TRADE & INDUSTRIAL POLICY STRATEGIES

SECTOR JOBS RESILIENCE PLAN:

COAL VALUE CHAIN

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Trade & Industrial Policy Strategies (TIPS) is a research organisation that facilitates policy development and dialogue across three focus areas: trade and industrial policy, inequality and economic inclusion, and sustainable growth

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FOREWORD

The National Climate Change Response White Paper requires the development of Sector Jobs Resilience Plans (SJRPs). These plans aim to protect vulnerable groups that may lose their jobs or livelihoods as a result of climate change impacts, related either to physical effects or to the transition to alternatives.

The proposals for the SJRPs, and the evidence supporting them, are presented as a suite of related documents. These are *The SJRP toolbox: Summary for Policy Makers* and proposals for five value chains that seem particularly likely to be affected: coal, metals, petroleum-based transport, agriculture and tourism.

The research for this project was conducted by Trade & Industrial Policy Strategies (TIPS) for the Department of Environment, Forestry and Fisheries, and funded by GIZ.

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ABBREVIATIONS

CCPs	Coal Combustion Products
DEFF	Department of Environment, Forestry and Fisheries
DMRE	Department of Mineral Resources and Energy
DPWI	Department of Public Works and Infrastructure
EPWP	Expanded Public Works Programme
GHG	Greenhouse Gas
GVA	Gross Value Added
IDPs	Integrated Development Plans
IRP	Integrated Resource Plan
MPRDA	Mineral and Petroleum Resources Development Act No. 28 of 2002
MQA	Mining Qualifications Authority
NEMLA IV	National Environmental Management Laws Amendment Bill
NSF	National Skills Fund
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SEIAS	Socio-Economic Impact Assessment System
SJRP	Sector Jobs Resilience Plan
SLPs	Social and Labour Plans
TOR	Terms of Reference
UIF	Unemployment Insurance Fund

EXECUTIVE SUMMARY

The coal value chain has been central to South Africa's development and feeds into important downstream industries such as electricity generation and petrochemical production. Employment in the value chain exceeds 120 000 workers. The South African coal value chain is highly localised to a handful of local municipalities in Mpumalanga where the majority of the coal mines, Eskom power stations, and Sasol coal-to-liquids (Secunda) facilities are located.

Due to the impact of coal on the environment, the coal value chain faces significant threats in the long term. The main climate-change related impacts on the coal value chain derive from a decline in demand for coal at home and abroad, as countries seek to reduce their greenhouse gas (GHG) emissions especially from electricity, but also from other uses. These impacts are difficult to distinguish in some cases from the effects of the slowdown in the South African and global economy over the past five years. In addition, Sasol faces pressure to reduce emissions from its coal liquification processes.

A vulnerability analysis of the coal value chain highlights four municipalities in Mpumalanga that are highly vulnerable to the potential impacts on the coal value chain and stand to be devastated by these impacts. These municipalities are eMalahleni, Steve Tshwete, Msukaligwa and Govan Mbeki. Based on the vulnerability analysis, coal miners are the most vulnerable in the value chain, as a result of their financial resources, relatively low skills and limited mobility in the labour market.

Table 1. Employment in the coal value chain

Stage of the value chain	Employment (number of jobs)
Coal mining	80 000
Power Generation (Eskom)	12 000
Petrochemical production (Sasol)	26 000
Small coal truckers	2 000

Implementation plans are guided by five principal interventions.

The first relates to allocating responsibility for driving the SJRP. It is vital that responsibility is clearly vested in an agency that is able to monitor impacts on the coal value chain as well as the implementation of the SJRP itself. This function will need to be dynamic and responsive given the current uncertainty in the coal value chain, both locally and internationally.

A second intervention is to improve the effectiveness of existing Social and Labour Plans (SLPs), which are a prerequisite for acquiring mining and production rights. In their current form, evidence indicates that SLPs have not delivered on their intended purpose of developing opportunities for workers and communities post-mining. Critically, the SLPs need to be more accountable to workers and coal towns that are affected by mine downsizing and closure.

Third, the coal towns need to have additional support in developing plans to diversify their economies away from coal over the longer run. The proposal indicates potential areas for economic diversification for illustration, with the caveat that far more in-depth studies on feasibility are required. The areas explored for diversification include the use of mining rehabilitation as a tool to increase agricultural production, the shift from coal-based

electricity generation to renewable energy-based generation, and potential opportunities in the beneficiation of coal waste.

Fourth, as discussed in the separate paper on the toolbox for the SJRPs, active labour market measures have to be strengthened and adjusted to serve potential future downsizing in coal. Linked to this, a fifth proposal relates to strengthening income support and social protection for workers and communities, including through an extension of public employment schemes.

This document first reviews the main dynamics in the coal value chain – in particular, trends in production, climate-change related impacts, and the nature and resources available to the vulnerable groups. It then lays out the proposals for the SJRP, in each case providing an initial impact assessment and the theory of change.

1 KEY DYNAMICS

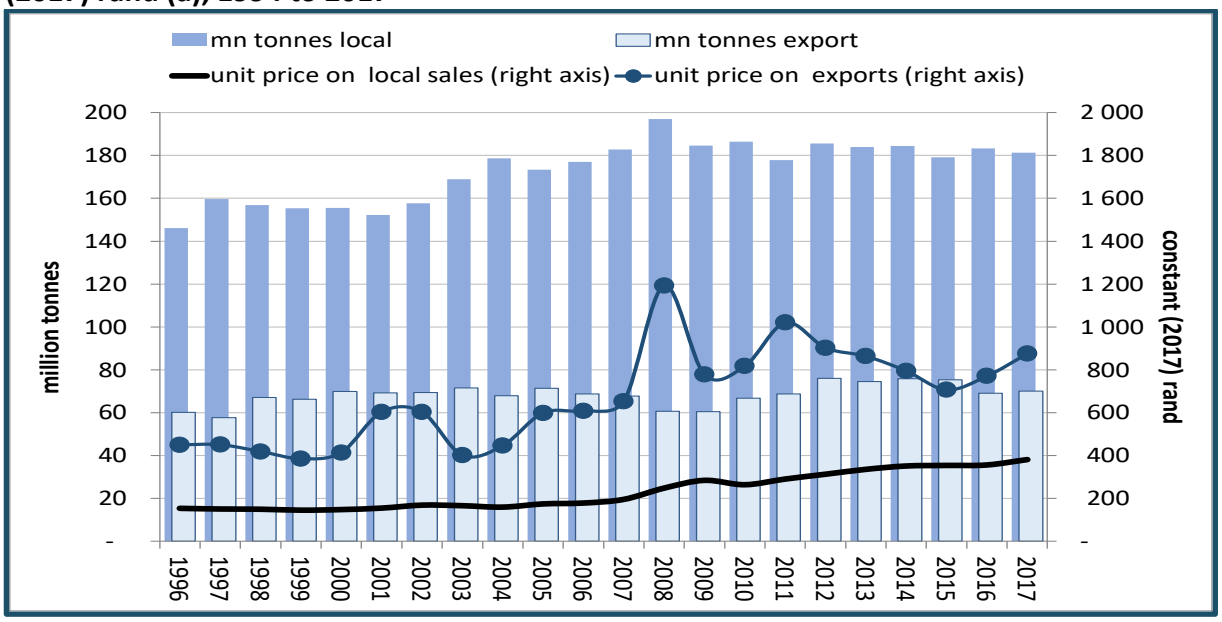
The coal value chain has been central to South Africa's development, especially for energy, petro-chemicals and metals refineries, for over a century. It now faces a downturn in large part because cleaner and cheaper technologies are emerging while governments move to internalise the cost of GHG emissions to users. The process will affect employment and incomes, particularly harshly for miners and small businesses, in the four Mpumalanga districts that supply almost all of South Africa's coal: eMalahleni (Witbank), Steve Tshwete (Middelburg), Msukaligwa (Ermelo), and Govan Mbeki.

