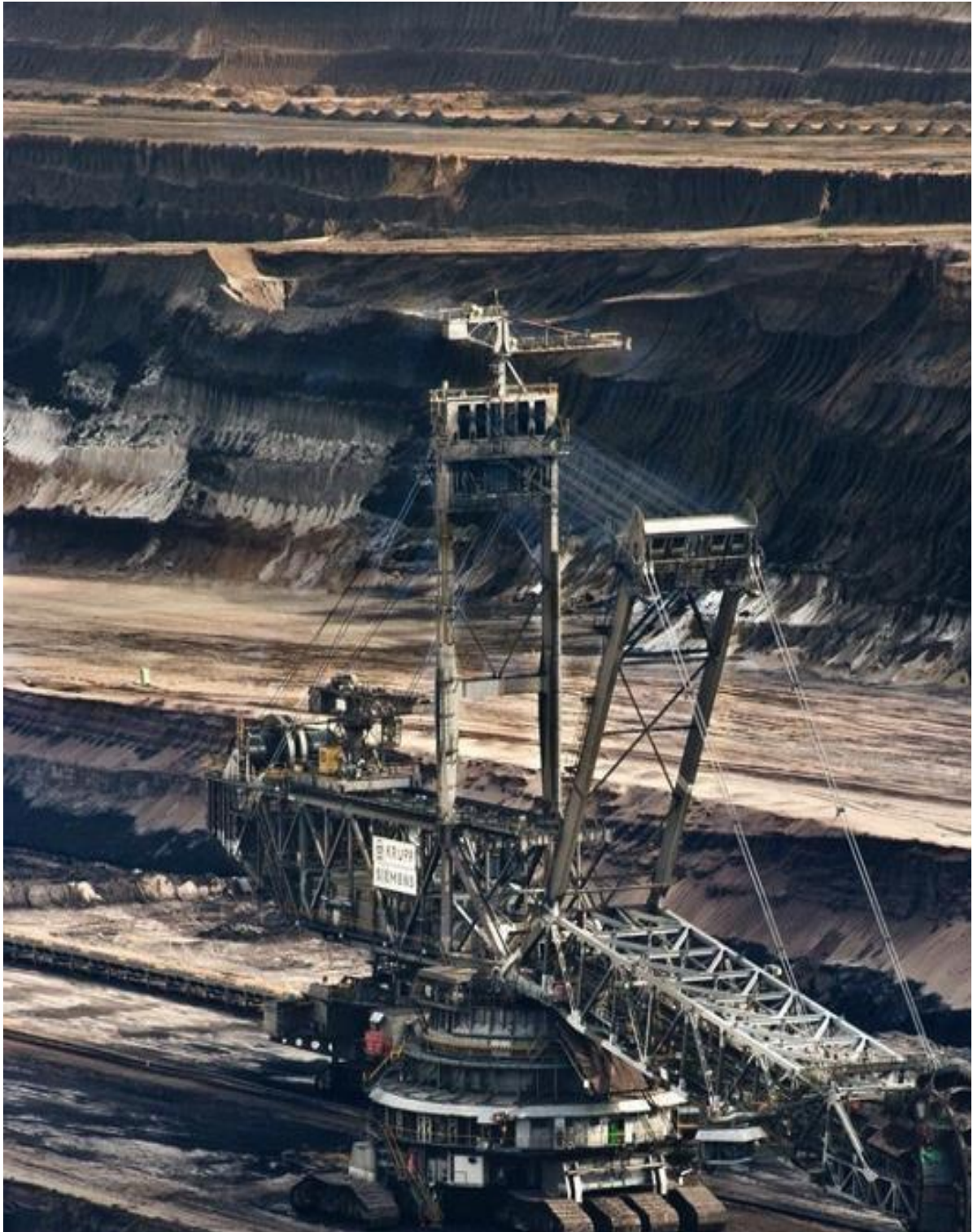




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RES-SKILL 02-T1: SKILLS MATCHING ANALYSIS AND DEVELOPMENT OF TRANSITION PROFILES



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Executive summary

The objective of the report O2-O1 is to create transition pathways as it will match, on the one side, the skillset of former coal workers and on the other side, the most relevant (skills-wise) occupation the RES sector. The overall purpose of O2 is to develop a toolkit that will enable VET providers and RES sector employers to identify the skillset of coal workers and outline the most appropriate learning and reskilling pathway to be followed for their employment in the RES sector. Moreover, the output aims to facilitate the transition of coal workers to the RES sector by developing individualised “transition pathways”, i.e., matching coal workers’ skillset with the most appropriate RES sector jobs in terms of skills complementarity.

