

# **SOUTH AFRICA'S MANGANESE INDUSTRY DEVELOPMENTS,**

**2004-2011**

*DIRECTORATE: MINERAL ECONOMICS*



**mineral resources**

Department:  
Mineral Resources  
**REPUBLIC OF SOUTH AFRICA**

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2004-2011**

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## **1. INTRODUCTION**

South Africa hosts about 75 percent of the world's identified manganese resources. However, the country has predominantly ranked second in the world's manganese ore production, contributing less than 20 percent per year, attributed by lack of capacity developments in the country's manganese industry. These conditions led to the country missing out on the commodity boom cycle between 2001 and 2007, which was mainly due to the rapid growth in the Chinese steel industry and other developing economies.

Following the commodity boom cycle was the global economic recession, which hit the global commodity market during the last quarter of 2008, including South Africa's manganese industry as a result of lower demand for steel. However, the global steel demand started to recover during the second half of 2009 driven by a combination of stimulus packages globally, the resilience of emerging economies and an overall market recovery. Subsequently, the global steel production reached a record peak by 2011, with greater intensity of manganese use in steelmaking. As demand for manganese grows, does South Africa's manganese industry have what it takes to develop, so as to dominate the market given its comparative advantage?

The objective of this report is to ascertain South Africa's future role in the global manganese industry by reviewing the local industry's performance, 10 years before the promulgation of the Mineral and Petroleum Resources Development Act (MPRDA) in 2004 and the performance since. The report also covers exploration and mining projects, policy developments as well as infrastructure developments since 2004. The report seeks to show the effects that the developments had on the industry and the future impact in terms of production and supply, prices, job creation as well as industry competitiveness.



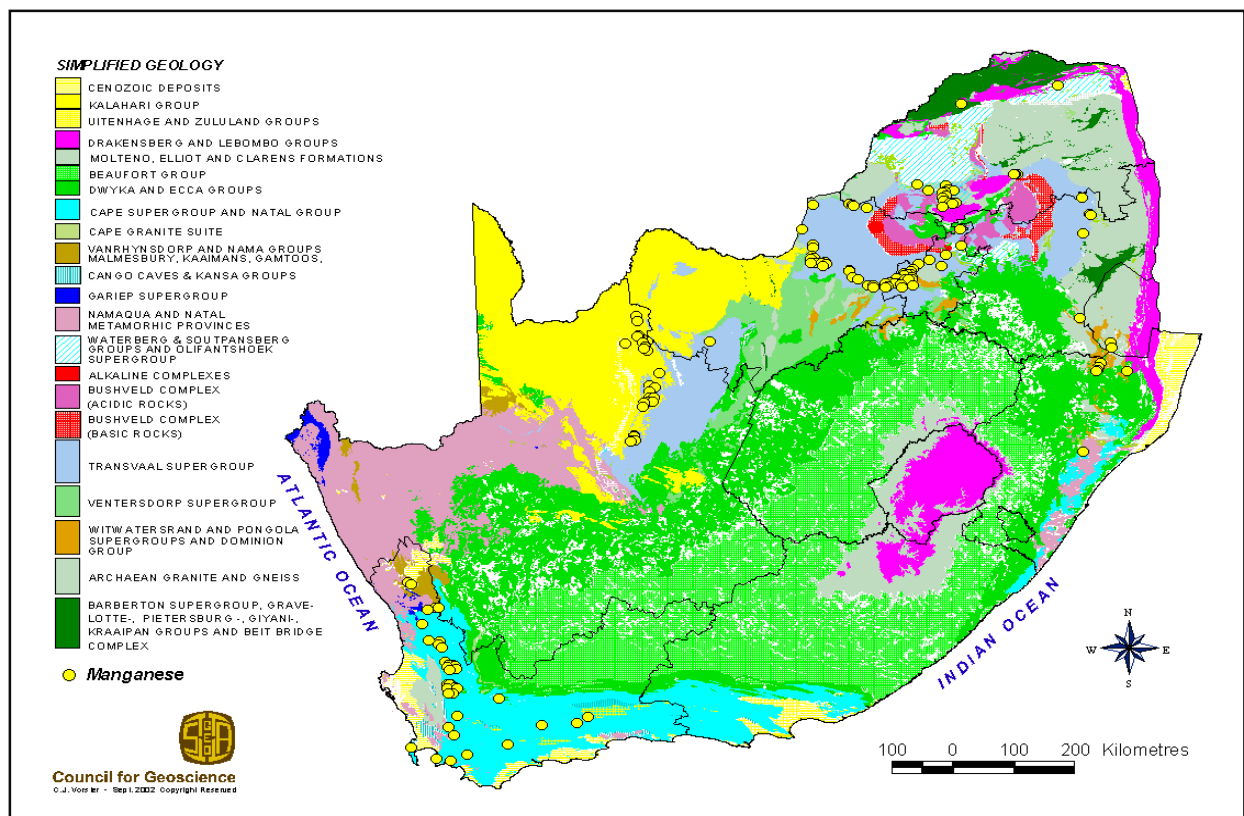
## 2. OVERVIEW OF SOUTH AFRICA'S MANGANESE INDUSTRY

### 2.1. ManganeseReserves

South Africa hosts about 75 percent of the world's identified manganese resources and about 24 percent of the world's reserves. Over 90 percent of these reserves are found in the Kalahari Manganese Fields (KMF) located in the Northern Cape (Fig. 1), which consists of an iron formation with inter-bedded units of manganese ore. Two main ore types present in the Kalahari deposit are low-grade primary sedimentary Mamatwan-type ore and hydrothermally altered high-grade Wessels-type ore.

Mamatwan ore is rich in carbonates, primarily calcites and dolomite while the manganese-bearing mineral is predominantly braunite ( $\text{MnMn}_6\text{SiO}_{12}$ ). The Wessels ore consists mostly of oxides, primarily braunite ( $\text{MnMn}_6\text{SiO}_{12}$ ) and braunite II ( $\text{Ca}(\text{MnFe})_{14}\text{SO}_{24}$ ), but also some hausmannite ( $\text{MnMn}_2\text{O}_4$ ), bixbyite ( $(\text{Mn,Fe})_2\text{O}_3$ ) and hematite ( $\text{Fe}_2\text{O}_3$ ).

FIGURE 1: SIMPLIFIED GEOLOGY OF SOUTH AFRICA'S MANGANESE DEPOSITS



## 2.2. Manganese Ore Production and Sales

Manganese (Mn) is the 4<sup>th</sup> most used metal globally in terms of tonnage after iron, aluminium and copper and it is the 12<sup>th</sup> most abundant element in the earth crust. Manganese ore is characterized by its contents of manganese, iron and various impurities into metallurgical (>35% Mn), ferruginous (15-35% Mn) and manganiferrous (5-10% Mn) ores. The ore is also commonly classified as high (>44% Mn), medium (30-44% Mn) or low (<30% Mn) grade ore.

