



**mineral resources**

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Department:  
Mineral Resources  
REPUBLIC OF SOUTH AFRICA

# **A BENEFICIATION STRATEGY FOR THE MINERALS INDUSTRY OF SOUTH AFRICA**

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## TABLE OF CONTENTS

GLOSSARY .....	i
LIST OF DEFINITIONS .....	ii
EXECUTIVE SUMMARY.....	iii
VISION.....	v
PURPOSE.....	v
SCOPE.....	v
1.INTRODUCTION.....	1
2.GLOBALECONOMICPERSPECTIVE .....	2
3.BENEFICIATION VALUE PROPOSITION FOR SOUTHAFRICA .....	3
3.1 Comparative Advantage.....	4
3.2 Competitive Advantage .....	4
4. CROSS-CUTTING CONSTRAINTS AND ASSOCIATED INTERVENTIONS TO ENCOURAGE BENEFICIATION IN SOUTH AFRICA .....	5
4.1 Cross-Cutting Constraints to Beneficiation.....	5
4.2 Interventions.....	6
5. STRATEGIC FRAMEWORK.....	8
6. SELECTED VALUE CHAINS.....	12
6.1 Energy Commodities.....	13
6.2 Iron and Steel.....	15
6.3 Pigment and Titanium Metal Production .....	17
6.4 Autocatalytic Converters and Diesel Particulate Filters.....	18
6.5 Jewellery Fabrication .....	18
7. CONCLUSION AND RECOMMENDATIONS .....	20
SELECT BIBLIOGRAPHY.....	23

## GLOSSARY

AMI	-	Advanced Metals Initiative
AMTS	-	Advanced Manufacturing Technology Strategy
APDP	-	Automotive Production and Development Programme
BBBEE	-	Broad-Based Black Economic Empowerment
CBM	-	Coal Bed Methane
CIP	-	Critical Infrastructure Programme
CTL	-	Coal to Liquid
DMR	-	Department of Mineral Resources
DSM	-	Demand Side Management
DST	-	Department of Science and Technology
DTI	-	Department of Trade and Industry
EPP	-	Export Parity Pricing
EDD	-	Economic Development Department
FDI	-	Foreign Direct Investment
GDP	-	Gross Domestic Product
IBSA	-	India Brazil South Africa
IDZ	-	Industrial Development Zones
IPAP2	-	Industrial Policy Action Plan 2
IPP	-	Import Parity Pricing
IRR	-	Internal Rate of Return
KAP	-	Key Action Plan
MMDB	-	Minerals and Mining Development Board
MPRDA	-	Minerals and Petroleum Resources Development Act
MQA	-	Mining Qualifications Authority
NIPF	-	National Industrial Policy Framework
NGP	-	New Growth Path
OECD	-	Organization for Economic Cooperation and Development
PBC	-	Platinum Beneficiation Committee
PGM	-	Platinum Group Metals
PVC	-	Polyvinyl Chloride
REACH	-	Registration Evaluation and Authorisation of Chemicals
R&D	-	Research and Development
SETA	-	Sector Education and Training Authority
SIP	-	Strategy Investment Programme
SMME	-	Small, Medium and Micro Enterprise

## LIST OF DEFINITIONS

**Beneficiation** entails the transformation of a mineral (or a combination of minerals) to a higher value product, which can either be consumed locally or exported. The term is used interchangeably with “value-addition”.

**Downstream value addition** involves a range of activities including large-scale capital-intensive activities such as smelting and refining as well as labour-intensive activities such as craft jewellery and metal fabrication such as machinery and equipment manufacture.

**Side stream** refers to infrastructure (e.g. power, logistics etc.), research and development, human resource development and inputs such as capital goods, consumables and services.

**Advanced investment casting** is an industrial process based on and also called lost-wax casting, one of the oldest known metal-forming techniques. From 5,000 years ago, when beeswax formed the pattern, to today’s high-technology waxes, refractory materials and specialist alloys, the castings allow the production of components with accuracy, repeatability, versatility and integrity in a variety of metals and high-performance alloys. Lost foam casting is a modern form of investment casting that eliminates certain steps in the process.

## EXECUTIVE SUMMARY

South Africa's economy experienced an average growth rate of 3.3 percent during the democratic dispensation, around the norm for middle-income economies excluding China and Asia, in contrast to the very slow growth experienced in the 15 years before the transition to democracy. Still, growth in itself did not address the deep inequalities inherited from the apartheid regime. The economy continued to suffer from low levels of employment, while poverty and income inequality continued more widespread than in other middle income economies.

South Africa has been a resource economy in excess of a century. An independent evaluation of South Africa's non-energy in-situ mineral wealth is estimated at US\$2.5 trillion (Citibank report, May 2010), making the country the wealthiest mining jurisdiction. However, a considerable amount of South Africa's mineral resources are exported as raw ores or only partially processed. Although South Africa has steadily improved its ratio of beneficiated to primary products exported since the 1970s, these ratios are still well below the potential suggested by the quality and quantity of its mineral resources endowment. The Government's industrialisation policy calls for a paradigm shift in mineral development, strategic investment in assets to maximise long term growth beneficiation projects, enhance value of exports, increase sources for consumption of local content, and create

opportunities for sustainable jobs. Minerals are a vital input to an industrialisation programme, which is intended to accelerate manufacturing in South Africa (for local consumption and export). Competitive access to minerals for local beneficiation is one of the key success factors for the country's industrialisation initiative.

Government recently adopted the New Growth Path (NGP), which seeks to create more inclusive economic growth by systematically encouraging more labour absorptive economic activities. The objectives of the NGP are clear and developmental focussed. It sets a target of 5 million new jobs by 2020 and identifies six priority sectors, focussed on infrastructure and rebuilding the productive sectors of the economy. The NGP identifies mineral beneficiation as one of the priority growth nodes for job creation.

The beneficiation strategy provides a framework that seeks to translate the country's sheer comparative advantage inherited from mineral resources endowment to a national competitive advantage. The strategy is aligned to a national industrialisation programme, which seeks to enhance the quantity and quality of exports, promote creation of decent employment and diversification of the economy, including promotion of the green economy. Further, the strategy is contributory towards strengthening of the

knowledge economy in support of the overall competitiveness of the economy.

The strategy presents an intervention that advances the developmental agenda of government. This strategy is anchored on a range of legislations and policies such as the Minerals and Mining Policy for South Africa (1998). It will also advance the objectives of the Minerals and Petroleum Resources Development Act (MPRDA), the Broad-Based Socio Economic Empowerment Charter (BBSEE), the Precious Metals Act, the Diamonds Amendment Act, energy growth plan as well as compliance with environmental protocols.

