may contribute to

this shortage. Despite these recruitment and retention difficulties, the business relayed that its operations remain unaffected. The primary barriers identified align with those recounted by businesses in the priority sectors, namely regulatory and permitting complexities, skills shortages and challenges in accessing the grid.

## 8. Discussion and conclusion

This research examines the occupations and skills required within key renewable energy sectors in the Western Cape, to support policy development for future growth. Concurrent work of the National Business Initiative identified priority sectors within the solar, wind and energy storage value chains as i) battery storage and renewable energy component recycling, ii) solar installation, repair and maintenance and iii) battery assembly. Building on that work, this study deepens the understanding of how these sectors operate from both the labour supply and demand side, with a focus on skills requirements. The approach is diverse, ranging from national labour market data analysis to interviews with TVET colleges and businesses operating in the sector. As a result, the work identified critical occupations and skills in the priority areas, estimated provincial employment in the relevant sectors, and analysed the insights and perspectives obtained from TVET colleges in the City of Cape Town, as well as local businesses.

The first component of the work centres around the occupations required in these sectors, and employment levels in the Western Cape. The findings are largely similar across all three priority sectors, indicating that a high level of technical and theoretical expertise is required, with most occupations classified as advanced or high-level. Many of the occupations identified can be found on the Western Cape Occupations in High Demand list (DNA Economics, 2024). The trend shows that employment in each set of occupations has grown to some degree, while its proportion of provincial employment has remained largely static. The vast majority of employment in the occupations required in all three sectors represents workers in entry level roles with low educational attainment levels. There are fewer workers employed in high level occupations, and they currently work across various sectors. This may mean that new businesses in the priority sectors struggle to find the high-skilled workers they require, or that they need to increase remuneration offers initially to attract these workers.

There is notable overlap in the technical skills needed across these sectors, with approximately thirty-five occupations appearing in multiple sectors. Three occupations, Logistics managers, Mechanical engineers and Electricians, are found to be required across all three priority sectors. Each of the three TVET colleges offers training in electrical systems and mechanical engineering. While technical skills development is crucial in supporting business growth in these sectors, the findings suggest that deficiencies in soft skills, such as problem-solving and decision-making, currently present key challenges.

Limited access to financing and insufficient demand were cited as key barriers by many businesses. One business in the solar installation, repair and maintenance sector highlighted the impact of demand uncertainty relating to loadshedding, noting that when loadshedding was abruptly halted, several businesses were forced to close. The business stressed the importance of an agile, multiskilled workforce capable of adapting to evolving market conditions. Additionally, the fact that most

businesses operate across multiple renewable energy sectors reinforces the need for a broad, rather than narrowly specialised, skill set. A workforce with diversified competencies can enable businesses in any of the priority sectors to mitigate the risks associated with fluctuating demand in the face of unpredictable power provision at the national level.

Despite differences in the offering of current TVET-level qualifications, all three TVET colleges expressed a commitment to expanding renewable energy training in the future. Two of the colleges emphasised the importance of integrating renewable energy content into existing qualifications. This aligns with the study's other findings, suggesting that businesses would benefit from a more multiskilled workforce, as integrated TVET college qualifications are more likely to produce graduates with broader foundation knowledge who are capable of adapting to change.

While the diverse approach followed in this study has yielded a unique set of findings, the work would have benefited greatly from the opportunity to interview more businesses in the priority areas to capture a broader range of perspectives within each sector. Further, a focus group with the TVET colleges would have produced a more in-depth discussion of their differing perspectives on renewable energy training provision and potentially allow for a robust debate on the way forward.