Section 1 forms the introduction of the report, Section 2 presents the objective and methodology of the report, Section 3 focuses on main occupation profiles in the coal industry and RES sector, Section 4 documents the skills of each occupation profile presented in Section 3 and Section 5 focuses on the transition profiles based on skills matching.



1. Introduction

The EU aims to be climate-neutral by 2050 and form an economy with net-zero greenhouse gas emissions¹. Moreover, as part of the European Green Deal, the Commission proposed in September 2020 to reduce the 2030 greenhouse gas emission target, including emissions and removals, to at least 55% compared to 1990². The Commission has already analysed the actions required across all sectors and started the process of making detailed legislative proposals by July 2021 to implement and achieve the increased ambition. This will enable the EU to move towards a climate-neutral economy and implement its commitments under the Paris Agreement by updating its Nationally Determined Contribution.

Coal (hard coal and lignite) is a carbon intensive energy source and a leading contributor to climate change. The burning of coal creates huge amounts of greenhouse gases and other toxic pollutants such as mercury, creating massive negative health impacts for populations living in the vicinity of coal power plants. Due to these negative climatic, environmental, social and economic impacts, the decline of hard coal and lignite on a global scale is inevitable in order to meet the international commitments of the Paris climate agreements from 2015, which aimed at limiting global warming well below 2° by end of this century against pre-industrial levels. Still, the decarbonisation of the EU27 is expected to result in the loss of ~76k workers' jobs in coal mines and plants until 2025 and 154k until 2030. RES-SKILL partnership countries (GR, DE, AT, RO, BG, PL) will be particularly affected, currently representing 81% of the total EU coal workforce (190k)³.

At the same time, a surge of jobs in the Renewable Energy Sources (RES) sector is already happening and expected to continue and probably grow. In the European Union in 2018/2019, 1,317,000 direct and indirect jobs were accounted to renewable energies. This number is expected to grow in the next years and decades.⁴

Coal workers are ideally fitted for covering unfilled positions in the RES sector due to similar skillset. The skills of coal workers (e.g. durability in hazardous environments,

¹ https://ec.europa.eu/clima/policies/strategies/2050_en

² https://ec.europa.eu/clima/policies/strategies/2030_en

³ <https://res-skill.eu/>

⁴ https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Sep/IRENA_RE_Jobs_2020.pdf



employment of manual and sophisticated technologies) are sought after in the solar photovoltaic (PV) and wind industries, being particularly transferable to the occupations of solar PV installer/technician and wind-farm/wind turbine technician. As a result, coal workers can avoid the lengthy training (~2 years) currently on offer by existing VET courses, requiring only a short course or on-the-job training.

Based on the above, RES-SKILL aims to strengthen VET provision in the energy sector aimed at coal workers for compatible RES sector jobs, to increase their reemployment opportunities while covering RES sector's skills demand. The project's specific objectives are to develop a novel curriculum and tailored training content to facilitate coal workers' reorientation to the RES industry; support VET providers to integrate the RES-SKILL materials into their VET and WBL offerings and improve cooperation between VET providers and businesses to provide opportunities that will enable coal workers to transition to the RES sector.



2. Objective & methodology

The objective of this report is to create transition profiles that will enable coal workers to transition from the coal industry to the RES sector. To this aim, occupation profiles of former coal workers will be matched with the most relevant occupations in the RES sector based on skills.

To achieve this, the methodology applied for the development of this report is based in three steps:

Step 1: Identification of main occupation profiles

The first step is to identify the main occupation profiles in the coal industry and in the RES sector. This identification is based on desk research and on data gathered during O1 and the data analysis in the deliverable O1-T3. Step 1 sets the basis to proceed to the next steps that include the documentation of skills, and the development of transition profiles through skills matching.

Step 2: Skills documentation

The second step is the documentation of skills in the coal industry and RES sector. This skillset includes knowledge, technical skills, non-technical/soft skills and is based on the deliverable O1-T3. Each occupation profile (as identified in Step 1) will be attributed a skillset with the aim to serve as a basis for the development of transition profiles that will be based on skills matching.