The strategy identifies several instruments that constitute an enabling environment for beneficiation (policies, legislation, incentives etc.). Furthermore, it illuminates prevailing constraints to the effective implementation of beneficiation that require an integrated

approach to mitigate. These include, albeit not limited to access to raw materials at developmental prices, infrastructure (access, costs and logistics), limited innovation and more broadly R&D and shortage of required critical skills. Synchronously, the strategy recommends a set of integrated solutions to mitigate identified binding constraints and leverage on existing national processes, such as the New Growth Path and the national infrastructure programme.

The strategy outlines ten strategic mineral commodities, from which five value chains are selected. The value chains specified herein are intended to indicate the inherent value for South Africa in embracing beneficiation for all strategic mineral commodities. The strategy is therefore, not a blueprint for individual commodity value chains, but provides a framework within which value chain specific interventions will be anchored.

## **VISION**

The strategy seeks to advance development through the optimisation of linkages in the mineral value chain, facilitation of economic diversification, job creation and industrialisation. It also aims to expedite progress towards knowledge based economy and contribute to an incremental GDP growth in mineral value addition per capita in line with the vision outlined in the NGP, NIPF and the Advanced Manufacturing Technology Strategy (AMTS).

## **PURPOSE**

This strategy outlines a framework that will enable an orderly development of the country's mineral value chains, thus ensuring South Africa's mineral wealth is developed to its full potential and to the benefit of the entire population.

## **SCOPE**

The strategy document covers the strategic framework to promote and enhance local beneficiation of mineral commodities mined in South Africa. It recognises that beneficiation should:

- Be considered on a value-chain by value-chain basis,
- Be geared towards higher levels of employment intensity and value-addition, and
- Take into account infrastructure considerations (such as energy and water availability).

The strategy selects ten strategic mineral commodities from which five value chains are outlined. The value chains specified herein are intended to indicate the inherent value for South Africa in embracing beneficiation for all strategic mineral commodities. They are also chosen to demonstrate intrinsic, multi-tier value proposition benefits for South Africa, including creation of new jobs, development of requisite skills, investment in research and development, economic growth, sustainable development and cost-effective support for the broader policies of government. Although the maximum value of mineral beneficiation is realised by optimising downstream and side-stream linkages, the latter will not be covered in this document. Side-stream linkages are catered for in the Broad-Based Socio Economic Empowerment Charter through procurement and enterprise development, human resource development as well as R&D elements of the charter.

The successful implementation of this strategy depends on intensive co-ordination across a range of government departments, particularly the Departments of Mineral Resources, Economic Development, Trade and Industry, Science and Technology, Public Enterprises, Energy and National Treasury as well other key mining stakeholders, including business and labour.

## 1. INTRODUCTION

The South African Government adopted a developmental economic policy known as “The New Growth Path”, which seeks to place the national economy on a production-led growth trajectory in order to tackle the country’s developmental challenges of unemployment, inequality and poverty. The New Growth Path sets a target of five million new jobs by 2020 and identifies six key sectors that must drive growth and job-creation. A particular focus is to ensure greater local processing of South Africa’s abundant natural resources. This policy framework prioritises the mining value chain, which includes mineral beneficiation, as one of the key economic activities that present the highest value proposition towards the attainment of its objectives. South Africa is host to considerable mineral reserves of strategic significance to the global economy, with an estimated in-situ value of US\$ 2.5 trillion and an economically exploitable life of mine of more than a century for non-energy mineral commodities. In essence, South Africa can broadly be defined as an economy with low levels of mineral beneficiation, in that most of its minerals are exported as ores or semi-processed minerals rather than high value intermediate to finished products.

The beneficiation strategy is aimed at providing a strategic focus for South Africa’s minerals industry in terms of developing mineral value chains and facilitating the expansion of beneficiation initiatives in the country, up to the last stages of the value chain.

The strategy is also aligned to other broader national programmes, including, albeit not limited to the industrialisation, energy security program and the Advanced Manufacturing Technology Strategy (AMTS). The strategy is premised on the need to unlock downstream and side-stream values and provides the initial analysis of opportunities and challenges in downstream beneficiation as well as suggesting instruments that must be investigated and implemented to enhance value addition. The total net beneficiation of minerals is maximised by a combination of downstream and side-stream linkages.

In the main, the beneficiation strategy is supported by a number provisions within existing national policy and legislation, such as the Minerals and Mining Policy for South Africa (1998), Minerals and Petroleum Resources Development Act, the Broad-Based Socio Economic Empowerment Charter, the Precious Metals Act, the Diamonds Amendment Act, energy security plan as well as compliance with environmental protocols.

A number of key constraints to effective implementation of the beneficiation strategy are identified and interventions intended to mitigate such constraints are also presented.



## 2. GLOBAL ECONOMIC PERSPECTIVE

Developing countries are increasingly playing a bigger role in global economic growth. The International Monetary Fund (IMF) predicts developing countries' growth to significantly lift world economic growth, wherein the aggregated GDP growth for such countries is projected to exceed 6.5 percent in 2012 against a global forecast of 4 percent. During the global economic and financial crisis (2008), the growth in developing countries confirmed assertions that the world has entered a new growth phase that will precipitate a long term high demand for natural resources, goods and services. Individually, the Chinese and Indian economies led the pack with 2009 economic growth rates of 8.7 percent and 7.4 percent, respectively at the depth of the crisis.

Per capita consumption of base metals and steel generally tends to rise with income. Countries in their early stages of development use long steel for infrastructure and construction purposes, whilst more developed economies use flat steel for manufacturing. Following a period of high steel intensive growth ranging between US\$15,000 and US\$20,000 gross domestic product (GDP) per capita in the United States of America (USA), South Korea, Japan and Taiwan reached a saturation point in their consumption of steel followed by a tapering thereof. China's GDP per capita in 2009 was just over US\$4,952, which is some distance below the US\$16,000 inflection point experienced by most developed economies. If the development path of China follows that of its predecessors, the conclusion can be reached that its consumption of commodities is likely to continue well into the foreseeable future. The combined population sizes of both India and China represent three times the Organization for Economic Cooperation and Development (OECD) population and possibly three times the resource requirements. It is therefore projected that the next commodities boom will be underpinned by the insatiable appetite for steel from the developing countries.

