



South African Energy Skills Roadmap

27th January 2023








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Agenda

| | | |
|---|--|---------------|
|  | Welcome and introduction | 09:00 – 09:15 |
|  | Project background | 09:15 – 09:30 |
|  | Presentation of detailed results – trends, skills and education implications | 09:30 – 10:15 |
|  | Questions | 10:15 – 10:45 |
|  | Way forward and closure | 10:45 - 11:00 |

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Context

- The energy transition is happening globally, and the pace of change is accelerating
- The energy transition is resulting in sector coupling into related sectors, increasing the complexity
- Future skills will also be needed for other new technologies such as robotics, artificial intelligence, nanotechnology and 3D printing - these technologies are impacting customers and suppliers
- According the WEF, South Africa has a long way to go in order to improve its Just Energy Transition readiness
- The transition provides many opportunities for South Africa, but the transition must be just
- Ensuring we have the right skills at the right place and at the right time will be a critical enabler

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Energy skills roadmap objectives

- To identify future skills and competencies needed for the energy sector's just transition
- To develop strategies to ensure that these skills are in place when they are needed
- To identify skills that will no longer or will be needed at much lower levels in the future due to the energy just transition
- The development of strategies that will reorient and reskill these groups of people.

The aim is to build on existing work, collate all relevant information into one place, and look longer term so that proactive measures can be taken



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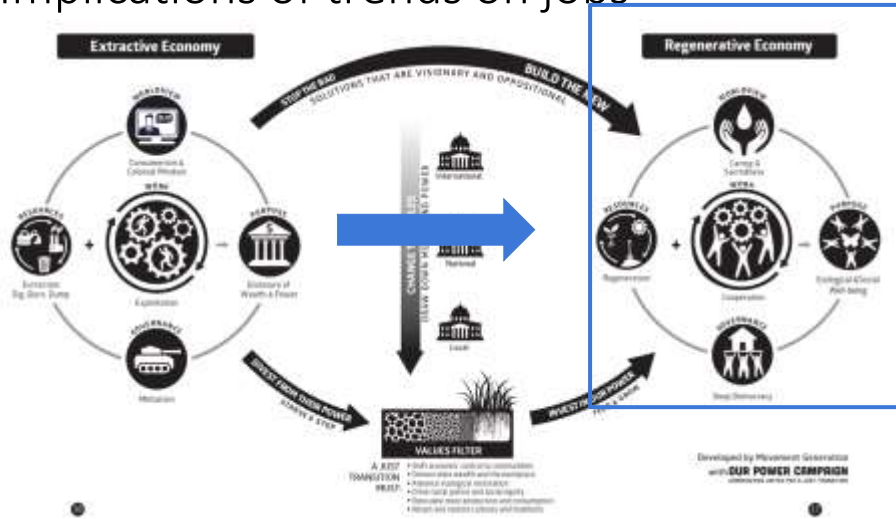


Considerations

- Ecosystem not silos
- In relation to trends not just techno-economic
- What is the journey that joins the start and end
- Scales of magnitude and timing
- Level of readiness – policy and actors in the system
- Is it just
- Risk and uncertainty

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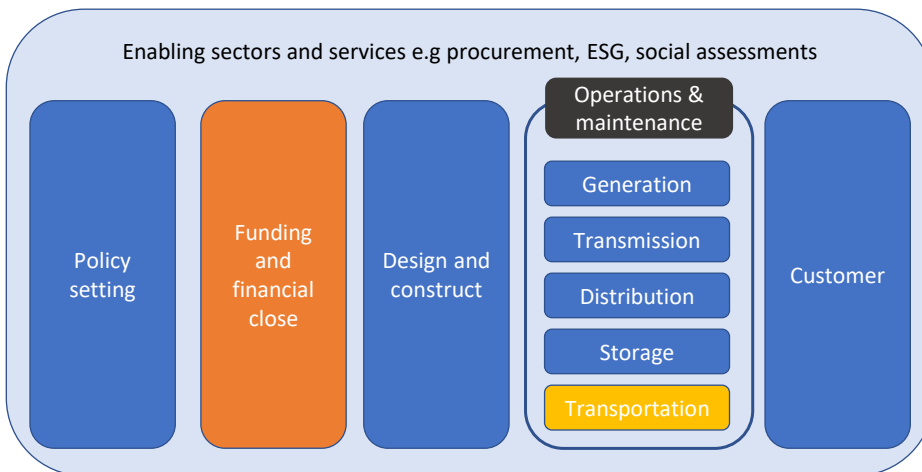
Implications of trends on jobs



Decarbonisation of the sector requires a major shift from fossil-fuels and a change in the country's energy mix. This will have significant implications on current jobs in the coal, oil and natural gas sectors. In turn a growth in clean and renewable energy provides an opportunity for those currently employed in these sectors to transition to sectors of growth, and the creation of new jobs.