Step 3: Development of transition profiles

The third step is the development of transition profiles based on skill matching: for instance, a mining electrician has a skillset similar to that of a PV electrician, therefore, it is possible to transition a mining electrician to a PV electrician. Furthermore, the hours of the duration of original training were provided to estimate the needs of retraining for each profile. The collection of data on the duration of the original training was based on desk research.



3. Occupation profiles

3.1. Coal industry

For the identification of occupation profiles, six (6) main profiles were identified in the coal sector and eight (8) main profiles in the RES sector based on the results of O1-T2 and subsequent analysis in O1-T3/T4. It must be noted that the six (6) main profiles of the coal sector were chosen deliberately with the purpose to “match” the eight (8) profiles in the RES sector which were previously identified in O1-T3/T4. In the Annex, a detailed list of occupation profiles in the coal industry is included.

Data from desk research⁵ was used for additional information.

- 1. Mining machine operators:** They are part of a crew at a mining site. They use machinery to drill holes and excavate rocks, coal, metals and other material. They assist in moving and clearing the excavated material and are responsible for the maintenance and repair of their machines.
- 2. Fitters in the coal industry:** They are responsible for the maintenance, repair and manufacture of metal products and machinery.
- 3. Maintenance and repair workers:** They oversee the maintenance of assets and equipment but also to routine inspections, installation of equipment, regular reporting, systems integrations, and reviews, and scheduled preventative maintenance.
- 4. Construction equipment operators:** They use machinery to move building supplies, earth, and other heavy materials at construction sites and mines. They operate equipment that clears and grades land to prepare it for the construction of roads, bridges, buildings, aircraft runways, dams, and other structures.
- 5. Heavy vehicle & mobile equipment service technicians & mechanics:** They are responsible for maintaining and repairing different types of heavy and mobile

⁵ The sources consulted during desk research include: <https://datausa.io/profile/naics/coal-mining> ; <https://hal.archives-ouvertes.fr/hal-02113504/document> ; <https://jscholarship.library.jhu.edu/bitstream/handle/1774.2/59900/Bottino%2C%20Tiziana.pdf?sequence=1>



machinery. Their job revolves around carrying out routine checks to ensure the safety, longevity, and performance of vehicles and equipment.

- 6. Mining electricians:** Mining electricians install, maintain and repair specialised electrical mining equipment using their knowledge of electrical principles. They also monitor mine electricity supply.

3.2. RES sector

In this section, occupation profiles in the RES sector are based on the findings of the report O1-T3, combined with a second round of desk research for additional information.

Solar/photovoltaics

- 1. Machinist of road construction machinery (PV):** They operate and maintain a road construction machine and they prepare and fill in reporting documents.
- 2. PV fitter/installers:** Photovoltaic Installers, or Solar PV Installers, assemble, install, and maintain solar photovoltaic systems on roofs or other structures. They do so in compliance with site assessment, plans, and schematics.
- 3. PV operation and maintenance technicians:** They manage preventive, corrective, and predictive maintenance in the field as well as plant equipment monitoring.
- 4. PV electricians:** They assemble, install, test and maintain PV-related electrical/electronic wiring, equipment, appliances, apparatus and fixtures

Wind



- 1. Machine operators:** They set-up, operate, and are responsible for ensuring the machine produces high quality products, runs smoothly and at capacity, and is properly maintained.
- 2. HVAC system installers:** They work with heating, ventilation, and air conditioning systems, primarily installing new systems in homes and offices.
- 3. Maintenance and repair electricians:** They perform routine maintenance procedures and repairs that are required due to normal wear on the system.
- 4. Energy electricians:** They assemble, wire, and maintain equipment that generates clean wind energy.



4. Skills documentation

4.1. Essential skills for coal and RES workers

The skills presented in this section are based on the skills of coal workers and RES sector workers as previously analysed during activity O1-T3. Section 4 of O1-T3 divides skills in three (3) main categories: knowledge level; technical skills; non-technical/soft skills.

1. Knowledge level

- **Mechanics** - machines and tools, including their design, uses, repair and maintenance.
- **Computers and Electronics** - circuit boards, processors, chips, electronic equipment and computer hardware and software, including applications and basic programming.
- **Building and Construction** - materials, methods, and the tools involved in the construction or repair of various infrastructures.
- **Public Safety and Security** - relevant equipment, policies, procedures, and strategies for the protection of people, property, and institutions.