The Chinese GDP has grown at a staggering average of 9.5 percent in the last two decades, which has coincided with levels of capital formation to the tune of 40 percent of GDP. Synchronously there has been intense industrialisation and urbanisation, both of which drove China's consumption of mineral commodities at an unprecedented rate (e.g. 30 percent of world's steel, which is more than what is consumed by the USA and EU combined). It is significant that China has committed to increase investment in South Africa's beneficiation programme in order to take advantage of proximity to mineral source of production, as outlined in the Comprehensive Strategic Partnership with South Africa in 2010.

The increasing regional and continent-wide geo-political stability present prospects for additional (and proximal) market access for South Africa's beneficiated products. This stability characteristically precedes economic reform, which requires inter alia infrastructure investments.

Similarly, South Africa has initiated good trade relations with a number of established and developing countries alike.

### **3. BENEFICIATION VALUE PROPOSITION FOR SOUTH AFRICA**

The concept of beneficiation is not new in South Africa. For an example, the bulk of the country's electricity is generated from coal power stations, which consume more than 50 percent of the country's annual production of coal. Consequently, the country's economic growth was sustained over an extended period, as a result of the globally cost-competitive form of electricity fuelling the economic growth and creating jobs. Currently, new forms of beneficiation opportunities are sought to compliment the conventional electricity generation in the country, which will underpin the much needed economic growth. For instance, alternative forms of energy sources, such as PGM fuel cells, present an opportunity for South Africa to become a prominent player in global manufacturing and distribution of fuel cell components. Additionally, the Coal-To-Liquid technology in South Africa further augments the need for investment in research and technology for prospects of discovering innovative means of optimising utilisation of mineral resources for the benefit of the country.

In lieu of the three spheres of sustainable development, namely environment, social and economic, the introduction of stringent environmental legislation presents opportunities for South Africa to leverage benefit in the balanced approach of implementing the strategy. This leverage will attract investment, technology and skills to expedite growth in the sector. This proposition recognises the importance of the balancing act between much needed socio-economic growth and compliance to established environmental laws of the country.

In 2008, gross revenue from sales of all minerals in South Africa amounted to just below R300 billion. Similarly, just over R86 billion was generated from processing of base metals, precious metals and other minerals, which represented 11 percent of the total volumes of minerals produced. This represents the national opportunity loss in export revenue and employment creation opportunities. Furthermore, beneficiating the minerals to finished consumer goods not only increases the revenue gained from the exploitation of the mineral resource, but also significantly increases labour absorptive capacity of the industry .

Comparative studies on beneficiation show that it is possible to industrialise by leveraging on a country's natural resources with Government driving the beneficiation initiative as it was done in the NORDIC countries<sup>1</sup>.

Contrary to the findings of Hausman *et al* (2007), the 2008 Nobel recipient for economics, Paul Krugman, supports value addition of commodities from producer countries, and also proposes that comparative advantage can be readily translated into competitive advantage, if managed in a coordinated manner. This can be achieved through the optimisation of linkages, which will in turn derive optimal benefit for the source countries, as indicated by the experience of the Nordic countries.

### **3.1 COMPARATIVE ADVANTAGE**

South Africa's endowment of mineral resources merely presents the country with a comparative advantage for developing downstream beneficiation. However, based on South Africa's historical mineral industry strength, there is a potential to attract and develop technological excellence in mineral related industries to support side-stream and downstream value addition.

### **3.2 COMPETITIVE ADVANTAGE**

The South African mining sector has undergone a noteworthy transformation from largely exporting raw minerals to the establishment of value-addition facilities (mineral processing and manufacturing). This has resulted in increased revenues from the ferrous and non-ferrous mineral sectors, with total annual sales of ferro-alloys (representing a percentage of input ores produced in South Africa) exceeding R49 billion in 2008, from a base of R44,98 billion from all ores of ferrous mineral sales generated in the same year. This transition has partly resulted in the construction of a number of large scale resource-based investment projects, such as Columbus Stainless Steel, Saldanha Steel, Lion Ferro-chrome smelter and others. This demonstrates the country's state of readiness for value addition albeit currently in a less orderly manner, the strategy seeks to streamline the value addition programs in South Africa and expedite further development of the sector.

South Africa continues to upgrade and create essential infrastructure, including an extensive transport network (road, rail, ports and pipelines), information and communications infrastructure

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<sup>1</sup>See Walker (2004) where the Finnish experience of resource based industrialization is analysed. Part of this analysis includes the basic metals industry where despite a long history of mining in Finland, the industry remained insignificant until the mid to late 20<sup>th</sup> century when Government made key investments in areas such as production efficiency and capacity amongst others, and placed an emphasis on the export of intermediate and finished products. These interventions grew the sector to become one of the three most economically significant economic clusters in Finland alongside forestry and electronics.

and has a highly advanced financial and banking system. Well established and reputable technology and training institutions can be readily resourced to advance skills and technology development that is required for industrialisation. As a result of this focused investment, the country is best positioned to take full advantage of value addition programs.

## **4. CROSS-CUTTING CONSTRAINTS AND ASSOCIATED INTERVENTIONS TO ENCOURAGE BENEFICIATION IN SOUTH AFRICA**

### **4.1 Cross-Cutting Constraints to Beneficiation**

Despite the comparative advantage in mineral resource endowment and more than a century of mining in South Africa, the levels of mineral beneficiation have been low and mostly concentrated in the high capital sectors of the mineral value chain. This demonstrates that having natural resource endowment does not automatically translate to downstream beneficiation, but requires dedicated interventions to address possible constraints to realise a competitive advantage for the mineral beneficiation industries. This chapter identifies current inhibitive factors to effective implementation and development of the beneficiation programs in the country, namely:

- a) Limited access to raw material for local beneficiation - This constraint is resultant from the current structural arrangement of the mining industry, which remains geared towards export orientation of raw material, with the bulk of current producers bolted in long term contracts with their international clients. Pricing mechanisms used by some raw and intermediate material producers also hamper beneficiation to the final stages of the value chain. This is evident in the case of steel sector in which the use of IPP renders downstream beneficiation uncompetitive.

The international price determination for raw and intermediate materials, which do not discount proximity to production further compound the requisite access to input minerals for local value addition. An example of this would be the diamonds and precious metals industries where legislation has been created specifically to ensure availability of minerals for local beneficiation. However, the envisaged targets of downstream value addition of these minerals reached a catatonic state of development as a result of uncompetitive pricing mechanisms.