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## Appendix A

**Table A1: List of renewable energy recycling occupations with short description, education, and experience**

Occupation	Level	Description
Labourers in mineral and metal processing	Entry	Perform material handling, clean-up, packaging and other elemental activities related to mineral ore and metal processing.
Machine operators in electrical apparatus manufacturing (e.g. Chemical production machine operator)	Entry	Operate machinery or equipment to fabricate complete products or parts for use in the assembly of electrical appliances and equipment, and electrical apparatus, such as batteries, fuses and plugs.
Inspectors and testers in electrical apparatus manufacturing	Entry	Inspect and test completed parts and production items.
Material handler (manual)	Entry	Handle, move, load and unload materials by hand.
Material handler (equipment operators)*	Entry	Handle, move, load and unload materials by using a variety of material handling equipment.
Other labourers in processing, manufacturing and utilities	Entry	Perform material handling, clean-up, packaging and other elemental activities in processing, manufacturing and utilities.
Health and safety manager*	Entry	Manages, reviews and evaluates work environments and oversee the design of programs and procedures to control, eliminate, and prevent disease or injury caused by chemical, physical, and biological agents or ergonomic factors.
Waste materials plant operator	Entry	Operates machinery which disposes of waste.
Materials recycler	Entry	Salvages materials from industrial, commercial and private establishments for resale.
Solar construction worker	Entry	Responsible for performing tasks involving physical labour at construction projects, excavations, and demolition sites while operating hand and power tools of all types, and other equipment and instruments.
Truck driver	Entry	Drive a truck / trailer to transport several types of construction equipment and materials throughout and between jobsites. Load and unload equipment and materials, including solar panels and work with crane operator for loading/unloading as needed.
Crane operator	Entry	Operate cranes (hydro cranes, crawler cranes, and/or pile driving hammers) to hoist, move and place materials and objects, and raise, lower and rotate boom and load lines.
Electrical and electronics engineering technologists	Mid-Level	May work independently or provide technical support and services in the design, development, testing, production and operation of electrical and electronic equipment and systems.
Electrical and electronics engineering technician*	Mid-Level	May work independently or provide technical support and services in the design, development, testing, production and operation of electrical and electronic equipment and systems.
Mechanical engineering technologists	Mid-Level	Provide technical support and services or may work independently in mechanical engineering fields such as the design, development, maintenance and testing of machines, components, tools, heating and ventilating systems, geothermal power plants, power generation and power conversion plants, manufacturing plants and equipment.

Mechanical engineering technician*	Mid-Level	Provide technical support and services or may work independently in mechanical engineering fields such as the design, development, maintenance and testing of machines, components, tools, heating and ventilating systems, power generation and power conversion plants, manufacturing plants and equipment.
Industrial engineering and manufacturing technologists*	Mid-Level	May work independently or provide technical support and services in the development of production methods, facilities and systems, and the planning, estimating, measuring and scheduling of work
Industrial engineering and manufacturing technicians	Mid-Level	May work independently or provide technical support and services in the development of production methods, facilities and systems, and the planning, estimating, measuring and scheduling of work.
Industrial electrician*	Mid-Level	Install, maintain, test, troubleshoot and repair industrial electrical equipment and associated electrical and electronic controls. Apprentices are also included in this unit group.
Construction millwrights and industrial mechanics*	Mid-Level	Install, maintain, troubleshoot, overhaul and repair stationary industrial machinery and mechanical equipment. Apprentices are also included in this occupation.
Contractors and supervisors in mechanic trades	Mid-Level	Supervise and coordinate the activities of workers classified in unit groups within the following minor groups: machinery and transportation equipment mechanics (except motor vehicle), automotive service technicians and small motor, engine and equipment mechanics and related repairers (including electrical components).
Supervisors, supply chain, tracking and scheduling coordination occupations*	Mid-Level	Supervise the activities of workers in production and transportation logistics coordinators and in supply chain logistics, tracking and scheduling coordination occupations.
Solar O&M technician (commercial/utility); Solar service technician (residential); Solar technician*	Mid-Level	Solar O&M Technicians perform operations and maintenance on large-scale photovoltaic systems. Residential Service Technicians are quality assurance professionals who monitor, diagnose, optimize, and repair underperforming PV systems.
Environmental experts; Environmental engineering technician	Mid-Level	Tests and implements new and existing engineering technologies relating to pollution control, recycling and waste disposal to remedy negative impacts of human activity on the environment to recommend improvement in the efficiency of environmental assessments of construction and civil engineering projects related to pollution control, recycling and waste disposal.
Chemical engineers*	Advanced	Research, design, and develop chemical processes and equipment, oversee the operation and maintenance of industrial chemical, plastics, pharmaceutical, resource, pulp and paper, and food processing plants and perform duties related to chemical quality control, environmental protection and biochemical or biotechnical engineering.
Industrial and manufacturing engineers*	Advanced	Industrial and manufacturing engineers conduct studies and develop and supervise programs to achieve the best use of equipment, human resources, technology, materials and procedures to enhance efficiency and productivity.
Electrical and electronics engineers*	Advanced	Design, plan, research, evaluate and test electrical and electronic equipment and systems.
Metallurgical and materials engineers	Advanced	Conduct studies of the properties and characteristics of metals and other non-metallic materials and plan, design and develop machinery and processes to concentrate, extract, refine and process metals, alloys and other materials such as ceramics, semiconductors and composite materials.
Computer and telecommunications hardware engineers	Advanced	Research, plan, design, develop, modify, evaluate and integrate computer and telecommunications hardware and related equipment.