2. Technical skills

- **Operation and Control** - controlling operations of equipment and/or systems (e.g., drilling)
- **Operation Monitoring** - watching gauges, dials, or other indicators to make sure a machine is working properly
- **Quality Control Analysis** - conducting tests and inspections of products, services, or processes to evaluate quality or performance
- **Equipment Selection** - determining the kind of tools and equipment needed to do a job
- **Systems Evaluation** - identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system



- **Equipment Maintenance** - performing routine maintenance on equipment and determining when and what kind of maintenance is needed
 - **Repairing** - repairing machines or systems using the needed tools.
3. **Non-technical/soft skills**
- **Practical thinking** - using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems
 - **Troubleshooting** - determining causes of operating errors and deciding what to do about it
 - **Spatial awareness** - being aware of others' reactions in relation to their environment and understanding why they react as they do
 - **Coordination** - adjusting actions in relation to others' actions
 - **Judgment and Decision Making** - considering the relative costs and benefits of potential actions to choose the most appropriate one
 - **Instructing** - teaching others how to perform routine tasks
 - **Dependability** - are reliable, responsible, and dependable, fulfilling obligations
 - **Adaptability** - are open to change (positive or negative) and to considerable variety in the workplace
 - **Persistence** - are persistent in the face of obstacles
 - **Stress tolerance** - dealing calmly and effectively with high stress situations
 - **Concern for others** - are sensitive to others' needs and wellbeing and are understanding and helpful on the job

4.2. Skills per coal workers' occupation profile

This table documents the essential skills of each occupation profile in the coal industry as presented in the previous section 3.



Table 1.

Profiles	Knowledge	Technical skills	Soft skills
Mining machine operators	- Mechanics	- Operation & control - Operation monitoring - Equipment selection - Equipment maintenance - Repairing	- Practical thinking - Troubleshooting - Coordination - Dependability - Stress tolerance
Fitters in the coal industry	- Mechanics	- Operation & control - Operation monitoring	- Practical thinking - Troubleshooting - Persistence - Dependability - Stress tolerance
Maintenance and repair workers	- Mechanics - Computers & electronics -	- Operation monitoring - Quality control analysis - Equipment selection - Systems evaluation - Equipment maintenance - Repairing	- Practical thinking - Troubleshooting - Judgment & decision-making - Dependability - Persistence - Stress tolerance
Construction equipment operators	- Mechanics & - Building construction	- Operation control & - Operation monitoring - Equipment selection	- Practical thinking - Troubleshooting - Judgment & decision-making - Dependability - Stress tolerance
Heavy vehicle & mobile equipment service technicians & mechanics	- Mechanics - Computers & electronics -	- Operation control & - Operation monitoring - Equipment selection	- Practical thinking - Troubleshooting - Judgment & decision-making - Dependability - Stress tolerance
Mining electricians	- Mechanics & - Building construction - Computers & electronics -	- Equipment selection - Systems evaluation - Equipment maintenance - Repairing	- Practical thinking - Trouble shooting - Judgment & decision-making - Dependability - Persistence - Stress tolerance



4.3 Skills per RES sector's occupation profile

The table below documents the essential skills of each occupation profile in the RES sector as presented in the previous section 3.

Table 2.

Profiles	Knowledge	Technical skills	Soft skills
Machinist of road construction machinery (PV)	- Mechanics & - Building construction	- Operation & control - Operation monitoring - Equipment selection - Equipment maintenance - Repairing	- Practical thinking - Troubleshooting - Coordination - Dependability - Stress tolerance
PV fitter/installers	- Mechanics	- Operation & control - Operation monitoring	- Practical thinking - Troubleshooting - Persistence - Dependability - Stress tolerance
PV operation and maintenance technicians	- Mechanics	- Operation monitoring - Quality control analysis - Equipment selection - Systems evaluation - Equipment maintenance - Repairing	- Practical thinking - Troubleshooting - Judgment & decision-making - Dependability - Persistence - Stress tolerance
PV electricians	- Mechanics & - Building construction	- Equipment selection - Systems evaluation - Equipment maintenance - Repairing	- Practical thinking - Trouble shooting - Judgment & decision-making - Dependability - Persistence - Stress tolerance
Machine operators (wind)	- Mechanics	- Operation & control - Operation monitoring - Equipment maintenance - Equipment selection - Repairing	- Practical thinking - Troubleshooting - Coordination - Dependability - Stress tolerance
HVAC system installers	- Mechanics	- Operation & control - Operation monitoring	- Practical thinking - Troubleshooting - Persistence - Dependability - Stress tolerance