- b) Infrastructure – Shortages of critical infrastructure such as rail, water, ports and electricity supply have a material impact on sustaining current beneficiation initiatives and a major threat to future prospects of growth in mineral value addition. For instance, the recent

unprecedented levels of energy demand, compounded by lack of investment in energy generation as well as South Africa's historical culture (business, public sector and individuals) of inefficient energy utilisation, resulted in deficit of energy supply in the first quarter of 2008. The bulk of early-stage beneficiation programs require large and uninterrupted supply of energy. Distal locality of mining operations to established manufacturing hubs and lack of infrastructure capacity linking the two also discourage growth of beneficiation activities.

- c) Research and Development: South Africa's limited exposure to break-through research and development programs thwarts the prospects of innovation in creating new products for beneficiation
- d) Skills sought for expediting local beneficiation - While the challenge for skills is not limited to South Africa, the skills-supply pipeline for scientists and engineers requires specific attention.
- e) Access to international markets for beneficiated products – the current trade barriers (both tariff and non-tariff) in some prospective recipients of South Africa's beneficiated products limit access to these markets.

## **4.2 Interventions**

Each of the identified cross-cutting constraints requires mitigating intervention(s) from all stakeholders. These interventions are intended to moderate such limitations, in order to implement the beneficiation strategy effectively. Table 1 summarises cross cutting strategic actions, responding to each of the constraints and proposes intervention by the two main stakeholders, viz. government and business.

**TABLE 1: CROSS CUTTING ACTIVITIES AND INTERVENTIONS**

Cross Cutting Constraint	Potential Instruments at Government's disposal	Action by Business
Limited access to raw materials for local beneficiation	<ul style="list-style-type: none"> <li>• Leverage the state's custodianship of the country's minerals to facilitate downstream beneficiation</li> <li>• The MPRDA is currently being amended to strengthen beneficiation provisions</li> <li>• Leverage the beneficiation offset element of the Mining Charter</li> <li>• Strengthen provisions within existing pieces of legislation such as the diamond export levy to promote reliable and competitive access to raw materials</li> <li>• Address import-parity pricing especially of steel and heavy chemicals, including if necessary through export taxes, conditionalities placed on infrastructure, and regulation.</li> </ul>	<ul style="list-style-type: none"> <li>• Take advantage of the mineral value proposition to expand local demand for mineral ores</li> <li>• Comply with legislation</li> </ul>
Shortages of critical Infrastructure	<ul style="list-style-type: none"> <li>• Identify specific infrastructure needs over the next ten to 20 years.</li> <li>• Ensure that existing infrastructure planning mechanisms and programmes such as the critical infrastructure programme properly consider infrastructure requirements for mineral beneficiation</li> <li>• Leverage on the NGP, which seeks to unlock infrastructure bottlenecks through massive expansion of transport, energy, water, and communications capacity.</li> <li>• Utilise the state's infrastructure (public good) as an effective instrument to promote local beneficiation</li> </ul>	<ul style="list-style-type: none"> <li>• Align production plans with national programs</li> <li>• Embrace energy efficiency</li> <li>• Explore co-generation prospects</li> </ul>
Limited exposure to Research and Development	<ul style="list-style-type: none"> <li>• Align beneficiation R&amp;D requirements (both current and recurrent) to the national ten year plan for science and technology</li> </ul>	<ul style="list-style-type: none"> <li>• Support and develop competitive technologies</li> </ul>
Inadequate skills	<ul style="list-style-type: none"> <li>• Align the beneficiation skills pipeline to the National Skills Development Strategy and the Sector Skills Plans for required skills</li> <li>• Promote skills development and partner with the relevant SETA's and institutions of higher learning for training and labour development</li> </ul>	<ul style="list-style-type: none"> <li>• Investment in Human Capital Development</li> <li>• Co-operate with government to leverage and enhance the National Skills Development Strategy and the Sector Skills Plans for required skills</li> </ul>
Access to international markets	<ul style="list-style-type: none"> <li>• Review existing and ensure that future trade agreements adequately support the beneficiation intent (FDI and market access)</li> <li>• Take advantage of the Comprehensive Strategic Partnership with China to support investment in beneficiation in South Africa as well as access to markets in China.</li> </ul>	<ul style="list-style-type: none"> <li>• Leverage on trade agreements</li> </ul>

## 5. STRATEGIC FRAMEWORK

The strategic framework presents a selection of enablers for effective implementation of mineral beneficiation initiative in South Africa. This selection includes, albeit not limited to: an existing enabling regulatory framework, multi-stakeholder structures/initiatives, existing international agreements (bi- and multi-laterals) and strategic interventions supporting various aspects of beneficiation (Figure 1). These channels are discussed below.

### (1) The enabling policy and regulatory framework

While the beneficiation strategy is rooted in the various policy provisions and regulatory framework of Government, there is an urgent need to review such provisions, and where required, further strengthen such provisions to enable a seamless implementation of beneficiation. Some of these provisions are detailed below:

#### (i) Minerals and Mining policy for South Africa (1998):

The concept of beneficiation is articulated within the Minerals and Mining policy of 1998, which aptly identified the need to adopt a policy that will create an enabling environment for the development of the country's mineral wealth to its full potential.

#### (ii) Mineral and Petroleum Resources Development Act, 2002 (MPRDA):

The MPRDA enunciates the Minerals and Mining Policy of 1998. Whereas the MPRDA has provisions supportive for immediate implementation of the beneficiation strategy, the concurrent amendment of the MPRDA will seek to further clarify and strengthen these provisions, as outlined here under

#### (a) Section 26 of the Act:

26. (1) The Minister may initiate or prescribe incentives to promote the beneficiation of minerals in the Republic.
- (2) If the Minister, acting on advice of the Board and after consultation with the Minister of Trade and Industry, finds that a particular mineral can be beneficiated economically in the Republic, the Minister promote such beneficiation subject to such terms and conditions as the Minister may determine

#### (b) Section 23 (2) of the Act:

23. (2) The Minister may, having regards to the nature of the mineral in question, take into consideration the provisions of section 26.

With these provisions of the Act, the Minister has been empowered to prescribe beneficiation levels. These levels will be specified in the regulations, which will be informed by the current and future absorptive capacity of the local beneficiation industry. These provisions will ensure that downstream industries have a reliable supply of input materials for conversion into higher value goods, resulting in increased job opportunities and export revenue gains through increased economic activities realised by extended mineral value chains.

(iii) *The Broad-Based Socio-Economic Empowerment Charter for the Mining Industry (i.e. Mining Charter), as amended (2010):*

The mining charter encourages both downstream and side stream value addition through the following provisions:

- The beneficiation element: This element makes provision for mining companies to offset up to 11% of their ownership requirements against the value of their levels of beneficiation
- The procurement and enterprise development element: This element requires mining companies to procure a minimum of 40% of their capital goods, 70% of services and 50% consumables from BEE entities.

