NBI
National Business Initiative

Powering Futures: The Green Skilling Opportunity

TOWARDS A JUST, CLIMATE-RESILIENT, PROSPEROUS FUTURE FOR SOUTH AFRICA

ENDORSED BY

PRESIDENTIAL CLIMATE COMMISSION
THE PRESIDENCY REPUBLIC OF SOUTH AFRICA
BUSA BUSINESS UNITY SOUTH AFRICA

IN PARTNERSHIP WITH

BCG BOSTON CONSULTING GROUP
real Centre For Researching Education and Labour

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THE AFRICAN CLIMATE FOUNDATION

Foreword

South Africa is undergoing a massive energy transition and there is significant risk if that transition is delayed unnecessarily. Over the past decade, significant strides in renewable energy have been made through adding 5 - 6 GW of capacity to the grid. However, as we plan for a future with 120 - 150 GW of renewable energy by 2050[1] and face the decommissioning of over 20 GW of coal-fired power by 2040 , the challenge ahead is immense.

It is further complicated by our most pressing socio-economic challenges of inequality, unemployment and poverty. If the energy transition is not inclusive or just, we risk further exacerbating the structural and systemic barriers that limit many people, particularly youth and women, and communities' ability to access opportunities in the economy.

By coming together to align our workforce with the demands of a greener future, we can secure a more inclusive, equitable South Africa—one where no one is left behind as we embrace a just transition.

In this context, skilling to support the Just Energy Transition is critically important. Our skills landscape needs to be aligned with the needs of the future and have the capacity to adjust in a dynamic way to support the speed and scale that is needed. A demand-led approach to skilling is the cornerstone of ensuring that our workforce is prepared for the opportunities ahead. It is also critical that we work with the current skilling system to adjust, strengthen existing structures, and bridge the gaps that hinder progress.

The **JET Skilling for Employment Programme (JET SEP)**, led by the National Business Initiative, is endorsed by the JET PMU in the Presidency as the co-ordinator of private sector effort in JET skills. In partnership with Boston Consulting Group, it addresses this need by contributing to and supporting the JET Implementation Plan (IP) Skills Chapter. The groundwork laid out in the JET IP is critical to guiding this transformation, ensuring that South Africa's energy transition is not only environmentally sustainable but also socially equitable. **JET SEP aims to coordinate the private sector to support a demand-led skilling approach that not only addresses today's needs but anticipates future demands.**

The private sector plays a key role in ensuring a future-fit, agile and empowered workforce that can meet the needs of emerging sectors but also ensures inclusive and sustainable employability. By investing in training and reskilling programs, aligning business needs with workforce development, and creating job opportunities for the newly skilled and re-skilled, we can directly contribute to the success of the JET-P vision. This is not a challenge that any one organization or sector can tackle alone. It requires the sustained partnership of **businesses, government, labor unions, educational institutions, and civil society.** Only through collaboration can we translate the insights from this publication into practical impact.

JET SEP is working to achieve this through deep research and analysis, strengthened by engagement with key stakeholders through a comprehensive governance structure. We are proud to have 28 CEOs from some of the country's leading companies and organisations on board as JET SEP CEO Champions, who bring commitment and leadership to this initiative.

1. Integrated Resource Plan (IRP), 2023

Building on the Climate Pathways and Just Transition study done by the NBI, BCG, and BUSA in 2022, JET SEP takes a rigorous approach to identify gaps and opportunities for skills development. Importantly, this program goes beyond analysis as it is outcome-driven, focused on implementing practical solutions that create jobs and support economic growth. As we embark on this ambitious journey, we recognise that skilling is not an end in itself—it is a means to securing meaningful, decent employment for all South Africans.

This first **JET SEP** publication consolidates data that estimates the specific demand for jobs and skills across technologies, value chain steps, and occupations—data that is vital for aligning our workforce development efforts with the needs of this new economy. This dataset provides a clear foundation for action, moving us towards practical and targeted solutions.

"I am filled with optimism about what we can achieve through partnership and collaboration. The road ahead is challenging, but with the commitment of the private sector, government, and all stakeholders, we can build a just, inclusive, and prosperous future for South Africa."

Shameela Soobramoney
CEO - NBI

Gugu Mclaren-Ushewokunze
Head of Economic Inclusion, Social Transformation, NBI

Acknowledgements

ABOUT THE JUST ENERGY TRANSITION SKILLING FOR EMPLOYMENT PROGRAMME (JET SEP):

The Just Energy Transition Skilling for Employment Program (JET SEP) is a multistakeholder and collaborative initiative led by the National Business Initiative (NBI), in partnership with Boston Consulting Group (BCG). Endorsed by the Presidency's JET Project Management Unit (JET PMU), as mandated by The Presidency, and supported by South Africa's CEOs, JET SEP coordinates private sector contributions to realising the skills chapter in the JET Implementation Plan, with a focus on inclusive workforce development and sustainable job creation

ENDORSED BY:

THE PRESIDENCY
REPUBLIC OF SOUTH AFRICA

About the JET Project Management Unit (JET PMU):

The PMU leads the execution of South Africa's Just Energy Transition (JET) Investment Plan, as mandated by The Presidency. It coordinates stakeholders, manages resources, and tracks progress to ensure the transition to a low-carbon economy. The PMU drafted the JET Implementation Plan (JET-IP) and plays a key role in driving the Skilling Chapter 9, which focuses on developing the workforce needed to support the JET through targeted education, training programmes, and capacitation

PRESIDENTIAL
CLIMATE COMMISSION
TOWARDS A JUST TRANSITION

About the Presidential Climate Commission (PCC):

The Presidential Climate Commission (PCC) advises the South African government on climate policies and strategies. It ensures that the Just Energy Transition is inclusive, equitable, and aligned with the country's climate goals, fostering collaboration among various stakeholders

BUSA
BUSINESS UNITY SOUTH AFRICA

About Business Unity of South Africa (BUSA):

BUSA represents South African businesses and advocates for policies that support sustainable economic growth. In the Just Energy Transition, BUSA works with the government and stakeholders to ensure an inclusive shift towards renewable energy

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POWER AFRICA
A U.S. GOVERNMENT-LED PARTNERSHIP

About Power Africa:

Power Africa is a U.S. government-led initiative to improve access to affordable and reliable electricity in sub-Saharan Africa, unlocking the potential for inclusive economic growth and prosperity, job creation, improved health, and environmental outcomes by adding 30,000 megawatts of new electricity generation capacity and 60 million new electricity connections for homes and businesses by 2030. Power Africa, through the U.S. Agency for International Development (USAID) and in support of the Just Energy Transition Partnership, has provided a grant to NBI to support the JET SEP.

THE AFRICAN CLIMATE FOUNDATION

About African Climate Foundation (ACF):

The African Climate Foundation (ACF) is the first and only African-led and fully African-run strategic climate change grant-making foundation on the continent. Our mission is to support interventions at the nexus of climate change and development that will deliver long-term socio-economic transformation and inclusive development in Africa, and our vision is a vibrant and climate-resilient Africa in which inclusive socio-economic development delivers sustainable and equitable growth

IMPLEMENTATION PARTNERS:

About National Business Initiative (NBI):

NBI is a South African NGO and independent business movement focused on promoting sustainable economic and environmental practices. It collaborates with public and private sectors to advance environmental responsibility and inclusive economic growth, particularly through projects like the Climate Pathways and Just Transition project released in 2022 and now through the Just Energy Transition: Skilling for Employment Programme

About Boston Consulting Group (BCG):

BCG is a global consulting firm that helps organizations tackle complex challenges.
As a partner in the JET SEP, alongside NBI, BCG leverages its local expertise in climate and sustainability to provide strategic advice to support an inclusive and just energy transition

About Wits REAL:

Wits REAL is a research initiative at the University of the Witwatersrand focused on tackling climate change. Through interdisciplinary research, education, and community engagement, Wits REAL promotes sustainable practices and policies. By fostering collaboration between academia, industry, and government, it drives innovative solutions to support a just transition to a sustainable future

Overview of CEO Champions

Lead CEO Champions

Nolitha Fakude
Anglo American

Dan Marokane
Eskom

Simon Baloyi
Sasol

Lungisa Fuzile
Standard Bank

Deidré Penfold
CAIA

Mohammed Akoojee
DP World

Gregvan Wyk
Mediclinic

Phuthi Mahanyele Dabengwa
Naspers

Gqi Raoleka
Pele Green Energy

Shirley Machaba
PwC

Paul Hanratty
Sanlam

Alexander Thiel
Sappi

Charles Russon
ABSA

Holger Reimensperger
AECI

Brian Dames
AREP

Theo Boshoff
AgBiz

Lassad Jaouani
Air Liquide

Stuart Kent
Aurex Constructors

Taelo Mojapelo
bp South Africa

Cas Coovadia
BUSA

Shameela Soobramoney
NBI

Brent Botha
Norton Rose Fulbright

Iain Williamson
Old Mutual

Crispian Olver
Presidential Climate Comission

Mike Teke
Seriti

Aluwani Museisi
Shell

Rob Aitken
Tongaat Hulett

Michelle Phillips
Transnet

Key take-aways

South Africa needs to prepare its people for the significant opportunities provided by the just energy transition:

- Over the next 25 years, South Africa will require capacity in the region of 400,000 – 600,000 gross jobs to execute the energy transition.

- For a just energy transition, the socio-economic context of skills development matters:
  - skilling should aim to reach marginalised and vulnerable communities, particularly youth and women, in an inclusive manner;
  - skilling should enable individuals to access sustainable job opportunities and equip them with the capabilities to navigate the workplace and the economy effectively; and
  - skilling should position informal and township SMMEs to obtain the necessary technical capabilities, combined with enterprise development, to unlock transformative market opportunities.

- The need (and opportunity) is also immediate, with 120,000 – 200,000 gross jobs expected to be created by 2030, based on the current project pipeline and demand. Of these jobs:
  - 50% (59,000 – 99,000) are in the solar value chain;
  - 44,000 –74,000 arise in the construction phase, but they are temporary and part-time;
  - 9,500 – 15,900 are generated in manufacturing and assembly, based on current levels of local manufacturing and assembly;
  - there will be a lot of demand for semi- to highly-skilled people: ~21,000 artisans, ~25,000 engineers and ~25,000 technicians. The greatest demand will be for ~72,000 low- to semi-skilled labourers (e.g. construction workers, cleaners, security guards, packers etc.);
  - immediate hot spots are Gauteng and the northern Free State for the next two years (2025 – 2027), with growth in the Northern, Western and Eastern Cape closer to 2030.

- The skilling system needs to deliver the skills demanded by the key value chains of the energy transition at an appropriate pace and scale. Some will be transferable to the green economy broadly.

- The solution is not just a massive scale-up of training, but a fundamental and sustainable shift towards an agile, co-ordinated, place-based ecosystem approach to skilling.

- An ecosystem approach calls for the active engagement of all social partners, optimised funding, strong institutional capacity, learner-centric pathways enabled by low-barrier technology, and a strong orchestrator.

400,000 - 600,000
JOBS TO BE CREATED BY SOUTH AFRICA'S JUST ENERGY TRANSITION

120,000 - 200,000
JOBS COULD BE CREATED BY 2030

50% OF JOBS BY 2030
ARE IN THE SOLAR VALUE CHAIN

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The just energy transition is also a skilling transition

The just energy transition begins with people. Over the next 25 years, South Africa has official plans to add 120 - 150 GW[1] of renewable energy capacity as it develops a low-emission, least-cost power sector. This is a significant transformation that will help the country to achieve its Nationally Determined Contribution (NDC) towards combating climate change.

At the same time, the drive towards decarbonisation is creating new opportunities in the electricity transmission, generation and battery energy storage systems (BESS), green hydrogen and electric mobility sectors . These new opportunities can be a source of dynamism, innovation and growth, if they are executed in a just manner that allows all people to participate. Without proper planning and management, however, economic transitions leave behind ghost towns, broken livelihoods and social upheaval. They also exacerbate already high levels of inequality and economic exclusion. Proper planning and management demands, among other things, an ambitious skilling strategy: the skilling system must train a significant number of people in the skills demanded by the energy transition, in the right locations, at the right scale, and particularly, with the right timing. This is essential for a transition that is 'just'[2] .

The manner in which skilling is conducted should also have an inclusive orientation. The skilling opportunities provided must provide pathways for marginalised and vulnerable communities to achieve meaningful economic participation. Skilling should be informed by the socio-economic realities of the intended trainees, so that they can overcome the economic, logistical and socio-cultural barriers they encounter. The skilling system should enable the targeted individuals to access sustainable job opportunities and acquire the capabilities to navigate the workplace and the economy effectively. An inclusive lens also means that skilling should position SMME, informal and township companies to gain the necessary technical capabilities, combined with enterprise development, to unlock transformative market opportunities.

Skills de-risk project delivery but do not themselves create jobs. Not having the right skills, however, curbs employment opportunities for the local workforce.

1. Integrated Resource Plan (IRP), 2023
2. "Just", as defined by the Presidential Climate Commission

02

Breaking down the skills need

To provide the local workforce with the skills required to participate in new opportunities, it is imperative to have a clear understanding of what the skilling system needs to deliver to support the just energy transition, and the green economy more broadly.

To break down the skills need, first and foremost requires a methodical approach that translates confirmed project pipelines into credible estimates of specific occupations and skills that will be in demand. Such an analysis, focusing on confirmed project pipelines in the short- to medium-term in particular geographic areas and within a measurable timeframe, ensures that skilling does not occur too far ahead of demand. It is essential to guide skills planning for both upskilling and reskilling of workers as well as new entrants to the labour market.

A balanced approach is needed in skilling for different timeframes. While some emerging green value chains, such as wind and solar, are at an advanced stage of planning and implementation, the scaling up of new energy vehicles is still dependent on the development of market demand. At the same time, we need to ensure the workforce is adequately prepared with foundational knowledge and skills that will enable them to upskill for demand in the future. Starting from a tangible project pipeline enables skills planners to make decisions in a concrete and structured way.

The role of the private sector

The just energy transition is occurring at a time when electricity markets have moved from a monopoly utility model to a more open market structure. In most economies, the model of a vertically-integrated utility has made way for competitive markets that include both public and privately-owned businesses as players. The energy transition also touches sectors of the economy where the private sector is most likely to create the bulk of jobs, such as heavy manufacturing, electric vehicles and green hydrogen.

The green economy is not only competitive, but also holds space for many small- and medium-sized enterprises. This includes companies in the informal and township economy, who need to upgrade their capabilities if they are to participate meaningfully in the opportunities presented by the transition.
Employers bring a detailed and practical sense of the skills needed and feel the impact of skills gaps acutely. They bear a social responsibility to help upskill, reskill, reskill and skill workers, especially those from vulnerable groups and communities. For this reason, inputs from the private sector are essential to determine the right type and number of jobs and skills required, where they are required and when. It is also vital to ensure individuals are equipped to pursue lifelong, sustainable careers in a constantly-evolving economy.

> **The private sector will play a pivotal role in supporting skills anticipation and in creating employment opportunities by informing the design of training programs that meet the specific needs of industry, especially in emerging sectors like renewable energy and green technologies.**
>
> – JET Implementation Plan, Chapter 9: Skills

The Just Energy Transition Skilling for Employment Programme (JET SEP) is a structured programme that presents a unified, pragmatic and additive perspective from the private sector on this topic. The JET SEP is led by the National Business Initiative in partnership with Boston Consulting Group (BCG) and the REAL Centre at Wits University. It is supported by approximately 30 CEO Champions from sectors across the South African economy, including the CEOs of Eskom, Sasol and

Standard Bank and the Chairperson of Anglo-American, who are Lead CEO Champions.

The programme has been formally endorsed by and integrated into government's green skilling efforts, led by the JET Project Management Unit (JET PMU), to help realise the ambition laid out in the Skills Chapter of the JET Implementation Plan (JET IP). The JET SEP achieves this through its multi-layered and inclusive governance structure that brings together industry, academia, industry associations, public sector agencies, skilling providers and others. As a result, the JET SEP is able to provide deep insights from the private sector and balance them with broader perspectives from other stakeholders across the skills ecosystem. A critical part of the JET SEP's structure is the CEO Champions Board, which brings together industry captains to advocate for and drive execution by their respective sectors.

In line with the JET SEP's mandate, this report presents a detailed, fact-based perspective on the potential jobs and skills required to execute South Africa's energy transition, and how the country can ensure that the investment in jobs and skills is just and inclusive. This perspective does not start from a blank slate. It builds on several important studies on jobs and skills needs across the key sectors identified in the JET Implementation Plan that were conducted by multiple stakeholders and organisations in the country.

> **As the Presidential Climate Commission (PCC), we believe that to successfully deliver on the JET skills implementation plan, the support of the private sector is critical to identify and quantity the skills required, guide curricula change and/or development, and to constructively change the skills ecosystem to meet market requirements.**
>
> – Presidential Climate Commission, Dr Crispian Olver

> **A well-coordinated contribution from business will contribute to enhanced ambition within business and government, allow greater collaboration within and across sectors and maximise our opportunities for success. In my capacity as the CEO of Business Unity South Africa (BUSA), I welcome NBI's proposal to play the orchestrator role for the private sector to ensure a meaningful, well-coordinated, contribution from the private sector in delivering on the JET skills implementation plan.**
>
> – BUSA CEO, Cas Coovadia

Unpacking the JET SEP's demand-led approach to quantifying skills needs

A dynamic, demand-led approach to skilling begins with reliable and quality information. The fact base used to plan for emerging green jobs and associated skills should reflect immediate industry demand while accounting for the fact that we are planning for industries that are still evolving and developing. As a first principle, the JET SEP strives to be demand-led, taking its cues from facts on the ground relating to projects as they evolve over time.

To make sense of both the immediate and emerging demand for skills, a four-step process is adopted.

Step 1: Understand project pipelines per sector, grouping projects by level of certainty

The JET SEP starts by leveraging over 20 authoritative public documents and databases, including the Integrated Resource Plan, the Eskom Renewable Energy Survey, the Just Energy Transition Investment Plan, and NERSA, to populate the latest view of project pipelines. A full list of the sources the JET SEP has leveraged are detailed in the annex to this report.

Projects are then categorised into three groups by the level of certainty of execution within two horizons: an immediate horizon to 2030 and a longer-term horizon to 2050, in line with the target period to achieve a net zero carbon economy. Projects categorised as high certainty are captured in base scenario forecasts for demand and skills, while those categorised as low certainty are considered in optimistic demand scenarios to quantify the upper limit of jobs demand.

For projects in the solar, wind and battery storage sectors, projects are categorised as high certainty if they are included in the REIPPP or RMIPPP, as medium certainty if they have received environmental and/or financial closure, and low certainty if they are in the feasibility phase.

Projects in the green hydrogen sector are classified as high certainty if labelled by the government as of strategic importance, as medium certainty if included in the JET IP, and as low certainty if they are exploring funding.

Projects in the transmission sector are classified as high certainty if they are already or will be in construction within six months, as medium certainty if they are in advanced feasibility, and as low certainty if they are planned for in the NTCSA's Transmission Development Plan (TDP, 2023 – 2032) but are not far in the feasibility process.

Projects in the New Energy Vehicles sector are classified as high certainty if they are currently included in local OEM production plans, and as low certainty if they would be implied by global OEM production plans based on South Africa's current share of global OEM production, but have not yet been announced locally.

Projects in the energy efficiency sector are classified as high certainty based on current pipelines, and as low certainty if they are more ambitious projects that are only likely to be taken forward if required by new building regulations on energy monitoring and savings.
Beyond 2030 (Horizon 2), the JET SEP leveraged national planning targets to provide a directional, long-term forecast of South Africa's future green labour force.

For each sector, categorisation of project pipelines was tested through multiple rounds of consultations with industry players through working groups as well as select direct engagements. These categorisation principles were validated by a wide group of industry and other stakeholders, for example by confirming project start dates and sharing potential risks and delays observed in the market that could impact project certainty.

Step 2: Articulate operational activities required for each step of each value chain and translate them into occupations

Detailed activities for each step of the full value chain, accounting for nuances by project type and/or size as relevant, were identified, leveraging industry expertise and global benchmarks. These activities are translated into occupations using South Africa's Organising Framework for Occupations (OFO) as a starting point. They were augmented with international classification systems to identify additional occupations that may be relevant but may not yet be reflected in the OFO. To date, JET SEP has conducted over 30 hours of expert calls with local and international industry players to identify the activities and key occupations.

3. Renewable energy & transmission (further broken down into solar, wind, battery storage, transmission, and energy efficiency sectors), green hydrogen, and New Energy Vehicles
4. REIPPPP = Renewable Energy Independent Power Producer Procurement Programme; RMIPPPP = Risk Mitigation Independent Power Producer Procurement Programme
5. Energy Efficiency is a broad sector. Following the programme principle of being demand-led, in consultation with industry and the working group, Energy Management Systems (EMS) and HVAC systems for residential, commercial and industrial buildings were selected as the sub-sectors of focus

Step 3: Calculate the number of jobs required per year to execute each project, understanding the duration of need

For each sector, project pipelines are segmented by size, given that the relative size of the project informs the size and make-up of the project teams across project phases, and which in turn informs the types of skills needed to fully execute the project. On this basis, for each project segment, the number of employees required for each relevant occupation is identified for every step of the value chain through detailed local industry consultations and comparisons with international benchmarks.