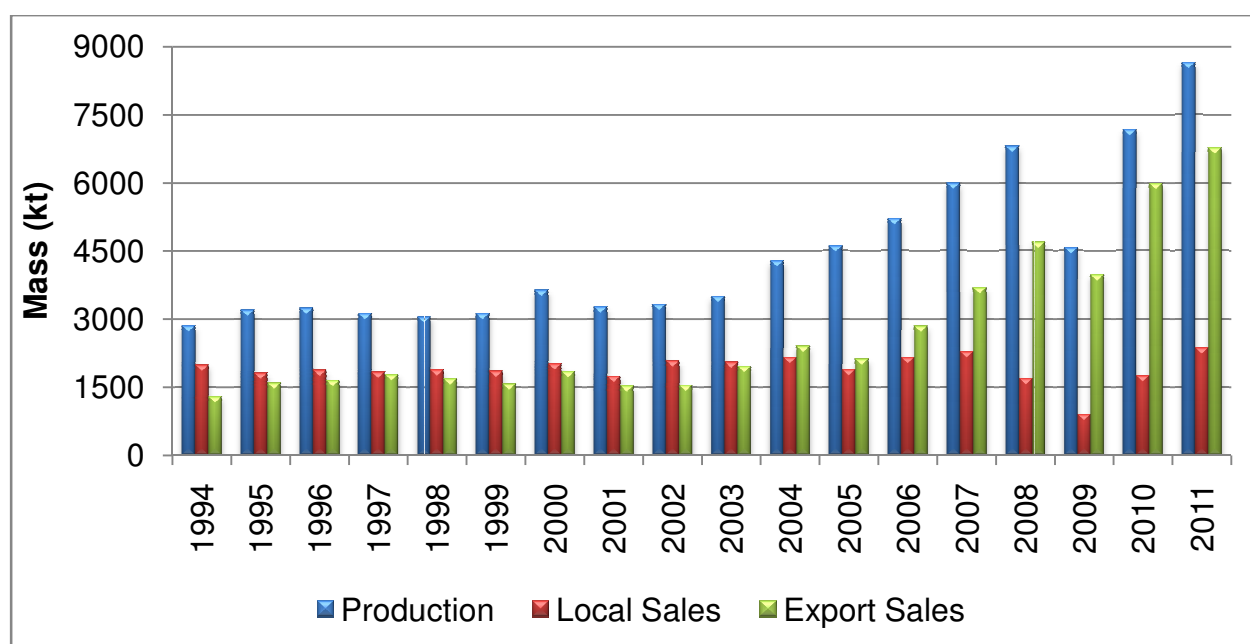
South Africa's manganese ore is dominated by metallurgical grade ore, which accounts for 99.8 percent of the ore produced. The medium metallurgical grade ore (30-40% Mn) accounts for about half of the production with the balance attributed to ore with a manganese content of over 40 percent up to 48 percent as well as over 48 percent.

Overall manganese ore production was steady from 1994 to 2003, growing at an average growth rate of 1.6 percent per year. Production has since grown at an average rate of 8.1 percent per year, from 4 282 kt in 2004 to 8 652 kt in 2011 due mainly to additional new capacity from green-field projects (Fig. 2). In 2009, the country's production declined by 33 percent compared with the previous year, on the back of the global economic crisis. However, the industry has since recovered, increasing by 57 percent to 7 172 kt in 2010 and by a further 21 percent in 2011.

Contribution of local sales volumes to total sales volumes declined from about 61 percent in 1994 to about 26 percent in 2011. Local sales volumes, which grew at an average rate of 0.7 percent per annum from 1994 to 2003, declined by an average annual rate of 3 percent from 2004 to 2011, due to poor demand from the local manganese alloys industry.

South Africa has predominantly ranked 2<sup>nd</sup> in the world's manganese ore exports. The ore export sales volumes grew at an average rate of 16.2 percent per annum from 2004 to 2011, a significant improvement from an average growth rate of about 2 percent per year during the 10 years preceding 2004. Export sales volumes for manganese ore declined by 15 percent to 3 975 kt in 2009, but increased by 51 percent to 5 986 kt in 2010 and a further 13 percent in 2011.

FIGURE 2: MANGANESE ORE PRODUCTION AND SALES, 1994-2011



Source: DMR, Directorate Mineral Economics

Note: Local sales are estimated

## 2.3. Manganese Alloys Production and Sales

South Africa's manganese alloys are dominated by high carbon ferromanganese (HCF Mn), which accounts for about 61 percent of the total alloy production, followed by silico-manganese (SiMn) and medium carbon ferromanganese (MCF Mn) at about 27 percent and 4 percent, respectively. Other processed manganese products include processed manganese metal, electrolytic manganese dioxides, manganese oxide and manganese sulphate.

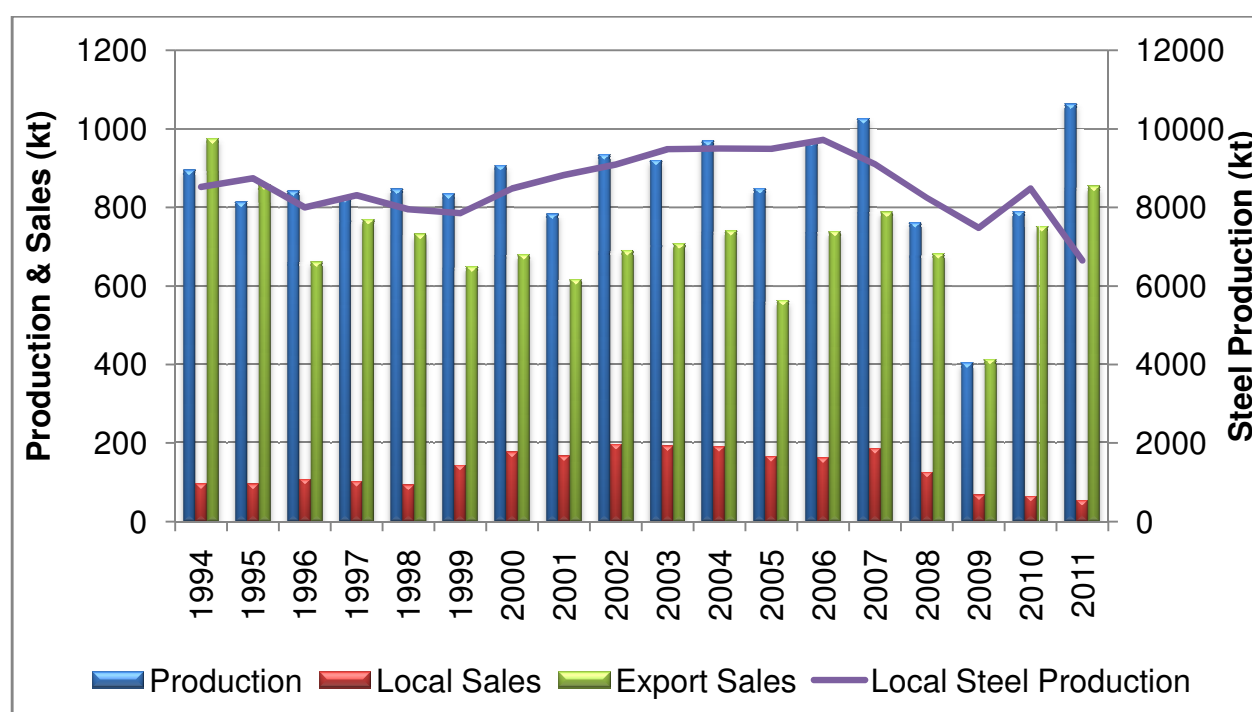
The country's alloys production was almost stagnant from 1994 to 2003, growing at an average rate of 0.6 percent annually due to lack of capacity expansions, and declined at a rate of 3 percent per annum from 2004 to 2011 (Fig. 3). Production declined by 26 percent in 2008 followed by a 47 percent decline in 2009, due to power supply challenges in the country and the global economic crisis. However, production increased by 95 percent in 2010 driven by the recovery of the global steel market and by a further 35 percent in 2011.