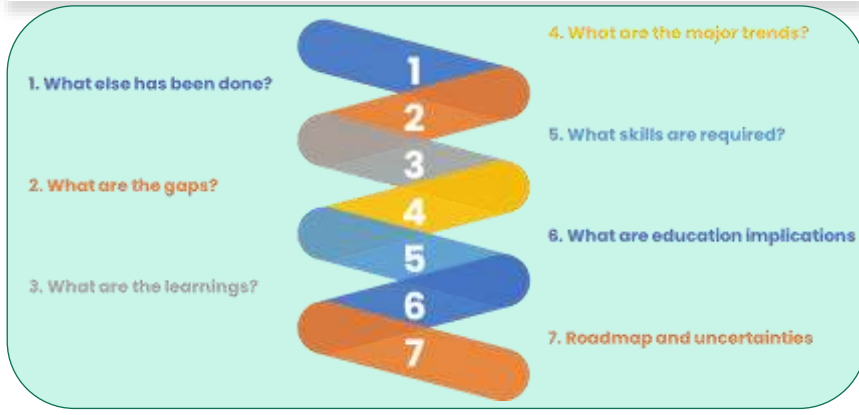
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Energy value chain



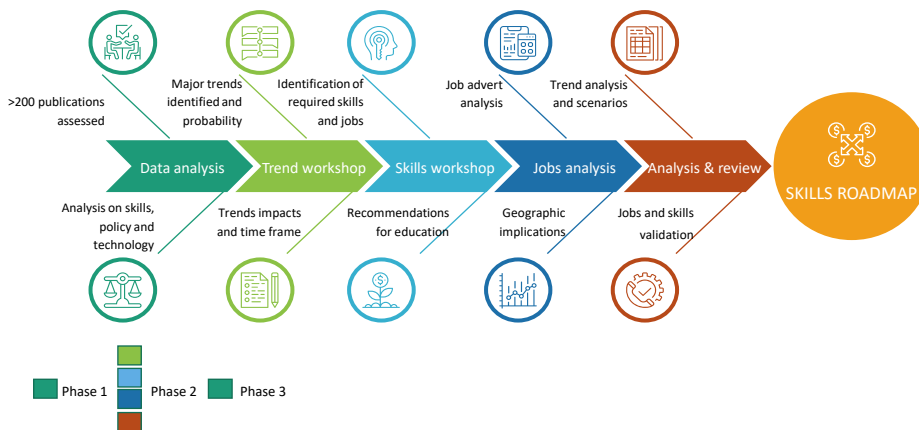
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Approach and questions to be answered



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Overall process



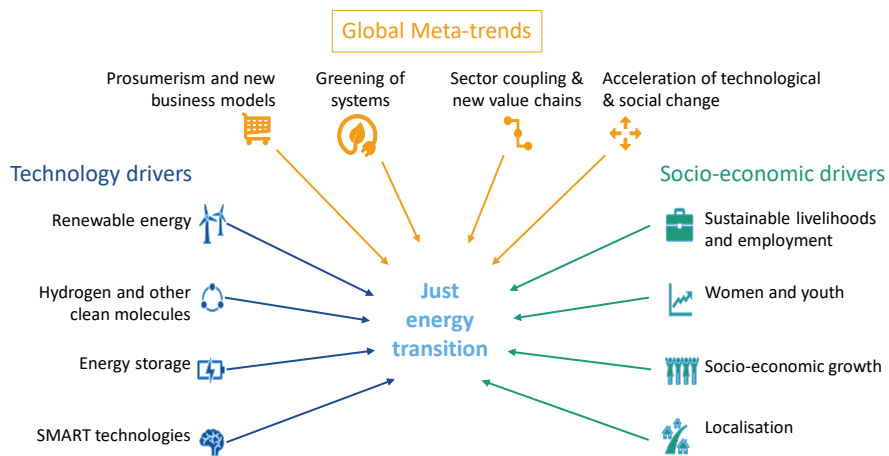
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Baseline assessment

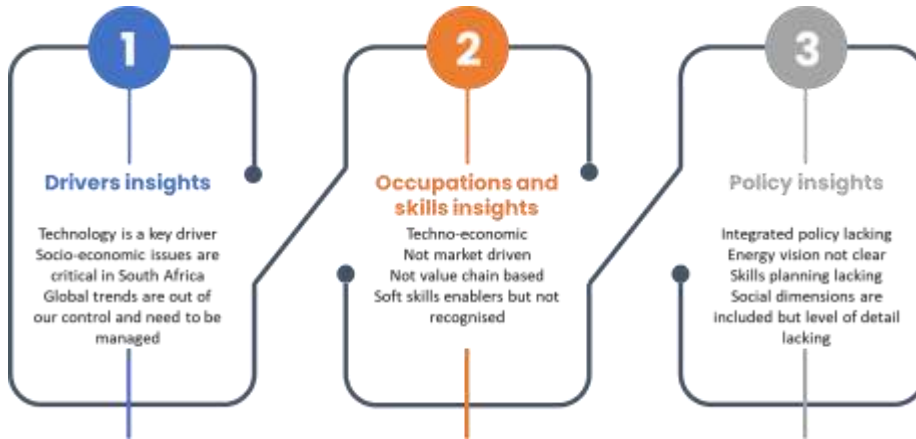
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System drivers