These are built up into a model which calculates the number and types of jobs required to execute each project within the pipeline, and aggregates estimates across the project pipeline. This is segmented by high and low certainty projects into a base and upper limit.

Team size estimates and underlying assumptions were tested with local industry during JET SEP working group sessions, and the assumptions underlying the estimates were found to hold true.

Step 4: Conduct scenario analysis to understand how demand estimates change based on level of local manufacturing and assembly (localisation)

Three scenarios - low, base and high - were considered for the different ambitions for the level of utilisation of locally-manufactured or assembled inputs.

The low scenario assumes that no local manufacturing and assembly takes place in South Africa.
The base scenario takes into account the specific components that are currently produced and/or assembled locally. For solar - lamination and packaging. For wind - towers and packaging. For batteries - management software and battery packs. For electric vehicles and charging - e-powertrain, structural components, installation hardware and network connectivity. For green hydrogen - some parts of electrolysis unit and storage systems. For energy efficiency - power supplies and software.

The high scenario, guided by national localisation strategies and industry input, accounts for components with potential to be produced in-country. These are: for solar - aluminium frame and junction boxes; for wind - rotor blades and nacelle; for batteries - inverter, power system and structural components; for electric vehicles and charging - the battery and charging units; and for energy efficiency - controllers.

The above assumptions have been pressure-tested with industry in sector working groups and additional consultations, to understand the actual level of demand for local manufacturing.

With these inputs, the JET SEP has produced seven individual sector forecasts that outline demand for jobs and skills along seven dimensions: by municipality, sector, value chain step, job type, occupation type, skill type, and time.

6. South Africa Green Hydrogen Commercialisation Strategy (2023)
7. South African Renewable Energy Master Plan (2024)

Figure 1 | JET SEP builds on existing studies by drilling down on granularity across 7 key elements

Location:

200+ municipalities

The model forecasts across every local municipality

Sector:

- Solar PV
- Transmission
- Green Hydrogen
- Energy Efficiency
- Onshore Wind
- Battery Energy Storage System
- New Electric Vehicles & Charging

(Guided by priorities in JET Implementation Plan)

Value Chain:

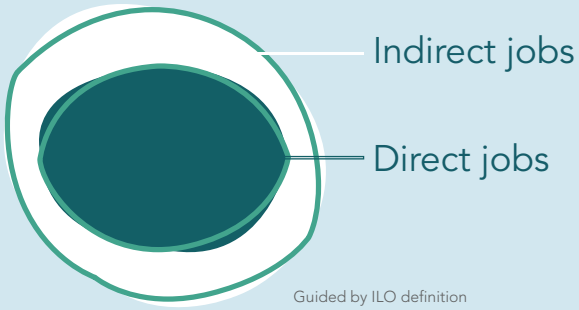
Project development → Manufacturing & Assembly

Construction → Installation & Connection

Operations & Maintenance → End-of-life

Across the entire sector value chain, by each step

In(direct):



Guided by ILO definition

Occupations (non-exhaustive):

Artisan
- Electrician
- Welder

Business Support
- Project manager
- Financial analyst
- Legal officer
- Administrator
- Community liaison officer
- Sales & Marketing
- Supply Chain management
- HR

Engineer
- Electrical
- Civil
- Mechanical
- Chemical

Labourer
- General construction worker
- General manual labourer
- General machine operator
- Electrician support
- Welder support

Plant / Site Personnel
- Safety officer
- Facilities and production manager

Scientist
- Data analyst
- Software expert
- Environmental practitioner

Transport and Logistics
- Logistics expert
- Transport operator
- Inventory specialist

Technician
- Electrical technician
- Civil technician
- Quality control
- Lab professional
- CAD designer
- Specialised machine operator
- Specialised technician

Skills:

Skill Level	Skills Category	Skill	Description of Skill
High	Mathematical analysis	Instrumental analysis	Qualitative and quantitative analysis of matter composition
High	Mathematical analysis	Applied chemistry analysis	Chemical engineering techniques to develop products or processes
High	Technical Operations	Unit operations	Converting raw materials to final product
High	Technical Operations	Chemical reaction engineering	Efficient design and operation of chemical reactors

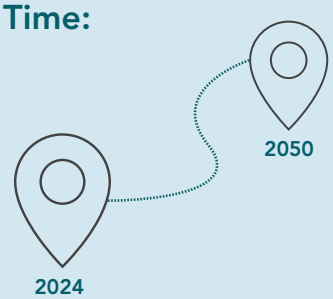
Sources: SAQA; ILO; ISIC

Key Components of skills mapping

Qualification	Skill types
Job family	Occupation

Technical and soft skills across occupations, qualifications, etc.

Time:



Annual forecast for key time horizons

This identifies that 400,000 – 600,000 gross jobs, i.e. total jobs required not considering jobs lost, will be required to execute the energy transition. The need (and opportunity) is also immediate, with 120,000 – 200,000 gross jobs to be created by 2030, based on the current project pipeline. This includes:

- ~50% (59,000 – 99,000) of the jobs in the solar value chain;
- 44,000 – 74,000 in the construction phase, which are temporary and part-time;
- 9,500 – 15,900 in manufacturing and assembly, based on current localisation levels;
- A significant portion of demand is for semi- to highly-skilled people – 21,000 artisans, 25,000 engineers, and 25,000 technicians.
- The greatest demand will be for ~72,000 low- to semi-skilled labourers, especially in the construction phase.

In the short term (Horizon 1, from now until 2030), the jobs anticipated are heavily anchored on the current project pipeline and the level of certainty. For example, there are 121 solar projects in the pipeline, with different levels of certainty for coming online based on whether the programme is part of REIPPP or not, and the project's stage (e.g. in feasibility study, environmental assessment completed, financial closure or in construction). This allows a dynamic forecast to be made, based on a changing project pipeline.

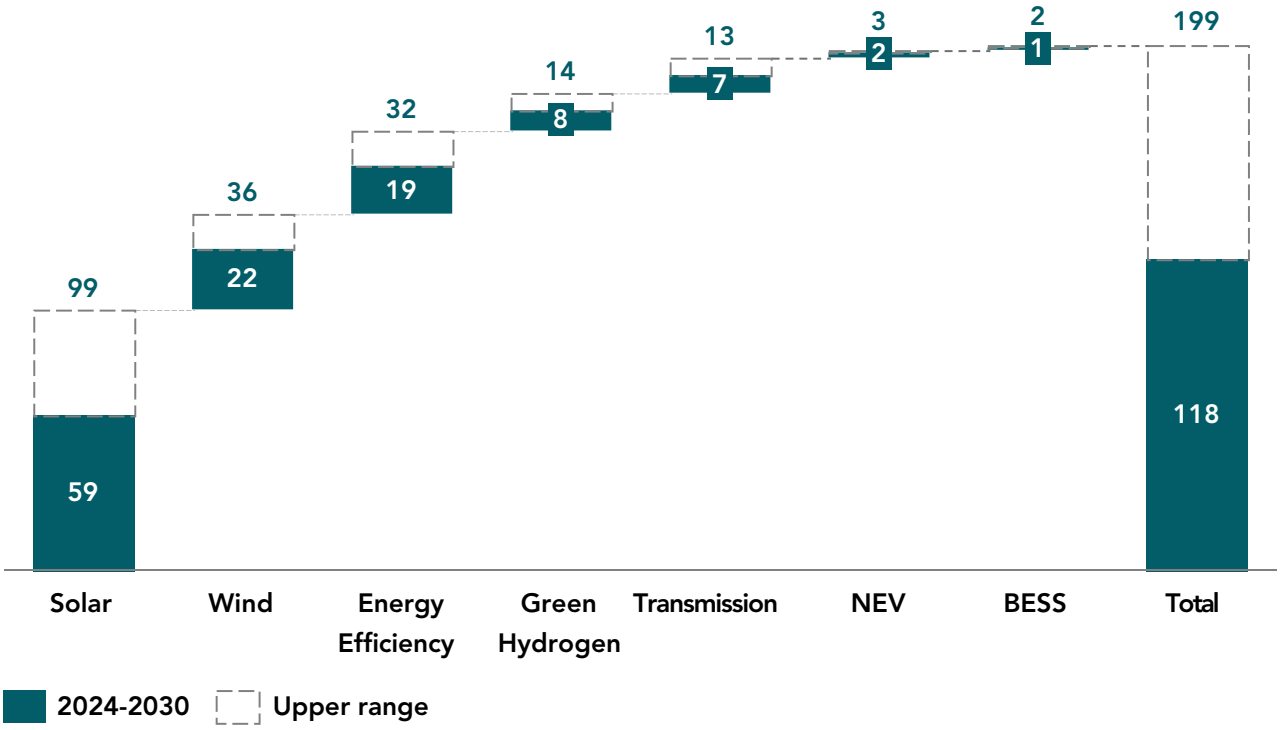
As the pipeline evolves and the certainty of projects change, the jobs demand landscape will change.

Figure 2 shows the "high" scenario. For solar, this included the 15 projects in the REIPPP, 58 projects where a PPA has been signed or is close to signature, or project would be ready to bid into the nearest REIPPP round (as stated in the RE Eskom survey), and a further 48 that are still in early development. This results in a projection of 59,000 – 99,000 gross jobs.

In the next five years, 59,000 – 99,000 (~45-50%) of the total job demand will come from solar, with >95% from utility-scale projects. Of all the renewable energy technologies explored, solar is the most advanced in South Africa, with 8 GW of solar already online. The modular nature of the technology and the country's high solar irradiance supports the quick expansion of solar projects and strong pipeline we currently see.

As power generation stabilises with the reduction of load shedding, local consumer sentiment and global trends indicate an uptake in energy monitoring and saving products and services. This corresponds to a growing

Figure 2 | Gross jobs (thousands) across sectors for horizon 1 (2024 — 2030), based on the current project pipeline



energy efficiency sector with the potential to create 19,000 – 32,000 gross jobs. There are varying levels of optimism in the current green hydrogen project pipeline coming online, but green hydrogen (and ammonia) projects, compared with other technologies, rely on smaller teams of highly-skilled professionals.

For longer-term horizons, project pipelines, even if they do exist, are insufficiently reliable to form the sole basis of a forecast. To provide directional guidance, a range of national targets was used.

For example, the IRP states the ambition for South Africa to build 35 – 97 GW of wind energy between 2031 and 2050. Taking an average turbine size of 5 MW, this equates to nearly 20,000 turbines. The sheer size of the wind farms needed to support this translates into a further ~190,000 – 310,000 gross jobs.

As expected with major capital projects, the greatest number of jobs (up to 74,000 for the 2030 project pipeline) are generated in the construction phase. The duration of jobs varies. For renewable energy, jobs can be expected to last from six months for more modular

Figure 3 | Gross jobs (thousands) across sectors for horizon 1 (2030) and horizon 2 (2050)

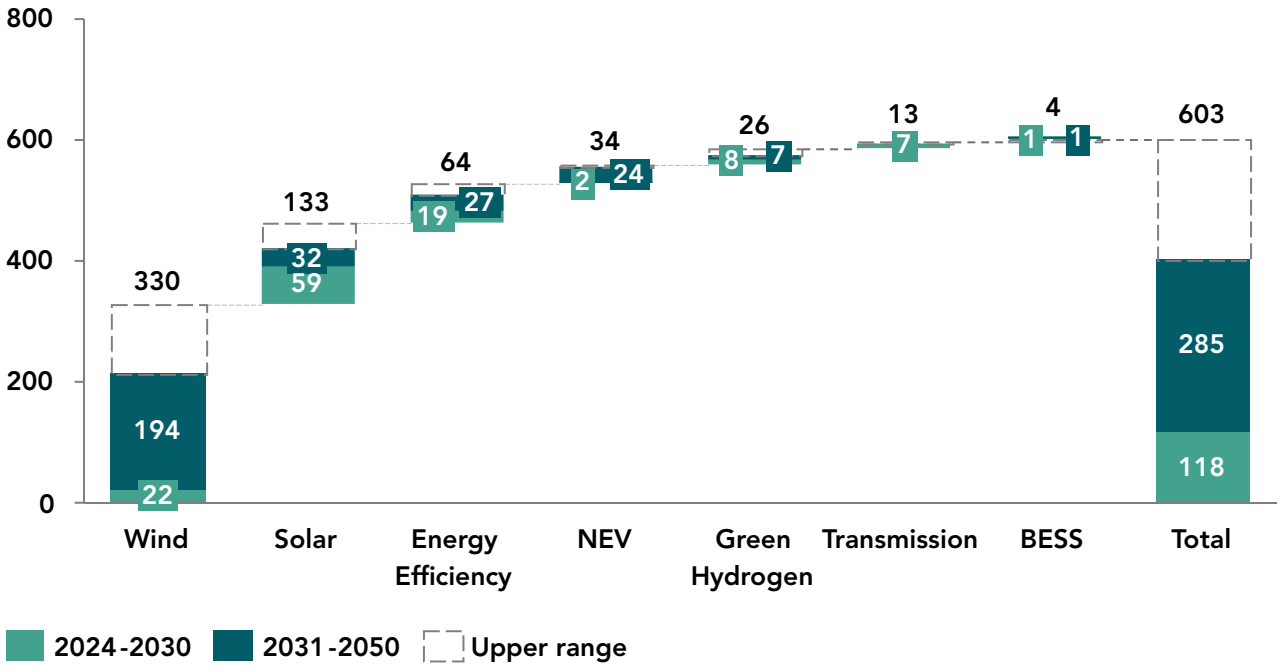
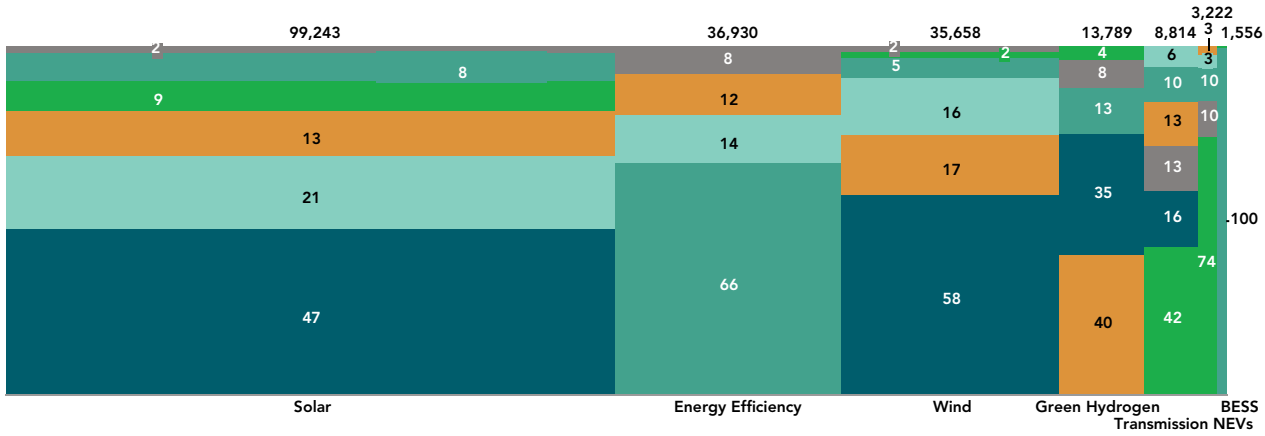


Figure 4 | Aggregate view: Value chain

Gross jobs needed to support upcoming project pipeline and demand, up to 2030, per sector broken down by value chain step (% of jobs in each job family per value chain step - segment label - and total jobs per value chain step - bar label)



Project development | Manufacturing & Assembly | Construction | Installation & Connection | Operations & Maintenance | End-of-life

projects (like solar utility) to three years for wind farms and green hydrogen projects. The operations and maintenance (~38,400 jobs) phase is second on the list, largely driven by the service-heavy energy efficiency industry and maintenance of solar utility plants. Excluding energy efficiency, installation and connection demands the greatest number of jobs (~32,000).

At the lowest end is project development (~8,300) – as this is the design phase, it requires a small team of more specialised individuals.

At the job family level, low- to semi-skilled labourers (~72,000) are needed the most. This is in line with the trend we see at the value chain step level, where construction, installation and connection require the largest workforce, mainly involving semi-skilled labour. Technical, high-skilled job families – engineers (~25,000), technicians (~25,000) and artisans (~21,000) – make up ~35% of the demand, often requiring an additional skill-set tailored to the requirements of each technology.

Figure 5 | Aggregate view: Job Family

Gross jobs (thousands) needed to support upcoming project pipeline and demand, up to 2030, broken down by job family

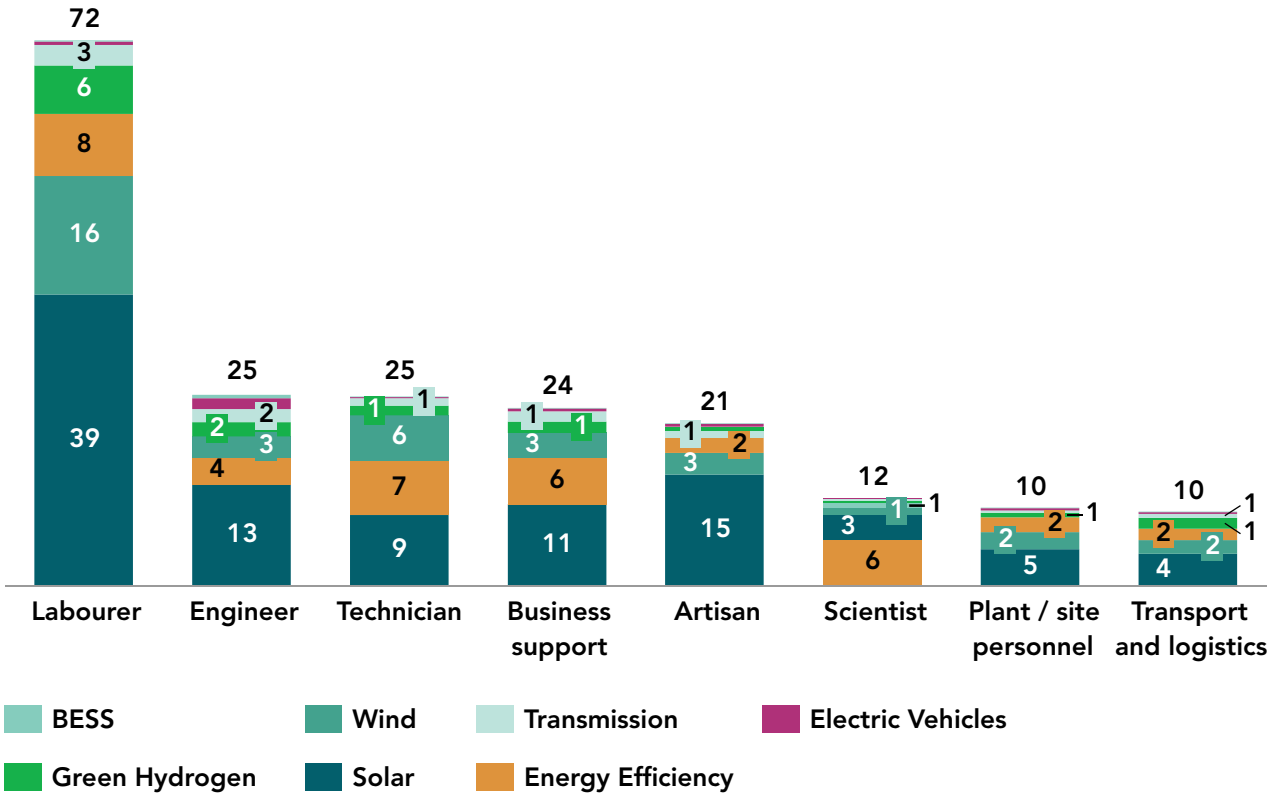
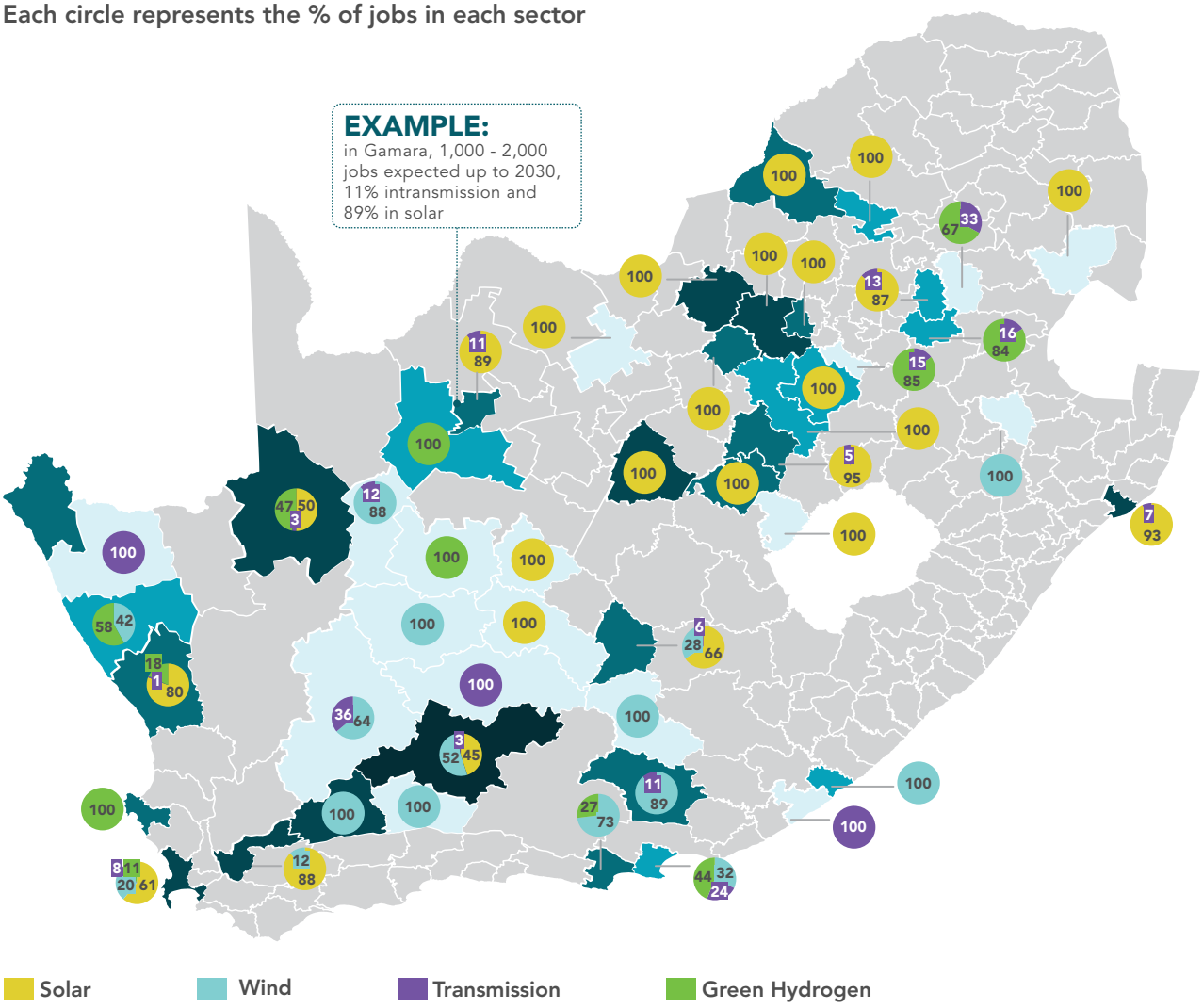