Local sales volumes of manganese alloys followed a trend similar to South Africa's steel production, increasing by an average rate of 9.4 percent annually from 97 kt in 1994 to 193 kt in 2003. Subsequently, local sales volumes declined at an annual rate of 19 percent from 191 kt in 2004 to 54 kt in 2011, due to lower demand from the local steel

sector. HCFeMn, which dominated the domestic consumption, was overtaken by the local consumption of SiMn since 2009.

Export sales volumes of manganese alloys declined at an average rate of 3 percent per annum, from 975 kt in 1994 to 707 kt in 2003. Lower demand in 2008 and 2009 resulted in a 13 percent and 39 percent decline in manganese alloys export sales volumes, respectively. However, the international market recovery during 2010 resulted in an 82 percent increase in manganese alloys export volumes followed by a 14 percent increase in 2011. During the study period, South Africa was ranked first in the world's supply of HCFeMn and one of the leading suppliers of SiMn.

FIGURE 3: MANGANESE ALLOYS PRODUCTION AND SALES, 1994-2011



Source: DMR, Directorate Mineral Economics

### **3. DEVELOPMENTS IN SOUTH AFRICA'S MANGANESE INDUSTRY**

#### **3.1. Role players in South Africa's Manganese Industry**

South Africa's manganese industry has for many years been controlled by a duopoly, Samancor and Assmang. Samancor Manganese is the world's largest integrated producer of manganese and is 60 percent owned and operated by BHP Billiton. The company owns two operations, Wessels, an underground mine commissioned in 1973 as well as Mamatwan, an opencast operation commissioned in 1964. Assmang Manganese acquired a manganese ore outcrop on a small hillock known as Black Rock in 1940. The company's manganese ore operations were subsequently extended and currently include the Gloria and Nchwaning underground mines. Gloria Mine commenced production in 1978 while Nchwaning mine was originally established in 1972, with the Nchwaning No.2 shaft coming into production in 1981. The Nchwaning No.3 shaft commenced production in May 2004 and became fully operational in February 2006.

Entrance in the industry was mainly restricted by lack of infrastructure development in the country, especially in the Kalahari Manganese Field (KMF). After the promulgation of the MPRDA in 2004, the government opened up the KMF for exploitation along with plans to overcome the infrastructure challenges. This led to the establishment of new manganese mining projects since 2004.

#### **3.2. Manganese Projects in South Africa**

##### **➤ Kalahari Manganese Field**

##### *United Manganese of Kalahari (UMK)*

The United Manganese of Kalahari (UMK) was granted a prospecting right in 2005, a first in about 30 years. A total of 361 boreholes were drilled, and the most significant manganese deposits were found on the Botha, Smart and Rissik farms with a total of 323.3 Mt of manganese resources identified. UMK was granted a mining right in 2008 and commenced small scale mining, concomitant with the development of the mine's permanent infrastructure. Production was ramped up in 2010 to a capacity of approximately 2.04Mt per annum run of mine (ROM), following the successful completion of the first phase of the mine development, the railway loop and the load-out silo. Towards the end of 2011 the permanent crushing and screening plant was commissioned.

### *Kalagadi Manganese*

Kalahari Resources, which was established in 2001, was granted a license to prospect for manganese in 2005 on the Gama, Olivepan and Umtu farms. Thirty boreholes were drilled, which identified 102 Mt of manganese resources with manganese content of 38 percent. After the completion of the exploration work, the Industrial Development Corporation (IDC) acquired 20 percent of the project. Kalagadi Manganese (Pty) Ltd was thus established in January 2006. ArcelorMittal, the world's largest steel producer, acquired a 50 percent interest in the project in 2007. The project is planned to consist of an underground mine to produce 3 Mt per annum of ROM ore and an ore preparation facility as well as a sinter plant which will beneficiate the ore into 2.4 Mt per annum of a high grade sinter. Also, the company plans to construct a smelter in the Industrial Development Zone at Coega that will produce 320 kt per annum of high carbon ferromanganese.

### *Tshipi é Ntle Manganese Mining*

In 2002, nine Black Economic empowerment groups formed Ntsimbintle Mining (Pty) Ltd. In 2007, Ntsimbintle concluded a transaction with the Pallinghurst Co-Investors which led to the creation of Tshipi é Ntle Manganese Mining (Pty) Ltd. The mining right for the company's first property, Tshipi Borwa, was initially issued to Ntsimbintle but subsequently transferred to Tshipi. The company is currently constructing a new open pit manganese mine which has been designed to produce 2.5 Mt per year of manganese ore containing 37 percent manganese with identified resources of 163 Mt. Tshipi's second property, Bokone project, is currently being drilled and explored. Tshipi acquired 16.3 km of historical drill data on the Bokone property that had been completed by its predecessors. From this data Tshipi was able to identify two primary exploration targets. The northern outlier is in the northern part of the Wessels farm where it borders on the Lehateng and Boerdraai farms. There is a second smaller anomaly on the Wessels farms called the southern outlier. The farms were mapped by hand held magnetic surveys and this data was analysed together with the historical borehole data. From this information, a further 10 targets were identified which were drilled during 2010. This exploration amounted to a further 3.5km of new drilling. Six of these holes intersected various grades of manganese at a depth of between 220m and 370m. Tshipi is exploring this property with the view of identifying high grade deposits that might lead to exploitation by means of underground mining methods.