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Baseline analysis

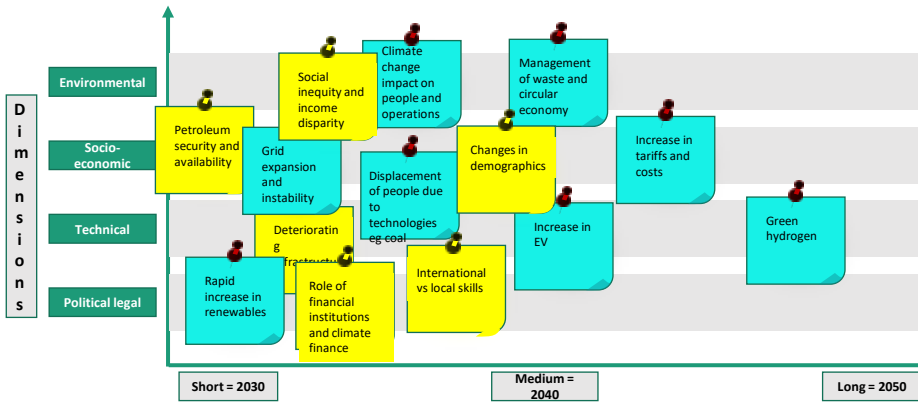


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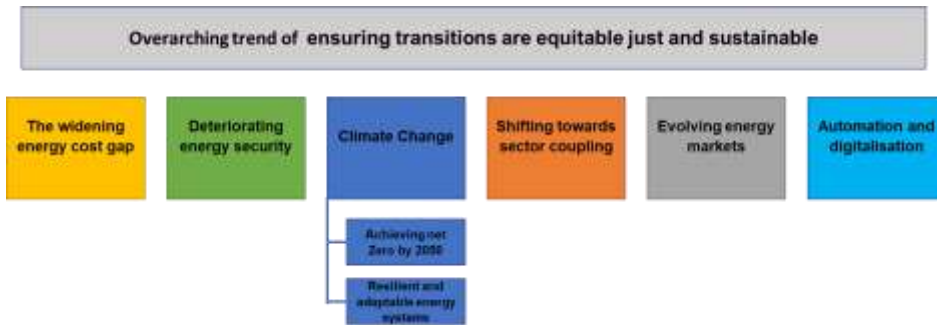
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Mapping South Africa's energy future outcomes



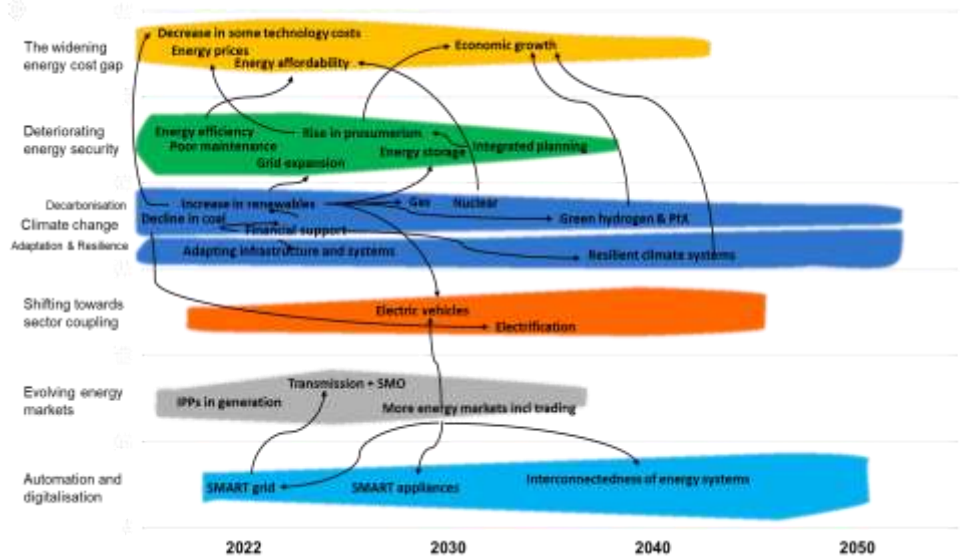
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Trends that emerged from the workshops



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Consolidated trends



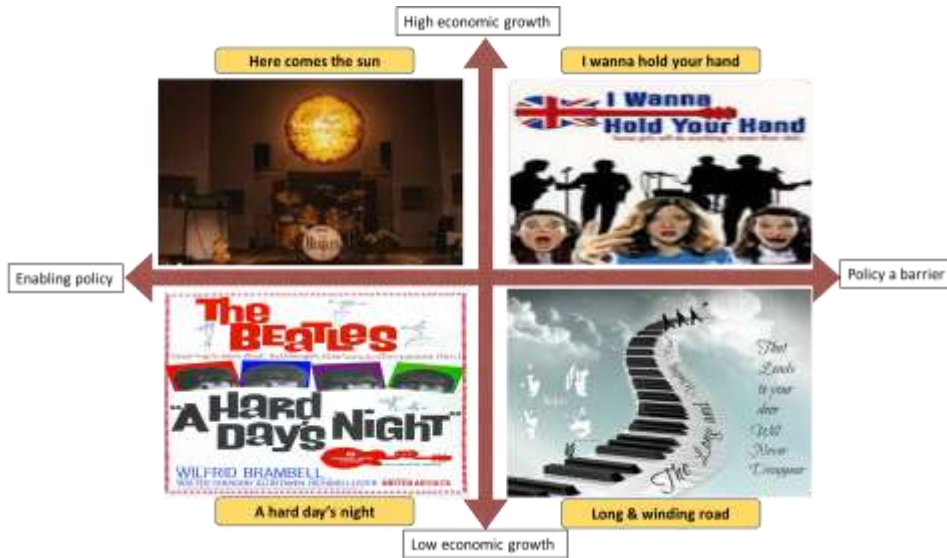
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Each trend was analysed in the workshops