Figure 6 | Jobs in each job family across the utility solar, wind, green Hydrogen and transmission value chain up to 2030

Each circle represents the % of jobs in each sector



Key (number of jobs)

>5000 | 5000-2000 | 2000-1000 | 1000-500 | 500-250

When it comes to the location of the 2030 renewable energy project pipeline and related job opportunities, there are geographic hotspots in Gauteng and northern Free State (majority solar projects) and Eastern, Western and Northern Cape (wind and Green Hydrogen). Transmission lines and sub-stations are dispersed through-out these geographic hot-spots.

Going beyond the aggregate

The value of a job and skills forecast for South Africa lies in understanding what sits behind the aggregate and how we can make sense of this to support inclusion. The green skilling opportunity covered in this report is detailed over seven sectors, six value chain steps, over 35 occupations and for every year up to 2050, in over 200 municipalities.

Insights by sectors

Numerous discussions with industry experts, through the JET SEP working groups, individual follow-ups and discussions with local industry experts, revealed key insights into the job and skills gaps across technical, managerial, and problem-solving skills for the seven sectors of focus. These conversations highlighted trends that cross sectors, as well as gaps unique to specific technologies.

Project developers, EPCs , IPPs, funders and equipment suppliers pointed to various pain points faced in resourcing their projects, from development to operations. Rigorous discussion with industry revealed the underlying issue behind what is reported. For example, a lack of critical problem-solving skills and technology-specific knowledge is often framed and reported as a lack of experience.

Note: The following demand forecasts are based on the 'high' scenario for the 2030 project pipeline and the 'base' scenario for localisation.

SOLAR

Our data analysis reveals a robust jobs outlook for utility-scale solar:

i. The solar utility pipeline up to 2030 can expect to create **55,600 – 93,400 gross jobs.**
ii. Most of the jobs are in the **construction (47,100)** and **installation and connection (17,700)** parts of the value chain
iii. The **labourer job family (36,200)** is the most prominent, particularly construction and low-skilled site workers, followed by **artisans (13,400)** and **engineers (12,400).**
iv. Projects are concentrated in upper South Africa, in **Gauteng, North-West, Mpumalanga and Northern Cape.**
v. Considering IRP targets for 2031-2050, gross job numbers roughly double from the 2030 range to **85,600 – 143,600 by 2050.**

Job creation potential of solar rooftop, both residential and commercial & industrial, is significantly lower due to the smaller-scale and less intensive nature of the projects, as well as decreasing demand and pessimistic outlooks in recent months with **2,400 – 5,600 jobs by 2030** and **5,000 – 9,100 by 2050.**

Figure 7 | Solar: Waterfall (up to 2030)

Gross jobs (thousands) needed to support upcoming Solar Utility projects and Rooftop demand up to 2030, indexed to the year that each project comes online, or when demand is realised

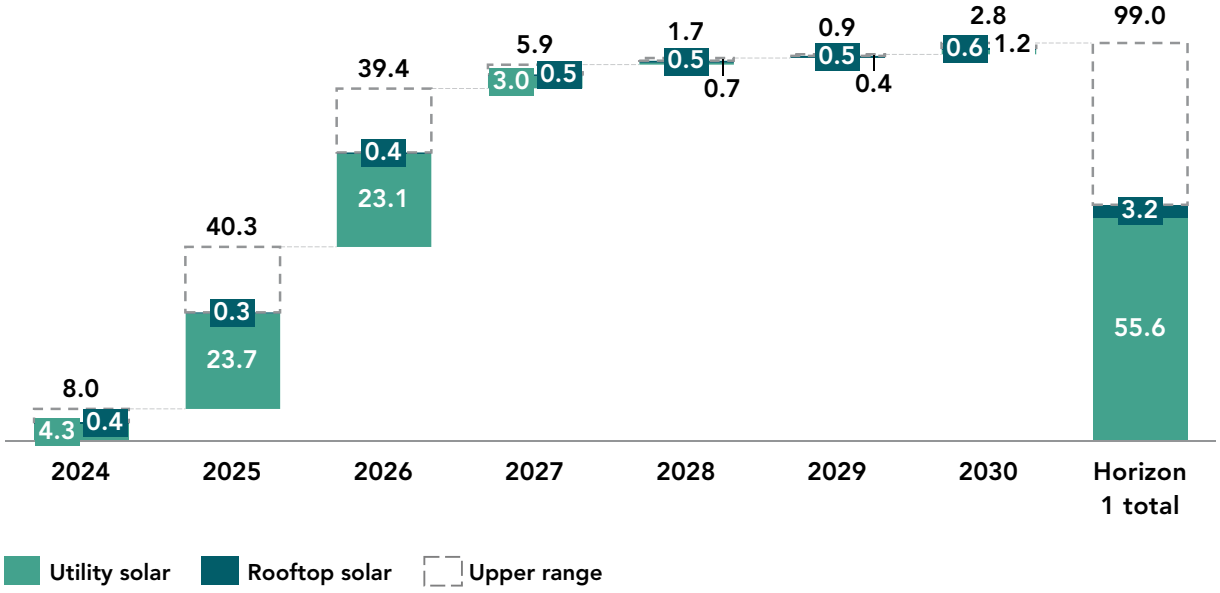


Figure 8 | Solar: Local municipality map (2030)

Geographic spread of jobs coming online based on solar demand, up to 2030

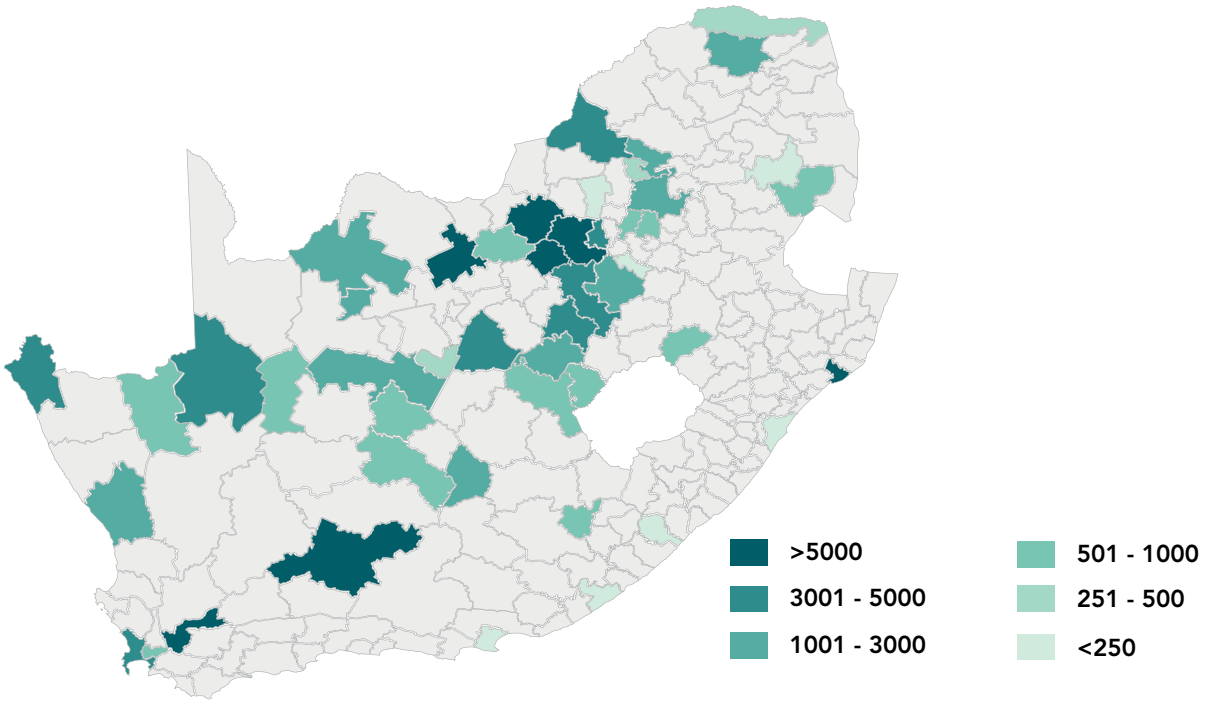


Figure 9 | Solar: Value Chain & Job Family (present — 2030)

Breakdown of gross jobs needed to support upcoming Solar Utility projects and Rooftop Solar – residential, commercial and industrial – demand up to 2030, broken down by value chain step and job family (% of jobs in each job family per value chain step — segment label — and total jobs per value chain step — bar label)

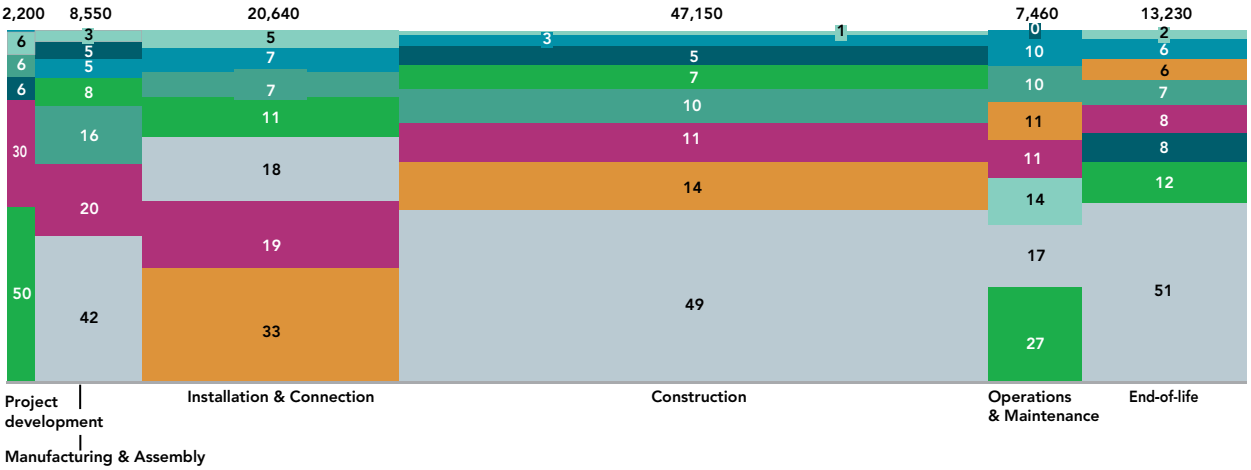
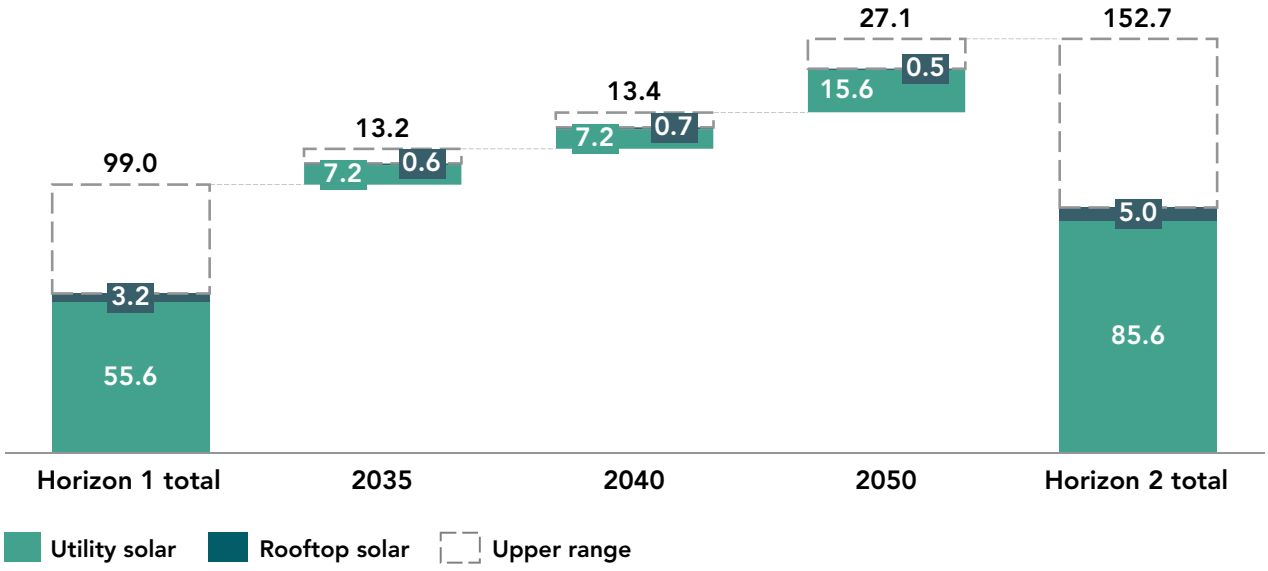


Figure 10 | Solar: Waterfall (2031 — 2050)

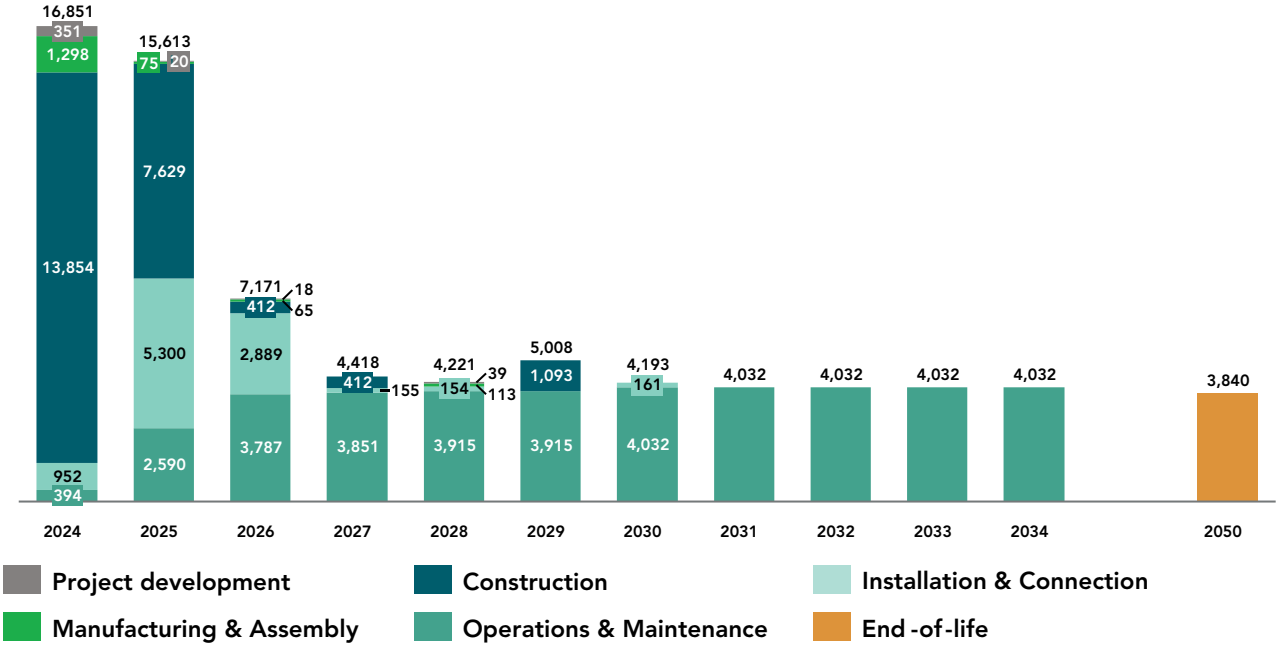
Gross jobs (thousands) needed to support projected Solar utility demand based on national targets in the Integrated Resource Plan, and constant Rooftop solar demand



8. EPC = Engineering, Procurement and Construction firms

Figure 11 | Solar: Time series

Time series of the jobs needed for solar utility projects based on the current pipeline up to 2030, staggered based on the timing and duration of each value chain step



As the country moves from centralised energy generation to a more disaggregated set of projects, there is a growing need for more individuals with high-quality technical skills related to energy regulation, connection, and maintenance as well as experience with the specific solar technology. On the management side, industry indicates a significant gap in technically-qualified and experienced project managers, from design and scoping to managing the efficiency of assets and ultimate decommissioning / disposal.

For utility-scale solar projects, industry flagged the following as the most pressing gaps:

- Transdisciplinary skills for advisory and guidance in setting up solar energy projects.
- Business developers who can find sites; engage with clients; finalise permits and lease agreements; bid and close projects.
- Contract negotiation and techno-legal skills that are often acquired from years in the industry – this is something new graduates and generalists lack.
- Experienced engineers with technical utility solar experience.
    - Currently, most of the roles are filled by people who either worked in thermal heat or at Eskom.
    - A critical shift from thermal to renewable creates the need for more electrical and civil engineers, rather than the traditional mechanical engineer skill-set.
    - Young graduate engineers lack the critical thinking and problem-solving abilities needed for cost-sensitive, mega-project design and construction that is typically learned through experience.
    - However, engineers with relevant, specialised experience are often older and are employed internationally. We need to find a blend between youth and experience, and make a deliberate effort to ensure skills and knowledge transfer.
- Artisans with dual mechanical-and-electrical skill-sets are in high-demand across the value chain, yet this is something that the current education system does not provide at sufficient scale.
- The rooftop solar industry has also witnessed gaps with business and technical skills, whilst the industry is experiencing a downward turn from the highs of mid-2023.
- For commercial & industrial projects, the business acumen and client-service skills needed to appeal to corporates and customers is missing; finding individuals with solar-specific skills on top of that is extremely rare.
- The recent collapse in demand has caused an oversupply of residential solar technicians and installers – the industry needs to be flexible in how it uses its resources and hire people in a market that is uncertain.

The JET SEP forecasting methodology is dynamic and enables stakeholders to form a view on changes in the market, such as what we have witnessed with the evolution of the rooftop solar market.