1.1 Production, location and exports

Coal is the main input for electricity generation and basic chemicals in South Africa and is an important export. Around 40% of coal is exported directly by the mining companies. Almost two thirds of the rest are used for electricity generation, with Sasol accounting for close to a quarter.

South African sales of coal are indicated in Graph 1, in volume and value. By volume, coal sales dropped 4% from 2012 to 2017, with a 2% fall in local sales and an 8% drop in exports. Although the average unit price was 3% lower in 2017 than in 2012, it was 20% higher in domestic terms mostly because of depreciation. That said, South Africa exports its higher quality coal, fetching a relatively high price per tonne.

Graph 1. Local and export sales of coal in million tonnes and average unit price in constant (2017) rand (a), 1994 to 2017



Notes: (a) Deflated with average annual CPI rebased to 2017. *Source:* Calculated from Department of Mineral Resources. 2018. *Minerals Statistical Tables 1996 – 2017.* Pretoria.

The decline in sales in volume terms has been associated with a fall in investment. Since 2009, net investment in the coal industry has declined at a rate of 10% a year, from R7.3 billion to R3.8 billion in 2017 (MCSA, n.d.).

Eskom's sales have also declined steadily in the past five years. This has resulted from a number of factors. These include relatively slow economic growth in recent years and the rapid increase in the price of electricity, which led to the closure of energy-intensive smelters and more efficient use by other customers. In addition, Eskom's sales have been affected by a shift to renewable energy both on the national grid and off it. The largest declines in sales (in GWh) over the 2013/14-2017/18 period occurred among industrial consumers that decreased electricity consumption by 12% (Eskom, 2018).

Coal mining, electricity generation and upstream petrochemical production are concentrated in Mpumalanga, where 80% of the production of coal occurs. The eMalahleni (formerly Witbank) and Highveld coalfields account for 75% of coal production in South Africa (DoE, n.d.). Coal mining also occurs in Ermelo, which is in the Gert Sibande district municipality.

Five companies account for over 80% of coal mining capacity in South Africa – Anglo Coal, South32, Sasol, Exxaro and Xstrata – while a cluster of much smaller companies supplies the remainder. The top 10 suppliers of Eskom's coal include Exxaro Coal, Seriti Coal, South32, African Exploration, and Universal Coal (Eskom, 2019).

Most of Eskom's coal-fired plants are located in Mpumalanga to be near the mines. As a result, changes in demand for coal can affect employment and growth in these districts through downsizing in both mining and generation. The newest plant, Kusile, is located just outside of eMalahleni. Medupi, however, is close to more recently developed coal mines in Limpopo. Given this, current plans to close down power plants result exclusively from age, not from the shift to cleaner energy.

1.2 Climate-change related impacts

The main climate-change related impacts on the coal value chain derive from a decline in demand at home and abroad, as countries seek to reduce their GHG emissions especially from electricity but also from other uses.

With the deepening of the climate emergency, increased pressure is being placed on South Africa to transition away from its long-standing dependence on coal-based electricity. According to the 2015 Greenhouse Gas Inventory for South Africa, the energy sector contributed 80% of overall emissions in South Africa, mostly because of its heavy dependence on coal. Since electricity accounts for the bulk of domestic coal sales, a shift away from coal-based electricity will inevitably lead to a decline in local demand for coal.

In terms of government policy, the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and the carbon tax both aim explicitly to reduce reliance on coal-based electricity. From 2011 to 2019, Eskom's sales of electricity in South Africa fell by 9%, while other producers saw an increase of 123%, albeit off a very low base. As a result, Eskom's share in South African electricity dropped from 95% or more through 2011 to 90% in the first nine months of 2019 (StatsSA, 2019).

In addition, in the late 2010s both domestic and foreign financial sources began to shift financing away from coal generation. In 2019, reports suggested that Eskom was increasingly facing difficulties in obtaining financing for this reason (Bloomberg, 2019). Two independent coal power stations, Thabametsi and Khanyisa projects, planned for completion in 2023/24, also came under threat as major commercial banks withdrew their funding support from these projects.

In addition, a range of other countries have committed to shifting away from coal. Since the high price for export coal means it contributes half the industry's revenues, a decline would have disproportionate effects. Forecasts do not predict a fall in world coal trade in the next five to 10 years, but climate policy is highly volatile both globally and nationally which creates substantial uncertainty in forecasting. In particular, India, which accounts for around 45% of South Africa's coal exports, has committed to reducing both coal imports and use. While it has not done much to implement this policy yet, it will likely have a dampening impact on demand in the longer run.

In sum, the main impact on the coal value chain from climate change arises from efforts to reduce the use of coal. The time frame for a significant change remains uncertain, however, since it depends on a combination of national and international government policy and private-sector decision-making, as well as the broader context of the economic growth rate and the relative prices of other sources of electricity.

2 VULNERABLE GROUPS AND COMMUNITIES

The vulnerability analysis for coal focuses on the coal-dependent municipalities in Mpumalanga and on miners.

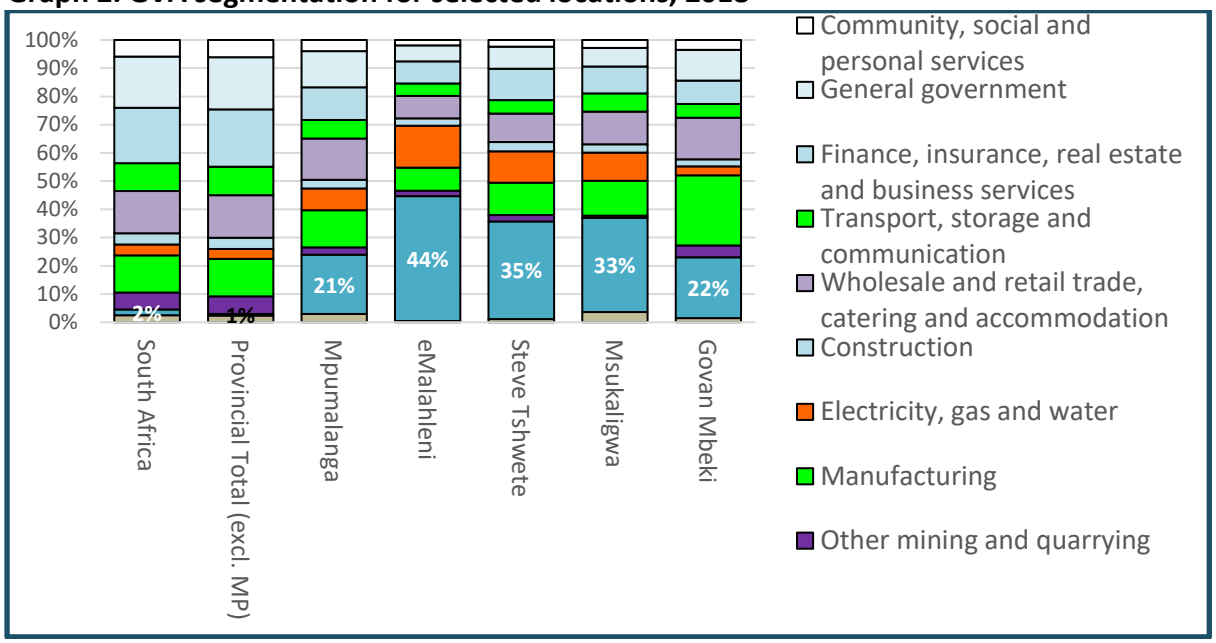
2.1 Affected municipalities

The most vulnerable municipalities are those which are highly economically undiversified and rely heavily on coal mining activity. To provide an indication of where the employment risk

"hot-spots" lie, the gross value added (GVA) and level of employment dependency for local municipalities are assessed.