| Trend: Deteriorating energy security | |
|--------------------------------------|---|
| Definition | Energy security is defined by the IEA as "uninterrupted availability of energy sources at an affordable price and long-term energy security mainly deals with timely investments to supply energy in line with economic developments and environmental needs and short-term energy security focuses on the ability of the energy system to react promptly to sudden changes in the supply-demand balance" (IEA, 2022). |
| Time horizon | |
| Probability of occurring | <div style="display: flex; justify-content: space-around;"> 100 90 30 </div> |
| What is it impacted by | <p>Short term energy security is impacted by:</p> <ul style="list-style-type: none"> • Lack of finance and skills. • Poor maintenance or Inadequate/bad quality maintenance • Lack of planning. • Poor governance. • Human behaviour. <p>Long term energy security is impacted by:</p> <ul style="list-style-type: none"> • Changes in technology and associated prices. • Changes in policy impacting on energy mix and timeous decision making • Lack of planning. • Poor implementation. |
| What it impacts | <p>Both long- and short-term security impacts:</p> <ul style="list-style-type: none"> • Adequacy of infrastructure e.g., grid constraints or lack of available generation. • Economic growth. • Investor confidence. • Productivity. • Ability to meet net zero carbon commitments. • Affordability. • Rise of prosumerism. |
| Actions or mitigation required | <p>The actions required to address this trend will require extensive action over an extended period of time including:</p> <ul style="list-style-type: none"> • Adequate and adaptive planning. • Enabling policy. • Accessing adequate financing. • Focus on implementation. • Quality and timely maintenance. • Management of sabotage. • Strengthening and expanding the electricity grid and to make it specific, measurable, achievable, relevant, and time-bound (SMART) including a shift away from physical networks to smaller standalone networks. |

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Energy scenarios



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What the scenarios tell us

No regret options

- Renewable energy (and by association GRID and SMART)
- Energy efficiency (and by association SMART)
- Prosumerism (and by association renewables)
- Finance
- Energy security especially in the near term

Decisions will need to be taken

- Gas
- Nuclear
- Market
- Green hydrogen and PtX

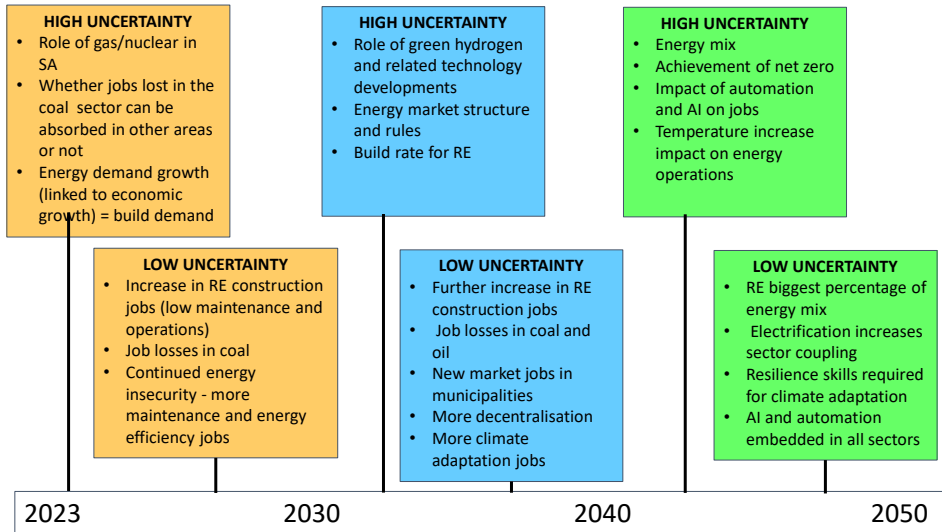
Declining

- Coal
- Oil

Finally, there are skills required to make the transition just no matter what the scenario.

