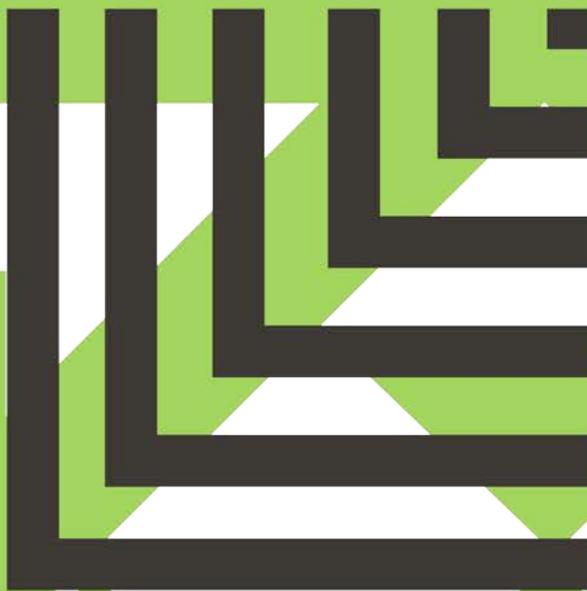# green skills

# Demand for Green Skills in Coal Mining

## Green Skills Methodology Case Study

**Prepared by Dr Eureta Rosenberg, Zoë Visser and Leigh Cobban**

# Introduction

## What is the status of this research?

This research was undertaken by a team based at Rhodes University's Environmental Learning Research Centre, at the request of the Mining Qualifications Authority (MQA) and the Sector Education and Training Authority (SETA) for the Mining and Minerals sector. The duration of the research was six months, from November 2014 to May 2015. Oversight was provided by the MQA's Research Specialist Vuyokazi Mofu and Acting Skills Development Manager, Francis Lamola, and its Skills, Research and Planning (SRP) committee, to whom the findings were presented and the final report submitted. At the time of writing this case study, the SRP was still to give permission for the release of the report for public use, and there are therefore no public records of the research. The research has been used to inform the Mining and Minerals Sector Skills Plan (2015).

# Purpose

## What problem or question motivated the research?

The research had two principal aims:

- **The first aim** was to guide the MQA in the supply of environmental skills to the Mining and Minerals Sector. This is achieved in the first instance by informing the Sector Skills Plan 2015 Update. SETAs such as the MQA update sector level skills plans annually, to inform their business plans and budget allocations for skills development in these sectors. By focussing on environmental skills, the MQA responded to the prioritisation of "skills to support the green economy" in the National Skills Development Strategy (NSDS III, 2010, p.25).
- **The second aim** was to provide the MQA with a research methodology that can be adapted for future studies. This was a small scale case study, and it was acknowledged at the start that further studies would be necessary if the sector was to fully understand its green skills needs. In approaching Rhodes University to assist with the research, the MQA met a directive in NSDS III to partner with universities in order to establish credible mechanisms for developing skills intelligence (i.e. insight into skills needs).

The research centred around four key questions: i) what are the essential 'green skills' for mining?; ii) which of these skills are scarce?; iii) what are the implications for career pathing?; and iv) what are the supply pipelines & challenges?

This research focused on the coal mining sector, but the intention was to inform all mining commodities. Green skills are strategic for the mining sector, if the following national imperatives and guidelines are considered: The National Development Plan; the King III Report on Corporate Governance; the Green Accord between Labour, Industry and Government in response to climate change; the National Skills Fund instruction to fund green skills programmes; the Department of Mineral Resources' Sustainable Development Framework; the Mining and Biodiversity Guidelines; and the MQA's Sector Skills Plan for

2013-2018. Coal was chosen for the case study as it is a major energy source in South Africa, with direct impacts on biodiversity and ecosystem services, and high greenhouse gas emissions. Job losses are anticipated in coal mining, and it is therefore important to look for alternative employment opportunities associated with coal mining, and green jobs could potentially open up such opportunities.