The procurement provisions of the Mining Charter (as amended in 2010) are already in force, creating the basis for rapid demand expansion for locally manufactured capital and consumable goods as well as services required to sustain the mining industry.

(iv) *Precious Metals Act, 2005 (PMA)*

Provisions of PMA ensure that priority will be given to those applicants whose beneficiation processes will be at the last stage of the mineral beneficiation value chain or will have a positive impact on the beneficiators in the last stage of the mineral value chain. The last stage of the mineral value chain presents the highest concentration prospects of creation of decent jobs.

6. (1) In considering an application for any license, permit or certificate the Regulator:
  - (a) must have regard to the promotion of equitable access to and the orderly local beneficiation of precious metal;
  - (b) must have regard to the requirements of the broad-based socio-economic empowerment Charter developed in terms of section 100 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);

Section 12 of the PMA provides Minister with the powers to only permit export of unwrought precious metals if she is satisfied the extent of the applicant's facilitation of



access for local beneficiation. The export approvals being granted currently have a validity period of one year. This provision must be used in conjunction with Section 26 of the MPRDA, 2002 to encourage mining companies to avail minerals for local beneficiation before they can export.

12. (1) No person may export any unwrought or semi-fabricated gold except with the approval of the National Treasury in terms of the Exchange Control Regulations made under the Currency and Exchanges Act, 1933 (Act No. 9 of 1933), granted with the concurrence of the (DMR) Minister.
- (2) No person may export any unwrought or semi-fabricated metals of the platinum group except with the written approval of the (DMR) Minister which shall be granted subject to the promotion of equitable access to, and the orderly local beneficiation of such metals.

(v) Income Tax Act

The Minister of Trade and Industry pronounced the Section 12i of the Income Tax Allowance Programme based on investment in new manufacturing assets and training provided to employees in the project. The 12i Tax Incentive aims to accelerate economic growth in the industrial sector and supports the Industrial Policy Action Plan (IPAP 2), particularly in terms of job creation, training and energy efficiency.

The Department of Science and Technology outlines the legislative provisions as well as processes for R&D tax incentives in the Income Tax Act, 1962 (Act 58 as amended) and South African Council for Natural Scientific Professions Act, Act No. 16 of 2004. These incentives include both scientific as well as technological R&D.

(vi) Manufacturing Investment Programme (MIP)

The MIP is an incentive designed to stimulate investment growth, in line with the South African government's National Industrial Policy Framework. The objective of the incentive is to stimulate investment within the manufacturing industry, to enhance the sustainability of manufacturing investment projects by small enterprises and to support large-to-medium-sized investment projects in manufacturing that would otherwise not be established without the grant.

(vii) Industrial Funding

The New Growth Path and its manufacturing driver, the Industrial Policy Action Plan, commit the state to a substantial increase in industrial financing primarily through the IDC. These resources will be used to support beneficiation where it will lead to large-scale employment creation either directly or by encouraging downstream activities. In

addition, the partnership agreement with China seeks to encourage increased Chinese investment in beneficiation in South Africa.

(viii) State-owned Mining Company

The new state-owned mining company has been created to participate and execute the developmental agenda of Government, including security of supply for local mineral beneficiation. The company should provide competition for existing producers, helping to hold down prices for downstream activities, identify innovative activities and projects, and mobilise private as well as public resources to develop the mining value chain.

**(2) Existing multi-stakeholder structures supporting various aspects of beneficiation.**

These structures have been created to identify and investigate specific value chains (or aspects thereof). The existing structures outlined in Figure 1 complement the objectives of the strategy and play an important role in informing the interventions of this strategy.

Coordination of these established structures must be maximised in order to achieve the collective objective of beneficiation in South Africa, i.e. attain a coordinated and incremental growth in beneficiation.

**(3) International trade agreements (bi- and multi-laterals)**

The bulk of the current agreements (bilateral and multi-lateral) present opportunities for South Africa to leverage optimal benefit in terms of attraction of foreign direct investment as well as access to international markets for South Africa's beneficiated goods. South Africa's trade agreements, both current and future, must seek to support the beneficiation policy of government.

The international agreements include, albeit not limited to;

- The Beijing Declaration on the establishment of a Comprehensive Strategic Partnership between the Republic of South Africa and the People's Republic of China
- The African Growth and Opportunity Act (AGOA)
- Trade Agreement between the European Union (EU) and South Africa
- The Southern African Development Community (SADC) Trade Agreement
- The Generalised System of Preferences
- Trade Agreement between Zimbabwe and South Africa
- Trade Agreement between Southern African Customs Union (SACU) and European Free Trade Association (EFTA) states
- Rules of Origin Guides / Trade Agreements

**(4) Beneficiation strategic interventions**

The document highlighted the cross-cutting constraints affecting effective beneficiation, for all minerals. The interventions are primarily intended to identify and recommend remedial action to mitigate the impact of such identified constraints to the development of the beneficiation sector.

**FIGURE 1: THE BENEFICIATION STRATEGY IMPLEMENTATION FRAMEWORK**



**6. SELECTED VALUE CHAINS**

This section indicates the advancement of selected mineral commodities through various stages of beneficiation, creating specific value chain(s), five of which have been selected to demonstrate the inherent value for South Africa in embracing beneficiation for all mineral commodities. The substantial increase in third-stage beneficiation achieved in the chemicals and metals industries is a direct result of policy orientation in the 1990's that partly targeted these value chains, supported by other institutions and incentives. However, these measures did not directly create sustainable employment and did not stimulate downstream fabrication, in part because of the prevalence of anti-competitive import-parity pricing and in part because of the lack of long-standing economic relationships and infrastructure to support it. The challenge for these value chains therefore, is largely to identify where greater final stage beneficiation (fabrication) can be initiated.

## 6.1 ENERGY COMMODITIES

Projections of energy demand growth in South Africa, the region and the world indicate aggregated annual growth rate of 3.2 percent to 2030 (BP Statistical Review, 2005). This demand growth challenge is compounded by climate change implication, as fossil fuels consumed in the generation of power are targeted as well as the important role of coal in power generation. Demand for low grade coal is also principally driven by the resurgence of the Asian economic players, viz. China and India as well as other developing economies.