WIND

Our data analysis reveals strong expected demand for the wind sector, concentrated in Northern, Western and Eastern Cape:

1. The wind project pipeline up to 2030 is expected to create **22,300 – 35,700 gross job.**
    i. Most of the jobs are in the **construction (20,500)** and **end-of-life (6,100)** parts of the value chain given the significant size of these projects, and the complexity of erecting and decommissioning turbines.
    ii. As with solar, the **labourer job family (15,700)** is the most prominent, particularly construction workers, plant operators and semi-skilled machine operators. It is followed by **technicians (6,000)** and **business support (3,300).**
    iii. As expected, given their optimal wind energy resources, projects are concentrated in the **Eastern, Western and Northern Cape.**

2. Considering the ambitious IRP targets for wind from 2031-2050, gross job numbers increase significantly to **216,000 – 340,000 by 2050.**

As with utility-scale solar projects, technical, regulatory and managerial skills related to designing, scoping and implementing large renewable energy infrastructure projects present a significant gap for the industry. Currently, international OEMs with projects in South Africa bring in their own engineers, artisans and technicians to design and implement wind projects.

Wind projects have particular skill needs, including those related to working at height:

- There is insufficient high voltage competence among engineers, electricians and technicians.
- Asset managers who possess both business and technical expertise are crucial yet scarce, particularly for operations and maintenance.
- Community engagement skills exist generally, but require technical upskilling on wind-specific environmental and social impacts and how to translate identified needs and risks into strategic plans.
- The 'height' element of wind turbines adds a new complexity for local workers, with gaps for:
  - Quality control experts who have experience working in high-precision environments and have knowledge of the necessary compliance and safety needs of an emerging industry.
  - Safety managers with the unique skills to work at heights over 100m and with components weighing 50-100 tons.
  - Wind technicians who are skilled in working with turbine technology for both installation and repairs.
- Wind turbine decommissioning and disposal is a niche skill. Companies bring in international engineers and technicians in the absence of local skills. This need will become acute in ~15-20 years.

Figure 12 | Wind: Waterfall (up to 2030)

Gross jobs (thousands) needed to support upcoming onshore Wind projects up to 2030, indexed to the year that each project comes online

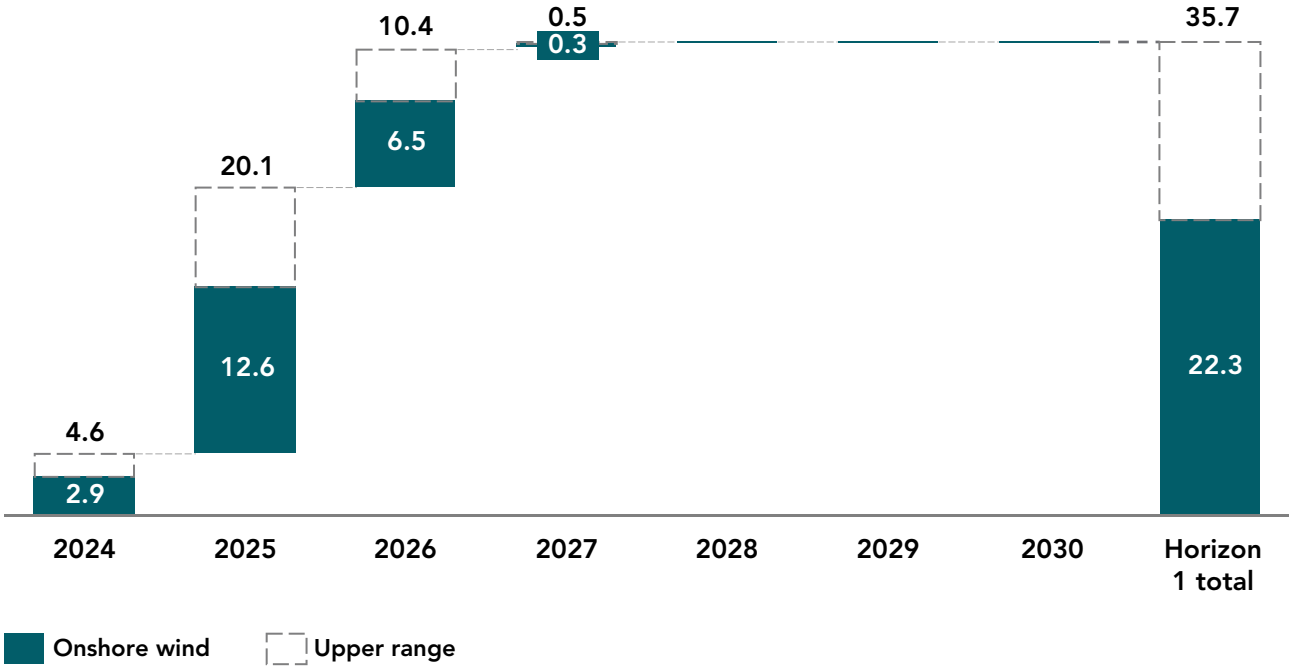


Figure 13 | Wind: Local municipality map (2030)

Geographic spread of jobs coming online based on wind demand, up to 2030

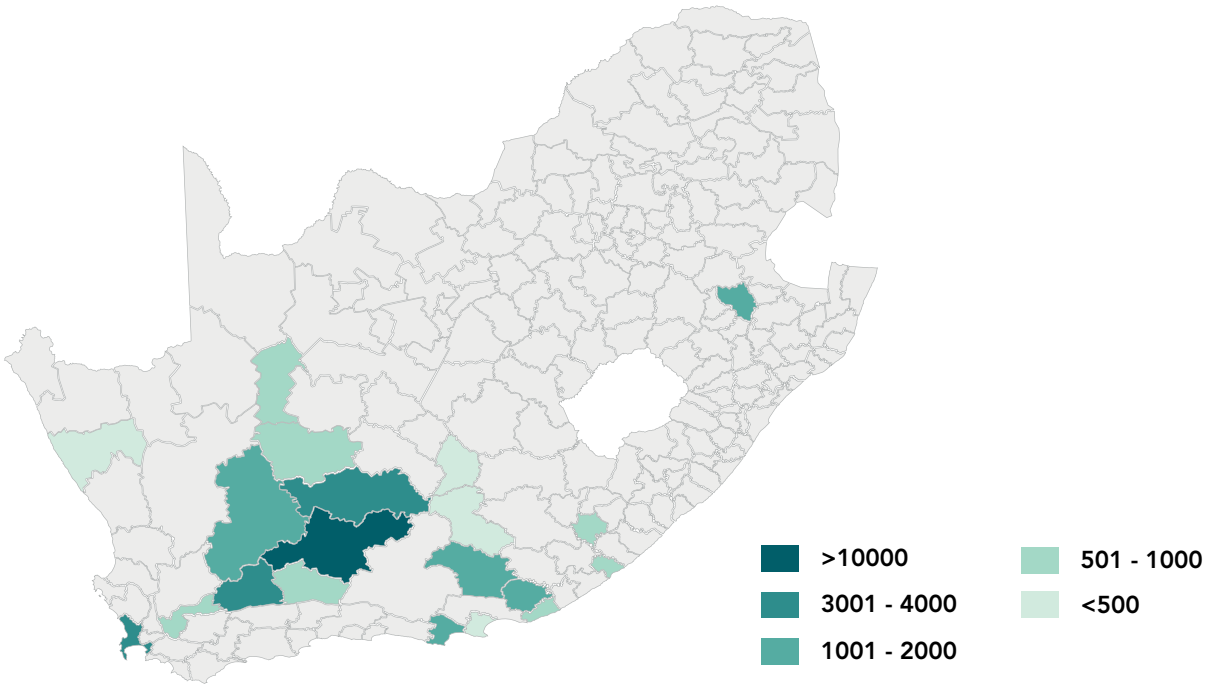


Figure 14 | Wind: Waterfall (2031 — 2050)

Gross jobs (thousands) needed to support projected Wind demand based on national targets in the Integrated Resource Plan

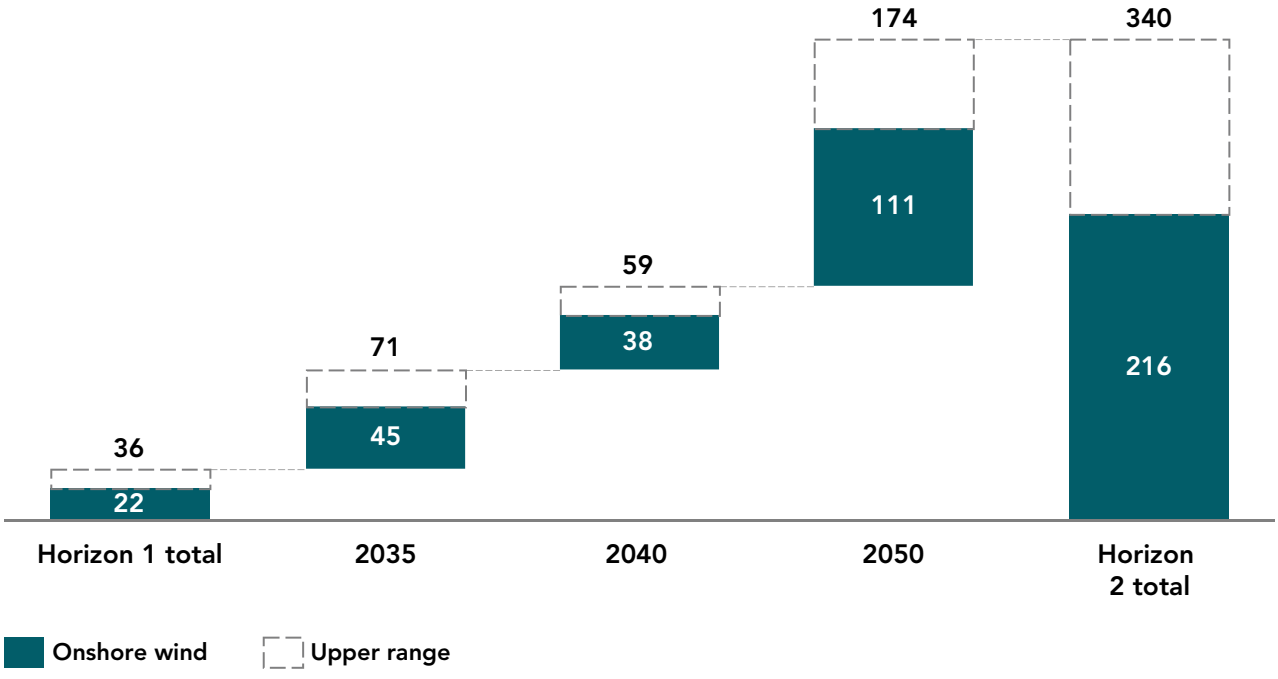


Figure 15 | Wind: Value Chain & Job Family (present — 2030)

Breakdown of gross jobs needed to support upcoming onshore Wind projects up to 2030, broken down by value chain step and job family (% of jobs in each job family per value chain step — segment label — and total jobs per value chain step — bar label)

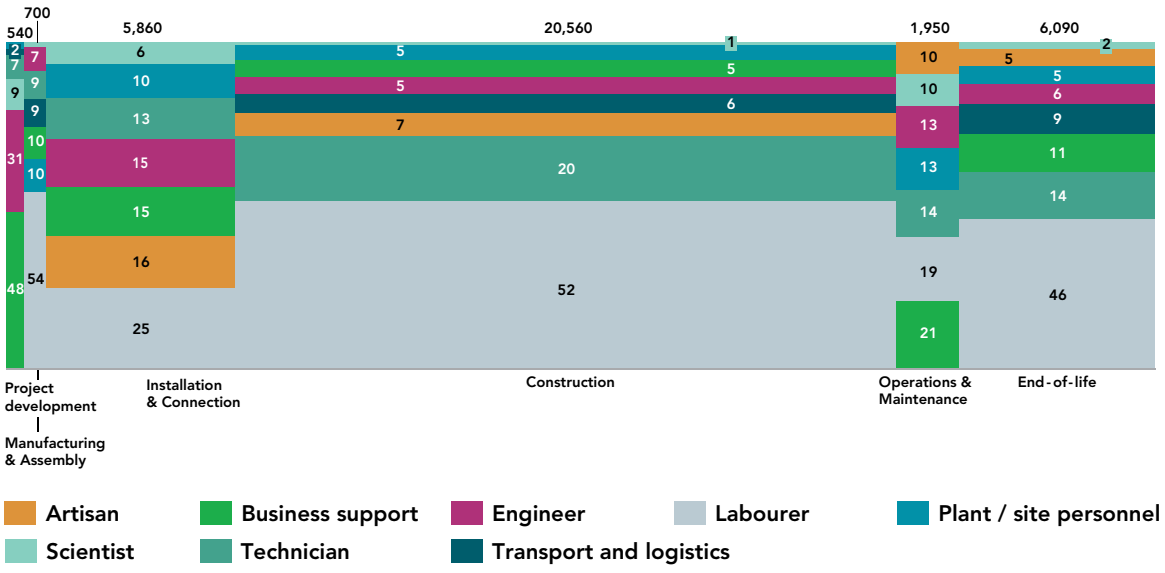
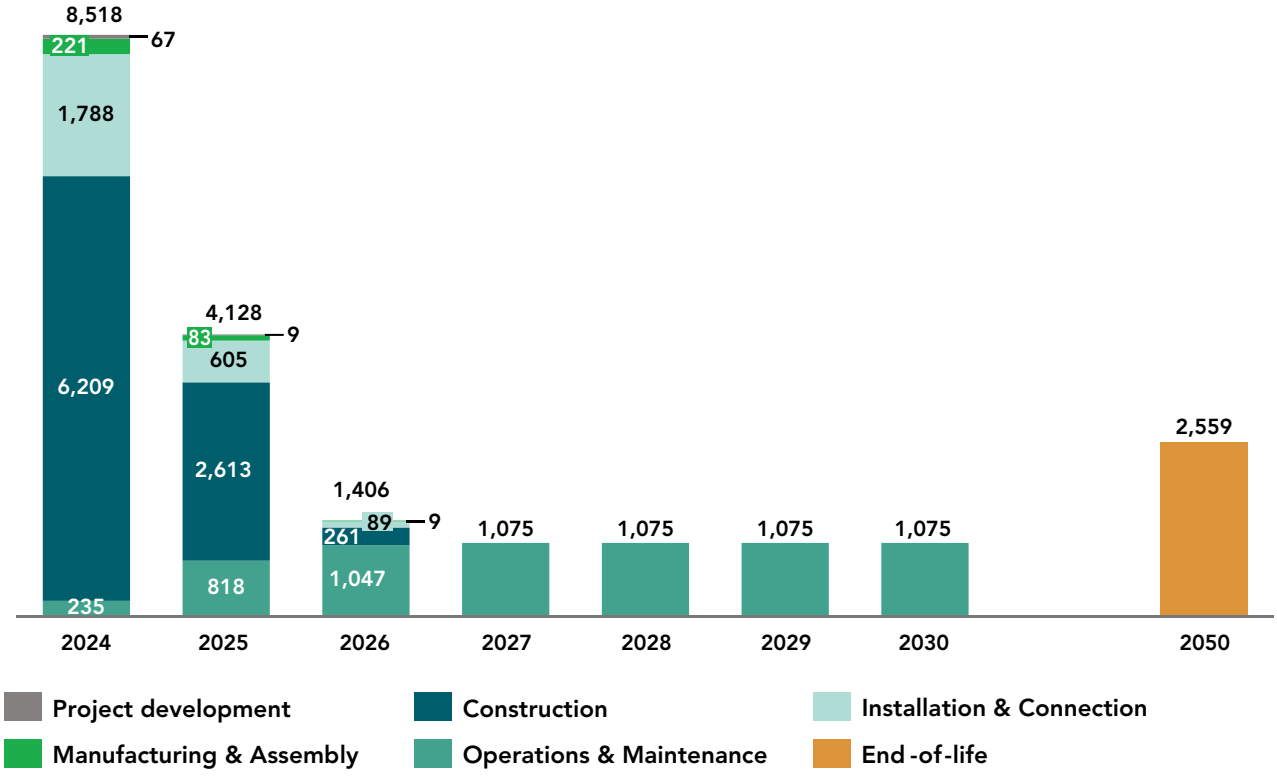


Figure 16 | Wind: Time series

Time series of the jobs needed for wind projects based on the current pipeline up to 2030, staggered based on the timing and duration of each value chain step



GREEN HYDROGEN

Our data analysis in the green hydrogen and ammonia sector reveals a small sector that supports job creation in the related renewable energy inputs (here we exclude jobs in the renewable energy sector):

1. The green hydrogen and ammonia project pipeline up to 2030 is expected to translate into **7,800 – 13,800 gross jobs.**
   i. Most of the jobs will emerge during **end-of-life (5,500)** and **construction (4,900)**, in line with the expectation for large capex projects.
   ii. As in solar and wind sectors, most of the jobs will be in the **labourer job family (6,400)**, particularly construction workers, and semi-skilled machine operators; This is followed by **engineers (1,800)** and **business support (1,500)** jobs.
   iii. Projects are concentrated in the west of the country, particularly in the **Northern, Western and Eastern Cape.**

2. Considering the green hydrogen industrialisation and JET IP 2050 targets, gross job numbers forecast could double to **15,000 – 26,500 by 2050.**

Green hydrogen projects require highly specialised workers (engineers, project developers and technicians) to operate equipment and processes, such as electrolysers, storage facilities and, in the case of green ammonia production, to operate the Haber Bosch process. They are therefore unlikely to create many jobs.

Although the production of green hydrogen and ammonia does not create many jobs, it supports job creation in the solar and wind energy sectors that provide an input for these projects.

While there is a need for a highly-skilled workforce, industry's input is that workers in the oil and gas, chemical manufacturing, and pulp and paper industries have transferable skills for this industry. The skill-set is also largely the same as that of the country's well-established hydrogen and ammonia industry.

- As in traditional renewable energy projects, engineers, technicians and quantity surveyors lack the specific knowledge needed for this technology, and the problem-solving skills to manage large-scale projects.
  - Industry participants are also concerned about procurement expertise and the ability to balance cost and logistics in often uncertain project timelines.
  - Again, limited on-the-ground experience among young engineering graduates manifests as gaps in critical thinking and problem-solving skills.
- The remote nature of these projects creates unique talent challenges:
  - There is a need for personnel skilled in town planning for this new technology, including logistics experts to plan the transport and distribution network around each site in remote locations.
  - The remote living and working conditions, particularly in the Northern Cape, deter new, skilled talent from working in this sector, and price-competitive international markets poach local hydrogen experts

Figure 17 | Green Hydrogen: Waterfall (up to 2030)

Gross jobs (thousands) needed to support upcoming Green Hydrogen and Green Ammonia projects, and associated storage and distribution network, up to 2030, indexed to the year that each project comes online

Note: excludes jobs related to the Renewable Energy source

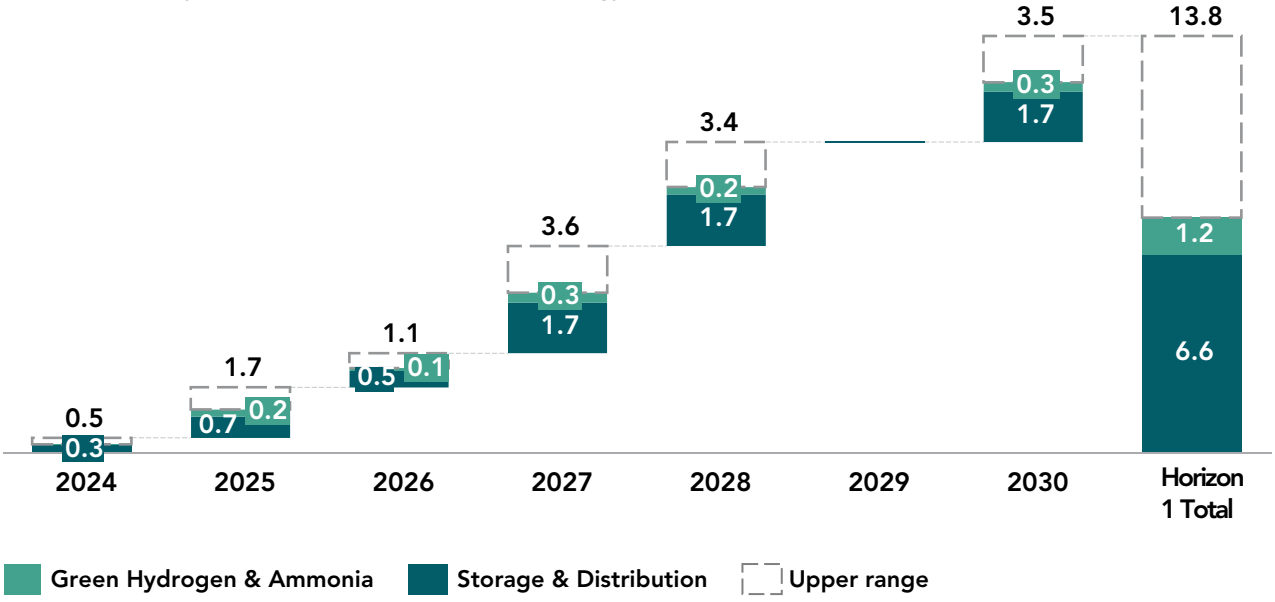


Figure 18 | Green Hydrogen: Local municipality map (2030)