Four municipalities in Mpumalanga exhibit highly undiversified economies that rely heavily on coal mining – eMalahleni (Witbank), Steve Tshwete (Middelburg), Msukaligwa (Ermelo), and Govan Mbeki. The graph below indicates the extent of dependence on coal in these municipalities as compared to Mpumalanga, other provinces and the entire country.

Graph 2. GVA segmentation for selected locations, 2018



Source: Calculated from Quantec EasyData.

As Graph 2 shows, eMalahleni is highly undiversified and relies heavily on coal mining. Coal accounts for 44% of total GVA in the municipality. Steve Tswhete and Msukaligwa also display high levels of dependency on coal, with coal accounting for 35% and 33% of total GVA in those municipalities, respectively.

Measures of employment also reflect these municipal dynamics. Based on employment, the smaller local municipalities where coal activity occurs exhibit high dependencies on coal for employment. In eMalahleni, Steve Tshwete, Msukaligwa and Govan Mbeki, coal employment accounts for 26%, 17%, 14% and 11% respectively. In many cases, these municipalities also rely on the mines and Eskom to support services such as water, sewage and waste management.

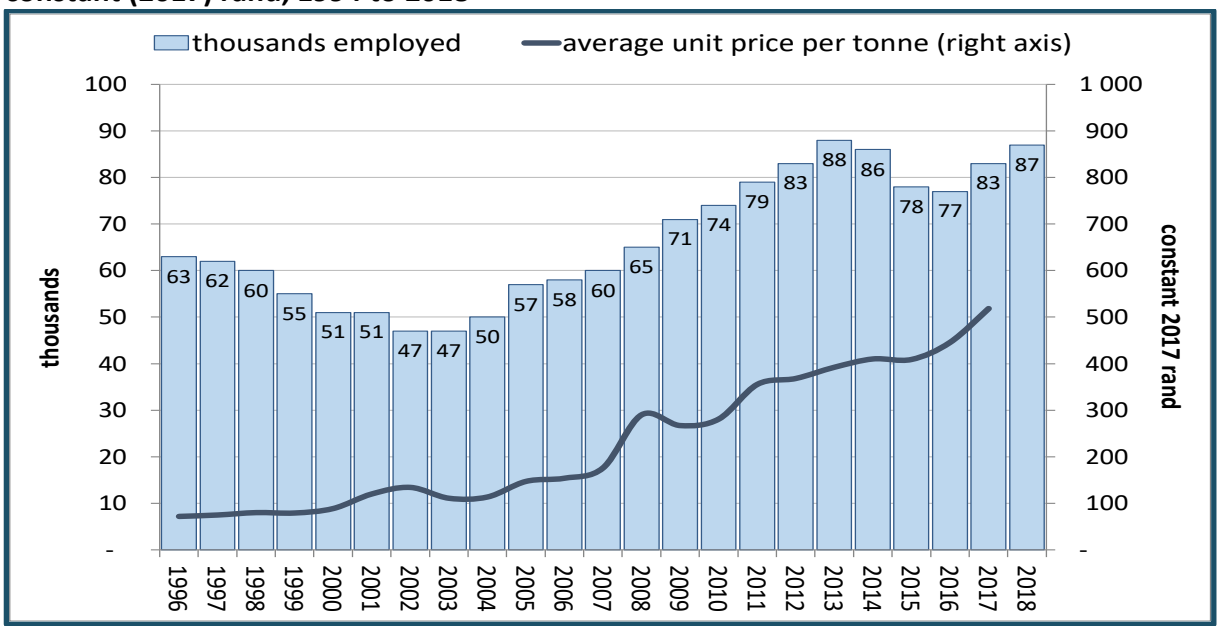
The relatively small group of coal transporters – around 200 enterprises with approximately 2 000 employees – have been vocal stakeholders in the coal municipalities. Their interests should be taken into account appropriately in developing plans to assist communities that depend on coal.

2.2 Miners

Coal mining employs almost 80 000 people, Eskom generation 12 000, and Sasol 26 000. From the early 2000s until 2008, coal employment climbed rapidly. Following a decline in employment with the global financial crisis, employment in coal mining has been steadily increasing. As Graph 3 shows, the level of employment tends to track the unit price of coal.

During the commodity price boom, it rose from 47 000 to close to 90 000, then declined before recovering nearly to its 2012 peak in 2018.

Graph 3. Employment in coal mining in thousands and the average unit price per tonne in constant (2017) rand, 1994 to 2018



Note: Deflated with average annual CPI rebased to 2017. *Source:* Calculated from Department of Mineral Resources 2018. *Minerals Statistical Tables 1996 – 2017.* Pretoria.

Information on workers' pay, pension funds and unemployment insurance are available, but not on physical assets. Workers in the coal value chain (where under 15% were women) typically compare well with other formal workers, especially given relatively low educational qualifications.

Based on Stats SA Labour Market Dynamics data, in coal mining and heavy chemicals, the median pay was over R10 000 a month, compared to just over R5 000 for other formal workers. In the electricity industry, median pay was closer to R15 000 a month. Some 80% of workers in the coal value chain had retirement funds in 2017, compared to less than 60% of other formal workers. Similarly, the coal value chain has a greater level of participation in the Unemployment Insurance Fund (UIF) than the rest of the economy, ranging from over 90% in coal to around 75% in basic chemicals.

Education levels in coal mining were, however, slightly behind the norm for other formal workers. Workers with matric or less comprised 80% of the coal labour force in 2017, compared to 74% for formal workers outside of the value chain, 73% for heavy chemicals and plastics workers, and just 53% in electricity.

The available information on social capital relates principally to the workplace, in terms of union membership and labour rights. Over 70% of miners are union members, as are 67% of workers in electricity generation and 45% in basic chemicals. In the formal economy as a whole, the figure is just 35%. Workers in the value chain are also more likely than most to see their positions as permanent (although the mining companies themselves report a high level of contract labour). Most workers also report that they get leave and have written contracts in line with labour law requirements.

3 PROPOSALS

This section presents proposals on mobilising capacity to drive implementation of the SJRP for the coal value chain; promoting technological adjustments to minimise the loss of jobs and livelihoods as far as possible; diversification of the economies of mine towns where viable and sustainable; active labour market policies to assist miners transition to alternative activities if necessary; and income support to assist workers and communities during the transition.

Implementing the SJRP will require coordination across a range of state agencies in all the spheres of the state. For most proposals, success also depends on the ability to mobilise stakeholders in the value chain. For this reason, it is important to be clear about the overall responsibility for implementing the SJRP as well as the roles of the various public and private stakeholders. The first proposal responds to this necessity.