Data scientist*	Advanced	Use advanced analytics technologies, including machine learning and predictive modelling, to support the identification of trends, scrape information from unstructured data sources and provide automated recommendations.
Environmental engineer (alt title: Hazardous substances engineer, Regulatory compliance manager) *	Advanced	Monitor and address environmental and hazardous concerns such as materials and facility practices. Work with regulatory personnel, conduct inspections of solar sites and facilities, evaluating compliance with environmental, health and safety regulations. Monitor improvements and needed changes to practices.
Mechanical engineer (Design engineer, Product engineer, Equipment engineer) *	Advanced	Develop technical engineering drawings and models. Verify and check project layouts and drawings. Outline materials needed based on engineering and quality standards.

Source: compiled from International Renewable Energy Agency's (IRENA) *Renewable Energy Benefits: Leveraging Local Capacity for Solar PV*; *Solar Career Map* from Interstate Renewable Energy Council; International Renewable Energy Agency's (IRENA) *Renewable Energy Benefits: Leveraging Local Capacity for Wind Energy*; *Wind Energy Career Map* by Office of Energy Efficiency and Renewable Energy; ACP's *Clean Energy Career Pathways Catalog: Wind Energy report*; Career map developed by Environmental Careers Organisation Canada (ECO Canada) and ACP's *Energy Storage: Clean Energy Career Pathways Catalog*.

\*Occupations that appear on the 2024 Western Cape List of Occupations in High Demand.

**Table A2: List of solar installation, repair and maintenance occupations with short description, education, and experience**

<b>Occupations</b>	<b>Level</b>	<b>General Description</b>
Cable and rope splicer	Entry	Perform cable splicing, terminations of cables, and electrical testing along cable line and on junction boxes and transformers, new construction, maintenance or repair of energized and de-energized cable work (above and below ground).
Concrete worker	Entry	Perform tasks involving concrete pouring, rebar tying and concrete finishing.
Crane operator	Entry	Operate cranes (hydro cranes, crawler cranes, and/or pile driving hammers) to hoist, move and place materials and objects, and raise, lower and rotate boom and load lines.
Equipment operator - Heavy (e.g. excavator operator; Loader operator)	Entry	Operate heavy machinery, such as a tractor, bulldozer, backhoe, or excavator, for the purposes of construction, demolition, or excavation. May be responsible for routine maintenance or repairs.
Health and safety manager*	Entry	Participate in planning, organising and implementing safety programs for construction projects while ensuring compliance with environmental, health and safety regulations.
Solar construction worker	Entry	Responsible for performing tasks involving physical labour at construction projects, excavations, and demolition sites while operating hand and power tools of all types, and other equipment and instruments.
Instrumentation and electrical technician	Entry	Perform maintenance, calibrate, install, and repair instrumentation including controls and electrical equipment.
Groundsman	Entry	Ensure upkeep and appearance of outdoor environments, including grounds and landscaping.
Commissioning technician	Entry	Perform visual and mechanical inspections and electrical testing to specifications of construction documents, prior to energization date, document all inspection findings and test results, and communicate the findings and test results with Commissioning Lead.
Solar PV installer, Solar assembler/ Basic (entry) installer*	Entry	Installers assemble and mount photovoltaic systems on roofs or other structures in compliance with system design schematics for residential, commercial, and utility-scale solar projects.
Warehouse assistant, Store person	Entry	Work directly with Warehouse Manager to coordinate the shipping, receiving and inventory, ensure cleanliness and organisation of warehouse, inspect all equipment and rigging coming in or leaving the warehouse, assist with loading and unloading trucks and prepare orders, process requests, and pull equipment and materials.
Site surveyor	Entry	Perform miscellaneous duties across the project to include surveying, quality control, and scheduling, survey and inspect site readiness and capabilities for projects and conduct land title surveys, topographic surveys, boundary surveys, and construction-staking and as-built surveys.
Truck driver*	Entry	Drive a truck / trailer to transport several types of construction equipment and materials throughout and between jobsites, load and unload equipment and materials, including solar panels and work with crane operator for loading/unloading as needed.