*Researcher reflection on the purpose of the research:*

"It is important to explore the purpose behind the given goals deeply with the client. Knowing that we needed to make an input into the Sector Skills Plan helped us to strategically time the completion of the report, and informed the format for presenting the information (e.g. including OFO codes). Knowing what other motivations there might have been for the research would have helped us look for additional forums to which we could send the recommendations, as the SRP recommended when the final report was presented."

Dr Eureta Rosenberg, Research Lead and Research Associate of the Environmental Learning Research Centre

# Design

## What methodology was used?

The methodology was based on a critical realist social science framework (Bhaskar, 2010 and Sayer, 2000) which encourages researchers to include multiple layers of reality in their studies. Hence data was gathered and analysed at a macro-level, sectoral level, firm or organisational level (cases of individual mines, companies, and training institutions' curricula). Figure 1 indicates these levels. The arrow indicates an iterative movement of the research process and analysis between the different levels. The steps were not followed in linear fashion, but rather the process was recursive.

The critical realist framework informs much of the research conducted in environmental learning at the ELRC. The methodology was also informed by a systems perspective and a common contextual analysis followed in business studies and sector reviews (PESTEL analysis).

The multi-method research methodology included a review of literature including policy guidelines and research reports on mining, coal mining, and related environmental considerations. Recently published coal and energy related skills analyses were particularly useful. Interviews were conducted with a small selection of informants in Mining and Environment and relevant public presentations were reviewed. A site visit to a coal mine was undertaken, where interviews were conducted with mine management, human resource management, environmental staff, health and safety staff, trainers and students. Educational and occupational data were collected from various sources including some employers and a limited number of educational institutions provided explanatory information.

The researchers used value chain analysis (Herr and Muzira, 2009) to identify and map out green skills required in the mining sector. The value chain framework supports a systems approach by capturing the full range of role-players at different scales and to identify intervention points (or 'levers') that could have the highest impact.

To strengthen the analysis, the researcher drew on multiple methods and sources of data and information. For the research design, a multi-level framework for analysis recommended by the International Labour Organisation (ILO, 2011) was adapted. The adaptation was informed by social science methodology; past annual sector skills research from SETAs in other sectors (which generally start with PESTEL analysis); and an ASSAF study (2014). The research assessed demand and supply in parallel components. For drivers and demand, the research started with a broad review or mapping of the context, processes and role-players using reports and online searches, and then narrowed to specific mines as case studies. The MQA COO, and its staff and Strategy and Research Planning (SRP) Committee (including representatives from the Chamber of Mines of South Africa and the National Union of Mineworkers) supported the research with funding and guidelines, and facilitated access to information.

For the analysis of drivers in the macro and commodity context, a PESTEL analysis was conducted, using these data sources:

- Literature including a variety of reports and research papers, including a general review of literature on mining and the environment.
- Other strategic analyses, e.g. the South African Coal Road Map (2011 and 2013), and national and international guidelines.
- Sustainability and integrated reports from one mining company.
- A review of documents such as the Mining and Biodiversity Guidelines (DEA et al, 2013), a report on the State of Energy Research (ASSAF 2014), and the South African Coal Road Map (2011, 2013).
- A small number of presentations in the public domain, e.g. public statements by politicians.
- Interviews were used in some cases to confirm findings from the other data sources.
- Once coal was chosen as the commodity, the literature on coal mining was reviewed and the analysis of the coal mining context undertaken in the following categories: i) socio-economic considerations, including aspects of history that still have a strong influence today; ii) policy and legal considerations, including the various mining and environmental laws that apply; iii) technological drivers; and iv) environmental considerations (generally and in relation to climate change, air quality and worker health, water, waste and biodiversity).