According to the World Coal Institute (2007), this energy demand growth is likely to introduce additional price pressure on the prices and accessibility of coal in South Africa. The forecast growth in demand will not alleviate the major concerns around energy poverty. In 2000, only one in six people worldwide had access to energy required to provide the high living standards enjoyed in the developed world. These one billion people consumed over 50 percent of the world's energy supply, while the one billion poorest used only 4 percent [WBCSD 2004]. As the UN-Energy stated: *"This situation entrenches poverty, constrains delivery of social services, limits opportunities for women and erodes environmental sustainability at the local, national and global levels"*.

The PGM fuel cells technology represents an opportunity for new energy generation sources, as the extent and scope for further growth in traditional sources of energy generation are limited.

### 6.1.1 COAL

Energy is essential to poverty alleviation. All fuel sources will be needed, but as the most abundant and affordable of all the fossil fuels, the role of coal will be vital. Coal will continue to play a significant role in meeting energy demand worldwide. The world currently relies on coal for 40 percent of its electricity and 66 percent of steel production is dependent on coal. Many countries rely on coal for much greater proportions of their electricity – South Africa, China, and India; for example, use their large, indigenous supplies of coal to generate most of their electricity. In the future, coal conversion technologies will make synthetic gas and liquid transportation fuels derived from coal an attractive alternative. Coal also plays an important role in cement manufacturing and other industrial processes.

The bulk of the South African electricity is generated from coal power stations, which emit significant proportions of carbon dioxide and other gasses. Given environmental pressures it might be necessary to capture harmful gases at source and have them sequestered in rocks (geological formations) at depths, in an attempt to mitigate their contribution to global warming.

The possible implementation of carbon emission reduction measures (either a carbon tax or market mechanism) may contribute to an increase in the cost of electricity.

Opportunities exist for research and development to be directed at finding an alternative approach, such as potential of recycling the use of captured gases in the process of energy generation for re-generation of electricity as well as other uses (beneficiation), for the benefit of South Africans, in order to comply to environmental protocol, derive a low/no carbon emission growth, while also contributing to increasing our energy basket.

#### **Interventions for optimal value creation (beneficiation) of coal:**

- a) Policy support for clean and efficient use of coal in power generation can encourage the take-up of existing advanced technologies for low emissions coal-fired electricity production – providing secure and clean energy
- b) Policy support for technology transfer, through mechanisms such as the Clean Development Mechanism, bilateral and multilateral funds such as the Global Environment Facility and the Prototype Carbon Fund must be further explored.
- c) Investment into research, development and demonstration of new technologies such as clean coal technologies and carbon capture and storage. These could provide a very significant opportunity for the major reductions in emissions.
- d) Investment in R&D to find innovative means for beneficiation (recycling) of gases emitted in the generation electricity.
- e) Investment in technology to optimise use of coal bed methane (CBM).
- f) Investment in research for metallurgical research to disentangle uranium and coal in the Springbok flats coalfield, which will increase the country's reserve base of coal and uranium.
- g) Exploration of options for further final-stage fabrication of coal through production of chemicals as feedstock for plastics and fertilisers

#### **6.1.2 URANIUM AND THORIUM**

Uranium is mainly used to fuel commercial nuclear power plants. South Africa is currently exporting uranium in its oxide form ( $U_3O_8$ ), the first stage of beneficiation and imports the enriched uranium from the northern hemisphere for power generation purpose. This is due to the closure for uranium beneficiation operations due to the obligations of the Non Proliferation Treaty (NPT) signed by South Africa in 1991.

The recent increase in energy demand in South Africa has prompted re-assessment of alternative primary source of energy, hence increasing the demand for uranium as the clean alternative mass power production. South Africa has gained expertise over many years in the

beneficiation of uranium from the mining of the ore to producing uranium for power generation and beyond.

Meanwhile, researchers have been exploring the possibility of using thorium as an alternative fuel for nuclear reactors. Thorium is estimated to be approximately three times more abundant than uranium. However, present knowledge of distribution of thorium resources is poor due to relatively low key exploration efforts arising out of insignificant demand. Preliminary research indicates that the prospects of using thorium as an alternative fuel for reactors are positive but for the moment, the uranium boom still continues.

With the commitment of government to build nuclear power stations to compliment the fossil fuel based electricity, preparatory work for beneficiation of uranium/thorium and other minerals sought, such as fluorspar and others is critical.

**Interventions for the successful implementation of nuclear power generation include:**

- a) Quantification of uranium and/or thorium reserves and resources in the country
- b) Ascertain the economic feasibility of re-establishing uranium enrichment
- c) Plan for comprehensive waste treatment and mine rehabilitation
- d) Finalisation of the uranium policy with all relevant stakeholders

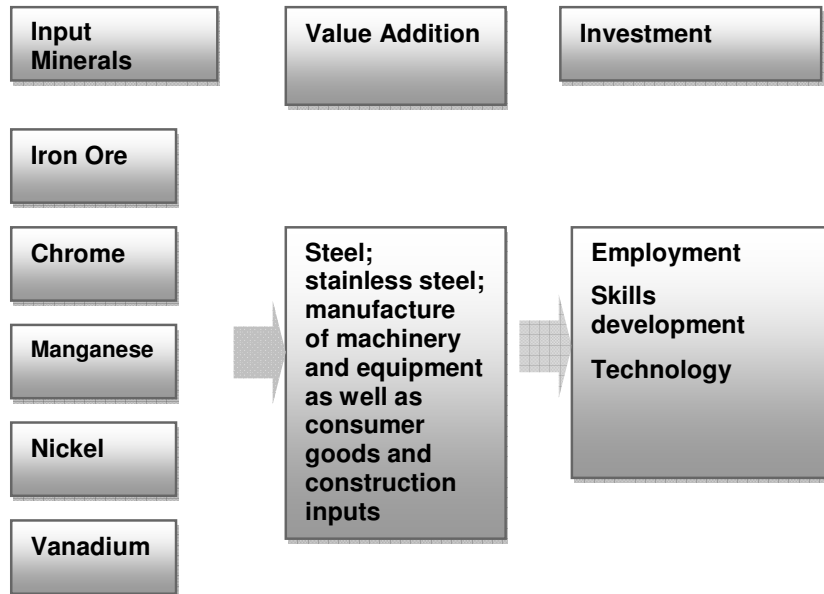
## **6.2 IRON AND STEEL**

Steel and stainless steel production are major consumers of iron ore, manganese, chromium etc. and South Africa is a major producer of these ferrous minerals. Access to these raw materials will therefore be essential to increase levels of local beneficiation of these minerals. Steel products are vital inputs into labour intensive manufacturing processes. However, current anti-competitive pricing practices in the steel industry are one of several constraints to the growth of manufacturing industries. Increasing competition in the local steel industry should be looked at as one of the interventions for countering anti-competitive pricing strategies.