Each proposal followed by tables that provide a brief impact analysis and a description of implementation phasing that derives from the theory of change for the proposal.

The impact assessment uses the Socio-Economic Impact Assessment System (SEIAS) methodology, which centres on evaluating costs, benefits and risks for different stakeholders, using detailed description when meaningful quantification is not possible. In this case, the aim is primarily to identify potential costs and risks as well as benefits, without attempting an in-depth discussion.

The phasing lays out each step from the initiation of the proposal to the achievement of the desired socio-economic impact. For these steps, it identifies the requirements for success and the main risks. The aim is to enable both a better understanding of the internal logic of the proposal itself, and to indicate where risk mitigation is required.

The proposals assume that a national structure will be given responsibility for managing implementation of the SJRPs. Since the nature of the structure has not yet been determined, the proposals in this report refer to it as the SJRP structure.

3.1 Mobilise implementation capacity

1. Establish structure to drive SJRP for coal

The national SJRP structure should establish a (small) office in Mpumalanga to take forward work on SJRPs in collaboration with municipalities, provincial government and stakeholders in the coal value chain.

Despite the high uncertainty and differing time frames surrounding the potential impacts on the coal value chain, any of the risks can be accelerated in timing should market sentiments or climate policies evolve. It is therefore imperative that this process is treated with urgency. This is in keeping with the best practice approach to a just transition that involves developing systematic processes to mitigate social and labour impacts before any labour layoffs can occur (World Bank, 2018).

2. Mobilise resources and stakeholder inputs at community level

Revise guidelines for SLPs, which are required under the Mineral and Petroleum Resources Development Act No. 28 of 2002 (MPRDA) and the Mining Charter, to give communities and workers more voice and to strengthen support for diversification. This should commence urgently with scaled up plans to address climate-change related impacts (which in practice

cannot be separated from other factors leading to downsizing of generation plants and mines). In addition, sufficient funding to implement meaningful plans will be required. Consideration should also be given to regulations surrounding the ring-fencing of funds for mining rehabilitation and capacity within the Department of Mineral Resources and Energy (DMRE) and the Department of Environment, Forestry and Fisheries (DEFF) to ensure that mining rehabilitation takes place as envisioned and that this process is monitored.

SLPs are required to be submitted to the DMRE before mining or production rights are granted. These plans are required to "*develop and implement comprehensive Human Resources Development Programmes, Mine Community Development Plan, Housing and Living Conditions Plan, Employment Equity Plan, and Processes* ***to save jobs and manage downscaling and/or closure***" (emphasis added) (DMR, 2010). This legislative structure is meant to deal with post-mining economies and is well-placed to manage the decline of coal mining.

In practice, however, research indicates that the SLPs do not fulfil their required function in terms of their design and implementation.

In terms of their design, the SLP process has been found to fail in community interaction regarding the SLPs, in addressing gender inequities, in ensuring access to SLPs by vulnerable workers and communities, in requiring the proper feasibility studies for local economic development projects, in clearly designating responsibilities among stakeholders, and in ensuring proper housing planning by mines (Centre for Applied Legal Studies, 2018).

From an implementation perspective, the SLPs have been found to fail in allowing workers and communities to access, monitor and influence SLPs. Further, SLPs have failed in implementation through a lack of communication between national and local government structures, a lack of alignment between SLPs and the municipal Integrated Development Plans (IDPs), through entire mining communities being excluded as beneficiaries, and by DMR not having sufficient monitoring and evaluation tools in place to ensure that SLPs work in the way that they are meant to (Centre for Applied Legal Studies, 2018).

Based on this evidence it is clear that the SLP process requires considerable reform if it is to act as a driver for local economic diversification after mining closure. It is vital to attend to these inadequacies for the SLP process to fulfil its intent as well as assisting in shielding vulnerable workers from declines in mining.

Table 2. Impact evaluation

Dimension	Coal miners and communities	National departments	Employers	Organised labour
Benefits	Improved alignment to promote measures designed to benefit them Miners and other citizens have greater say in community development	SJRP structure reduces difficulty of coordinating with other departments	SJRP structure provides single point of engagement Improved alignment across state agencies	SJRP structure provides single point of engagement Improved alignment across state agencies
Costs	Time and energy required to engage on SLPs and their implementation	Might have to compromise on disagreements with other state agencies Time and energy required to reform SLP legislation and monitor their development and implementation	Time and energy required to engage on SLPs and their implementation	Time and energy required to engage on SLPs and their implementation
Risks	Unit lacks adequate staff, competencies or resourcing to carry out functions SLPs are not adequately resourced to diversify local economy	Unit lacks adequate staff, competencies or resourcing to carry out functions	Unit lacks adequate staff, competencies or resourcing to carry out functions Increased demand for resources for SLPs	Unit lacks adequate staff, competencies or resourcing to carry out functions Might not agree with some measures in SJRP and SLPs

Table 3 Phasing and risks

Action	Requirements	Risks
Phase 1: Decision on SJRP unit structure	SJRP structure establishes unit to drive SJRP for the coal value chain	Mandate is delayed SJRP structure does not define role, powers and tasks of the SJRP unit appropriately or clearly
Phase 2: Unit is adequately resourced	SJRP structure allocates adequate positions and funds Hiring procedures ensure strong competencies (policy expertise, innovative approach, ability to manage planning and implementation processes with stakeholders inside and outside of government)	Unit is unable to obtain adequate resources Unit employs people without required competencies and qualities
Phase 3: Unit implements SJRP for coal value chain effectively, including engagement to revise SLP requirements	Clear, timely mandates and clarity on relationship to relevant departments and state agencies Efficient platforms to engage stakeholders inside and outside of government Resources to monitor implementation of SJRPs Resources and authority to unblock and/or initiate a course correction as required Platforms to professionally manage disagreement and conflict, within a framework that is driven by the overarching policy.	Mandates are delayed or relevant partners within government can circumvent or ignore them Platforms for engagement on the SJRP do not include key stakeholders, who then circumvent them, and/or are poorly facilitated, leading to delays and disputes Inadequate resourcing in terms of funding or capacity, so unable to monitor implementation, or unblock and/or course correct Ongoing disagreement.

Action	Requirements	Risks
Phase 4: Vulnerable groups in the coal value chain are effectively supported	Unit is able to ensure government implements SJRP for coal value chain effectively, with on-going improvements and course corrections as information and forecasts improves and better solutions emerge, with effective policy and dispute resolution.	Unit lacks necessary policy, frameworks, resources, information, capacity and authority

3.2 Diversification of local economies

Aim: Develop practical plans with a 10-year time horizon

Proposal: The SJRP structure will provide coal towns with resources for substantive, costed planning for economic diversification. A second implementation phase will depend on proposals from the initial plan. The planning process should include a review of all possible opportunities, including the options discussed below relating to the potential of mine rehabilitation to create areas for recreation and farming; generating renewable energy; and the circular economy around coal waste. The plans must specify the benefits for vulnerable workers and communities, especially retrenched workers and small businesses. They should indicate regulatory, funding and capacity requirements for implementation as well as the main risks and cost bearers.