Geographic spread of jobs coming online based on Green Hydrogen demand, up to 2030

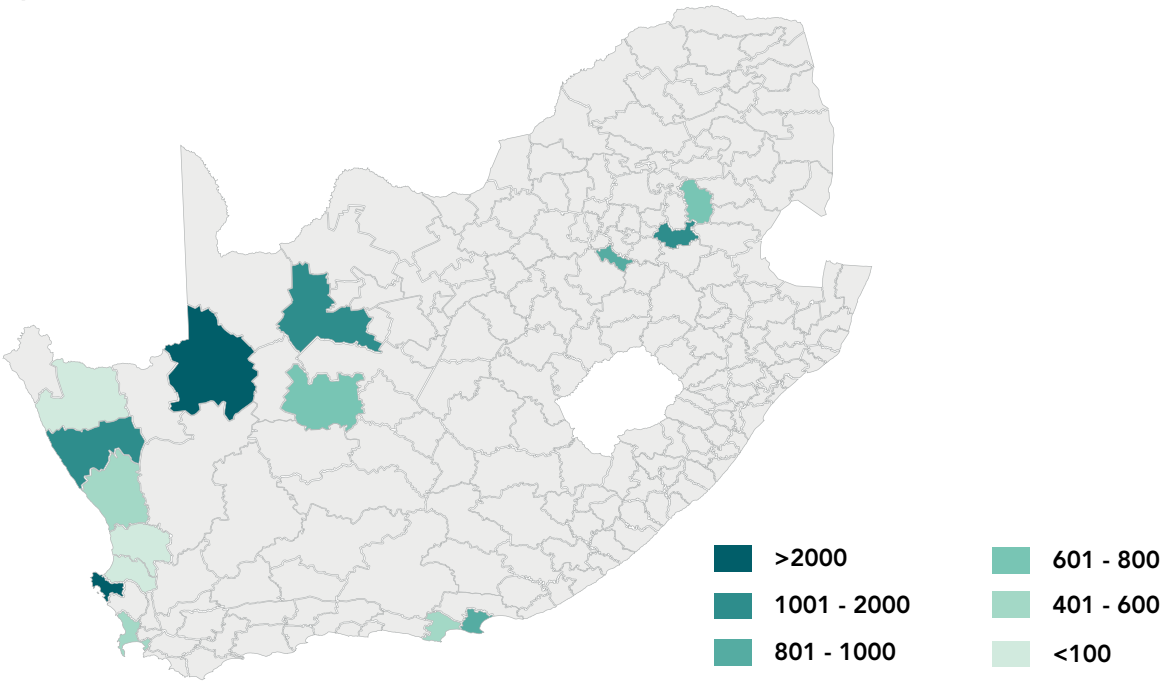


Figure 19 | Green Hydrogen: Value Chain & Job Family (present — 2030)

Breakdown of gross jobs needed to support upcoming Green Hydrogen and Green Ammonia projects, and associated storage and distribution network, up to 2030, broken down by value chain step and job family (% of jobs in each job family per value chain step — segment label — and total jobs per value chain step — bar label)

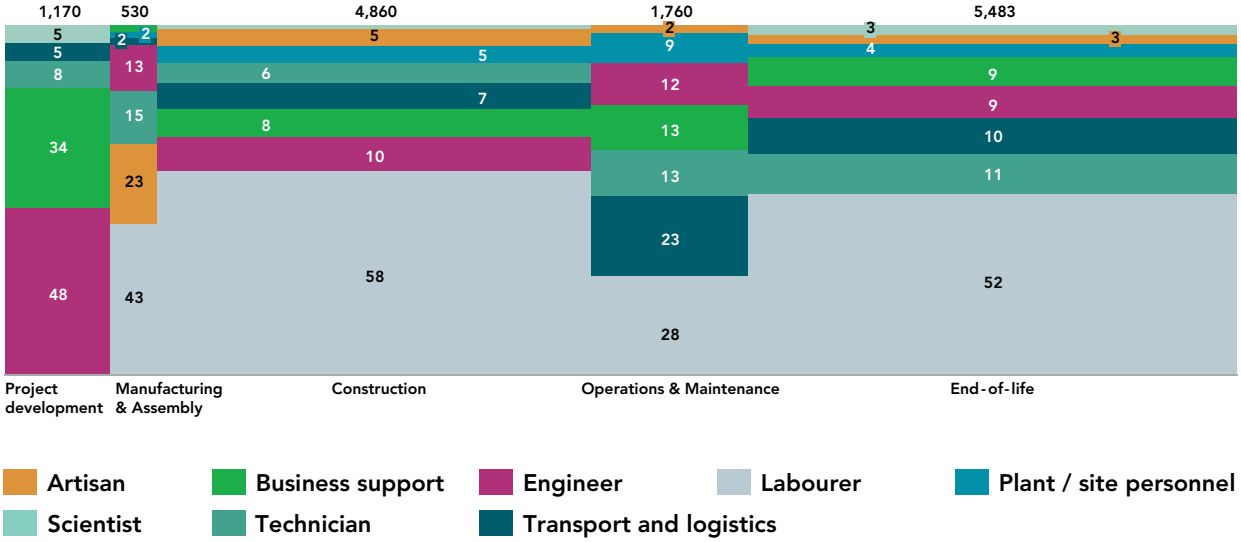


Figure 20 | Green Hydrogen: Waterfall (2031 — 2050)

Gross jobs (thousands) needed to support projected Green Hydrogen & Ammonia production based on national commercialization 2050 strategy

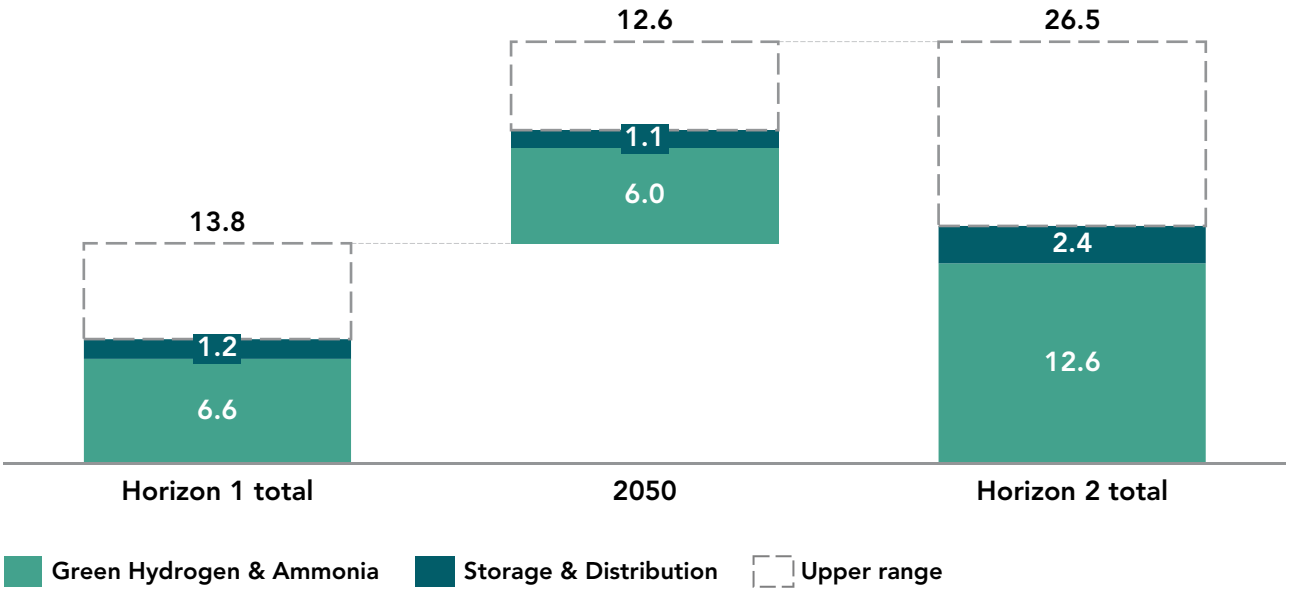
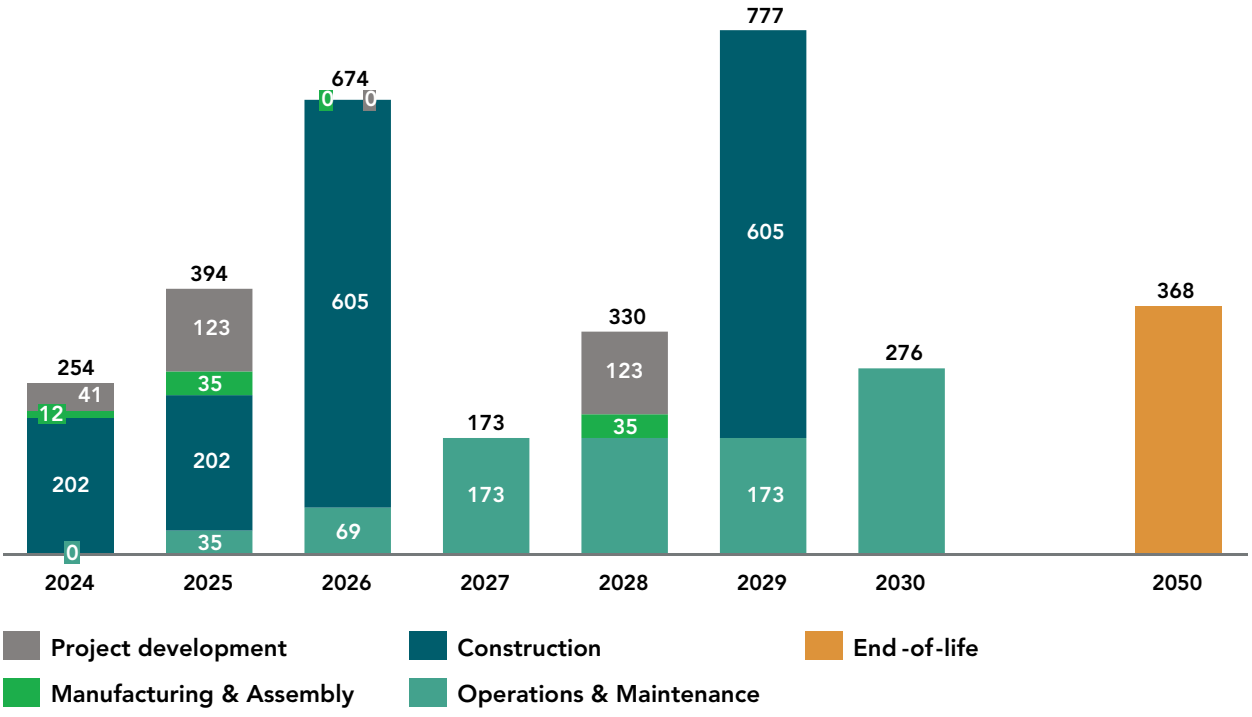


Figure 21 | Green Hydrogen: Time series

Time series of the jobs needed for Green Hydrogen & Ammonia projects based on the current pipeline up to 2030, staggered based on the timing and duration of each value chain step.



BATTERY STORAGE

Our analysis of the utility and small-scale battery storage sector reveals an outlook for a small sector which requires highly skilled workers:

1. We focus on the manufacturing and assembly, operations and maintenance and end-of-life value chain steps to avoid double counting with the attached RE technology. In aggregate, the Battery Energy Storage Solution (BESS) pipeline and demand for storage solutions up to 2030 can expect to create **800 - 1,600 gross jobs.**
    i. Over 97% of the jobs are found in **operations and maintenance (1,500).**
    ii. The **scientist job family (800)** dominates, particularly in data analysis and managing battery efficiency; It is followed by **engineers (500)** and **business support (100)** jobs.
    iii. Projects are spread across the country, with hotspots in **Gauteng and the Free State**, and the **major cities**

2. Despite IRP targets to increase utility-scale BESS in 2031-2050, gross job numbers remain low, ranging between **2,100 and 3,800 by 2050.**

The jobs related to BESS are limited by the high level of imports needed to manufacture cells and modules. This import intensity is due to the weak commercial case for local production. The teams required to install and operate the batteries tend to be small, often utilising the same team as the renewable energy generation source (in South Africa's case, solar and wind). To avoid double counting of jobs between the generation and storage technology, only additional jobs over and above the core generation team were quantified for BESS, namely in manufacturing and assembly, operations and maintenance and end-of-life.

Despite the limited job opportunity, industry players have indicated critical gaps that are potentially hindering the effective installation, monitoring and disposal of these batteries:

- The most critical skills gap locally is for the technical expertise to safely handle lithium-ion batteries across the value chain.
  - Current safety officers on site lack formal training on handling lithium-ion technologies. This gap extends to first responders and their ability to manage fires.
  - At disposal, beyond technical expertise, there are gaps in analytical and management ability to adequately scope out and plan for the environmental impacts.
- Young graduates' lack of critical thinking and problem-solving skills to tackle on-the-ground challenges is a common theme that is also raised as an area of concern in BESS.
- In manufacturing, even at the assembly stage (where South Africa is likely to localise), the precision machinery requires specific technical expertise to balance speed-to-output while limiting errors, and proficiency in conducting on-site repairs of components – this is critical in cost-sensitive, highly price-sensitive and low-margin sectors like BESS.
  - The lack of highly-specialised technical expertise can be overcome with robust critical thinking and problem-solving skills, however this skill-set takes time to develop.

Figure 22 | BESS: Waterfall (up to 2030)

Gross jobs needed to support upcoming BESS Utility projects and Small-scale demand up to 2030, indexed to the year that each project comes online, or the demand is realised

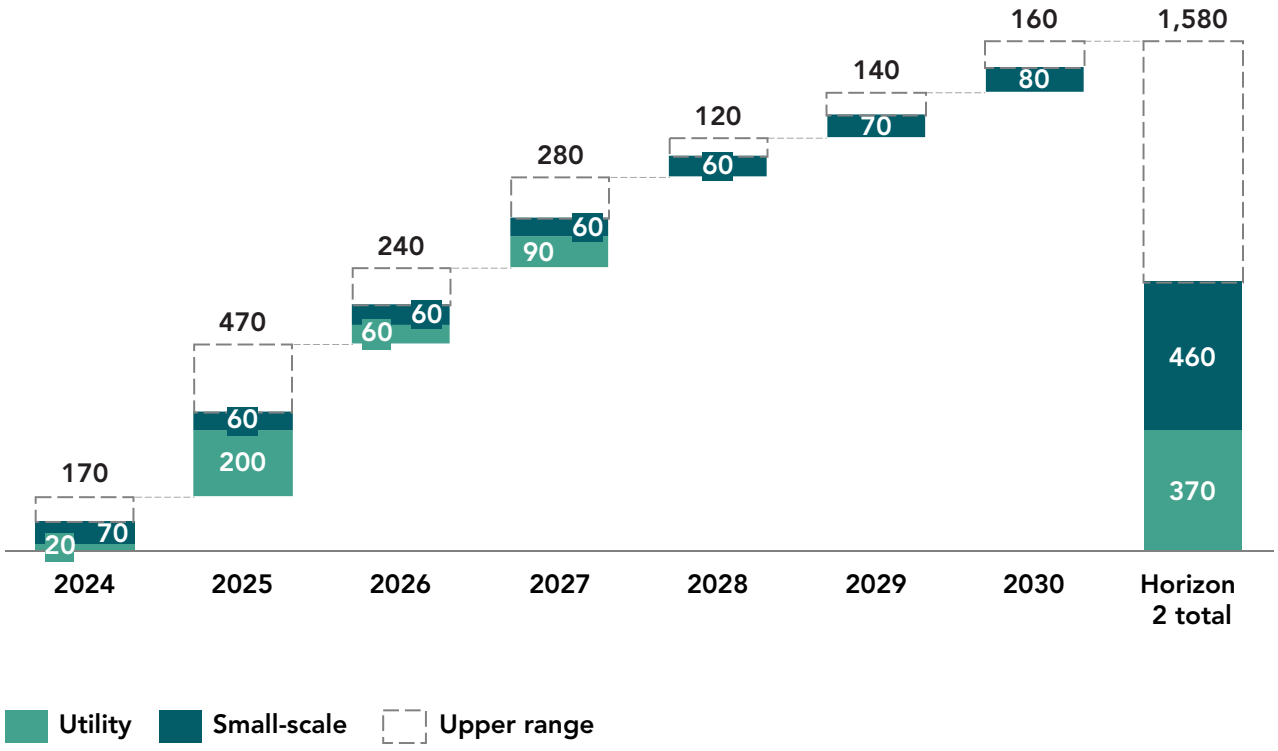


Figure 23 | BESS: Local municipality map (2030)

Geographic spread of jobs coming online based on BESS demand, up to 2030

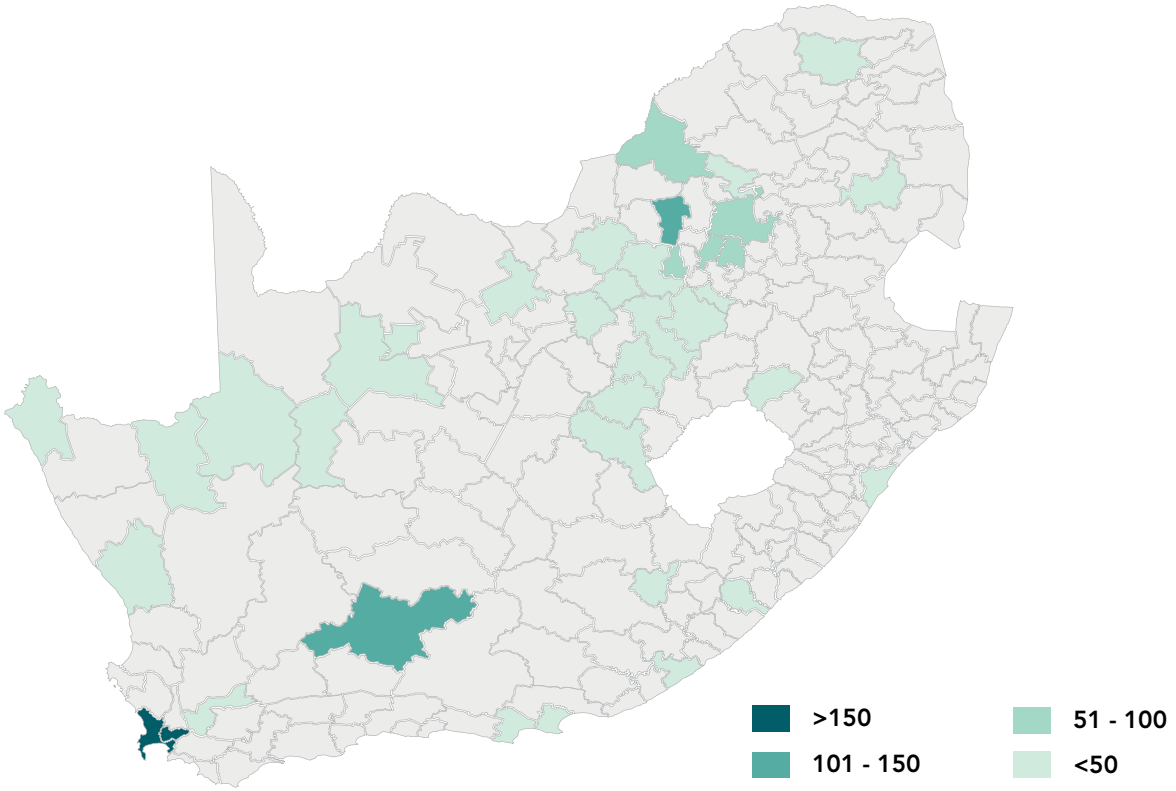


Figure 24 | BESS: Value Chain & Job Family (present — 2030)

Breakdown of gross jobs needed to support upcoming BESS utility project and demand for residential, commercial and industrial units up to 2030, broken down by value chain step and job family (% of jobs in each job family per value chain step — segment label — and total jobs per value chain step — bar label)