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Uncertainty variation over time



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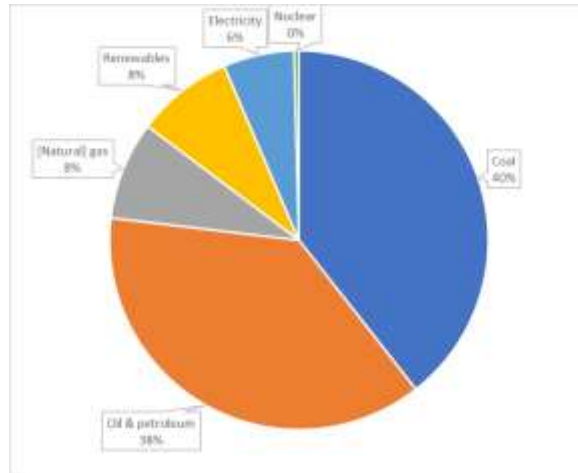
Implications for skills

- Job demand analysis
- Trends implications on work
- Implications on skills



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Labour market for energy-related sectors in South Africa



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Potential shifts and changes in the labour market should and when the trends are realised

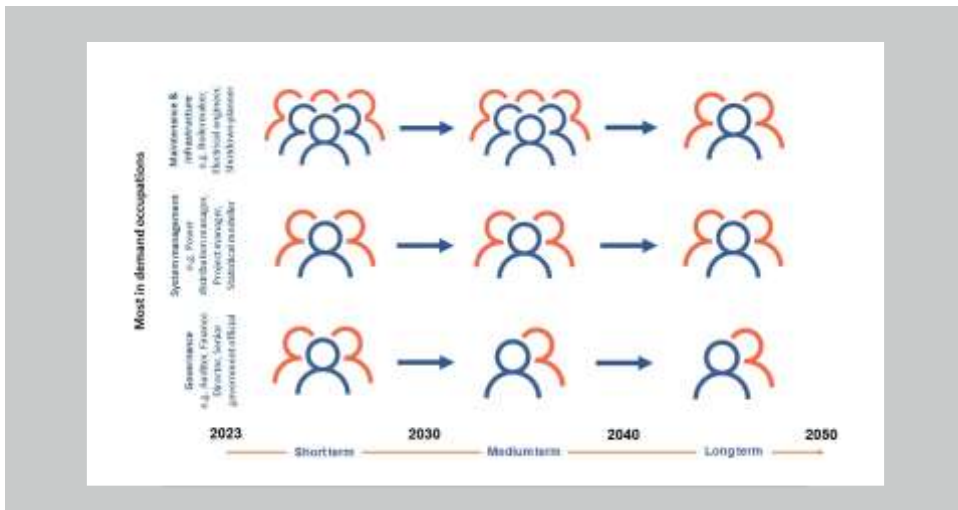
| Trend: Deteriorating energy security | |
|--------------------------------------|---|
| Time horizon | |
| Impact on the world of work | <ul style="list-style-type: none"> • To transform the generation of electricity into an effective and efficient operation that the country's businesses and population can rely on, good leadership and management, union negotiation, policy development, planning, implementation (including quality control) and monitoring; risk mitigation (including security); financing; coordination and core maintenance skills are required (Peyton, 2022). <ul style="list-style-type: none"> ◦ Given the need for maintenance skills (an estimated shortfall of 40,000 artisans in the country), emphasis on electrical / maintenance technician and planning training is critical (accredited / certified) (Alphonus et al., 2021). ◦ Recruitment of skilled personnel, including former Eskom personnel, to work with current permanent teams to resolve urgent issues and to transfer skills to permanent staff (Gerber, 2022). • With the transmission grid facing constraints there is a need to expand the grid, to incorporate renewables and mini grids (see Climate change - achieving net zero by 2050 trend below). This will require individuals with the knowledge and skills to seek investment; finance, coordinate and implement the expansion. It is likely that these skills will be required in more decentralised nodes of activity e.g., districts and municipalities (see the evolving energy markets trend below). |
| Minor occupation groups | <ul style="list-style-type: none"> • Legislators and Senior Officials • Managing Directors and Chief Executives • Mathematicians, Actuaries and Statisticians • Engineering Professionals • Architects, Planners, Surveyors and Designers • University and Higher Education Teachers • Vocational Education Teachers • Finance Professionals • Legal Professionals • Physical and Engineering Science Technicians • Process Control Technicians • Financial and Mathematical Associate Professionals • Sales and Purchasing Agents and Brokers • Machinery Mechanics and Repairers • Electrical Equipment Installers and Repairers |

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Potential shifts and changes in the labour market should and when the trends are realised

| Types of priority occupations required for the transition | | |
|--|---|--|
| 2023 - 2030 (Short term) | 2031 - 2040 (Medium term) | 2041 - 2050 (Long term) |
| <p>Maintenance and infrastructure:</p> <ul style="list-style-type: none"> Boilermaker / welder Construction Manager Control & Instrumentation Engineer Electric Power Generation Engineer Electric Substation Operations Manager Electrical Engineer Electrical Engineering Technician Electrical Engineering Technologist Electrical Design Engineer Electrical Inspector Construction Electrical Inspector Lines Electrician Electronic Engineering Technician Engineering Manager Fossil Power Plant Process Operator Instrument Mechanician (Industrial Instrumentation & Process Control) Linesman Maintenance Planner Maintenance Technologist Mechanical Engineer Mechanical Engineering Technologist Metre Technician Operations Manager (Production) Pipe Fitter Power Distribution Engineer Power Generation Operations Manager Power Systems Engineer Power Transmission Engineer Process Operator | <p>Carry over of occupations listed in the short term, plus an increased focus on the following:</p> <ul style="list-style-type: none"> Boilermaker Educator Electrical Technician Educator | <p>Carry over of occupations listed in the short and medium term</p> |