### *Kudumane Manganese Mine*

Kudumane Manganese Mine is the latest mining operation to enter the industry in 2012, owned by Kudumane Manganese Resources, a joint venture between two empowerment firms, Dirleton Minerals & Energy and the Northern Cape Manganese Company, which own equal shares in the firm. The main components of the project comprise an open pit or combination of open pit and underground mine (with further underground mining planned in the future), a crushing and screening plant, mine residue disposal storage and facilities, and various support infrastructure and services. Production of manganese ore from the project is expected to be approximately 1.5 Mt per year, which will increase to 2 Mt per annum and later to 2.5Mt per annum with the introduction of underground operations in 2019. The expected life of the mine is 10 to 15 years for the open pit or combination of mining operations, after which underground mining will continue for an estimated 30 years. The first phase will be bulk sampling activities followed by production. The project is estimated to be in full production by end of 2013.

#### ➤ **Other projects**

### *Emang Manganese Project*

The Postmasburg Manganese Field (PMF) was discovered in 1922 and various companies have completed exploration and production in the area. In the 1980's operations ceased when mining companies moved to the higher-grade KMF. However, exploration and mining activities have recommenced in the PMF in recent years as demand for medium grade manganese ore (34-44% Mn) has gradually increased. In July 2011, Segue Resources Ltd, a minerals exploration and development company, entered an acquisition agreement with a black economic empowerment partner, Emang Mmogo Resources, to acquire 51 percent of the Emang manganese project. The project area covers 1668 hectares within the western limb of the PMF. A drill program of 62 reverse circulation holes and 2 diamond holes began in September 2011 and identified maiden Joint Ore Reserves Committee (JORC) compliant inferred resource of 14 Mt with a 25 percent manganese content including a medium grade component of 4 Mt with 34 percent manganese content. The company aim is to develop an open pit manganese project of 500 kt per annum of saleable product with a manganese grade of 36-38 percent.

### *Avontuur Manganese Project*

Aquila Resources' Avontuur manganese project is located adjacent the KMF in the Gravenhage manganese deposit. The project comprises of the Avontuur and Kathu tenements. The company undertook drilling on the Eersbegint target in the south of the Avontuur tenement and on the Gravenhage target in the north of the tenement.

Haakdoorn and Gravenhage south manganese prospects were discovered later and brought the total mineral resource to 147.8 Mt containing 38.2 percent of manganese. Aquila has finalised a Definitive Feasibility Study (DFS), confirming the technical and economic feasibility of a medium to high grade development stage manganese project at Gravenhage. The DFS proposes a 1.5Mtpa year run of mine open cast operation, with subsequent underground mining by decline access from the open pit. Mining operations will produce manganese ore over a total life of mine of 17 years, inclusive of the initial ramp-up in production. The DFS shows that mined Gravenhage ore will be crushed and screened to produce 1.125Mtpa year of lumpy ore for export and 330ktpa year of fine ore for supply to domestic sinter plants.

#### *Leinster Manganese Project*

Ferrex's Leinster manganese project covers 46 868 hectares in the Leinster Basin, an erosional outlier of the KMF and holds two prospecting rights over ten farms. During 1977 to 1988, Anglo American drilled 51 holes on the Leinster property. Ferrex subsequently used this information to calculate an exploration target of 5.5 to 8.7Mt at 28.6 to 31 percent manganese content. A fast-tracked exploration and development programme is planned, consisting of an airborne magnetic survey and a drilling campaign to twin historic drill holes to define a maiden Joint Ore Reserves Committee (JORC) Code compliant resource in the third quarter of 2012. The deposit lies at an average depth of 80m and is envisaged to be a small underground operation with ore trucked or railed to port for the export market.

## **4. SOUTH AFRICA'S MINING LEGISLATION**

In the past decade, South Africa has made major changes to the laws regarding mineral rights that have brought the country into alignment with other countries. The MPRDA (2002) objectives allowed for the State to be the custodian of all mineral resources in South Africa, as well as to promote economic growth and development of these resources, as per Section 24 of the Constitution. However, rights over the minerals in the KMF resided with the State since 1967 and the development of these resources is subject to development in infrastructure (rail, water, ports and power supply).

On the back of combating unemployment, alleviation of poverty and inequality as per the Millennium Development Goals (MDG's), the South African government adopted industrialisation policies, including Industrial Policy Action Plan 2010/11 (IPAP2) and the New Growth Plan (NGP). These policies identified infrastructure, the mining value chain—especially the final stage beneficiation, as well as manufacturing as key job drivers. Accordingly, additional policies and strategies were devised to develop these



sectors. Also, the government has approved and adopted the National Development Plan (NDP), which aims to eliminate poverty and reduce inequality by 2030. This plan builds on the NGP and states that, to acquire sustainable and inclusive growth by 2030, South Africa needs to invest in a strong network of economic infrastructure designed to support the country's medium and long-term objectives.

The Beneficiation Strategy for the mineral industry of South Africa is aimed at promoting local downstream value addition of some mineral commodities in the country, in order to enhance the quantity and quality of exports. This strategy ties in with the industrialisation policies, which identify the significance of the country's mineral endowment to economic growth. Steel and stainless steel manufacturing are amongst the identified value chains critical for South Africa's development and the government is working on creating an enabling environment for the development of these industries. Potential instruments that the government is considering include addressing import-parity pricing especially of steel, aligning beneficiation research and development requirements to the ten year plan for science and technology as well as reviewing existing trade agreements and ensuring that future agreements adequately support the beneficiation intent.

The Integrated Resource Plan (IRP 2010) ties in to determine the long term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. The accuracy of the IRP 2010 is improved by regular reviews and updates as and when things change or new information becomes available. For this reason all long term plans are considered as indicative. The IRP 2010 forecasts an almost double electricity capacity by 2026, with 42 percent of new generation coming from renewable sources and 23 percent from nuclear power.

The new Infrastructure Development Bill, which is aimed at fast-tracking and enhancing the coordination of South Africa's planned strategic infrastructure projects, was approved by Cabinet in December 2012. Greater emphasis is placed on the expansion of rail transport, with more railway tracks and rolling stock.