Various government departments have combined efforts to create an enabling environment for the development of steel and stainless steel plants in South Africa. Access to competitively-priced iron ore, as well as manganese, chromium, nickel and vanadium, are essential for the projects identified through this process to be viable and to enable the new facilities to compete with existing players. The development of the plants would also assist in creating an environment for competitive pricing in the domestic market.

The challenge for the interdepartmental team is to facilitate the beneficiation of these ferrous minerals to the final stages of the value chain, as outlined in the Figure 2 below:

**FIGURE 2: IRON AND STEEL STRATEGIC OUTCOME**



**Interventions for iron and steel value chain development:**

Address import-parity pricing of iron ore and steel for downstream users to support the final fabrication process. Measures to achieve this end could include taxes on exports and conditionalities linked to the provision of infrastructure.

Develop strategies to address other constraints on downstream steel fabrication, including identifying major opportunities for using steel for local products, for instance for elements of capital equipment and construction inputs. Where appropriate, the state should assist with industrial financing. These measures require close collaboration between the Dti, the DMR and EDD.

- Invoke regulatory provisions to ensure sustainable and developmentally priced input mineral commodities for new and existing steel manufacturers in South Africa
- Investigate mechanisms to protect and support the competitiveness of existing intermediary plants, such as ferro-chrome smelters
- Encourage investment into South African steel industry to break prevailing anti-competitive behaviour of current operators

It will be necessary, therefore, to ensure that the resources required for any new plants established are accessible.

### **6.3 PIGMENT AND TITANIUM METAL PRODUCTION**

The development of the titanium value chain is a potential key growth area for South Africa. The titanium dioxide pigment industry consumes 95 percent of the titanium mineral concentrates production. Urbanisation and increasing personal consumption of titanium dioxide are expected to underpin growth in demand for titanium mineral concentrates. The development of a new low cost titanium metal production process would also enable titanium to displace other cheaper but lower performance metals. An inter-departmental task team has been formed to advance the beneficiation of titanium and the establishment of titanium industry in South Africa.

#### **Interventions for the pigment and titanium metal production development:**

- a) The funding of fundamental research into the production of titanium from the Bushveld titano-magnetites. Such a facility would also be a major iron producer which could facilitate competitive pricing of steel
- b) The development of a more cost effective and proprietary primary titanium metal production process is seen as a key enabler for the establishment of a South African titanium industry.
- c) The continued development and commercialisation of technologies to compete cost effectively in the international market
- d) The development of an infant titanium industry. This includes the required infrastructure to support South Africa's entry into the titanium market, commercialisation of existing technologies and the development of human capital to sustain a future large-scale industry.
- e) The development and demonstration of an advanced investment casting capability for titanium alloys. Further projects are proposed to develop key technology platforms and establish local competence and capacity in areas like powder metallurgy of titanium, machining etc.
- f) Commitment by the mining companies with respect to ensuring access to minerals is critical for growth. Continued discussion with the major pigment producers around the world to ensure that government (the Dti, DMR, DST and other stakeholders) know what all of their requirements are to set up a plant in South Africa
- g) It is also worth investigating the viability of establishing a new chlorine plant in conjunction with a pigment plant. A second stage would be to establish titanium metal production on the back of titanium tetrachloride for pigment production, followed by titanium metal fabrication for the aerospace, automotive, leisure and medical sectors



- h) Continued R&D with respect to mineral beneficiation, the preparation of intermediate metal salts, purification thereof and metal manufacturing itself.

#### **6.4 AUTOCATALYTIC CONVERTERS AND DIESEL PARTICULATE FILTERS**

South Africa is a major producer of platinum group metals, and it has the largest reserves of these metals. The increasing levels of platinum consumption as well as other PGMs represent the advances made in industrial technology with respect to the use and importance of PGMs within the high tech sectors of the economy. The over-riding increase in local PGM off-take over the past decade has been the auto-catalyst, or more correctly Catalytic Convertors for Vehicular Emission Control, which, as the name suggests, limits the emission of carbon oxide (CO) and Nitrogen oxide (NO) gases in line with ever-stricter international controls on the emission of particulate matter and greenhouse gases.

##### **Interventions for the autocatalytic converters and diesel particulate filters:**

- a) Invoke relevant provisions of the law to ensure security of PGM supply. The major mining companies have so far demonstrated their readiness to advance beneficiation in the country by initiating and fully participating in the PBC.
- b) Develop the modalities for the development of local metal access mechanism through an agreed approach between government and mining houses
- c) Unlocking intrinsic value within PGM sector through research programmes. This could be done through industry sharing forums, and formation of international partnerships. In addition, technology upgrades (recapitalisation) for R&D Centres of Competence, as indicated in the Advanced Metals Strategy, would be supported
- d) The alignment of existing initiatives on skills development as well as promotion of careers in related fields
- e) The promotion of investment in the automotive industry and the continuation of the sector incentive, such as the Automotive Production and Development Program (APDP).

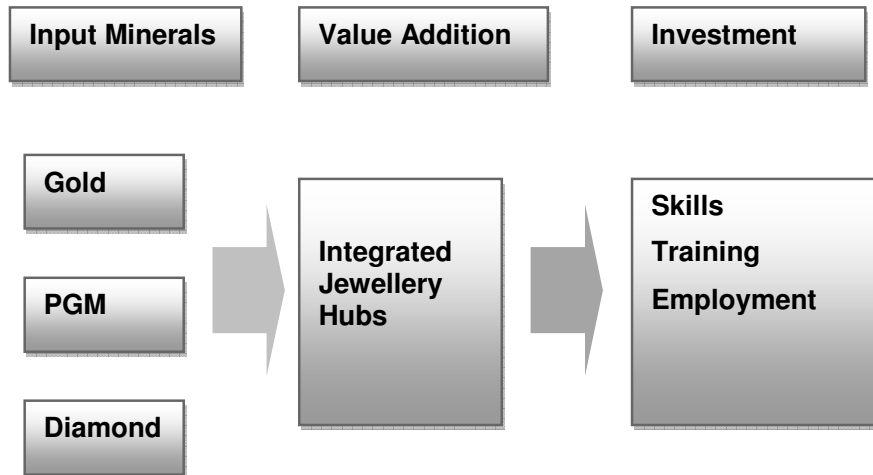
#### **6.5 JEWELLERY FABRICATION**

The beneficiation of gold and diamonds requires the establishment of Integrated Jewellery Hubs throughout the country (Figure 3). Although the fabrication of platinum jewellery is not a priority area for platinum group metals (PGM) beneficiation, the integration of specialised platinum jewellery facilities into any of the jewellery hubs would be well received.