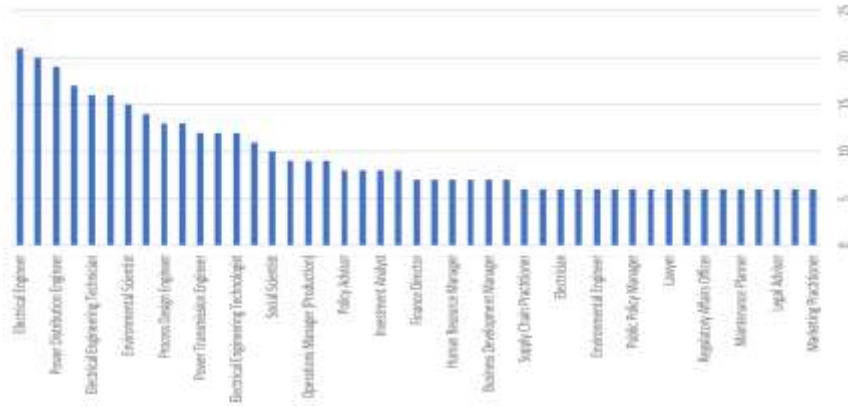
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Most in demand occupations for deteriorating energy security

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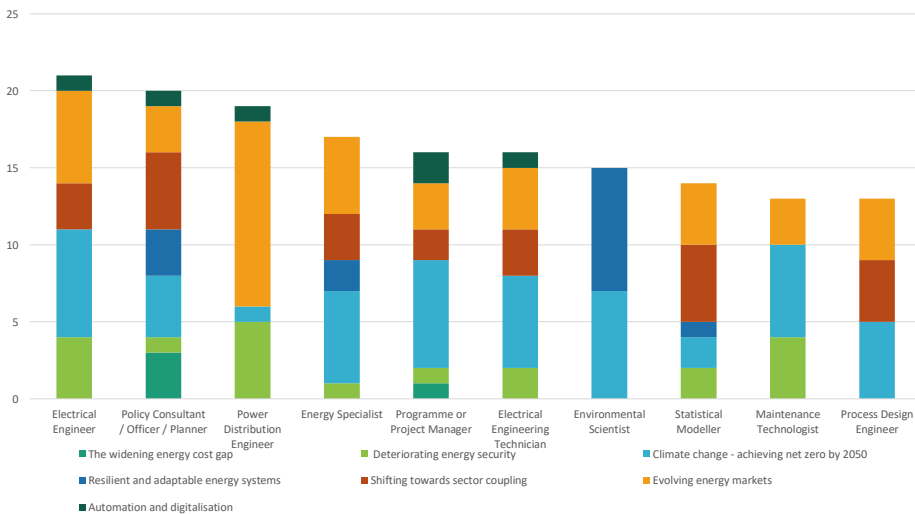
Top most commonly cited occupations in demand



Of the occupations identified, 60 are also listed as critical by DHET for the country's economic reconstruction and recovery.

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How occupations are distributed across the trends



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Energy sector transition occupations listed as critical

- Actuary
- Agricultural Engineer / Technician
- Air-conditioning & Refrigeration Mechanic
- Applications Programmer
- Biotechnologist
- Business Development Officer
- Chemical Engineer / Technician
- Chemist / Chemistry Technician
- Civil Engineer / Technician
- Climate Change Scientist
- Computer Network & Systems Engineer
- Construction Project Manager
- Corporate General Manager
- Customer Service Manager
- Data Management Manager
- Data Scientist
- Draughtsperson
- Economist
- Electrical Engineer / Engineering Technician
- Electrical Equipment Mechanic
- Electronic Engineer / Technician
- Energy Engineer / Technician
- Engineering Manager
- Environmental Manager / Scientist
- Geologist
- Geophysicist
- Forensic Accountant
- Information & Communication Technology (ICT) Systems Analyst
- ICT Security Specialist
- Industrial Designer
- Industrial Engineer / Technician
- Instrument Mechanician
- Integrated Manufacturing
- Line Process Control Technician
- Investment Advisor / Analyst / Manager
- Lift Mechanic
- Manufacturing Operations Manager
- Manufacturing Technician
- Market Research Analyst
- Mechanical Engineer / Technician
- Mechatronics Technician
- Meteorologist
- Metallurgist
- Microbiologist
- Millwright
- Mineralogist
- Mining Engineer
- Organisational Risk Manager
- Physicist
- Policy & Planning Analyst / Manager
- Product Assembler
- Programmer Analyst
- Project Manager
- Purchasing Officer
- Refrigeration Mechanic
- Quality [Systems] Controller / Manager (Manufacturing)
- Quantity Surveyor
- Research & Development (R&D) Manager
- Safety Inspector
- Software Developer
- Solar Photovoltaic (PV) Service Technician
- Supply & Distribution Manager
- Transportation Electrician
- Wind Turbine Power Plant Process Controller

•Source: DHET 2022, 2022a; EWSETA, 2021.