3.2.1 Context

It is impossible to put in place broad stroke employment mitigation plans for the whole region of Mpumalanga as each local municipality is unique in its economic activities, labour pool and infrastructure endowment, among other variables. Economic diversification of a region post-mining is a complex process that requires accurate and in-depth information on the profile of the vulnerable as well as existing industries. It is important that, for each municipality, key stakeholders that represent the private sector, community, workers and the state (local and national) are involved in planning economic diversification strategies for the affected municipalities.

While some potential avenues of diversification are indicated below, further analysis and feasibility analysis have to be conducted at the municipal level for eMalahleni, Steve Tshwete, Msukaligwa and Govan Mbeki. Economic diversification has to be a continual process, and it is recommended that this become a planning process, much like the IDP process which municipalities follow. This can take the form of the municipal IDPs insofar as a similar study can be commissioned for the vulnerable municipalities outlining the economic diversification strategies for these municipalities after mining. For large metros, the commissioning of an IDP costs in the region of R2 million while for smaller municipalities costs range from R500 000 to R700 000. However, if supplementary studies are required for smaller municipalities, this cost can easily rise to, or even exceed R2 000 000.

3.2.2 Some options for diversification

This section outlines some options for diversification into more sustainable activities. It aims only to indicate possible opportunities, as far more work is required to test their viability and to identify the existing constraints on their development.

Mining rehabilitation is one avenue with which to develop future economic activities. Mining rehabilitation is a fundamental process that needs to occur throughout the process of mining and begins at the commencement of mining activity (World Bank, 2018). Rehabilitation refers to restoring land that is impacted by mining activity back to a sustainable usable condition (Chamber of Mines South Africa and Coaltech, 2007). In reality it is not possible to fully restore land to its previous state after mining. Engagements with mining rehabilitation experts have revealed that the legal framework for mining rehabilitation in South Africa is regarded as sound, however, implementing this rehabilitation is less than desirable.

With mining rehabilitation, recent regulation advancements in the form of the National Environmental Management Laws Amendment Bill (NEMLA IV) seek to expand regulatory control surrounding rehabilitation, provide the platform for creating new rehabilitation economic opportunities, and provide greater certainty to mining firms. This new amendment also accounts for the fact that rehabilitated land will never be the same as the original undisturbed soil. NEMLA IV is currently awaiting presidential signature and should be encouraged to ensure that mining rehabilitation is conducted satisfactorily and that DEFF is given expanded powers in regulating the process (ESI Africa, 2019).

Experiences in other countries that have gone through coal transitions indicate that mine closure must involve the repurposing of land to a state that enables the land to become an asset to whichever stakeholder takes over the land (World Bank, 2018). This involves limiting the negative impacts of mining on the environment, restoring soil, and maintaining or improving the land; as well as ensuring that existing infrastructure such as buildings, are suited to use. Due to the complexity of mine closure and rehabilitation, some countries have found that delegating the process to specialised mine closure companies and not the mining firms themselves ensures that this process is satisfactorily completed with environmental harm mitigated to the best possible level. In Germany and Poland, specialised mining companies were used for the mining rehabilitation process and those cases were regarded as examples of comprehensive mine rehabilitation (World Bank, 2018).

In other countries that have transitioned away from coal and other mining, there have been a number of post-mining uses of old mines and power stations to generate new economic opportunities that warrant further scrutiny and study. One such avenue is the restoration of mine land for agriculture – an activity which already happens in Mpumalanga. Repurposing land for agriculture is a complex process and the soil will never be restored to its original state. There are many variables at play, and engagements with mining rehabilitation experts reveal that absent any soil intervention it can take about 100 years or more for soil to become fertile after a mine is filled in the case of surface mining. Through fertilisation, the land can be restored to an arable state in less time. Underground mining disrupts relatively smaller areas of top soil due to the disturbance of underground structures, after agricultural production has commenced, but it is possible for these structures to give way and impact agricultural production (Bureau for Food and Agriculture Policy, 2012). At the onset of mining, mines may remove the most upper layer of land, known as topsoil, before accessing the coal deposits beneath. After the mine is closed, the topsoil is placed back into the mine.

Further research should be done on the extent to which mining land can be rehabilitated for agriculture in the coal municipalities. Mpumalanga contains approximately 46% of highly arable land which makes it ideal for agricultural activities (Bureau for Food and Agriculture Policy, 2012). Due to the concentration of coal in the province, mining firms and agricultural producers tend to compete for land. Further, coal mining activities affect adjacent agriculture and it was estimated in 2012 that over the next 20 years, about 450 000 tonnes of maize could be taken out of production (Bureau for Food and Agriculture Policy, 2012). Yet in the late 2010s, Mpumalanga accounted for about 30% of South Africa's maize production. Leveraging off the province's existing maize and soya production, the repurposing of mining land to agricultural land for the production of staple crops such as maize and soya is an avenue that can be pursued.

Beyond agriculture, other countries have experimented with mining rehabilitation for new economic opportunities such as (oekom, 2012):

- Repurposing coal slag-heaps into adventure sports infrastructure such as ski slopes, hiking, and cycling;
- Creation of lake districts by flooding open-cast mines for bathing and water sports;
- Repurposing mines into open-air geological museums; and
- Conversion of old mining land into green areas such as parks, shopping centres and services production.

Such interventions should be analysed in terms of their match with the vulnerable municipalities in Mpumalanga.

Within the broader narrative of transitioning energy supply towards a greater share of **renewable energy**, Mpumalanga can partially retain its reputation as an energy hub of the country through the development of renewable energy generation plants in municipalities that are vulnerable to declines in coal activity. The second phase of the Strategic Environmental Assessment for wind and solar photovoltaic (PV) energy in South Africa has proposed three additional Renewable Energy Development Zones (REDZs) for wind and solar PV projects, which include eMalahleni – the largest coal employing local municipality in the country (CSIR, 2019). This is a positive step in diversifying that municipal economy. These proposals should be encouraged with a potential further rollout in other vulnerable municipalities such as Steve Tshwete, Msukaligwa, and Govan Mbeki. The REDZs are in conformance (and respond to) the envisioned solar and wind capacity additions in the final version of the 2019 Integrated Resource Plan (IRP), which totals in excess of 20 000 MW (DMRE, 2019).

Adjacent vulnerable municipalities, if not included in further renewable energy generation plans, should be developed to supply into the renewable energy value chain by developing the skills and expertise in supplying the value chain. This can include developing skills in the maintenance and repair of renewable generation infrastructure, and the manufacture of renewables generation components and allied services.

Intertwined with mining rehabilitation is the development of biomass production on mining land, which in turn can be used as the basis for producing electricity and heat or producing biofuels. In mining areas this technology is still in its infancy, however. In cases where agriculture for food is not viable (land is contaminated or less fertile), then biomass production for generation can be investigated such that energy and food production do not compete in the broader province. Models that draw on community ownership and

partnerships can go far in increasing social cohesion in vulnerable municipalities. Such models should be piloted and scaled up where they are successful.