Solar site supervisor, Crew lead	Entry	Lead teams of PV Installers at a worksite and keep crews focused and on schedule, verify safety procedures and equipment, and provide quality assurance.
PV site inspector	Entry	Determine degree of conformance of materials, equipment and installation of materials and equipment to specifications, codes and design requirements, generate reports of conditions found during inspection activities.
Solar PV crew chief	Entry	Coordinate work, ensure schedules are followed, provide leadership to crews, ensure safety, operations and installation specifications, and procedures are followed and provide quality control for tasks and project.
Logistics manager*	Entry	Plans, directs, or coordinates purchasing, warehousing, distribution, forecasting, customer service, or planning services. Manages logistics personnel and logistics systems and directs daily operations.
Cable joiner*	Mid-Level	Joins insulated electric power cables installed in underground conduits and trenches and prepares cable terminations for connection to electrical equipment and overhead lines.
Carpenter with solar expertise, Construction carpenter	Mid-Level	Maintain structural and support for utility-scale, commercial and residential solar projects. By using materials including wood, metal, and concrete, carpenters ensure that solar installations are secure and meet quality standards.
Control centre operator, Power system operator, Electrical system operator	Mid-Level	Direct, monitor and coordinate the operation of solar energy assets from an Operations Control Center ensuring that the operations of solar farms comply with all applicable standards and practices.
Electrical line mechanic	Mid-Level	Installs, maintains, repairs and patrols electrical sub-transmission and distribution systems.
Solar installation electrician, electrician with solar expertise, Journeyman electrician, Energy storage installer*	Mid-Level	Electricians are responsible for installing, maintaining, and repairing electrical wiring, equipment, fixtures and ensuring that work is in accordance with relevant codes. Energy Storage Installers set up and maintain sophisticated battery storage equipment and wiring that connects to a residential, commercial, or utility-scale solar energy system.
Engineering manager*	Mid-Level	Oversee operations and staff, support the site / facility manager in operating the site, develop strategy for improved maintenance diagnostics and operation and lead and train more junior maintenance personnel.
Maintenance supervisor	Mid-Level	Oversee safe operation and performance of mechanical, electrical and hydraulic maintenance activities, schedule all maintenance, replacement and inspection and ensure the troubleshooting of failures, faults, and problems; interpret fault reports, and implement corrective actions.
Solar project manager, Solar energy installation manager*	Mid-Level	Coordinate all of the workers and materials involved in a solar installation, managing time and budgets, and translating between engineers, system designers, and installers in the field.
Heating, ventilation, and air conditioning (HVAC) technician with solar expertise, HVAC/R mechanic*	Mid-Level	Install, service, and repair commercial solar thermal systems and manage whole-building systems, which is key to the future of residential solar energy.
Roofer with solar expertise	Mid-Level	Use best practices in roofing to install racking systems, mount photovoltaic panels or thermal collectors, and waterproof the flashing around installed components.