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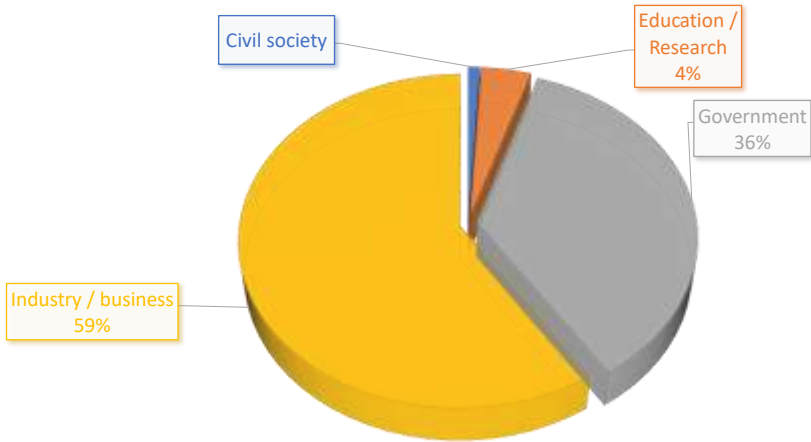
Top 10 most commonly cited technical and 'soft' skills

| Technical skills | 'Soft' skills |
|---|---|
| <ol style="list-style-type: none"> 1. Research & Development (R&D) 2. Legal & Regulatory 3. Financial 4. ICT (Computer Literacy and Advanced IT) 5. Monitoring & Evaluation 6. Renewable Technology Installation 7. Renewable Technology Operations 8. Procurement 9. Renewable Technology Maintenance 10. Policy Development | <ol style="list-style-type: none"> 1. Project management 2. Leadership 3. Communication 4. Agility 5. Emotional Intelligence 6. Mentoring 7. Community Outreach 8. Critical Thinking 9. Decision Making 10. Problem Solving |

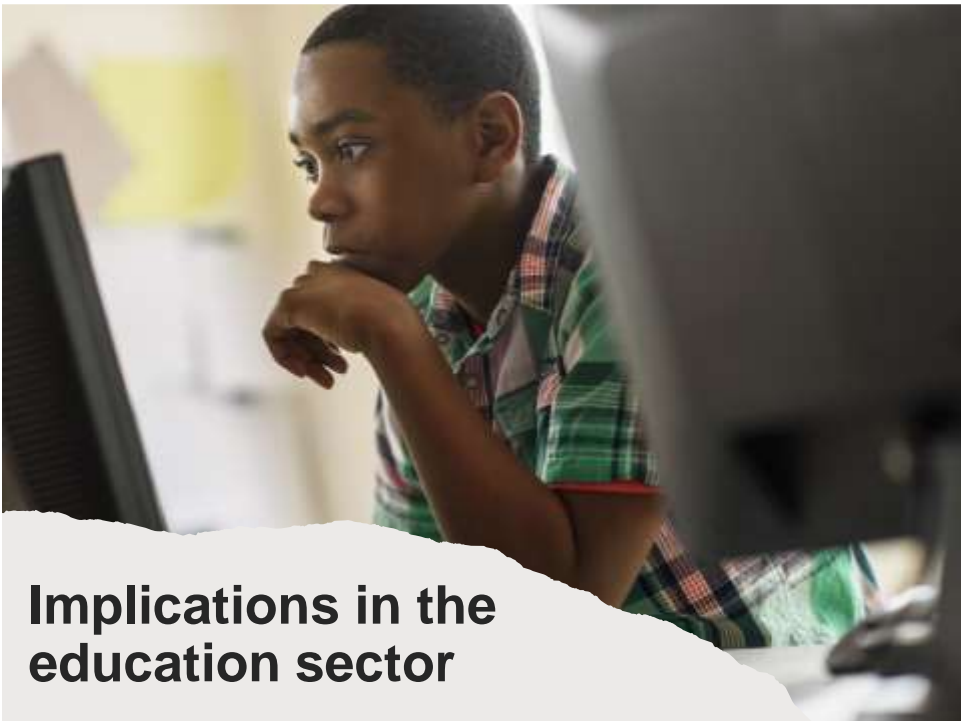
Red text: Deemed as critical skills gaps by EWSETA

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Job advert analysis: By employer type