Profiles	Knowledge	Technical skills	Soft skills
Maintenance and repair electricians	<ul style="list-style-type: none"> - Mechanics 	<ul style="list-style-type: none"> - Operation monitoring - Quality control analysis - Equipment selection - Systems evaluation - Equipment maintenance - Repairing 	<ul style="list-style-type: none"> - Practical thinking - Troubleshooting - Judgment & decision-making - Dependability - Persistence - Stress tolerance
Electricians (wind)	<ul style="list-style-type: none"> - Mechanics - Building & construction 	<ul style="list-style-type: none"> - Equipment selection - Systems evaluation - Equipment maintenance - Repairing 	<ul style="list-style-type: none"> - Practical thinking - Trouble shooting - Judgment & decision-making - Dependability - Persistence - Stress tolerance



5. Transition profiles

To develop the transition profiles, the occupation profiles and skills of workers in the coal industry and RES sector were matched. To estimate the retraining needs of each profile, additional information based on desk research was used and primarily the data base “Career explorer”⁶. The estimated retraining needs were evaluated using the ranking ‘high’ (~ 6 months of retraining), ‘medium’ (~3 months of retraining), ‘low’ (~1 month of retraining).

- 1. Mining machine operators -> machinist of road construction machinery (PV) and machine operators (wind):** Even though mining machine operators have a similar set of skills to machinists of road construction machinery and machine operators (wind), workers in the RES sector operate with heavy machines and therefore mining machine operators may need approximately ~6 months to learn how to operate heavy machinery and be retrained to machinists of road construction machinery (PV) and machine operators (wind).
- 2. Fitters in the coal industry -> PV fitter/installers and HVAC system installers:** Fitters can transition to PV fitters/installers and HVAC system installers with a low retraining (~1 month) as they already have the skillset required.
- 3. Maintenance and repair workers -> PV operation and maintenance technicians:** Maintenance coal workers have extensive experience on maintenance and will need approx. ~1 month to transition to the RES sector.
- 4. Construction equipment operators -> Machinist of road construction machinery (PV), Machine operators (wind):** Construction equipment operators have significant knowledge in handling construction machinery and therefore will need low retraining of approx. ~1 month to transition to PV. Nonetheless, they will

⁶ Career explorer: <https://www.careerexplorer.com/>. Furthermore, for the transition profiles, the study “Retraining investment for U.S transition from coal to solar photovoltaic employment” was used <https://ideas.repec.org/a/eee/eneeco/v57y2016icp295-302.html>



need significantly more time (~6 months) to transition to machine operators (wind) as they will have to adapt to new equipment.

- 5. Heavy vehicle & mobile equipment service technicians & mechanics -> PV operation and maintenance technicians, Maintenance and repair electricians:** Heavy vehicle technicians and mechanics are already experienced in maintenance and repair and will need approx. ~1 month of retraining.
- 6. Mining electricians -> PV electricians, Electricians (wind), Maintenance and repair electricians (wind):** Mining electricians can transition to PV electricians with a low retraining (~1 month) as they already have the skillset required. However, they will need a medium retraining of approx. ~3 months to acquire the skills needed to transition to electricians (wind) and maintenance and repair electricians (wind).



TRANSITION PROFILES

Estimated retraining needs (calculated in months)	Low ~ 1 month	
	Medium ~3 months	
	High ~ 6 months	