South Africa is a water-constrained country and with the full recognition that water is one of the most critical resources in the world, the Department of Water Affairs and Forestry (DWAF), has recently released the National Water Resources Strategy (NWRS-2) as required under the National Water Act (Act 36 of 1998). The first edition of the strategy (NWRS-1) was published in 2004 and set out the 'blueprint' for water resources management in the country for the first time. This NWRS-2 sets out the strategic direction for water resources management in the country over the next 20 years, with a particular focus on priorities and objectives for the period 2013 – 2017. It provides the framework for the protection, use, development, conservation, management and control of water resources for South Africa, as well as the framework within which water must be managed at catchment level, in defined water management areas.

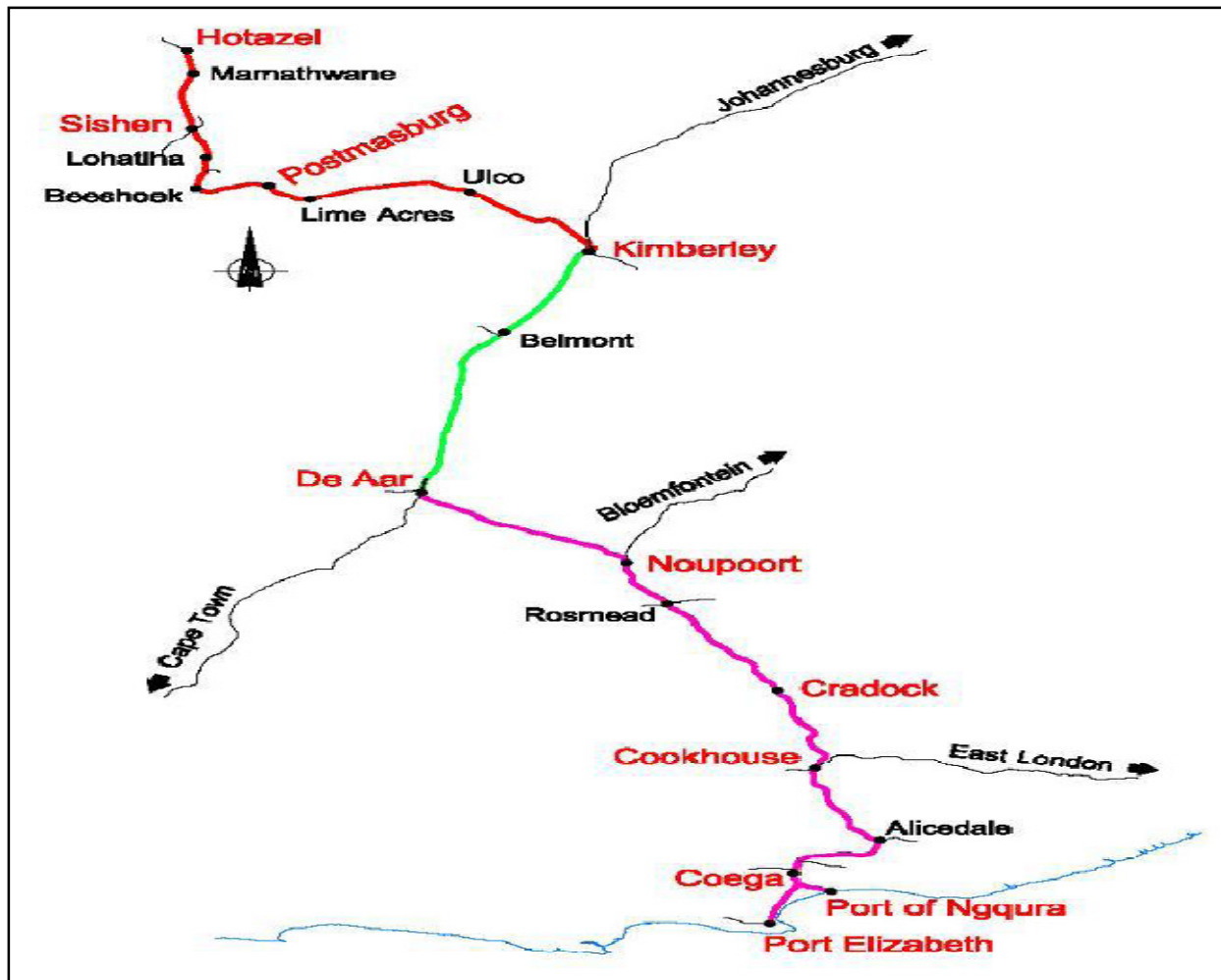
## 5. INFRASTRUCTURE DEVELOPMENTS

### ➤ Rail

South Africa has the potential to increase manganese ore exports drastically if its rail infrastructure is improved. The railway network is preferred by mining houses to transport ore to smelters for further processing or to export destinations, given the cost and logistics advantages for freight transport as compared with road transport. Transnet, a state owned company, is a custodian of rail and ports in South Africa. A large portion of the country's manganese is exported via ports in Port Elizabeth in the Eastern Cape and Durban in Kwa-Zulu Natal. The Port Elizabeth Manganese Ore Port Terminal is operated by Transnet Port Terminals and has a stack capacity of 400 kt. The terminal was refurbished in 2010 and the current maximum throughput capacity is 5.5 Mt per annum, however, the actual capacity is 4.2 Mt per annum due to rail limitations. The Durban Manganese Ore Port Terminal is operated by a private company called Bulk Connections, which is part of the Bidvest group. The current maximum throughput capacity is 1 Mt per annum which is also constrained by rail capacity.

South Africa's manganese industry expects export capacity to increase to 12 Mt per year by 2016 and possibly go up to 20 Mt per year. However, Transnet has committed to decommission the current manganese facility in Port Elizabeth by the end of 2016 due to limited capacity and environmental concerns. The company then decided that manganese will be exported through the port of Ngqura, a new deepwater port currently under development just outside of Port Elizabeth (Fig. 4). The schedule of the project indicates an initial capacity of 8 Mt per year by the first quarter of 2017 and 16 Mt per year by 2020. The provision of rail to Ngqura from the KMF will also supply ore to a Manganese Smelter at the Coega Industrial Development Zone. In the interim, a capacity solution is to increase manganese rail capacity to 4.8 Mt per annum in 2011/12 and then to 5.5 Mt per annum in 2012/13 to match the Port Elizabeth port capacity, until the 12 Mt per annum facility is completed. Also, Transnet plans to improve and optimise rail capacity to Durban to meet the port capacity.