Solar O&M technician (commercial/utility and residential), Solar service technician (residential)	Mid-Level	Perform operations and maintenance on large-scale photovoltaic systems which involves highly technical performance monitoring with sophisticated instrumentation and controls.
Engineering technician (Civil, Electrical, Mechanical, or Environmental) *	Mid-Level	Work with engineers in applying the theory and principles of engineering to plan, design, evaluate, and improve the performance of solar energy-related equipment, processes, and facilities.
Solar installation contractor (general, electrical), Plumbing contractor, Construction project manager, Project superintendent*	Advanced	Plans and directs solar installation projects—submitting bids, pulling permits, and managing material, labour, and equipment.
Solar energy systems designer, System integrator, Solar energy systems engineer	Advanced	Solar Energy System Designers perform site-specific engineering analysis of commercial, industrial, or utility-scale solar projects and design large photovoltaic or solar thermal systems.
Industrial engineer*, Manufacturing engineer, Process engineer industrial engineer	Advanced	Increase solar manufacturing productivity through the management of people, the use of technology, and the introduction of more efficient processes in solar component production. Assess and study manufacturing and industry needs and issues.
Solar fleet manager, Solar O&M manager, Fleet services manager*	Advanced	Identify, cultivate, and manage third-party vendors to service residential or commercial solar installations and interact with multiple business interests to ensure service level agreements are met, and they oversee logistics coordination for existing and new solar installation equipment.
Structural engineer	Advanced	Responsible for the design and/or analysis of structural support systems for solar projects and may supervise the construction of Concentrated Solar Power plants, PV plants, and related structures.
Solar project developer	Advanced	Provide a critical link between engineering, procurement, and construction by using the best technologies to produce the most effective solar energy solutions for their clients.
Electrical systems engineer, Power systems, Electrical interconnection, electrical design, Electrical engineer*	Advanced	Provide power system expertise, electrical theory, research and analysis for renewable energy company to connect to power grid, prepare and study specs of electrical systems and technical drawings and develop construction, installation and manufacturing specifications.
Environmental engineer*, Hazardous substances engineer, Regulatory compliance manager	Advanced	Use tools and principles from a variety of engineering disciplines and establish practices to prevent, control, and/or remediate environmental, health, and safety hazards in solar industry operations.
Environmental manager	Advanced	Provide engineering expertise and general support to the onsite operations and maintenance teams, lead and develop the engineering team to work on engineering solutions, read and interpret documents such as operating and maintenance instructions, procedures manuals, blueprints and schematics.

Mechanical engineer*, Design engineer, Product engineer, Equipment engineer	Advanced	Develop technical engineering drawings and models, verify and check project layouts and drawings and outline materials needed based on engineering and quality standards.
Meteorologist*	Advanced	Monitor and manage data from meteorological towers to prepare reports and presentations to internal and external stakeholders.
Operations manager, O&M manager, Site manager, Facility manager—solar	Advanced	Provide hands-on technical support and supervision for generation equipment and power delivery systems, as well as with other facility civil work, building maintenance, and upkeep.
Assistant facility manager	Advanced	Lead the use of maintenance documentation, reporting tools and performance systems necessary for reporting and performance improvement and provide hands-on technical support and supervision for generation equipment and power delivery systems, as well as with other facility civil work, building maintenance, and upkeep.
Buyer, Procurement specialist, Procurement associate, Purchasing officer*	Advanced	Provide commercial support to pre & post award projects and report to the assigned Procurement Manager or Director of Procurement by receiving and evaluating proposals, negotiate pricing with suppliers, working closely with engineering project management, scheduling, legal and insurance.
Reliability engineer	Advanced	Conduct failure mode and effect analysis, root cause assessments, equipment troubleshooting, and system impact studies. Support field operations by performing studies in response to major component and systemic equipment failures.
Commissioning manager	Advanced	Responsible for planning, checking, quality assurance, monitoring, evaluation, and preparation of commissioning reports to management and creating guidelines and procedures to ensure all project activities are completed according to a standard process, project plan and budget.
Operations specialist	Advanced	Involved in monitoring of plant and system processes by operating electrical and SCADA systems and monitoring critical elements in a complex and regulated system.
Civil engineer*	Advanced	Provide civil engineering expertise including evaluating structural loads and limits for solar structures and buildings and providing expertise to project managers and others regarding structural loads and limits.
PV system designer	Advanced	Design solar /photovoltaic (PV) systems, analyse site for commercial or utility scale solar projects and recommend engineering or manufacturing changes based on project objectives and in response to project issues.
Senior financial analyst and planner, Physical asset manager*	Advanced	Manage the range of assets for the business, from a financial standpoint by preparing financial statements, forecasts, and reports and managing the project financing process for various projects.
Planner - renewable energy	Advanced	Prepare proposals and provide direction for the development of environmental impact analysis documents, related technical studies, mitigation monitoring, exemptions/ exclusions, and discretionary permit applications.
Administrative staff (e.g. Business administrator; Accountant*, Attorney*)	Various levels	Assorted administrative staff.

