

10 YEARS OF ZINC MARKET DEVELOPMENT IN SOUTHERN AFRICA

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Abstract

The zinc industry in Southern Africa is undergoing changes with the announcement of the disposal of the Anglo Base Metals business to Vedanta Resources. This paper outlines the structure and opportunities in the zinc market in South and Southern Africa as identified through the International Zinc Association (IZA).

The South African Zinc Initiative was established in 2002 to identify key market opportunities which could be developed through leveraging the activities of the IZA's successes in other developing regions. A full analysis was carried out which identified key drivers and constraints within the zinc industry in Southern Africa. These are primarily poor market understanding of the benefits of zinc and developments in current usage. Over the past 8+ years focused projects have been managed with industrial partners.

This paper will highlight a small number of projects to show how market development can be carried out in what is generally viewed as a commodity business and reference will be made to some global initiatives. In South Africa developments in galvanized piping will be used to show how new products can replace alternative materials and how rural electrification can assist mines with Corporate Social Responsibility Programs.

Globally, the development of new alloys for the auto industry has resulted in challenges for the industry to retain steel as the material of choice for body-in-white components. New steels challenge the general galvanizing industry and new zinc die-cast alloys for the auto industry assist in retaining zinc market share. An interesting new market is the use of zinc additions to fertilizers and this will be discussed to show the essentiality of market development activities in commodity businesses.

1. Zinc Production in Africa

South Africa ranks 8th in the world in terms of zinc mine reserves⁽¹⁾. These are located in Northern Cape Province (Black Mountain, Broken Hill and Gamsberg). In 2008, the Southern African Development Community (SADC) countries sold some 125 000 tonnes of zinc concentrate. Refined primary metal output came in at around 240 000 tonnes with almost 90 000 tonnes being produced in South Africa. During 2008, it is estimated that Africa produced just over 270 000 tonnes of refined zinc.

Further development of the Gamsberg region is now likely (300kt per year) with the purchasing of Anglo American's zinc interests by the Vedanta Group. Other South African zinc projects include Letaba (4kt per year) and the reopening of the Minero Zinc's Pering mine (85kt per year of concentrate). In the rest of Africa mining activity is centered on the

Tala Hamza deposit in Algeria (likely output to be 115kt in 2011) and with new developments in Burkina Faso (the Perkoa Project) and possibly Botswana (the Kihabe Project) Africa has the potential to become a major zinc producer over the medium term.

2. Introduction to the Zinc Market

It is estimated that the global demand for zinc in 2010 was of the order of 12.05m tonnes ⁽²⁾. This can be segmented by the various First User market categories and is shown in Figure 1⁽³⁾. Whilst the percentage contribution has remained largely constant over the past decade or so, it is worth noting that around 50% of the zinc market is used for the protection of steel against corrosion, i.e. galvanizing. The remaining market segments are similar in size and represent the value adding industries typical of developed countries.

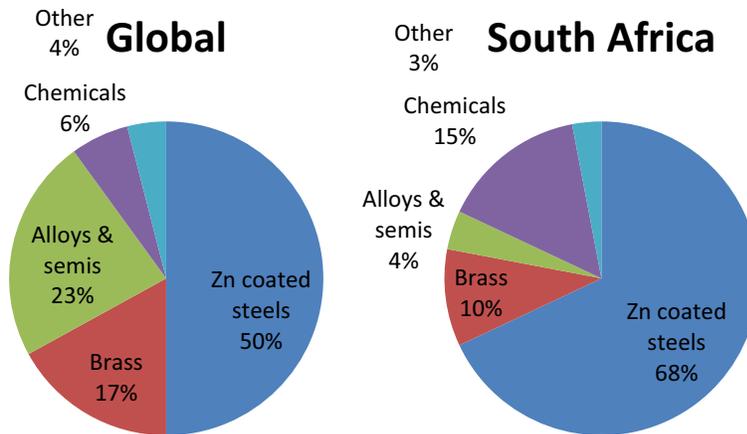


Figure 1. First User market demand for zinc (Global 2005 (ILZSG), South Africa 2008)

Whilst it is true that certain industries shift in location to accommodate cheaper factor input costs, the global picture remains largely unchanged. For instance, it is estimated that around 8.5kg of zinc is used in each automobile in OECD countries with over 16kg of zinc used in the larger North American vehicles⁽⁴⁾. This is shown in Figure 2. The key uses are shown in Figure 3. Applications are primarily body-in-white and die-casting. Body-in-white is the term used for the body panels of cars. During the 1970s, in response to the first oil crisis, focus was upon mass of the finished car. The continued use of servo-motors and other ancillaries have meant a switch in focus to mass of the body panels. The steel industry has responded with the introduction of high strength steels enabling significant reductions in mass. The IZA through its research organisation (formerly the International Lead Zinc Research Organisation – ILZRO) has managed the General Auto Partnership (GAP) Program for many years. This Program has all the worlds' key auto-steel makers as partners (some 60 in all) and has enabled the industry to ensure the galvanizability of the new steels. Perforation warranties are in place by most reputable auto makers and this has been made possible by this research effort. In addition, material substitution (primarily by aluminium) has been avoided.