The research also defined a value chain for coal mining. This included mapping the functions, processes and activities that form part of the mining enterprise in order to identify the demand for green skills in the mining sector. This value chain was in fact more of a web of connected processes than a simple chain. However, the researcher focused on identifying green skills across functions as these interact across sectors and would be most impactful. Identifying the green skills required across the value web was based on the following data sources:

Figure 1: Multi-levelled research

| Review of National Policies, Laws, Social and Economic Drivers, Educational Trends |
| :---: |
| **Macro Level** |

⬇

| Review of Mining policy, regulatory frameworks, incentives, sector specific drivers |
| :---: |
| **Sector Level** |

⬇

| Cases of Individual Companies, Mines, Departments, Training Provider Curricula |
| :---: |
| **Organisational Level** |

⬇

| Vignettes of Individual Employees |
| :---: |
| **Transitioning into the Workplace** |

- Interviews and email consultations with regulatory bodies (the Departments of Mineral Resources, Water and Sanitation, and Environmental Affairs).
- Interviews, face to face and email consultations with environmentalists, researchers and educators with expertise in mining.
- A site visit to a coal mine in Mpumalanga and interviews with the following staff (most of whom had more than one job): Management, SHE, HR, environment and student.
- A review of jobs and job descriptions in coal mining advertised on online list-serves (e.g. Coal Jobs Alerts from www.indeed.co.za).
- Attending and reviewing various presentations. This included a presentation on environmental functions in one coal company.
- Reviewing case studies conducted by other researchers, notably research commissioned by the National Union of Mineworkers (NUM) and the National Labour and Development Research Institute (NALEDI) on climate change, involving focus groups with workers at two coal mines (Holmes, 2013).

In the absence of a theoretical framework and because of the competing perspectives and tensions (e.g. between the mining sector, governance bodies, civil society and labour), the data from the research was filtered through a multi-faceted matrix. This created more 'neutral' findings which did not prioritise any one perspective.

The analysis of supply focused on identifying the supply of green skills for coal mining in the form of available learning pathways or study opportunities, and associated challenges. The following data sources were consulted through a number of steps:

- Search of existing databases: The MQA keeps a database on mining learnerships, but does not keep a list of other mining-related qualifications. For qualifications with both mining and environmental relevance, the National Learner Records Database (NLRD) was searched using different combinations of search terms. The NLRD is kept by the South African National Qualifications Authority (SAQA).

- Search of University and research institute websites: A limited search of university websites identified many qualifications with titles that reflect environmental content, but few with information as to their content and learning pathways. A number of relevant research institutes were also identified, not all of which were at universities.
- Exploring workplace training: Interviews at the mine were very useful for understanding aspects such as human resource development and management, identification of aptitude and talent, the role of mentors, short courses and on-the-job training, and the role of mining companies and the MQA in providing bursaries for further studies in various fields, including environmental qualifications.
- Identifying challenges associated with the supply: Around 10 training providers were contacted, including the Colliery Training College (CTC), Artisan Training Institute, ADCORP Technical Training, Anglo American, De Beers Consolidated Mines, the University of Venda's School of Environmental Sciences, and the Wits Centre for Sustainability in Mining and Industry.
- The State of Energy Research in South Africa (ASSAF, 2014) was referred to for skills for clean coal technology related to mining and energy. This document covered the topic in some depth, and included consultations with employers and suppliers of relevant research skills, which identified associated challenges such as shortages of supervisors, budgets and equipment.
- Career pathways mini case studies: Interviews were conducted with two graduates and a student, to complement the national level overview of pathways and associated challenges (such as the transitioning from study into work).

These data sources provided insight across levels in the system: from a macro-level analysis of broad social, policy and economic trends, to a micro-level perspective on how environment-related work and associated training play out in on-the-ground contexts.

*Researcher reflection on the methodology:*

- There were limitations to the methodology due to the short timeframe (6 month research). This highlights the importance of connecting similar or related studies to increase the scope or depth of research.
- For the desk-top components, it is useful to connect with organisations or researchers who have done similar work before. e.g. ASSAF had done a study on The State of Energy Research in South Africa (2014).
- The PESTEL analysis is a useful methodology for understanding future drivers.
- To develop an environmental justice perspective, reports from the civil society sector were useful resources.
- It is very important to identify the right people within the sector. To identify and contact these people it is useful to have knowledge of the sector and pre-existing relationships (as trust can be a problem).
- For the job searches, it's important to find the right job search platform. The ones used in the research did not cover the full range of occupations, but were industry-specific.