An opportunity that is linked with the coal value chain is the potential for the **beneficiation of coal waste products**. In the case of combusted coal, the broad term for waste products is coal combustion products (CCPs). CCPs include fly ash, bottom ash, boiler slag and flue gas desulphurisation gypsum (World Coal Association, 2019). Fly ash recycling has been gaining traction worldwide and in South Africa as well. Countries like India, China and the United States employ reuse projects to beneficiate fly ash (Millington, 2019). Ash is left over after coal is combusted in power stations. This ash is stored close to the power stations in ash heaps and is regarded as waste. There has been a surge in interest recently in the ash value chain with major producers of ash such as Eskom and Sasol showing interest in selling the ash that is produced at their processing facilities. An industry body, the South African Coal Ash Association, exists to support the development of ash opportunities and develop the coal ash value chain. Large ash producers such as Eskom, Sasol and Sappi are members of this association. There is also academic research supporting the development of the ash value chain at institutions such as the University of Pretoria, which has close links with the South African Coal Ash Association. The University of Pretoria is involved in research pertaining to the use of fly ash in construction and agricultural applications. Ash can be used to manufacture a diverse array of goods and can be incorporated into processes to serve many needs. These include rare earth metal extraction from ash, mine backfilling after mine closure, mine drainage treatment, soil amelioration, and land reclamation.

Based on available information there is a potential to beneficiate CCPs. Eskom, for example, has noted recently the cost and legislative challenges it faces with the storage of coal ash at its power stations and its interest in selling a greater share of ash to limit its own costs (Reynolds-Clausen and Singh, 2017). Eskom's storage facilities are approaching their maximum capacity at power stations and building additional storage involves substantial capital expenditure. Strict environmental regulations surrounding ash storage further increases the costs of such expansions to storage capacity. About 7% of Eskom's ash is sold from six power stations and Eskom has embarked on reviving its Ash Utilisation Project to limit costs of expanding storage. About 30% of residual ash is left over after a unit of coal is burned is Eskom's power stations.[1] There is a limit on the fraction of ash produced that can be sold at the Eskom power stations, as some ash is used to treat effluent water the emanates from the power station. While the fraction of ash that can be sold varies by power station, on average 19% of ash produced at a power station can be sold (Reynolds-Clausen and Singh, 2017). Currently Eskom's main off-taker for ash is the construction industry, which uses ash in the production of cement and bricks.

Sasol is another large producer of ash in the country and it liberates 200 000 tons of ash for beneficiation per year (South African Coal Ash Association, 2019). Sasol commissioned a study to examine ash beneficiation and that study revealed that ash could be competitively sold within a 200 km radius. A barrier to transport emanating from that study was the inferior state of provincial and municipal road infrastructure which required upgrading.

Since ash is considered hazardous waste, the use of ash was required to be accompanied by a Waste Management Licence which is issued by DEFF. In February 2020, DEFF released

[1] Based on a total of 120Mt of coal burned in 2014/15 and 34.4Mt of ash produced from that combustion (see Reynolds-Clausen and Singh, 2017).

regulations around exclusions to the Waste Act which was a positive policy move for the development of circular economy initiatives related to ash recycling. Eskom and Sasol specifically have been granted exclusions for the management of ash at their facilities for downstream production including brickmaking, block making, cement production, road construction, soil amelioration (DEFF, 2020) which is an encouraging policy unblocking. Another cost barrier for small businesses wanting to enter the space is the cost of capital associated with installing liners beneath ash-handling facilities, based on the hazardous nature of ash (Reynolds-Clausen and Singh, 2017).

One of the applications of ash recycling that warrants further investigation in the region is the use of coal ash to improve the fertiliser value of previously mined land, referred to as soil amelioration. Part of the mine rehabilitation process involves filling up voids left in the ground, for example in surface mining. The upper-most portion of the soil, referred to as topsoil, is removed at the beginning of excavation and is generally the medium in which agricultural produce grows. When mines are refilled after closure, the topsoil can be regenerated through the use of fertiliser, and coal ash can be used to improve the fertiliser value of the soil such that agricultural activities can be conducted. Fly ash has a high content of essential plant nutrients (chiefly phosphorus) (Mupambwa et al., 2015). As fly ash also contains toxic elements like heavy metals, it is important that the toxic elements be reduced before used in agricultural applications. Transport costs between ash producers and consumers are an important constraint to take into account, and thus it is generally recommended that ash processing plants be close to ash suppliers. This would mean that ash processors would benefit from being located near to the Eskom power stations and Sasol Secunda.

Transitioning workers and communities from coal mining and plant operation to the ash beneficiation value chain will involve imparting the requisite skills and education to these groups. A proper understanding of the potential for ash beneficiation is the first step.

Table 4. Impact evaluation

Dimension	Vulnerable groups and communities	National departments	Employers	Organised labour
Benefits	Higher levels of employment and economic opportunities and incomes	Avoid new "rust belt" with long-term recession, loss of capacity and frustration National economic growth is strengthened	Plans open up new economic opportunities Maintaining employment and incomes for vulnerable reduces social conflict	Improved opportunities for union members facing job losses Improved response to demands that oppose renewable energy to save coal jobs
Costs	Time required to engage in planning process	Resources, time and expertise required to develop realistic plans Costs of implementing the plan	Time required to engage in planning process Resources for new investments	Time required to engage in planning process Need to convince members that it can work
Risks	Plans do not work, leading to higher costs for towns that are already poor and wasted time for intended beneficiaries	Plans do not work, leading to higher costs for towns that are already poor Unable to identify viable options	Plans do not work, leading to wasted effort and loss of invested resources	Plans do not identify viable options or fail, leaving members bereft and angry

Table 5. Phasing and risks

Action	Requirements	Risks
Phase 1: SJRP structure develops proposal for how it will support and resource municipal planning processes	SJRP structure decides its position on what municipalities must do, contracting and procurement process, access to expertise and quality control for plans	SJRP structure cannot decide what it wants from municipalities

Action	Requirements	Risks
Phase 2: SJRP structure engages coal mining towns on proposal	SJRP structure has capacity to engage with municipalities in coal belt Municipalities' capacity and political will to engage with the SJRP structure	SJRP lacks capacity to engage with municipalities or does not prioritise process Municipalities do not prioritise engagement, so meetings are not productive
Phase 3: SJRP structure and municipalities reach agreement on process and resourcing	SJRP structure and municipalities are able to agree on resourcing required, how to access expertise, methodology and quality control	Parties are unable to agree Parties do not allocate sufficient time to reach agreement
Phase 4: Municipalities initiate planning process	Municipalities set up team with well-defined oversight, outputs and time frames	Municipalities cannot set up team due to lack of capacity or interest Terms of reference remain vague, leading to confusion and delays
Phase 5: Planning process generates useful proposals for diversifying local economy	Planners use methodology that identifies viable, sustainable opportunities that can be realised on a sufficient scale, with viable and specific steps to realise them There are real opportunities for coal towns to diversify	Parties are unable to develop realistic proposals either due inappropriate methodology or because the opportunities do not exist
Phase 6: Municipalities and SJRP structure agree on diversification plans and mobilise resources to implement them	Municipalities and SJRP structure reach agreement on proposals and are able to identify resources to implement them	Unable to agree on proposals Resources are not available for implementation

Action	Requirements	Risks
Phase 7: Plans are implemented successfully	Municipalities and other relevant government agencies dedicate sufficient capacity, expertise and resources to implementation Plan builds in sufficient monitoring, unblocking and course correction capacity to avoid failures Businesses and communities respond constructively to new opportunities, leading to investment, job creation and growth National economy is strong enough to support investment and growth	Municipalities and other government agencies do not prioritise implementation, so resourcing remains insufficient and contradictory policies and measures persist Plans are implemented rigidly even if failing, leading to significant losses Businesses and communities are sceptical, so they do not support plans National economy goes into a downturn, making growth more difficult
Phase 8: Coal towns diversify and grow, reducing the effects of the decline in coal value chain on jobs and livelihoods	Successful measures and projects to diversify economy	Projects and policies fail to bring about diversification and the number of employment opportunities required, leading to failure of enterprises and possibly aggravating local job losses. There may also be mass local immigration if there are new opportunities, leading to competition between unemployed locals and others.