FIGURE 4: THE MANGANESE CORRIDOR



Source: Transnet Freight Rail

Note:

Capacity Utilisation (%) = Trains needed/ Slots Available	
<span style="display: inline-block; width: 15px; height: 15px; background-color: red; border: 1px solid black;"></span>	Heavy Congestion - 105-130% New Infrastructure needed
<span style="display: inline-block; width: 15px; height: 15px; background-color: green; border: 1px solid black;"></span>	Moderate Traffic - 60-80% Operational Re-engineering
<span style="display: inline-block; width: 15px; height: 15px; background-color: pink; border: 1px solid black;"></span>	Network Collapse - 130% Doubling or new lines needed

## ➤ Power supply

South Africa could also be able to increase production and exports of its beneficiated manganese products if the power supply to processing plants improves. Since 2008, the mining sector has faced electricity rationing that limited production due to electricity shortage in South Africa. Thus, the establishment of new manganese alloys smelter plants is dependent on the availability of electricity. Eskom, a State owned power utility, is in a process of building additional power stations and major power lines to meet the rising demand. The company expects to double its capacity to 80 000 MW by 2026. The programme started in 2005 with an additional 4453.5 megawatts (MW) already commissioned. The plan is to deliver additional 16 304 MW in power station capacity by 2017.

Since the country has high potential of renewable energy (mainly from biomass, wind, solar and small-scale hydro), the government has determined that 3 725 MW is required to be generated from renewable energy sources to ensure uninterrupted supply of electricity. This 3 725 MW, which is about 42 percent of electricity generated in South Africa, is broadly in accordance with the capacity allocated to renewable energy generation in the IRP 2010. The Independent Power Producers (IPP) Procurement Programme has been designed so as to contribute towards the target of 3 725 MW.

#### ➤ **Water**

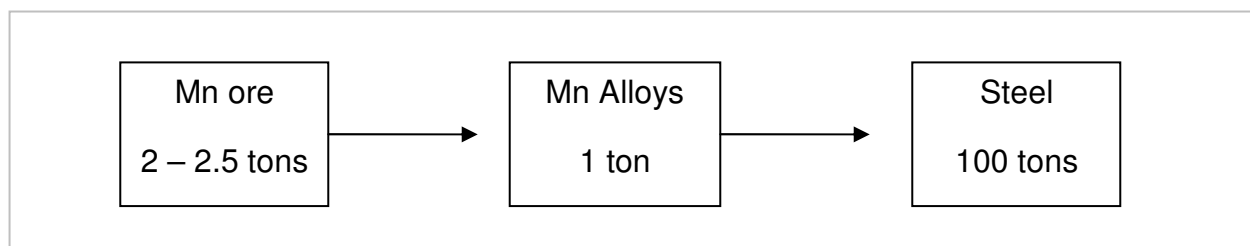
South Africa has average rainfall of approximately 500 millimetre (mm) per annum, which is well below the world average of 860mm per annum as well as high levels of evaporation due to the hot climate, and increasing challenges from water pollution. All of these pose constraints on the amount of water available for use. The country ranks as the 30<sup>th</sup> driest country in the world. Furthermore, water resources are very unevenly distributed within the country and it is estimated that South Africa will be extremely water scarce by 2025. At present, there is a well-developed infrastructure, with more than 4 395 registered dams in South Africa, of which 2 528 are water supply related. However, in many parts, the country has either reached or is fast approaching the point at which all of the financially viable freshwater resources are fully utilised.

Water is one of the inputs required for economic growth and water use in the combined minerals sector is fairly substantial, at more than 7 percent (although small in individual minerals). Water is a crucial input in the beneficiation process of manganese, therefore, the development of the new manganese mines requires forward planning to make arrangements for the transfer of water and development of new sources. The National Water Resources Strategy (NWRS-2) makes provision for investment in the development of these new sources, so as to support economic development.

## 6. Manganese End-use Markets

Steel is said to be the key driver in the world's economy and during the past 10 years, the production of manganese ore and its alloys has been in tandem with that of global steel as over 90 percent of manganese consumed goes into steel making. Approximately 2-2.5 tons of manganese ore is consumed in order to produce 1 ton of manganese alloys (Fig. 5). The apparent consumption of manganese is estimated at an average of 10 kg per ton of steel produced. The amount varies significantly from region to region with the differences related to the steel production process, the quality of raw materials used, such as iron ore grades and types of steel products produced.

FIGURE 5: MANGANESE VALUE CHAIN



Steel is an alloy of iron and carbon with high content of oxygen and sulphur. Insufficient manganese in steel results in the sulphur combining with iron to form a sulphide with low melting point, causing surface cracking. The addition of manganese in steel improves strength, elasticity, forging, welding and grain refining as well as wear resistance. Out of the total manganese alloy that is added in steel making, 30 percent is used as a de-sulphurizing and de-oxidising agent while 70 percent is used as an alloying element.

Steel, with a manganese content exceeding about 0.8 percent, is categorized as an alloy steel. Manganese intensive steel can be classified into two groups. The first group contains low amounts of manganese as an alloying agent (0.8-2%) and the second group contains high amounts of manganese as an alloying agent (11-16%) and is known as austenitic steels (Table 1).

TABLE 1: CLASSIFICATION OF MANGANESE INTENSIVE STEEL

Low Mn Content Steel	High Mn Content Steel
Construction Steel	High Mn Non-magnetic Steel
Engineering Steel	Hadfield Steel
High Strength Low Alloy Steel (HSLA)	200 Series Stainless Steel
Stainless Steel except 200 Series	