The high value and low bulk of gold, platinum and diamond jewellery lends itself to export markets such as the United States of America (USA), Japan and Europe. The African Growth

and Opportunity Act (AGOA), which provides access to markets in the USA gives an opportunity for local beneficiaries to grow their markets internationally.

**FIGURE 3: PRECIOUS MINERALS STRATEGIC OUTCOME**



**Interventions for jewellery include:**

- a) Consider the establishment of an applicable and effective metal advance scheme aimed at ensuring local metal/mineral access for local value addition. The feasibility of this mechanism has been proven internationally and is being applied successfully on a small scale in the PGM sector. Government would need to investigate the reasons for less than adequate access in the gold sector in South Africa and identify issues that should be addressed to implement the scheme successfully
- b) A structured training programme which takes into consideration current specific demands and the expansion of the jewellery industry could be developed in collaboration with the Mining Qualifications Authority (MQA) and relevant SETA's
- c) Jewellery investment promotion, including the promotion of existing incentives in the jewellery sector  
An analysis of a new capital redemption legislation to encourage investment into the industry should also be conducted and instrument specific incentives considered
- d) Interventions such as the Kgabane Jewellery project, the Olifantsfontein Jewellery Training and Manufacturing facility, the Small Enterprise Development Agency (SEDA) Platinum Incubator, as well as all private sector initiatives could contribute significantly towards furthering the objectives of this Strategy in relation to diamond and jewellery manufacturing. These initiatives must be prioritised and provided with necessary support for further development.

## **7. CONCLUSION AND RECOMMENDATIONS**

The composition of South Africa's trade with most parts of the world is characterised by the export of raw materials and the import of manufactured goods. This is an opportunity for economic development and job creation that is foregone, even in instances where the capacity and know-how exists and where there are clear opportunities for local processing. Given the heritage of mining in this country, coupled with the concept of "mineral resources are limited, but creativity is unlimited" the time has never been more opportune for a more coordinated growth in mineral value addition. The beneficiation strategy is rooted in several policies, including the MPRDA, the BBSEE, Precious Metals Act and the Diamonds Amendment Act. In addition, this strategy seeks to fundamentally transform the industry from being largely resource based to knowledge based. It also compliments programs of Government, such as the New Growth Path, NIPF (IPAP 2), energy security, skills development and others.

As South Africa develops towards a more coordinated industrialisation era, underpinned by the NIPF (IPAP 2), the role of the country's mineral commodities as input materials will be even more significant in a short to medium term. The NIPF (IPAP 2) will be achieved at a significant premium, if the bulk of the input materials are not sought from the country's production at a competitive price.

The energy supply deficit experienced in the first quarter of 2008; albeit with subsequent attainment of a rather fragile stability in energy supply, presented opportunities for beneficiation of minerals (and gases) intended at prolonging the provenance of the country's fossil fuels, aimed at compliance with environmental protocol obligations and reducing the cost of doing business in South Africa.

The beneficiation strategy for the minerals industry of South Africa proposes a co-ordinated approach to encouraging the increase in the beneficiation of minerals, through the development of specific value chains. While a few value chains are proposed in this strategy document, namely; energy generation, steel and stainless steel fabrication, pigments and supper alloy production, and jewellery manufacturing; they are intended to indicate the inherent value for South Africa in embracing beneficiation for all mineral commodities. Through this strategic intervention, there are direct and indirect benefits for South Africa. South Africa's employment and diversification gains will only be achieved if these value chains are extended to the last stages of the value chain, where co-ordination is also critical.

The fiscal and regulatory environment must support the development of the selected value chains to ensure successful implementation of the strategy. In this regard, the finalisation of

relevant legislative policies will enable smooth implementation of various strategic activities identified in this document. The diamond industry can be viewed as a pilot for setting aside part of the production for local consumption as it has led the way through the establishment of the State Diamond Trader. On the basis of this model, the PGM downstream beneficiation study has proposed setting aside a portion of their production for local consumption and this can demonstrate the confidence expressed by the industry on the viability of the model. Mining companies can also off-set part of their Black Economic Empowerment (BEE) percentage compliance based on a formula per commodity stream, which considers the extent of beneficiation support after promulgation of the MPRDA. Other regulatory consideration will consider export duty on some mineral ores/concentrates, in line with the trade policy which is currently being developed by the Dti, based on the outcome of cost benefit analysis, analogous to the diamond export duty.

A number of commodity value chains consume large quantities of electricity. The bulk of these value chains are also emitters of gasses and heat, both of which can be captured and recycled to generate a significant portion of the operation's energy needs, with only the balance being sourced from the national grid.

Establishment of such plants requires State encouragement and support as it will not affect the currently fragile energy supply.

The cross-cutting constraints to beneficiation in South Africa require implementation of various interventions by Government and Business alike. The risk of not implementing the beneficiation strategy is too high for the country.

The synopsis highlights critical areas of intervention that will ensure a seamless and effective implementation of a coordinated implementation of beneficiation of South Africa's mineral commodities. This includes, albeit not limited to:

- Regulatory incentive: The beneficiation off-sets against the Mining Charter's requirement for 26 percent BEE ownership is a major milestone towards creating an enabling environment for value addition, as embedded in Section 26 of the MPRDA. However, there's scope for establishment of favourable trading conditions (such as use of export/import levies, where necessary) on ore to improve local access to the required minerals for local consumption as well as the use of existing versus new incentives. It is critical to propose competitive pricing mechanisms supportive of the beneficiation strategy in the MPRDA
- Investment in research and development initiatives, which will be aimed at unlocking the intrinsic value of South Africa's minerals through finding new products and/or technologies in support of local beneficiation

- Commitment by producers of minerals to support local beneficiation in terms of availing access to minerals in South Africa readily
- Alignment of existing initiatives on skills development to required proficiency for optimising beneficiation
- Ensuring security of energy supply through investment in new generation capacity, implementing energy efficiency measures and pursuing co-generation potential, where possible
- Expanding South Africa's economic policy framework to ensure international market access to locally beneficiated goods.

While the above critical areas of intervention are neither exhaustive nor listed in any order of priority, they are intended to highlight crucial areas of intervention sought by all industry stakeholders in support of a well coordinated beneficiation initiative.

The beneficiation initiative presents one of the rarest opportunities for South Africa to continue sustainable growth of its economy beyond mining.

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