3.3 Active labour market policies

1. Identification of skills and needs of vulnerable workers

The SJRP office for coal to commission research into the skills, experience, age and long-term career plans of workers likely to be affected by downsizing in next 10 years, funded by the Mining Qualifications Authority (MQA) or the National Skills Fund. The research should have an adequate process to identify real information needs and it should have an efficient methodology to get the necessary information, since it has to cover close to 100 000 people.

For active labour market strategies to be effectively developed, a full profile of vulnerable miners will be required. Specifically, a survey of mining firms to get an accurate profile of miners in terms of their age, origin and skill set. The age profile, for example, allows for the determination of whether retraining and reskilling would be necessary to protect employment of younger workers (who have a higher probability of facing impacts due to their longer tenure) or whether employees that are close to retirement age can be provided with early retrenchments. The origin of miners determines where they would likely relocate to, or where they might have sufficient existing resources such as property or families, given that miners tend to shift resources to their places of origin while they are employed.

Table 6. Impact evaluation

Dimension	Vulnerable groups and communities	National departments	Employers	Organised labour
Benefits	Transition time for workers into new employment or livelihoods reduced and at least partly funded	More effective active labour market policies for workers retrenched from coal value chain	Easier retrenchment and hiring processes Less conflict over downsizing as workers have options	Members in better position if downsizing occurs Scope for negotiating stronger support measures for workers
Costs	Need to provide details to research process Increased uncertainty as research process raises prospect of downsizing	Funding for research (Department of Higher Education and Training or MQA)	Need to provide information for research	Process makes workers think they will get support and therefore they are less resolute in opposing retrenchment If MQA funds, less resources for other training

Dimension	Vulnerable groups and communities	National departments	Employers	Organised labour
Risks	Research does not generate useful information Government does not use research findings to improve active labour market supports	Coal value chain recovers and research becomes obsolete	May face pressure to help fund research and/or active labour market measures	

Table 7. Phasing and risks

Action	Requirements	Risks
Phase 1: SJRP structure develops Terms of Reference (TOR) and budget for research project and engages MQA and National Skills Fund (NSF) on funding	SJRP structure can get capacity and expertise to draft TOR SJRP structure has capacity to engage MQA and NSF MQA and NSF willing to put in time to engage	SJRP structure unable to obtain appropriate capacity and expertise to draft TOR SJRP structure lacks capacity to engage MQA and NSF MQA or NSF do not respond to efforts to engage
Phase 2: MQA and/or NSF approves funding	Budget is adequate for process to succeed Relevant structures approve the funding	Funding provided is not adequate for a successful study Structures do not approve funding
Phase 3: SJRP structure consults on TOR with stakeholders and experts, finalising the TOR	SJRP structure had capacity to consult effectively and efficiently Stakeholders and experts provide constructive advice SJRP structure incorporates suggested improvements	SJRP structure cannot convene consultations effectively, does not invite key stakeholders or experts, and/or does not accept important comments and corrections Stakeholders and experts do not provide useful advice
Phase 4: SJRP commissions team to carry out research	Procurement procedures do not impose excessive delays and identify capable team	Applicants are not able to conduct the research Procurement process leads to long delays

Action	Requirements	Risks
Phase 5: Research is carried out and finalised with worthwhile insights	Methodology proves to be appropriate, with mechanisms built in to course correct if necessary Team is able to implement it effectively Stakeholders cooperate in providing information Team is unable to interpret information in interesting ways	Methodology is not effective but team does not adapt, leading to unhelpful research Team lacks capacity or competencies to implement research effectively or interpret findings Stakeholders are sceptical of process or concerned about confidentiality, so they do not share required information
Phase 6: Research guides improvements in measures to support workers in the coal value chain who suffer from downsizing	Relevant agencies know about the research and are able to use it to develop appropriate measures Relevant agencies prioritise support for workers in the coal value chain who face downsizing Downsizing in the coal value chain actually occurs before the information becomes outdated	SJRP structure does not communicate findings to relevant agencies or it is too hard to understand Agencies do not use the research Agencies do not prioritise support for workers in the value chain, in part because they are older, and many had a comparatively high income Coal value chain recovers
Phase 7: Improved measures reduce transition time for workers who lose jobs in coal value chain	Economic opportunities are available if workers get support	Economic opportunities are not available even if workers get support Coal value chain does not downsize

2. Development measures to assist vulnerable workers to transition into new, sustainable activities

The SJRP structure should work with relevant agencies to strengthen measures to assist miners and other groups affected by downsizing in the coal value chain and coal towns. The measures should include training proposals submitted to the MQA and NSF, and resources for career counselling and job search funded by the SJRP structure but managed by municipalities.

Table 8. Impact evaluation

Dimension	Vulnerable groups and communities	National departments and agencies	Employers	Organised labour
Benefits	Transition time for workers into new employment or livelihoods reduced and at least partly funded Workers gain skills Potential career in a lower carbon society that is not under threat	More effective active labour market policies for workers retrenched from coal value chain	Easier retrenchment and hiring processes Less conflict over downsizing as workers have options	Members in better position if downsizing occurs Scope for negotiating stronger support measures for workers
Costs	Time lost to retraining and reskilling opportunities Possible relocation depending on where new economic opportunities lie and accompanying erosion of social networks	Cost of measures		
Risks	Agencies do not agree to support SJRP New economic opportunities do not prosper and retraining and reskilling is wasted	Contestation over prioritisation of coal value chain ahead of other industries Unable to help miners find new jobs or only at lower pay, leading to resentment	Raised expectations and/or uncertainty increase workplace conflict May face pressure to help fund research and/or active labour market measures	Raised expectations and/or uncertainty increase workplace conflict

Table 9 Phasing and risks

Action	Requirements	Risks
Phase 1: SJRP structure engages with agencies to develop specific measures to support retrenched workers in the coal value chain to find new employment	SJRP structure has capacity to engage with relevant government departments and agencies Government departments and agencies are willing to co-ordinate with the SJRP structure on the project Parties have expertise, resources and capacity to design effective system	SJRP lacks capacity to initiate engagements Departments do not prioritise the engagement or the project, so do not participate meaningfully Agencies do not have requisite expertise, resources or capacity
Phase 2: SJRP structure leads engagement with stakeholders on proposals	Stakeholders are prepared to engage constructively SJRP structure has mandating system in place plus capacity and time to ensure meetings are convened and to engage constructively	Employers and unions are not prepared to engage constructively SJRP structure is not able to manage engagements efficiently or effectively
Phase 3: Government implements the measures, with SJRP structure as champion	Measures are appropriate and well designed, and incorporate sufficient mechanisms for course correction to avoid significant errors Parties have expertise, resources and capacity to implement the system Stakeholders, including unions and employers, support or at least can live with the measures	System is poorly designed or inappropriate; in particular, training is not provided for miners who do not have matric Mechanisms to monitor actions and outcomes are inadequate or do not lead to course corrections where needed, so implementation fails Parties lack the expertise, resources and capacity to implement the plans
Phase 4: Vulnerable workers make more rapid transition to new employment	Measures succeed in helping miners and other workers in the coal value chain to find new jobs relatively quickly if they are retrenched	New employment opportunities are not available

3.4 Social protection

Aim: Provide income support for vulnerable workers and communities during the transition.