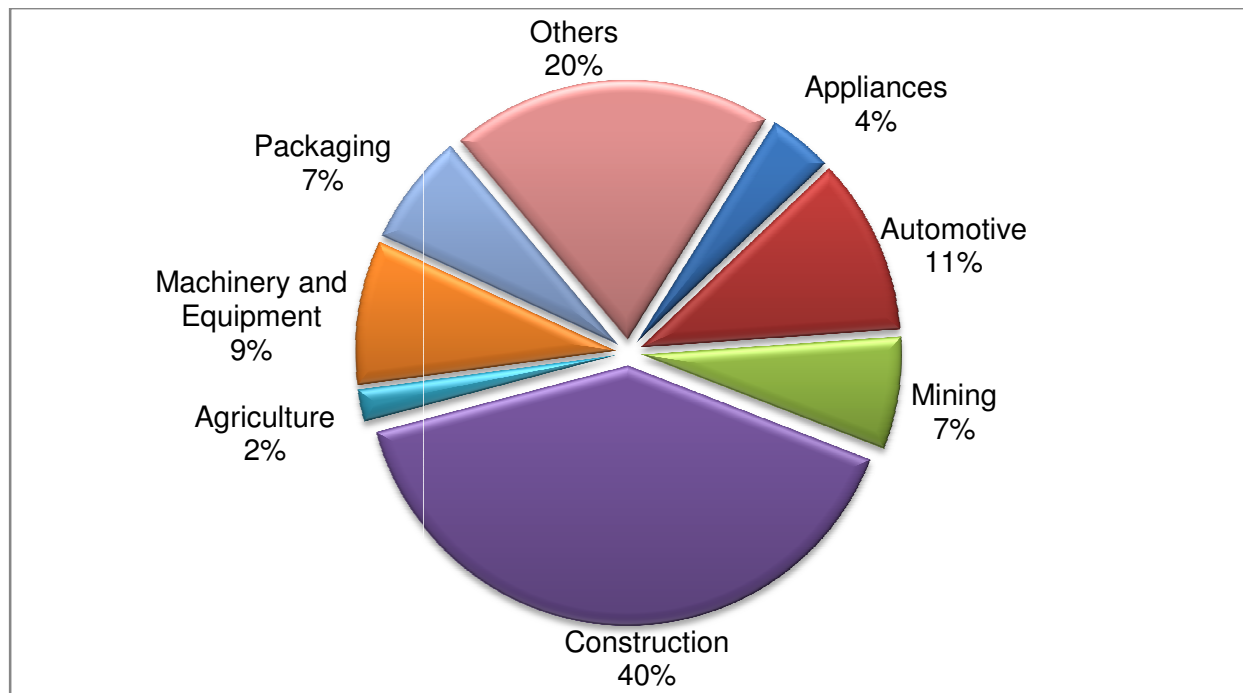
## 7. THE FUTURE ROLE OF SOUTH AFRICA'S MANGANESE INDUSTRY

### ➤ Supply and Demand

World steel output has been growing by 5 percent per annum for the past decade, reaching 1.5 Bt in 2011 and anticipated to reach 2.5 Bt to 3 Bt in the next 15 to 20 years. The demand for steel will continue being driven by emerging economies, particularly in Asia, due to the high rate of infrastructure growth and industrial expenditure. Since there is no known substitute for manganese in steel making, the strong demand for steel will continue boosting demand for seaborne manganese ore, of which most will come from South Africa. According to the CRU, manganese ore production is expected to reach 19.8 Mt (Mn contained) by 2017 while consumption is forecast to grow at an average rate of 4.5 percent per annum to reach 19.9 Mt by 2017. The expected 10 Mt per year of new manganese mining capacity in South Africa will significantly increase manganese ore production as well as ore available to the export market, so as to improve South Africa's competitiveness.

Also, the development of the infrastructure projects as well as the mining projects will include massive constructions (e.g. power stations, processing plants, rail tracks and port infrastructure), which will increase local demand for steel. Construction (40%) and mining (7%) are two of the largest steel users in South Africa (Fig. 6). South Africa currently has theoretical steel production capacity of over 11 Mt per year, with actual capacity of about 9 Mt per year. However, the country consumes about 5.4 Mt of steel annually, resulting in excess production capacity. The expected increase in local steel demand could lead to production reaching full capacity and leave room for additional new capacity. Consequently, local demand for manganese products will increase.

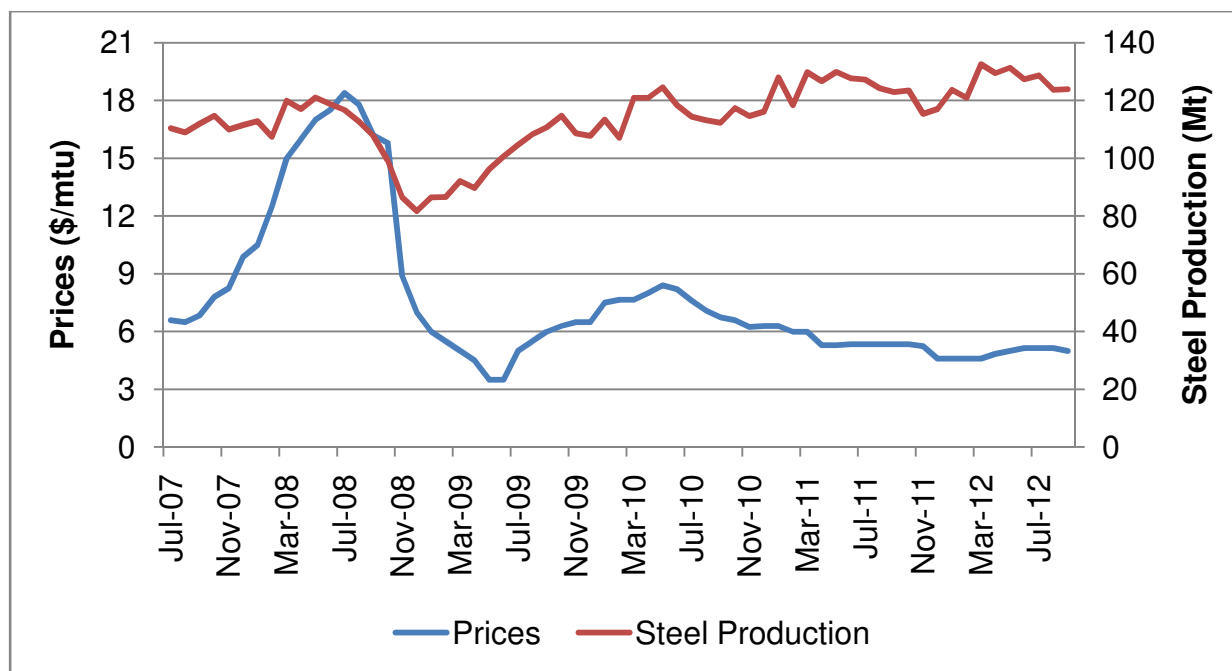
FIGURE 6: SOUTH AFRICA'S STEEL CONSUMPTION BY INDUSTRY



Source: The South African Iron and Steel Value Chain, Kumba Iron Ore

As South Africa's position strengthens, it might be able to influence prices. During the current market of lower steel demand, the increase in supply by new entrants will exacerbate the oversupply in the manganese market putting a downward pressure on ore prices, which are already low. This condition is projected to continue to 2016 and 2017. However, in the long term, the global manganese ore market balance is anticipated to return to a state of deficit and thus increase the price level. Manganese ore is currently trading at an average of about \$5/mtu, a far cry from about \$18/mtu peak reached in mid-2008, a period characterised as the end of the commodity boom (Fig. 7).

FIGURE 7: MANGANESE ORE PRICES



Sources: CRU  
World Steel Association

### ➤ Beneficiation

The government policy on mineral beneficiation in the country and the ultimate implementation of the beneficiation strategy will increase South Africa's market share in the world's manganese alloys industry. Currently, the decision to cease SiMn production by Samancor, mainly due to the power demanded to produce SiMn, is expected to lower the country's 11 percent market share. However, South Africa's ore grades are high and have low purity, which facilitates very high quality HCFeMn compared with SiMn, thus the country's market share in HCFeMn is expected to rise.