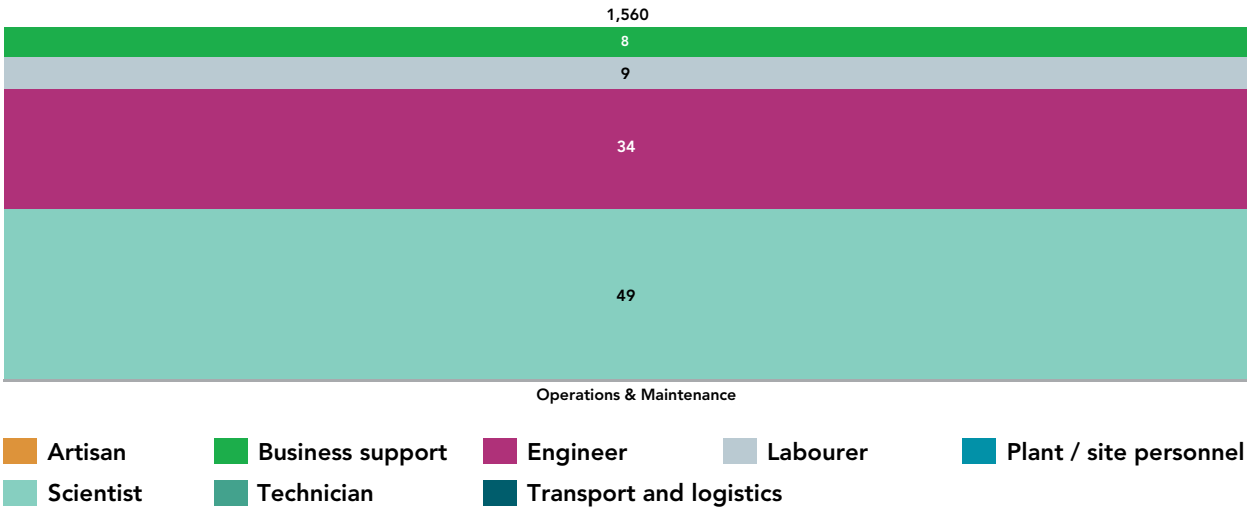
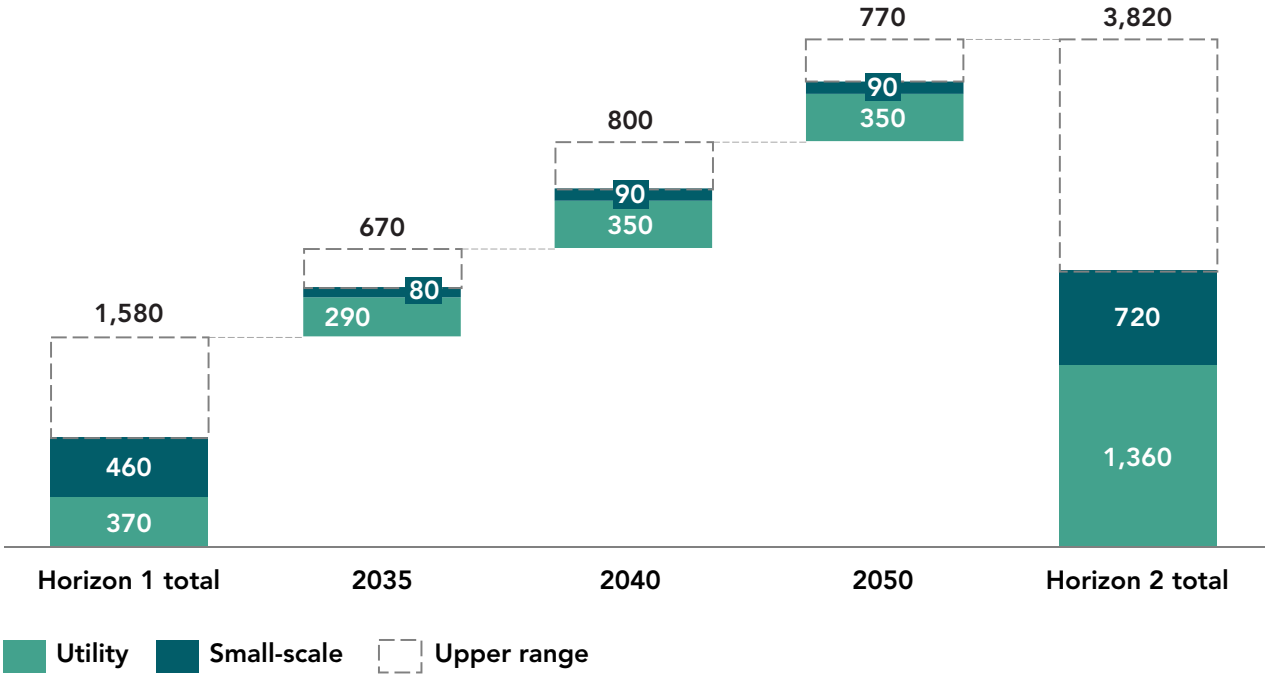


Figure 25 | BESS: Waterfall (2031 — 2050)

Gross jobs needed to support projected BESS demand based on national targets in the Integrated Resource Plan, and constant small-scale demand



TRANSMISSION

Our analysis points to the negative impact of stop-start deployment of the national transmission programme:

The TDP project pipeline up to 2030 is expected to create **7,300 – 13,400 gross jobs.**

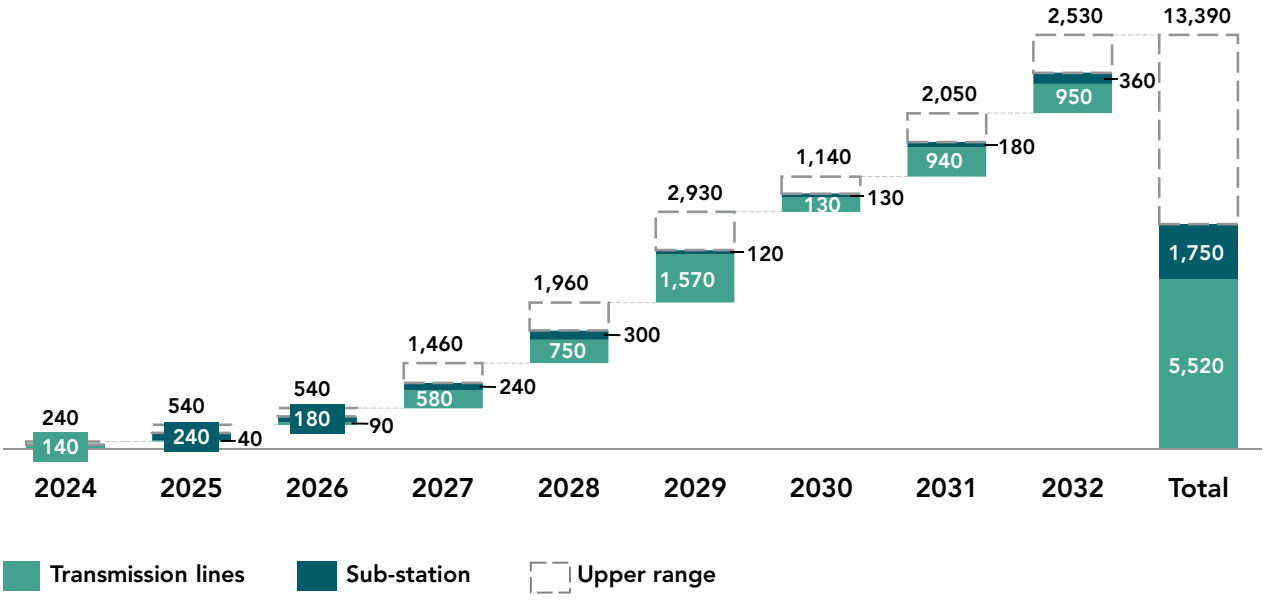
i. The majority of these will be created in **manufacturing and assembly (3,700)** and **construction (1,400)**, in line with South Africa's well-established manufacturing capacities in the transmission sector.
ii. The largest demand is in the **labourer job family (2,700)**, particularly construction workers, and semi-skilled machine operators; followed by the **engineering (1,700)** and **business support (1,400) job families**
iii. Projects are spread across South Africa, with hotspots in (a) Mpumalanga, where coal-powered generation is located, (b) the Eastern, Western and Northern Capes, the future hubs for Renewable Energy generation, and (c) metropolitan areas.

Building ~16,000km of transmission lines requires a significant scale-up in South Africa's skills related to medium-and-high voltage connections, project management of large capex projects, and optimising mechanical and electrical processes. These skill-sets used to exist in the country but were lost, given the stop-start nature of the national transmission project pipeline:

- High- and medium-voltage electricians with the sufficient regulatory training are scarce. Training institutions have also noted that limited employer willingness to register electricians exacerbates this gap, driven by the cost-sensitivity of projects and uncertainty about project roll-out.
- There is high demand for engineers with a unique combination of mechanical, electrical and IT skills:
  - This is a highly-specialised skill-set (often hired under the title of 'process / system' engineers) needed to effectively scope projects from the design phase, and work with technical teams to maintain the efficiency of assets and know when and how to intervene to adjust processes when they are off-track.
  - Given the stop-start nature of projects, many of these specialised engineers have left transmission for the growing ICT sector.
- Beyond the engineer leaders, a well-trained operations and repair team of high-voltage electricians and technicians is needed across the country to maintain the extensive line network and substation nodes.
- The nature of the sector demands a focus on technical skills. New graduates entering the workforce have been found to lack 'soft' work readiness skills. This is particularly important given the often-remote nature of these projects and highly-regulated team environments.
- There is a need for community engagement specialists who can balance navigating what is often a slow change management process with local communities with the time pressures and cost-sensitivity of projects, while also driving localisation, sustainable practices and ownership of resources with communities.

Figure 26 | Transmission: Waterfall (up to 2032, in line with the TDP*)

Gross jobs needed to support upcoming new Sub-Station and Transmission line projects up to 2030, indexed to the year that each project comes online



*TDP = Transmission Development Plan (2023 - 2032)

Figure 27 | Transmission: Local municipality map (2030)

Geographic spread of jobs coming online based on transmission demand, up to 2030

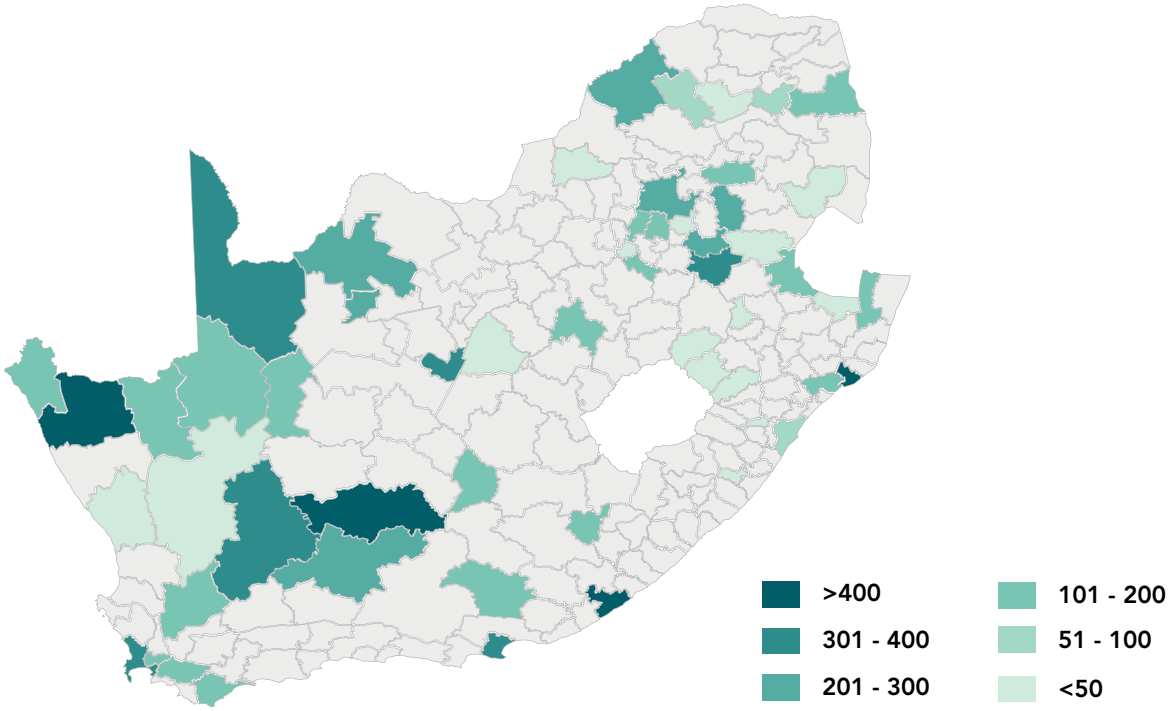


Figure 28 | Transmission: Value Chain & Job Family (present — 2030)

Breakdown of gross jobs needed to support upcoming New Sub-Station and Transmission line projects up to 2030, broken down by value chain step and job family
(% of jobs in each job family per value chain step — segment label — and total jobs per value chain step — bar label)

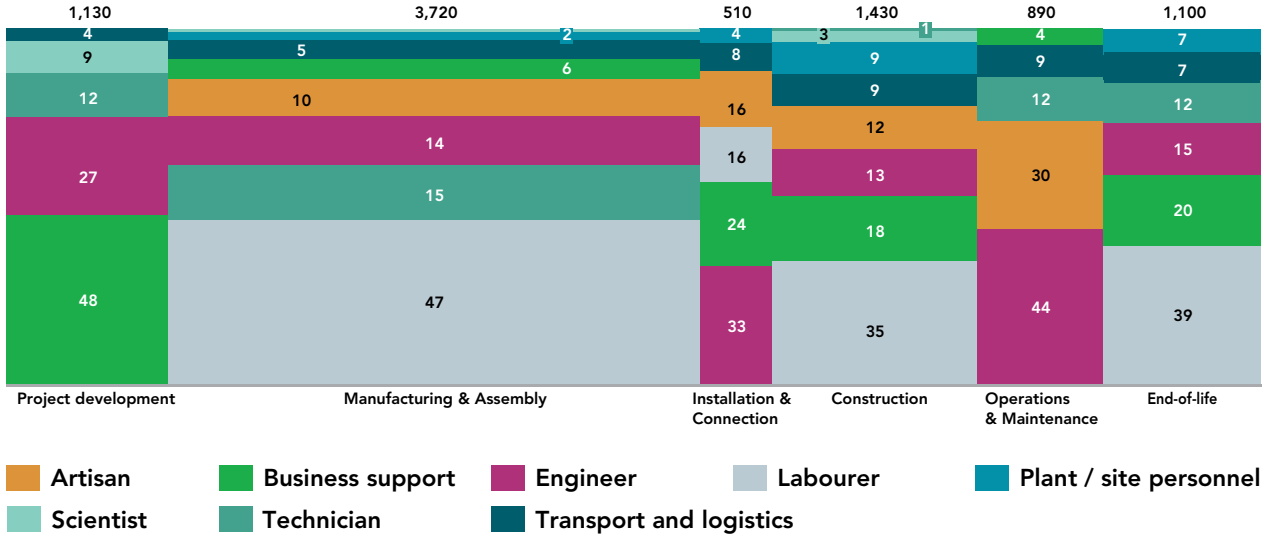
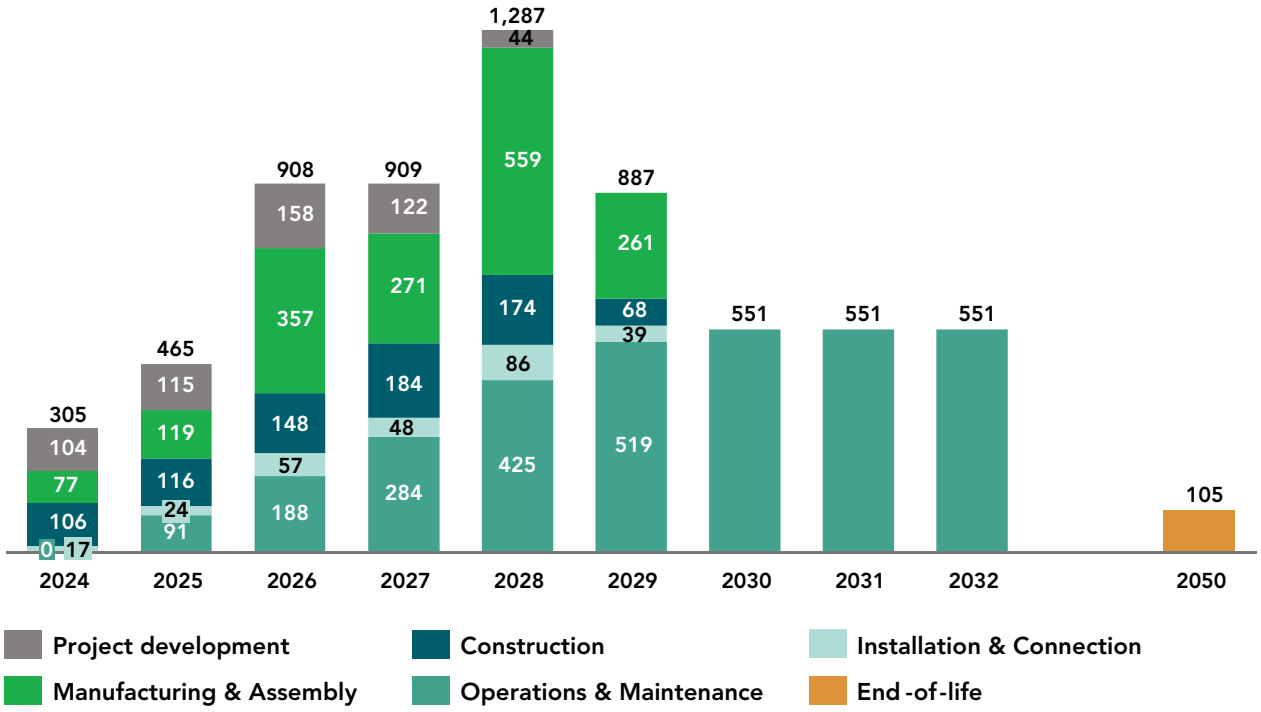


Figure 29 | Transmission: Time series

Time series of the jobs needed for transmission line and sub-station projects in the current pipeline up to 2030, staggered based on the timing and duration of each value chain step



NEW ENERGY VEHICLES (NEV)

Global auto manufacturers with operations in South Africa have indicated plans to convert part of their internal combustion engine (ICE) factories into NEV production hubs. In numbers, only 60% of the employees required to manufacture an ICE vehicle are required to manufacture an electric vehicle.

1. Based on current OEM plans to manufacture New Energy Vehicles in South Africa, and local projected sales, the sector could create **2,400 – 3,200 gross jobs** by 2030 in vehicle and component manufacturing, and charging infrastructure:
   i. 75% of the jobs are in the actual manufacturing and assembly part of the value chain.
   ii. The biggest need is for **engineers (1,400)**, followed by **general labourers (400).**

2. In the long-term, optimistic growth of the NEV market could lead to the sector supporting **21,000 – 26,800 gross jobs** by 2050. However, this is highly dependent on international OEM plans to locate NEV production in South Africa to meet global and local demand, and the regulatory environment that would make South Africa attractive to manufacture of NEVs.

Note: While the Electric Vehicle market is expected to grow, it will in place of the Internal Combustion Engine (ICE) - in South Africa, local ICE manufacturing and the demand for ICE vehicles is expected to be maintained at least up to 2030

While specific skill-sets are often unique to each OEM and part of their personal IP, industry notes a foundational gap in experience related to project and process networking planning, and technical skills in the after-sales part of the value chain (which often requires replacement rather than off-site repair).

The most acute gaps raised by industry are:

- A shortage of project managers specialising in scoping out charging infrastructure networks to optimise reach and reduce cost, particularly in an uncertain market. This is a similar skill-set to engineers in ICT and transmission networks, where individuals have learned from decades of experience.
- Unique to this sector, software engineers are a critical skill for operations and maintenance. Industry noted that while there is no quality gap, there is concern about the current supply in the country.
- The move from ICE vehicles to NEVs requires less expertise related to mechanical engineering, and more knowledge on electrical circuits and connections.
    - OEMs often fill this gap as part of on-the-job training in the manufacturing and assembly, but there is a gap in after-market sales of mechanics available to do repairs and provide on-road immediate assistance.
    - Digital literacy is also a foundational gap in South Africa. It is needed in both the car value chain (e.g. highly-automated assembly-line machinery, interpreting diagnostic results) and charging infrastructure (e.g. call centre agents live-monitoring the network).