Source: compiled from International Renewable Energy Agency's (IRENA) *Renewable Energy Benefits: Leveraging Local Capacity for Solar PV and Solar Career Map from Interstate Renewable Energy Council*.

\*Occupations that appear on the 2024 Western Cape List of Occupations in High Demand.

Table A3: List of occupations required in the assembly of battery storage systems with short description, education, and experience

Occupation	Level	Description
Electronics assemblers and fabricators	Entry	Assemble and fabricate electronic equipment, parts and components.
Electronics inspectors and testers	Entry	Inspect and test electronic and electromechanical assemblies, subassemblies, parts and components to ensure conformance to prescribed standards.
Labourers in metal fabrication, metal fabricator	Entry	Remove excess metal and unwanted materials from metal parts, castings and other metal products and perform other labouring activities.
Labourers in mineral and metal processing	Entry	Perform material handling, clean-up, packaging and other elemental activities related to mineral ore and metal processing.
Machine operators in electrical apparatus manufacturing	Entry	Operate machinery or equipment to fabricate complete products or parts for use in the assembly of electrical appliances and equipment, and electrical apparatus, such as batteries, fuses and plugs.
Inspectors and testers in electrical apparatus manufacturing	Entry	Inspect and test completed parts and production items.
Material handler (manual), store person	Entry	Handle, move, load and unload materials by hand.
Material handler (equipment operators), forklift driver	Entry	Handle, move, load and unload materials by using a variety of material handling equipment.
Other labourers in processing, manufacturing and utilities, Manufacturing labourers	Entry	Perform material handling, clean-up, packaging and other elemental activities in processing, manufacturing and utilities.
Commissioning technician	Entry	Work with team to perform required system inspections on utility energy storage facilities including performing visual and mechanical inspections and electrical testing to specifications of construction documents, prior to the energization date.
Electrical and electronics engineering technician*	Mid-Level	May work independently or provide technical support and services in the design, development, testing, production and operation of electrical and electronic equipment and systems.
Mechanical engineering technologists	Mid-Level	Provide technical support and services or may work independently in mechanical engineering fields such as the design, development, maintenance and testing of machines, components, tools, heating and ventilating systems, geothermal power plants, power generation and power conversion plants, manufacturing plants and equipment.
Mechanical engineering technician*	Mid-Level	Provide technical support and services or may work independently in mechanical engineering fields such as the design, development, maintenance and testing of machines, components, tools, heating and ventilating systems, power generation and power conversion plants, manufacturing plants and equipment.