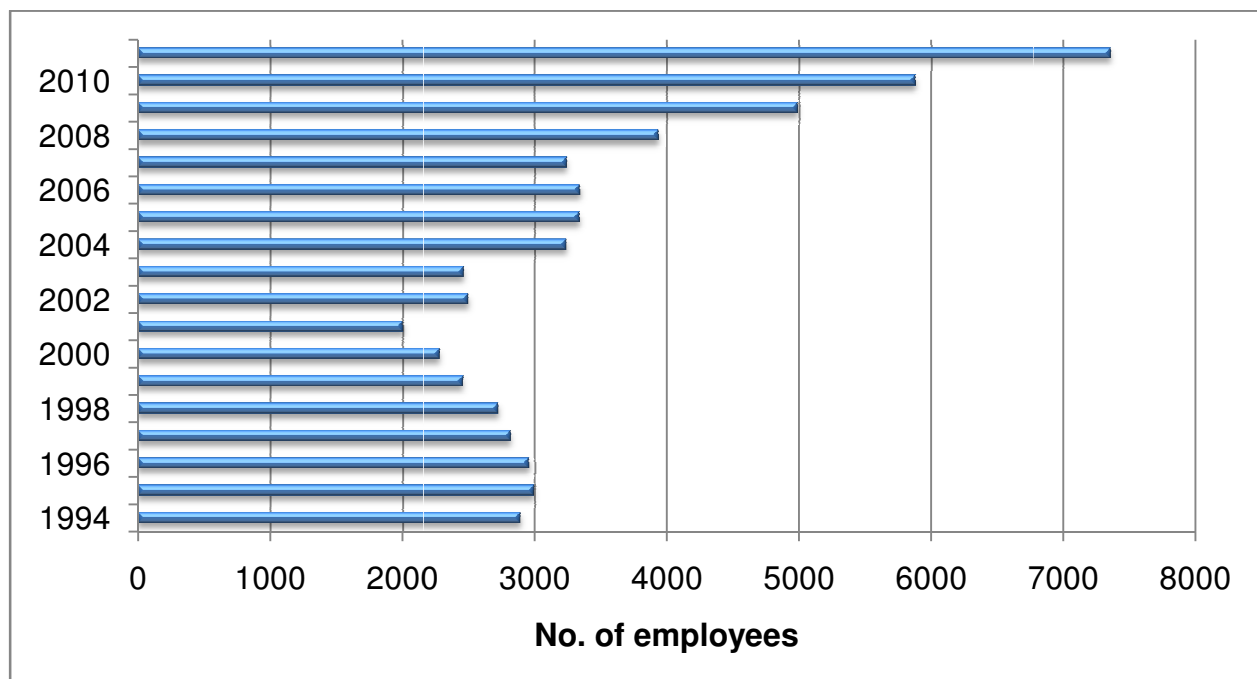
Although the HCFeMn market is about half that of SiMn due to a higher global demand for SiMn, South Africa has the opportunity to change the dynamics in the market given its position in terms of reserves and as a leading supplier of HCFeMn to overturn the market in favour of HCFeMn. This will also create an opportunity to increase ferrosilicon production capacity in the country to complement the HCFeMn.



## ➤ Employment

South Africa's manganese industry shed jobs by an average of 3 percent annually, from 2 892 in 1994 to 2 460 in 2003 (Fig. 8). However, employment grew by an average annual rate of 11.8 percent from 3 236 in 2004 to 7 356 in 2011 as demand and production capacity increased. Productivity reached a peak of 1.85 kt per employee in 2008 and appears to have declined since, reaching 1.18 kt in 2011. This could be mainly due to operations that are still under construction and not yet in production. Since these projects are mainly green-fields, they have a huge potential for job creation as well as through side stream (infrastructure, research and development, human resource development as well as inputs such as capital goods, consumables and services) and downstream value addition. The current manganese mining projects are expected to employ over 3 000 people at full production.

FIGURE 8: EMPLOYMENT IN SOUTH AFRICA'S MANGANESE INDUSTRY, 1994-2011



Source: DMR, Directorate Mineral Economics

## 8. CONCLUSION

South Africa's manganese industry has surged since 2004, evidenced by an additional new production capacity in the industry and ongoing projects aimed at increasing capacity further. The country's manganese industry already has a comparative advantage since it hosts 75 percent of the world's identified manganese resources. However, the comparative advantage has to be converted to competitive advantage by means of stable regulatory framework, infrastructure development as well as skills development and availability to maximise South Africa's value extraction from the exploitation of the country's manganese resources.

The government's policies, which are aimed at economic freedom, will continue boosting the manganese industry, as they prioritise job creating sectors such as construction, mining and manufacturing. The planned infrastructure development as well as the construction of the new mining projects is expected to drive local demand for steel, which, in turn, will increase local demand for manganese products. Consequently, manganese ore production and exports volumes are expected to double by 2016, positioning the country to become the world's leading supplier. An increase in power supply will be an incentive for local value addition of manganese and attract investments to raise the country's processing capacity in line with the beneficiation strategy.

Employment is expected to grow further as projects reach operational stages. This optimistic market will have a positive effect on the national economy in terms of increased revenue through the collection of mining tax as well as personal income tax, which will afford more developments in the country.

## 9. REFERENCES

1. *A Beneficiation Strategy for the Mineral Industry of South Africa*, June 2011
2. *Avontuur Manganese Project*, [www.aquilaresources.com](http://www.aquilaresources.com)
3. Basson, J., Curr, T.R.1 and Gericke, W. A.2, 2007, *South Africa's Ferro Alloys Industry - Present Status and Future Outlook*
4. *CRU, Bulk Ferroalloys Monitor*, [www.crumonitor.com](http://www.crumonitor.com)
5. *DMR, Directorate Mineral Economics*
6. *Emang Manganese Project*, [www.segueresources.com](http://www.segueresources.com)
7. *Ideasfirst Research, Manganese*, 2010
8. *Metal Bulletin, 5th South Africa Ferroalloys Conference, Industry Panel Discussions*
9. *Kalagadi Manganese*, [www.kalahariresources.co.za](http://www.kalahariresources.co.za)
10. *Kudumane Manganese Resources*, [www.kmr.co.za](http://www.kmr.co.za)
11. *Kumba Iron Ore*, March 2011, *The South African Iron and Steel Value Chain*
12. Samantha Herbert, 26 May 2011, *The Key to Unlocking South Africa's Manganese Potential*
13. *Segue Resources*, [www.segueresources.com](http://www.segueresources.com)
14. *Transnet Freight Rail*, [www.spoornet.co.za](http://www.spoornet.co.za)
15. *Tshipi é Ntle Manganese Mining*, [www.tshipi.co.za](http://www.tshipi.co.za)
16. *World Steel Association*, [www.worldsteel.org](http://www.worldsteel.org)