Figure 30 | New Energy Vehicles: Value Chain & Job Family (present — 2030)

Breakdown of gross jobs needed to support upcoming demand for New Energy Vehicles and related Charging infrastructure 2030, broken down by value chain step and job family (% of jobs in each job family per value chain step — segment label — and total jobs per value chain step — bar label)

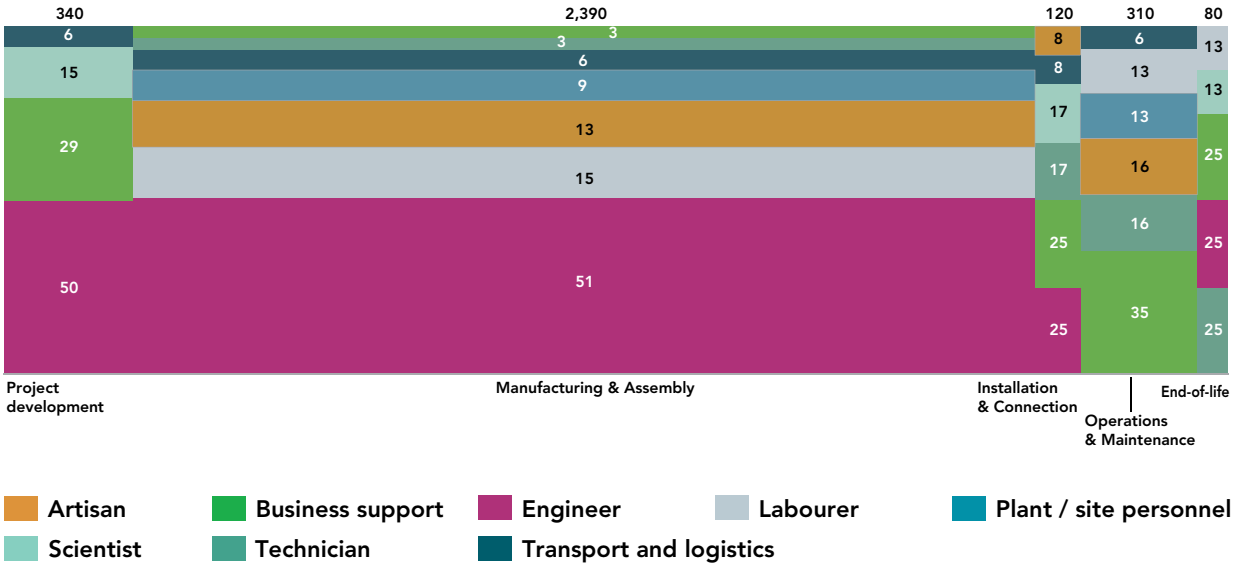
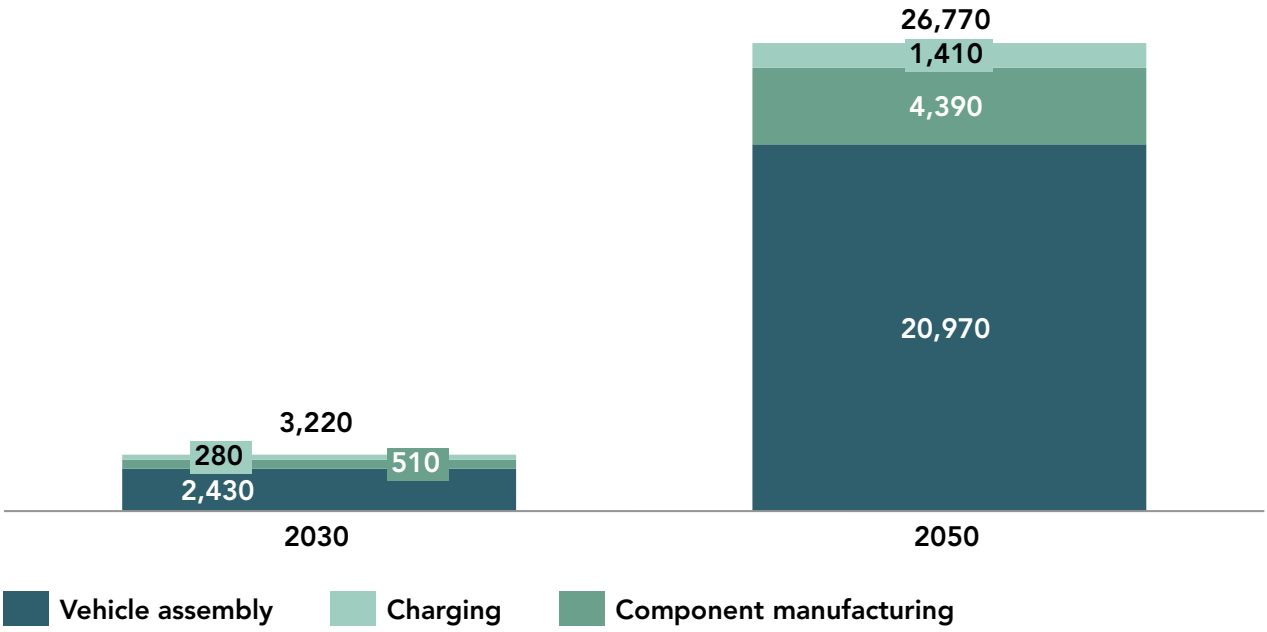


Figure 31 | New Energy Vehicles & Charging: Time series (2030, 2050)

Gross jobs needed to support upcoming demand for New Energy Vehicles and related Charging infrastructure in 2030 and in 2050

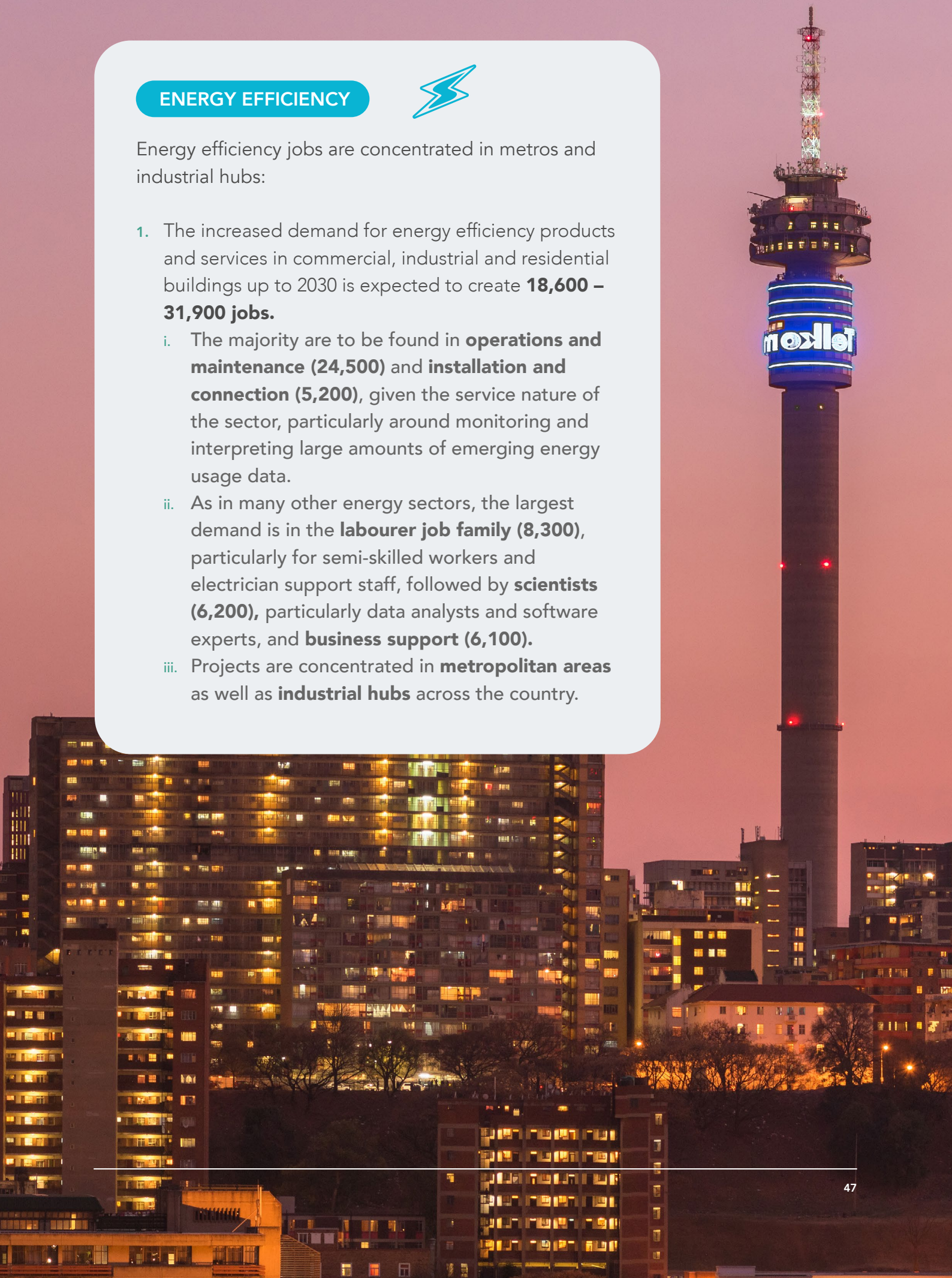


While the Electric Vehicle market is expected to grow, it will be in place of the Internal Combustion Engine (ICE) - in South Africa, local ICE manufacturing and the demand for ICE vehicles is expected to be maintained at least up to 2030

ENERGY EFFICIENCY

Energy efficiency jobs are concentrated in metros and industrial hubs:

1. The increased demand for energy efficiency products and services in commercial, industrial and residential buildings up to 2030 is expected to create **18,600 – 31,900 jobs.**
    i. The majority are to be found in **operations and maintenance (24,500)** and **installation and connection (5,200)**, given the service nature of the sector, particularly around monitoring and interpreting large amounts of emerging energy usage data.
    ii. As in many other energy sectors, the largest demand is in the **labourer job family (8,300)**, particularly for semi-skilled workers and electrician support staff, followed by **scientists (6,200),** particularly data analysts and software experts, and **business support (6,100).**
    iii. Projects are concentrated in **metropolitan areas** as well as **industrial hubs** across the country.



The nature of the emerging energy efficiency market with various niche sub-sectors reflects the industry challenge in finding individuals with the right combination of technical and energy management skills to scope out, implement and monitor projects end-to-end.

An entrepreneurial and critical-thinking mindset, coupled with the ability to analyse energy usage data, is required to identify dynamic, cost-saving opportunities. In a market that is bound to be saturated with Energy Management Service (EMS) providers, this will underpin competitive success. Industry describes this unique skill-set as highly scarce, even though it is a critical enabler of the energy efficiency sector as a whole.

Specifically this entails looking at skills gaps in energy management services for buildings:

- As the sector moves from implementing *ad hoc* energy saving interventions to a growing and sustained demand for end-to-end energy management, the deficit of engineers who can scope out systems end-to-end, manage them from design to implementation, and apply continuous refinement will be aggravated.
  - On the technical side, this includes expertise in the various hardware and software solutions, knowledge of different industries, and how to tailor interventions to meet each specific project's energy usage profiles and savings goals.
  - On the process side, as with large renewable energy capex projects, there are very few experienced project managers who can bring together management of various stakeholders, cost-savings goals and elements of risk management.

Beyond a national gap, industry faces a skills drain of talent from local municipalities to metros and cities, making it even harder to fill vacancies.

Figure 32 | Energy Efficiency: Waterfall (up to 2030)

Gross jobs (thousands) needed to support upcoming demand for EMS and HVAC systems in buildings, up to 2030, indexed to the year that each project comes online

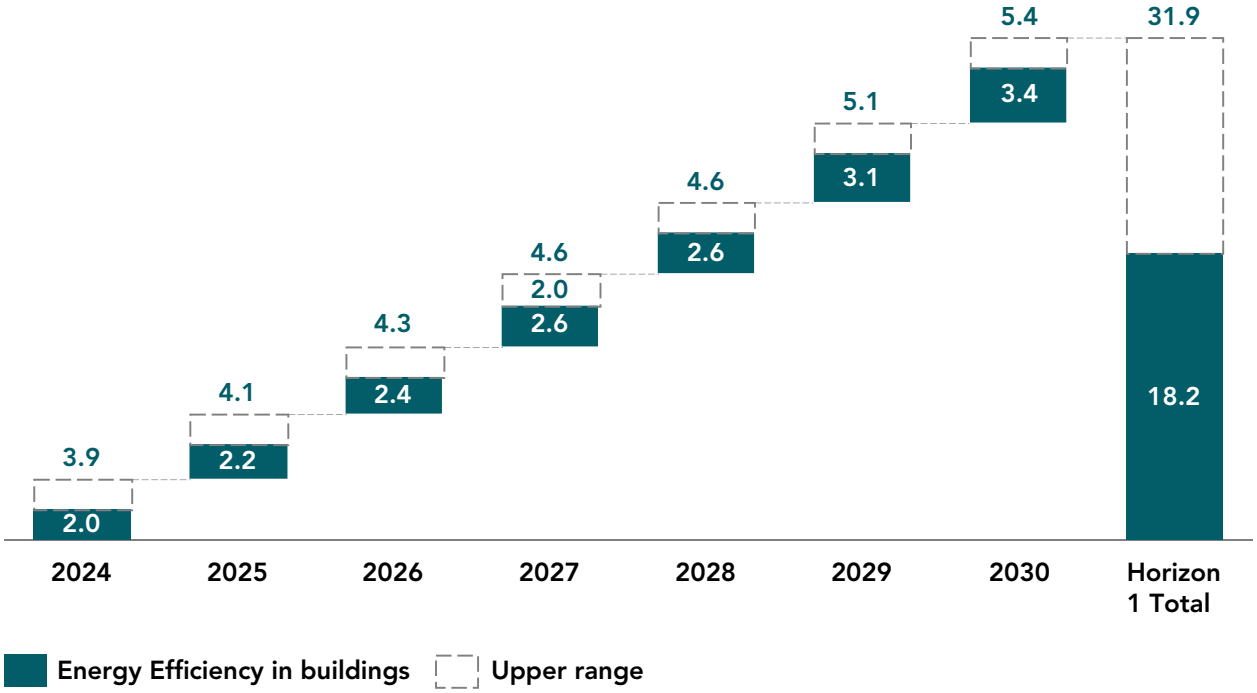


Figure 33 | Energy Efficiency – Local municipality map (2030)

Geographic spread of jobs coming online based on Energy Efficiency demand, up to 2030

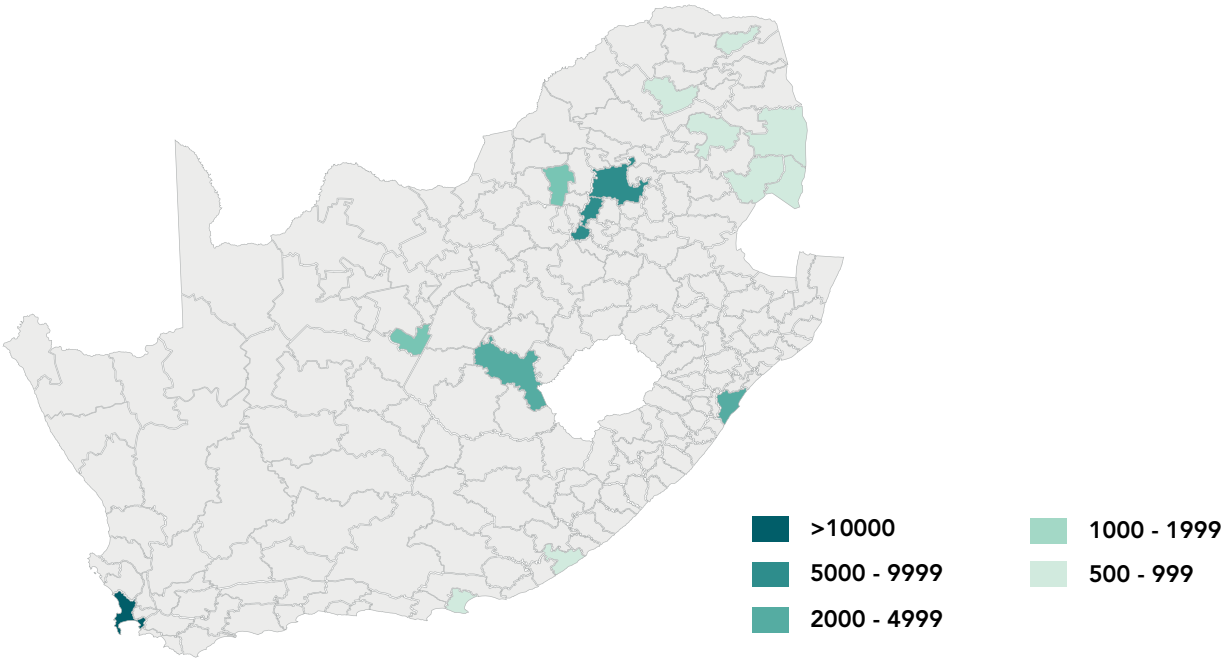


Figure 34 | Energy Efficiency: Value Chain & Job Family (present — 2030)

Breakdown of gross jobs needed to support upcoming demand for EMS and HVAC products in residential, commercial and industrial buildings up to 2030, broken down by value chain step and job family (% of jobs in each job family per value chain step — segment label — and total jobs per value chain step — bar label)

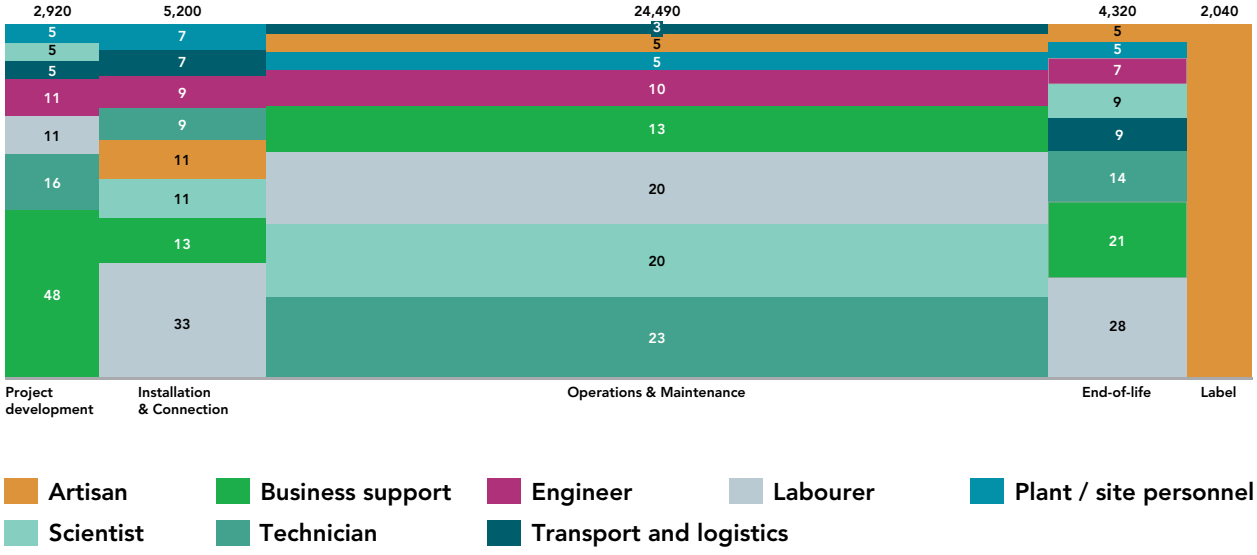


Figure 35 | Energy Efficiency: Waterfall (2031 — 2050)

Gross jobs (thousands) needed to support projected demand for EMS and HVAC systems in buildings based on projected CAGRs for residential, commercial and industrial buildings

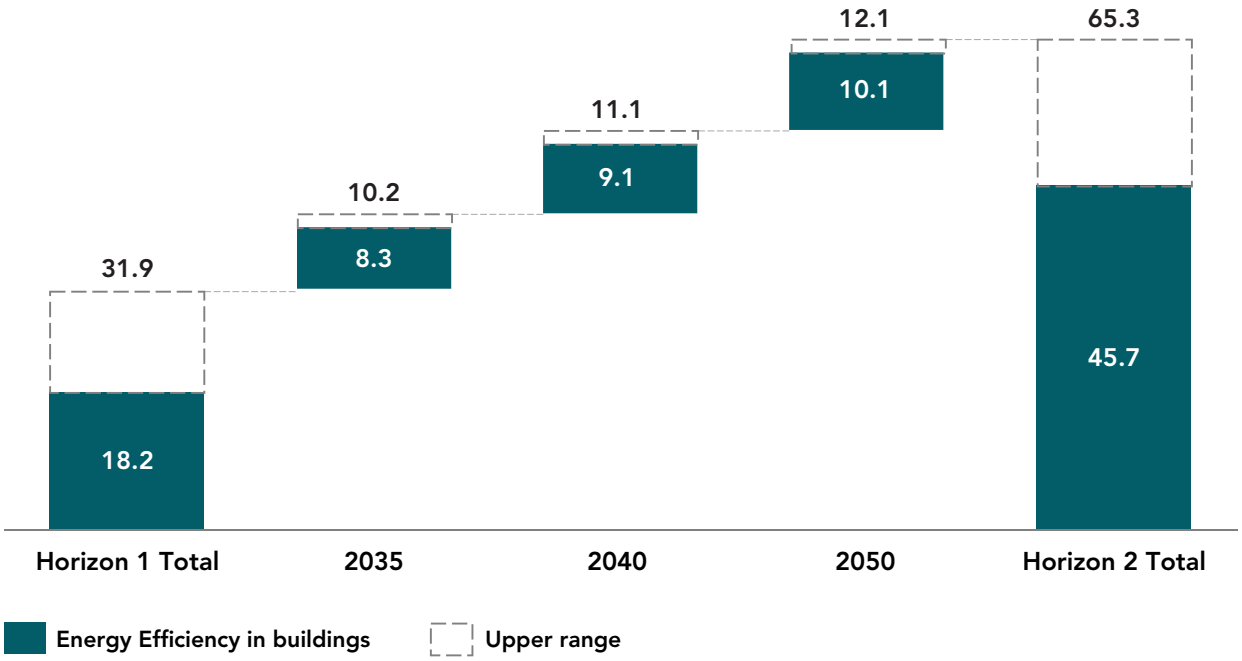
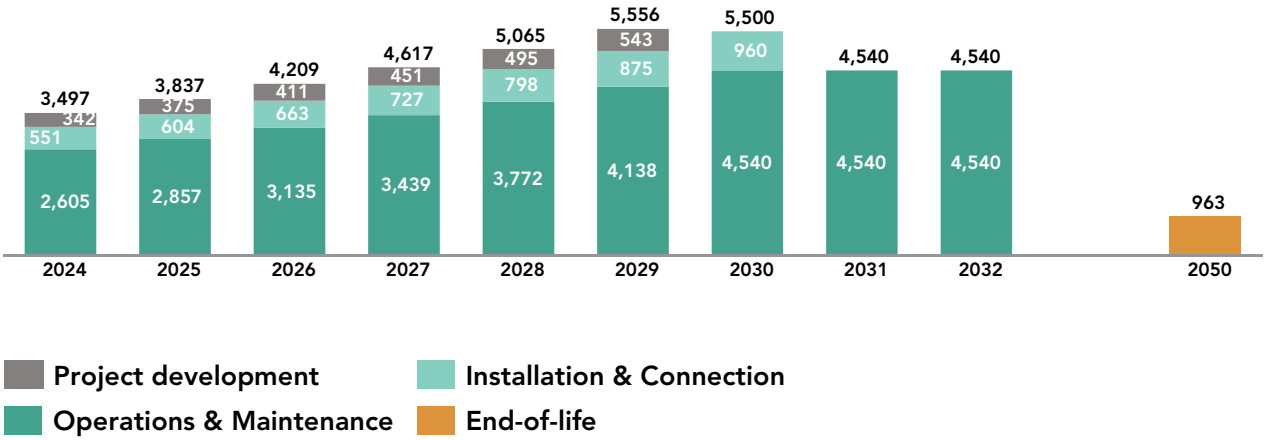


Figure 36 | Energy Efficiency: Time series

Time series of the jobs needed to support Energy Efficiency demand up to 2030, staggered based on the timing and duration of each value chain step



What this dataset and approach enables

The fact base and approach developed by the JET SEP provides a publicly-available, consolidated resource that enables stakeholders in the sectors of the just energy transition, and the green economy more broadly, to plan, deliver and employ in-demand skills. In this section, we present the municipal level view, based on a few examples, to demonstrate what is possible. This analysis is available for all municipalities.