Industrial engineering and manufacturing technologists*	Mid-Level	Develop and conduct production, inventory and quality assurance programs in manufacturing or in other industries
Industrial engineering and manufacturing technicians	Mid-Level	May work independently or provide technical support and services in the development of production methods, facilities and systems, and the planning, estimating, measuring and scheduling of work.
Industrial electrician*	Mid-Level	Install, maintain, test, troubleshoot and repair industrial electrical equipment and associated electrical and electronic controls. Apprentices are also included in this unit group.
Construction millwrights* and industrial mechanics	Mid-Level	Install, maintain, troubleshoot, overhaul and repair stationary industrial machinery and mechanical equipment. Apprentices are also included in this occupation.
Contractors and supervisors in machining, metal forming, shaping and erecting trades, metal machinist	Mid-Level	Supervise and coordinate the activities of workers in the following unit groups: Welders and Machine operators in electrical apparatus manufacturing
Contractors and supervisors in mechanic trades	Mid-Level	Supervise and coordinate the activities of workers including industrial mechanics.
Supervisors in electronics manufacturing, Production / Operations supervisor (Manufacturing)	Mid-Level	supervise and coordinate the activities of workers who assemble, fabricate, test, repair and inspect electronic parts, components and systems
Supply chain, tracking and scheduling coordination occupations*	Mid-Level	Supervise, plan, assign and review the work of clerks engaged in the following duties: shipping, receiving, storing, distributing and maintaining inventories of materials, parts and products; processing purchasing transactions; coordinating production work; dispatching crews; scheduling transportation crews and routes; and other related activities.
Stock controller, Stock clerk / office*	Mid-Level	Monitors stock levels and maintains stock, order and inventory records.
Welder*	Mid-Level	Fabricates and repairs metal products using various welding techniques.
Chemical engineer*	Advanced	Research, design, and develop chemical processes and equipment, oversee the operation and maintenance of industrial chemical, plastics, pharmaceutical, resource, pulp and paper, and food processing plants and perform duties related to chemical quality control, environmental protection and biochemical or biotechnical engineering.
Industrial and manufacturing engineers*	Advanced	Conduct studies and develop and supervise programs to achieve the best use of equipment, human resources, technology, materials and procedures to enhance efficiency and productivity.
Electrical and electronics engineers*	Advanced	Design, plan, research, evaluate and test electrical and electronic equipment and systems.
Metallurgical and materials engineers	Advanced	Conduct studies of the properties and characteristics of metals and other non-metallic materials and plan, design and develop machinery and processes to concentrate, extract, refine and process metals, alloys and other materials such as ceramics, semiconductors and composite materials.

Computer and telecommunications hardware engineers	Advanced	Research, plan, design, develop, modify, evaluate and integrate computer and telecommunications hardware and related equipment.
Data scientist*	Advanced	Use advanced analytics technologies, including machine learning and predictive modelling, to support the identification of trends, scrape information from unstructured data sources and provide automated recommendations.
Commissioning manager	Advanced	Oversee installation and commissioning operations from the Storage project kick-off through customer acceptance.
Industrial products sales representative; Sales solutions engineer	Advanced	Present storage solutions in a compelling and value-based approach to prospects and customers as part of the sales process.
Mechanical engineer*, Design engineer, Equipment engineer	Advanced	Design, develop, analyse and test Storage equipment and products.
Programme or Project manager; Renewable energy planner	Advanced	Responsible for assessment and permitting of renewable energy facilities and associated storage and transmission infrastructure.
Purchasing officer; Strategic procurement manager- energy storage*	Advanced	Lead and support the development of strategy for and the procurement of the key components that comprise projects and products, including energy storage solutions, tracking systems and other key technologies with a focus on energy storage.
General accountant*	Advanced	Plans and provides systems and services relating to the financial dealings of organisations and individuals, and advises on associated record-keeping and compliance requirements.
Engineering manager*	Advanced	Provide engineering expertise and general support to the onsite operations and maintenance teams.

Source: Compiled from Career map developed by Environmental Careers Organisation Canada (ECO Canada) and ACP's *Energy Storage: Clean Energy Career*

\*Occupations that appear on the 2024 Western Cape List of Occupations in High Demand.



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Founded in 1975, the Southern Africa Labour and Development Research Unit (SALDRU) is a research-based social responsiveness initiative housed in the School of Economics at the University of Cape Town.

The unit carries out research and capacity building in applied empirical microeconomics with an emphasis on poverty and inequality, labour markets, human capital and social policy. We strive for academic excellence and policy relevance.

SALDRU has implemented a range of innovative surveys in South Africa including the Project for Statistics on Living Standards and Development (PSLSD), Cape Area Panel Study (CAPS) and the National Income Dynamics Study (NIDS), among others. Building on these large data gathering projects, we conduct a range of training and capacity building activities in the use of survey data to analyse social well-being.

Our mission is to challenge inequalities through policy relevant academic research.

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