Current Occupation Profile	New Occupation Profile	Training Reuirements	Estimated retraining needs
MINING MACHINE OPERATORS	MACHINIST OF ROAD CONSTRUCTION MACHINERY (PV)	Original duration of training: min. 4 months	
	MACHINIST OF ROAD CONSTRUCTION MACHINERY (PV)	Original duration of training: min. 300 hours of apprenticeship & min. 3,000 hours of paid on-the-job training	
FITTERS IN THE COAL INDUSTRY	PV FITTER/INSTALLERS	Original duration of training: min. 24h	
	HVAC SYSTEM INSTALLERS	Original duration of training: min. 6 months	
MAINTENANCE AND REPAIR WORKERS	PV OPERATION AND MAINTENANCE TECHNICIANS	Original duration of training: 1-year on-the-job training	
CONSTRUCTION EQUIPMENT OPERATORS	MACHINIST OF ROAD CONSTRUCTION MACHINERY (PV)	Original duration of training: min. 4 months	
	MACHINE OPERATORS (WIND)	Original duration of training: min. 300 hours of apprenticeship & min. 3,000 hours of paid on-the-job training	
HEAVY VEHICLE & MOBILE EQUIPMENT SERVICE TECHNICIANS & MECHANICS	PV OPERATION AND MAINTENANCE TECHNICIANS	Original duration of training: 1-year on-the-job training	
	MAINTENANCE AND REPAIR ELECTRICIANS	Original duration of training: 2-3 years	
	PV ELECTRICIANS	Original duration of training: 1-year on-the-job training	
MINING ELECTRICIANS	ELECTRICIANS (WIND)	Original duration of training: 2 years	
	MAINTENANCE AND REPAIR ELECTRICIANS (WIND)	Original duration of training: 2-3 years	

Learn more at <https://res-skill.eu>



ANNEX

Detailed list of occupation profiles in the coal industry

Administration	Supervisor	Health and safety
Administration	Coal Handling Preparation Plant (CHPP) Supervisors	Non-Destructive Testing (NDT) Inspector
Maintenance Scheduler	HD Trade Qualified Supervisor	Coal Mining – Prestrip Trainer/Assessor
Technical Writer	Electrical Supervisors	Occupational Hygiene Consultant
IAM (identity and access manager) pipelines	Maintenance Supervisor	Paramedic ESO
Leader Major Project Development	Mechanical Supervisor	Safety Training and ERT Advisor
Onshore Installation Manager (OIM)	Pre-Strip Supervisor	Emergency Services Officer (ESO)
Project Manager	Production Supervisor/ OCE	Open Cut Examiners (OCE)
Planners	Longwall Electrical Supervisor	
Operations Planner	Superintendent Underground & Surface	
CHPP Maintenance Planners		



Operator	
Shot Firer, Blaster, Dynamite Man or blast equipment Operator	
Coal Handling Preparation Plant (CHPP) Operator (Electrical)	
Coal Mining Operator	
Coal development Operators	
Explosion Risk Zone (ERZ) Controllers, Trades and Operators	
Mine Services Operator	
Production Operators	
Open Cut Mining Production Operators	
Conveyor system operator	
Pump crew operator	
Underground Operator (Ventilation)	
Warehouse Operator	
Machine or Heavy equipment operators	Mobile Plant Operators
	Crane Operator
	Digger Operator
	Dozer Operator
	Front end loader operator
	Dragline Operator
	Drill Rig (Blast Hole drills) operators
	Excavator Operator
	Water truck / cart Operator
	Haul truck Operators
	Mobile mixing unit (MMU) Operator
	Dump Truck Operators
	Rigger Operators
	Scraper Operators
	Longwall move Operator
	Shovel Operator
Ultrasonic Rail Testing vehicle Operator	
Grader Final Trim operator	



Electrician	Fitter	Mechanic / technician	Others
Auto Electrician	Tyre Fitter	Heavy Duty (HD) Diesel or heavy duty equipment mechanics	Shot Firer
Industrial electricians	Pipefitters	Industrial mechanic (Millwrights)	Bench Hands or labourer
Longwall Move Electricians	Mechanical Fitter	Plant mechanics or Pit Fitter	Painter & Blasters
High Voltage (HV) Electrician	Longwall Move Fitters	Boilermakers	Storeperson
Inspection and Maintenance (I&M) Electrician	Scaffolder	Truck Mechanic or Digger Fitter	Peggy or Indigenous Housekeepers
Outage Crew Fitters		Crane Technician	Bus Driver
		Fire and vehicle suppression Technician	Poly Welders
		conveyor system technician (Belt Splicers)	Welders
		Servicemen (repair or maintain equipment)	Trades Assistant
		Coal Handling Preparation Plant (CHPP) Shutdown/Maintenance Mechanical Tradespeople	Plumbers