Proposals: Engage with coal employers and Eskom to establish an enhanced retrenchment package with financial planning for coal and Eskom workers. The SJRP structure should engage with the Community Work Programme and the social sector of the Expanded Public Works Programme (EPWP) to establish programmes in all coal towns, providing employment to at least 2 000 workers per town for a minimum of six months each.

Table 10 Impact evaluation

Dimension	Coal miners and towns	National departments	Eskom and mines	EPWP and DPWI
Benefits	Larger retrenchment package and possibility of public employment if retrenched or lose livelihood	Greater economic and social stability in coal towns	Less contestation over downsizing	Meet mandate of providing support for unemployed people
Costs		Time and capacity to engage with employers and EPWP	Additional cost of retrenchment	Cost of programmes
Risks	Even with higher package, run out of money before finding new job or livelihoods	May have to provide resources to leverage EPWP support		Contestation over prioritisation of coal towns

Table 11 Phasing and risks

Action	Requirements	Risks
Phase 1: SJRP structure engages with EPWP/DPWI and employers to develop options for assisting miners and others in coal towns facing job losses	SJRP structure has capacity to engage effectively EPWP/ Department of Public Works and Infrastructure (DPWI) and employers are willing to engage constructively	SJRP structure does not have sufficient understanding of EPWP and employers' resources and constraints to engage effectively EPWP/DPWI and employers avoid serious engagement

Action	Requirements	Risks
Phase 2: Parties develop effective support package for coal miners and coal communities	EPWP is willing to prioritise communities Eskom and employers are able and willing to enhance retrenchment package	EPWP does not agree to prioritise coal towns Employers do not agree to increase package
Phase 3: Implementation by employers and EPWP	EPWP and employers have sufficient and appropriate resources and capacity to implement commitments	EPWP and employers do not have resources or capacity, so they do not implement in full or at all
Phase 4: Coal towns are at least partially protected from job and income losses due to downsizing in value chain	EPWP and employer measures are rolled out efficiently and in full	EPWP and employers do not implement in full or at all

REFERENCES

Squazzin, A. and Goko, C. Bloomberg, 2019. Eskom Gets Bailout Funding. Now It Needs a Rescue Plan [WWW Document]. URL https://www.bloomberg.com/news/articles/2019-07-26/eskom-gets-bailout-funding-now-it-needs-a-rescue-plan (accessed 1.28.20).

Bureau for Food and Agriculture Policy, 2012. Evaluating the Impact of Coal Mining on Agriculture in Delmas, Ogies, and Leandra districts - with a spesific focus on maize production [sic] [WWW Document]. URL http://www.bfap.co.za/wp-content/uploads/reports/The%20impact%20of%20coal%20mining%20on%20agriculture%20-%20a%20Pilot%20study%20focus,%20based%20on%20maize%20production%20(2012).pdf (accessed 11.11.19).

Centre for Applied Legal Studies, 2018. The Social and Labour Plan Series Phase 3: Alternative Models for Mineral-Based Social Benefit [WWW Document]. URL https://www.wits.ac.za/media/wits-university/faculties-and-schools/commerce-law-and-management/research-entities/cals/documents/programmes/environment/resources/SLP%20Report%203%20For%20Web%2018%20January%202018.pdf (accessed 11.18.19).

Chamber of Mines South Africa, Coaltech, 2007. Guidelines for the Rehabilitation of Mined Land [WWW Document]. URL https://www.mineralscouncil.org.za/work/environment/environmental-resources/send/26-environmental-resources/349-rehabilitation-guidelines-29november (accessed 11.11.19).

CSIR, 2019. Additional Renewable Energy Development Zones Proposed for Wind and Solar PV [WWW Document]. URL https://www.csir.co.za/renewable-energy-development-zones (accessed 11.14.19).

DEFF, 2020. Notice Indicating the Exclusion of Certain Waste Streams or Portions of Waste Streams from the Definition of Waste for Beneficial Use [WWW Document]. URL https://www.gov.za/sites/default/files/gcis_document/202002/42990gon85.pdf (accessed 3.19.20).

DMR, 2010. Guideline for the Submission of a Social and Labour Plan [WWW Document]. URL https://www.dmr.gov.za/Portals/0/social%20and%20labour%20plan_guideline.pdf (accessed 11.14.19).

DMRE, 2019. Integrated Resource Plan 2019 [WWW Document]. URL http://www.energy.gov.za/files/docs/IRP%202019.pdf (accessed 11.14.19).

DoE, n.d. South African Coal Sector Report [WWW Document]. URL Department of Energy. Available: http://www.energy.gov.za/files/media/explained/South-African-Coal-Sector-Report.pdf (accessed 10.9.18).

ESI Africa, 2019. Environmental framework bill must be revived states law firm [WWW Document]. URL https://www.esi-africa.com/industry-sectors/finance-and-policy/environmental-framework-bill-must-be-revived-states-law-firm/

Eskom, 2019. Integrated Report - 31 March 2019 [WWW Document]. URL http://www.eskom.co.za/IR2019/Documents/Eskom_2019_integrated_report.pdf (accessed 12.17.19).

Eskom, 2018. Integrated report - 31 March 2018 [WWW Document]. URL http://www.eskom.co.za/IR2018/Documents/Eskom2018IntegratedReport.pdf (accessed 2.5.19).

MCSA, n.d. Coal [WWW Document]. URL https://www.mineralscouncil.org.za/sa-mining/coal (accessed 1.28.20).

Millington, B., 2019. Coal ash has become one of Australia's biggest waste problems — and a solution is being ignored [WWW Document]. URL https://www.abc.net.au/news/2019-03-10/coal-ash-has-become-one-of-australias-biggest-waste-problems/10886866 (accessed 12.11.19).

Mupambwa, H.A., Dube, E., Mnkeni, P.N.S., 2015. Fly ash composting to improve fertiliser value – A review (No. S Afr J Sci. 2015;111(7/8), Art. #2014-0103,).

oekom, 2012. Post-Mining Regions in Central Europe - Problems, Potentials, Possibilities.

Reynolds-Clausen, K., Singh, N., 2017. South Africa's power producer's revised Coal Ash Strategy and Implementation Progress. Presented at the 2017 World of Coal Ash conference in Lexington, KY, Eskom.

South African Coal Ash Association, 2019. Ash Flashes - Issue 46 – September 2019. South African Coal Ash Association.

StatsSA, 2019. Electricity generated and available for distribution, March 2019 - South Africa Data Portal [WWW Document]. URL https://southafrica.opendataforafrica.org/odjeqwb/electricity-generated-and-available-for-distribution-march-2019 (accessed 1.28.20).

World Bank, 2018. Managing Coal Mining Closure - Achieving a Just Transition for All [WWW Document]. URL http://documents.worldbank.org/curated/en/484541544643269894/pdf/130659-REVISED-PUBLIC-Managing-Coal-Mine-Closure-Achieving-a-Just-Transition-for-All-November-2018-final.pdf (accessed 9.9.19).

World Coal Association, 2019. Coal combustion products [WWW Document]. URL https://www.worldcoal.org/coal/uses-coal/coal-combustion-products (accessed 12.11.19).