Although the jobs and skills demand projections in this report are based on best-practice workforce planning techniques and the best available data, we know that demand for jobs and skills will be dynamic. It will change materially over time. This is because project pipelines are not fixed. They are influenced by several factors that range from policy changes to operational bottlenecks, availability and affordability of financing. In addition, we expect that, as the transition progresses, the profiles of both new and existing occupations will evolve. For example, our industry working group consultations have noted that working with high-voltage electricity is becoming an essential requirement for electricians. Previously, this was considered a specialised skill, which was called upon in limited circumstances, and electricians with such skills were considered at the top of their profession. Therefore the projections in this report are not fixed in stone, but will depend on macroeconomic conditions, policy execution and technological developments. They will also depend on the degree to which efficiency-enhancing policies that increase production while maintaining cost competitiveness are adopted.

One use-case of this study, and one of the areas of interventions for JET SEP in the coming months, is to provide a picture of upcoming projects, the jobs needed – when, where and for how long - and how to dynamically plan for people's employability.

For example, **Beaufort West's** project pipeline is made up of 10 wind, 16 BESS and three transmission line projects until 2030. This effort will create ~5,400 gross jobs. If it is left to each employer to resource their projects, we risk missing out on opportunities to co-ordinate skilling interventions across sectors (e.g. upskill artisans that can maintain both wind and transmission projects) and importantly risk not achieving a just people transition rooted in the local community.

Figure 37 | Beaurfort West local municipality in Western Cape

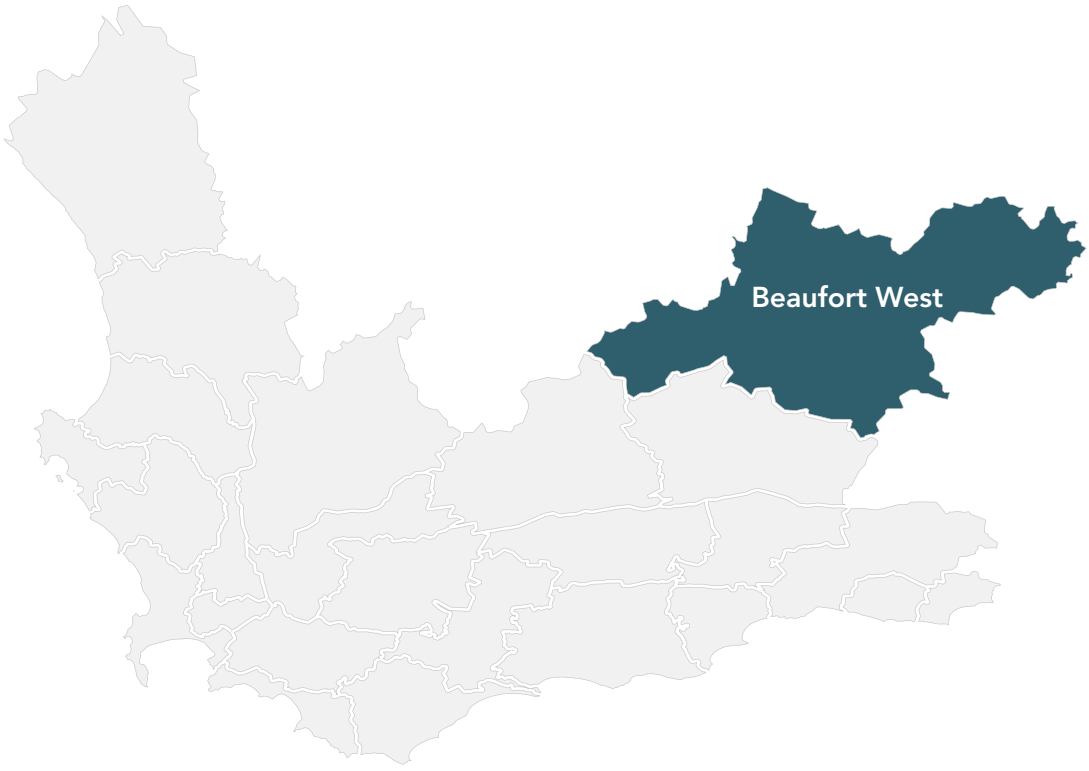
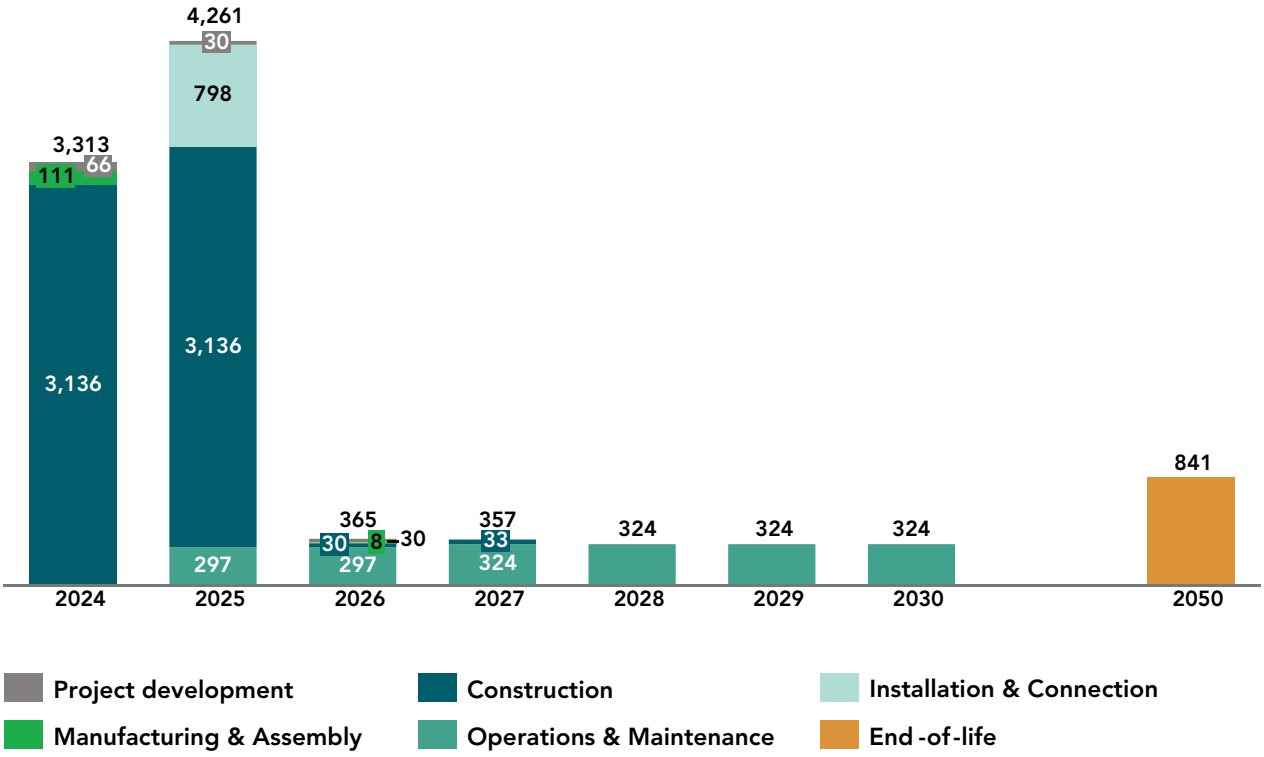


Figure 38 | Time series of the jobs needed in Beaufort West for upcoming wind, transmission and BESS projects up to 2030, staggered based on the timing and duration of each value chain step



As with other large capex projects, the majority of job demand emerges in the construction, and installation and connection phases of the projects. To support long-term employability, there is a case for supporting the employability of the large low- to semi-skilled labourer pool required in the short term. For example, in Beaufort West's case, this would be training to support the move into related operations and maintenance roles, or other non-energy-related opportunities. A well-planned approach would also consider how to enable SMMEs, including those in the construction industry, to participate in opportunities emerging from this pipeline through upskilling and enterprise development.

In **Steve Tshwete,** the current pipeline consists of one green hydrogen project (planned to be operational by 2030), one substation (planned for 2026) and four transmission lines. These projects will create ~600 gross jobs, largely in green hydrogen construction.

Figure 39 | Steve Tshwete local municipality in Mpumalanga

Figure 40 | Time series of the jobs needed in Steve Tshwete for upcoming Green Hydrogen and Transmission projects up to 2030, staggered based on the timing and duration of each value chain step

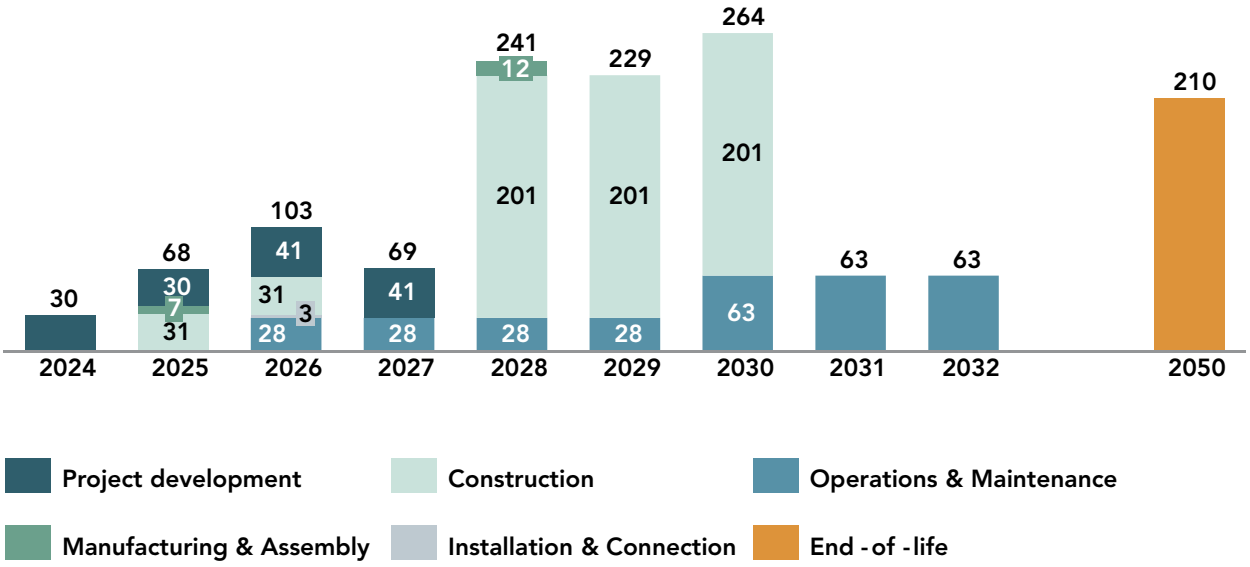
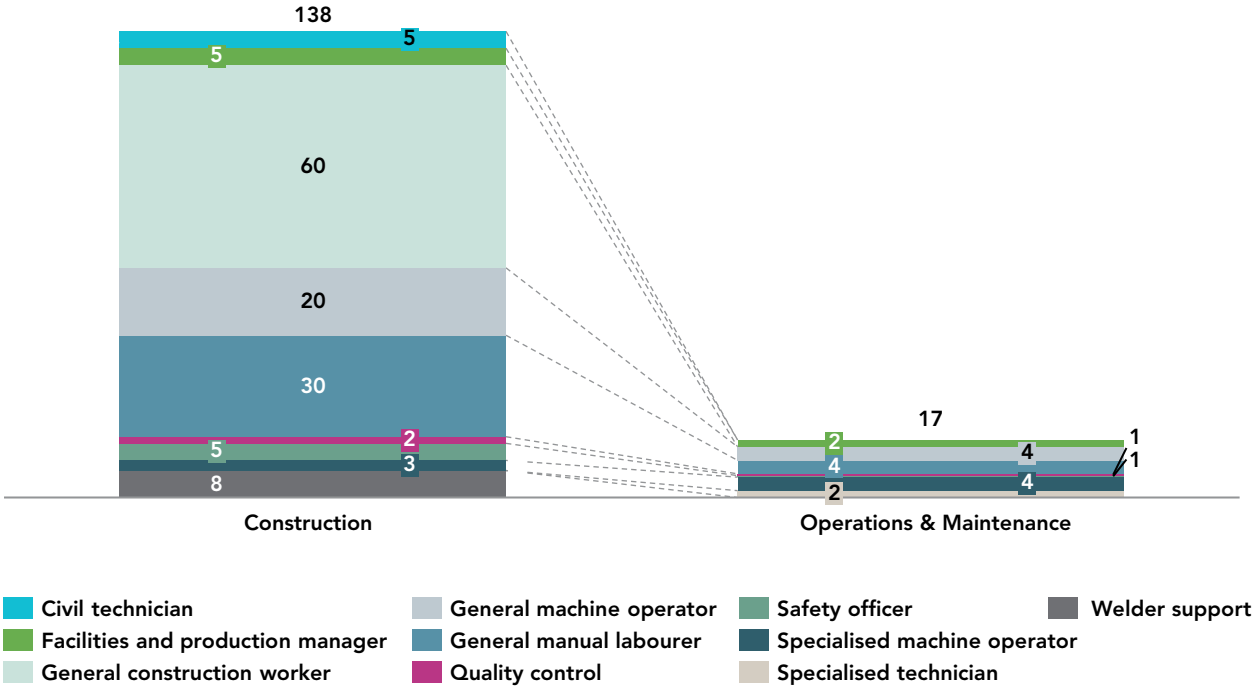


Figure 41 | Breakdown of the labourer, technician and site & production personnel occupations in Green Hydrogen in the Construction and the Operations & Maintenance phase



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In Steve Tshwete, the current pipeline consists of one green hydrogen project (planned to be operational by 2030), one substation (planned for 2026) and four transmission lines. These projects will create ~600 gross jobs, largely in green hydrogen construction.

Understanding the specific occupations required for each phase supports planning for skilling interventions to ensure long-term employability. For example, the green hydrogen project in Steve Tshwete requires the effort of 110 'labourers' consisting of construction workers, and non-specialised machine operators for three years. After construction, the need for manual labour drastically decreases to less than 10%. To support a just energy transition, provision needs to be made to potentially transition some employees into operations and maintenance (with upskilling), and others into other opportunities in emerging value chains.

03

Planting the seeds for skills development ecosystems of the future

Our understanding of the likely evolution of skills demand in the green economy raises two pressing questions: 'are the skills systems in place fit for purpose for the nature and scale of change required?' and 'are they set up to support just and inclusive outcomes?' The JET IP articulates various challenges faced by the current South African skills creation system which limit its ability to prepare candidates at the right scale and in an inclusive manner:

1. The system lacks a comprehensive view of skills supply and demand. This makes it difficult to plan for and resource skills development that would best equip the workforce for the evolving demands of the labour market. The result may be skills shortages and inefficiencies that hinder the transition.
2. Co-ordination of skills development is fragmented. Many good skilling programmes have been initiated to produce green skills, but educational institutions, employers and government entities are operating in silos. This raises the risk of overlap and missed opportunities.
3. Education and training programmes related to the JET tend to be *ad hoc*, not part of core curricula, and are often not properly aligned with the needs of the industry.
4. The curricula delivered are often mismatched and irrelevant to the capabilities that individuals need to succeed in the workplace. The needs of the green economy are rapidly changing, and educational institutions struggle to keep up.
5. There is a disconnect between training institutions and local communities. Training institutions are not integrated with the local community, which loses an opportunity to address the unique needs of different regions and make training inclusive and responsive to local demand.

This means that today's system will be unable to respond to the dynamic needs for skills that will be imposed by the just energy transition. ***The solution is not simply to massively scale up training for in-demand job families.*** Static, multi-year plans will be dead on arrival - over-skilling, or skilling ahead of time will create talent gluts that perpetuate graduate unemployment, reinforce disillusionment with the transition and perpetuate further marginalisation. Under-skilling will leave the skills system struggling to meet demand and drive employers to seek foreign talent to fill gaps.

As a result, there is a real risk that South Africa's energy transition will be slower and more expensive than it needs to be. This threatens the fundamental principles of social justice and undercuts the economic promise of the energy transition.

This moment presents an opportunity to create a new skilling paradigm. Government has identified a range of constraints that have to be overcome to realise a green skilling revolution, and proposed solutions.

The Just Energy Transition Skills for Employment Programme (JET SEP) is mobilising the private sector's contribution to accelerate green skills development, in partnership with other social partners.

1. In this publication, we use the term 'sector' to refer to a particular technology and the economic effort around it, including companies, jobs, investments, and economic activities. For example, we refer to the solar energy sector, but when we refer to specific methods, equipment, and innovations used to harness solar power, we use 'technology'.

Chapter 9 of the JET IP advocates an ecosystem approach to meet the skilling needs of the energy transition in a just manner. The private sector fully supports this approach. Skills ecosystems enable demand-led skilling at scale, and adopting an ecosystem approach has immediate implications for the national skilling system. We have identified the need for at least five strategic paradigm shifts:

- A fundamental change in the approach towards sector and national skills planning which takes project pipelines as the starting point, rather than relying purely on workplace skills plans.
- An unprecedented level of collaboration is required between the skills system actors from both the private and public sector. Employers and the private sector will need to shift from being customers of the skills system to active participants, who actively help to shape and operate the ecosystem.
- All funding stakeholders need to agree to channel their funding towards priorities identified by a clear ecosystem orchestrator, to maximise resource efficiency.
- Skills development requires a fundamental shift to a learner-centric approach that enables different recognised learning pathways and associated programmes for skilling, reskilling, and upskilling, aligned to the needs of different learner groups.
- Technology is a mission-critical enabler for a sustainable, agile ecosystem that operates at scale and pace, dynamically adjusts to changes in skills needs, and ensures equitable distribution of support around the country. Multi-stakeholder collaboration to overcome challenges with uptake will define success, and will harness the power of technological platforms in a co-ordinated manner to support all learner groups and ensure inclusive access to opportunities.

The JET IP warns that the current skills formation system needs significant reform to enable the country to capitalise on the green transition. In the absence of reform, South Africa risks falling behind as new industries emerge globally, resulting in economic stagnation and lost opportunities for its workforce. The country needs all stakeholders in the skilling system to embrace a fundamental shift towards a demand-led, collaborative and ecosystem approach to skilling. The private sector is gearing itself up to heed this call. We believe that this is an opportunity to fully modernise the JET skills formation system in a way that addresses critical questions of justice and socio-economic equity.

Our next publication in this series will share the private sector's perspective on how to develop a fit-for-purpose skills development ecosystem.

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