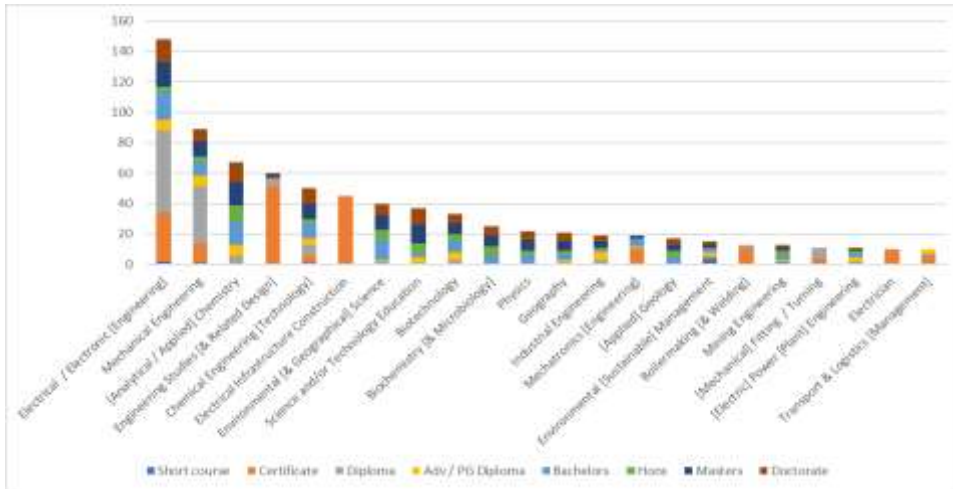
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**Implications in the
education sector**

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Top most identified energy courses by qualification level



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Supply and demand gaps

| Trend: Deteriorating energy security | |
|---|--|
| Core areas of occupation demand | Gaps |
| <ul style="list-style-type: none"> Legislation and regulation Leadership and management (incl. good governance) Mathematics and statistics Electrical and process engineering and associated technical Financial and investment Sales Maintenance and repair Security | <ul style="list-style-type: none"> While courses on public sector management and governance exist, access and uptake needs to be encouraged and increased. Inadequate supply of maintenance, repair and non-electrical technical (e.g. mechanical, boilermaker) courses at TVET and community colleges |

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Conclusions and Recommendations

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Conclusions: Uncertainty and trends

- The energy sector is being driven by a number of key trends both global and local. These have critical implications for skills development as not only will current jobs be impacted, but new occupations and skills will be needed.
- Skills requirements for the energy system necessitates an ecosystem approach and acknowledge the transformative process that is occurring over time and local geographic areas. Siloed approaches need to therefore be avoided to maximise any opportunities and build any trade-offs into decision making.
- The energy sector is in crisis and faces a great deal of uncertainty in developing a skills roadmap as a result. This means that flexibility and contingencies need to be built into any skills roadmap as well as continual tracking of the environment as uncertainties unfold

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Conclusions: Occupations and skills

- The shift to decarbonisation and electrification is being reflected in the increased demand for a wider variety of jobs, including outside the energy sector. This has resulted in the emphasis on only techno economic jobs shifting to a socio-economic and just transition emphasis.
- The private sector is employing specialists in future areas such as green hydrogen to inform policy and clients to drive the trajectory. The public sector tends to be more focused on current jobs and issues.
- The decentralisation and automation/AI trends are resulting in a shift in the types and location of jobs from more technical to more construction jobs.
- The emerging energy markets are driving new types of jobs but also where they are located geographically and sectorally, eg from a central utility to a municipality etc.
- Consideration needs to be given to transversal skills that can be used across various national initiatives such as infrastructure development.

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Conclusions: Implications for the education sector

- There is adequate education supply for traditional energy jobs at university level (number of courses not number of graduates).
- Traditional energy education is not adequately supplying specialisations such as for renewables or clean energy.
- It is unclear if curricula and education quality are responding adequately or are appropriate for future demand.
- Community and TVET colleges are not responding to or providing appropriate training for current and future local demand e.g. solar in the Northern Cape.
- The pipeline from basic education is poor. This is having an impact on the throughput of students in the relevant courses at tertiary education level.

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Conclusions: Skills planning

Needs to:

- Be flexible given the uncertainties. This is currently not adequately considered.
- Acknowledge occupation demand and skills along the transition time continuum, not just current and end goal.
- Consider the ecosystem of activity. This being the broader energy sector value chain, and geographical location.
- Be included upfront in sector and development plans - not at 'tagged on' at the end.
- Be driven by one accountable entity, yet include government, industry, academia and civil society (at all levels) to:
 - Avoid duplication,
 - Ensure that the enabling jobs are adequately provisioned, and
 - Be responsive to uncertainties.

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Considerations and Recommendations

| Consideration | Recommendation |
|--------------------------------|---|
| Uncertainty and trends | <ul style="list-style-type: none"> Develop a more detailed set of scenarios and impact on jobs to pick up the nuances of each scenario on jobs and locations eg Northern Cape etc Track uncertainties to feed into flexibility of skills planning |
| Occupation and skills | <ul style="list-style-type: none"> Development of an occupation and skills atlas Undertake an employee workplace based survey/learning Undertake skills ecosystem mapping in high impact areas (either decrease or increase in jobs) "Soft" skills need to identified and allocated across various job levels |
| Impact on the education sector | <ul style="list-style-type: none"> A focused and detailed study of how job seekers can progress within the energy sector is undertaken. This should inc lude the streams of work associated with core jobs that are going to be impacted by or required to transition South Africa's energy sector To investigate energy transition-related course graduates (numbers) vs demand Review energy transition-related course content relevance / specialisms (especially within critical hotspot areas) |
| Skills planning | <ul style="list-style-type: none"> Cross-SETA collaboration to support skills provisioning for the energy transition Develop and implement an energy just transition skills implementation plan (governance, time, cost, research) |

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Thank you