Dr Eureta Rosenberg, Research Lead and Research Associate of the Environmental Learning Research Centre

# Findings

## What did the research find in relation to the research question?

Building on the traditional idea of a value chain, the research identified a system (rather than a chain) of value creation processes essential for mining, with integrated environmental management processes to work towards environmental sustainability and social justice. The value creation processes for mining range from the core business of research, exploration and development; construction and production (mining); to processing; (concurrent) rehabilitation and closure; and attendant activities like governance; regulation and enforcement; water, energy and waste management; logistics (specifically transportation); financing and investment; reporting; supply chain management, human resource management and training; as well as the sideways value chains of beneficiation (such as the production of energy and liquid fuels) and local and regional socio-economic development.

Green skills are needed in all these activities. They are needed both as specialist skills or occupations (such as environmental management) and as additional understanding and competence within traditional mine occupations (such as site managers). Mining companies source in or employ specialist environmental skills, and they prefer specialists who understand the specifics of the mining context of environmental management. This combination of skills is scarce, as is the ability to plan in an integrated manner across systems including water, energy, mining, transport and community development. The research identified areas where investment in skills development would act as high impact 'levers' for change:

- The research identified an interrelated system or web (rather than a chain) of value creation processes in coal mining. This web comprised of a core business value chain, a regulatory or governance value chain, and an operational or enabling value chain. Across these chains were integrated environmental management processes working towards environmental sustainability and social justice. The research identified the need for green skills across these different chains.
- New and technical skills are needed for ensuring compliance, particularly for small mines which often have to bring in these technical skills.
- As the regulatory element was a key area for green skills, resourcing the regulatory and governance side of the chain (monitoring and compliance) would have a high impact. These appointments were found to often be young or inexperienced staff who did not have the authority or capacity to challenge processes and 'green' the chain. Similarly, developing more green skills within senior governance or HR structures would be important.
- The closing and restoration of mines was an area in the commodity value chain where skills and capacity need to be developed. This could be supported by a restoration fund (such as in Australia). The restoration of mines would be integrated into municipal IDP plans, with a person from the mine on the IDP committee, skilled in environmental health and safety and with environmental networks.
- The research was unable to take its findings further as there were no mechanisms. There was no funding to feedback and reflect on findings with relevant bodies. The existing mechanisms are quite limited; these are to list scarce skills and associated recommended interventions in the Sector Skills Plan, through which funds would be allocated.
- In terms of the research questions, the research identified prioritised green skill categories as essential 'green skills' for mining, their scarcity and relevant training options.

"The strength of the research was in the use of multiple perspectives and sources. The supply side of the research (and the challenges in the supply side) was weaker and actually needed to be informed by the demand , than running in parallel."

Dr Eureta Rosenberg, Research Lead and Research Associate of the Environmental Learning Research Centre

# Reflections on the research

## What did the researchers learn regarding the methodology?

Future studies might benefit from these changes and additions to methodology:

- A more thorough analysis of course contents and associated research projects, and/or interviews with programme coordinators, may reveal different results within the supply pipeline.
- A more participatory approach to research could help to disseminate the results of the research and generate discussion among key stakeholders. For example, focus groups to reflect on findings around governance and compliance could promote critical thinking around important capacity issues.
- Data on the numbers of students entering and successfully completing courses with mining and environmental content were not included in this research. This would be useful to do in follow-up studies to identify potential challenges e.g. over-supply, under-supply, or difficulties in completing studies. Gender and racial profiles of students may also be relevant. National databases such as EMIS (Education Management Information System kept by the Department of Basic Education) and HEMIS (Higher Education Management Information System kept by the Department of Higher Education and Training) would be good starting points.

On skills for clean coal technology related to mining and energy, a useful source of information was the research on The State of Energy Research in South Africa (ASSAF, 2014a). This recent document covered the topic in some depth, and included consultations with employers and suppliers of relevant research skills, which identified associated challenges such as shortages of supervisors, budgets and equipment. The research did not follow up with these training and research institutions, but in follow up studies, it may be important to do so.

## RESEARCH TEAM

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