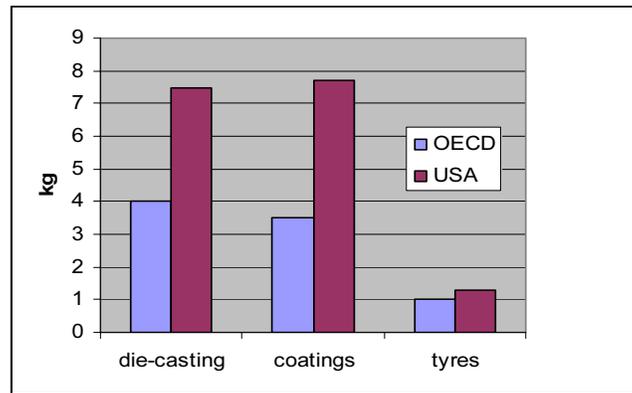


Figure 2. Key uses of zinc in the automobile industry (1996)

Die-castings are used widely in autos as shown in Figure 3. Substitution has also been avoided through alloy and process changes over the years. The die-casting industry has shifted its production base to countries such as China where labour costs are lower ⁽⁵⁾. However, the design capability has been largely retained in the developed countries where the automakers have their major design facilities.



Figure 3. Pictorial view of die-casting applications in the auto industry

2.2 Market dynamics influences upon Southern Africa

The observation above is made to put Figure 4(Zinc per capita) into perspective⁽³⁾. If one simply takes zinc consumption per capita as a measure of showing market penetration and therefore indicating market potential in those markets with low per capita consumption, market development efforts could be largely diffuse and ineffective. This information can be used to provide guidance in country selection for market development activity.

With government assistance, the South African Zinc Initiative was formed to determine the key drivers and constraints to development of the zinc industry regionally. A series of reports were written to identify key issues. Typically, zinc consumption growth follows Gross Domestic Product (GDP) growth as reflected by Industrial Production (Figures 5 and 6) ⁽⁶⁾. A similar picture can be seen for the demand for zinc within South Africa (Figure 7) ⁽⁷⁾.

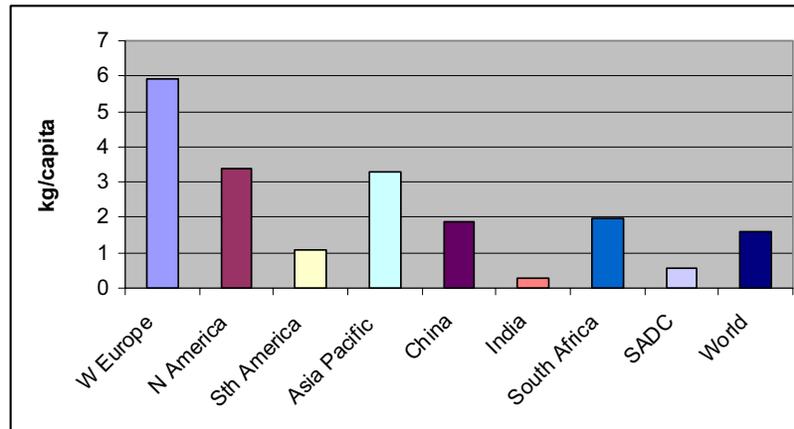


Figure 4. Zinc consumption per capita for selected countries (2004).

It can be shown that industrialisation and growth in infrastructure is a key requirement for industrial (and economic) growth and thus zinc demand. It is difficult to get reliable figures of GDFI (Gross Domestic Fixed Investment) for most Southern Africa countries (although Government Capital Formation is an equivalent measure) but, with cognisance of the infrastructure spend required in many countries, looking at the GDP growth figures does provide some indication of the potential for the zinc industry. Indeed, a recent study points to real take-off of metals demand occurring once the GDP per capita level exceeds \$5000 ⁽⁸⁾.

The growth in the regional economy would tend to favour annual zinc consumption growth rates in double digits for many years to come should a meaningful market development programme be employed.

The importance of a targeted market development strategy is clearly shown by reference to the development phases in the use of metals in economies in different stages of development. Analysis of data on various metals and their consumption indicates that there is a rapid growth potential realisable as the economy grows (measured as GDP per capita). At some point, growth tapers off with growth in consumption being more related to the contribution the material makes to the economic, environmental and cultural values of a nation. This growth region requires a close match between market development initiatives and the values of a nation. Figure 8 shows the per capita consumption values for aluminium, stainless steel and zinc ⁽⁷⁾. Logarithmic trend lines are plotted to indicate likely peak per capita consumption

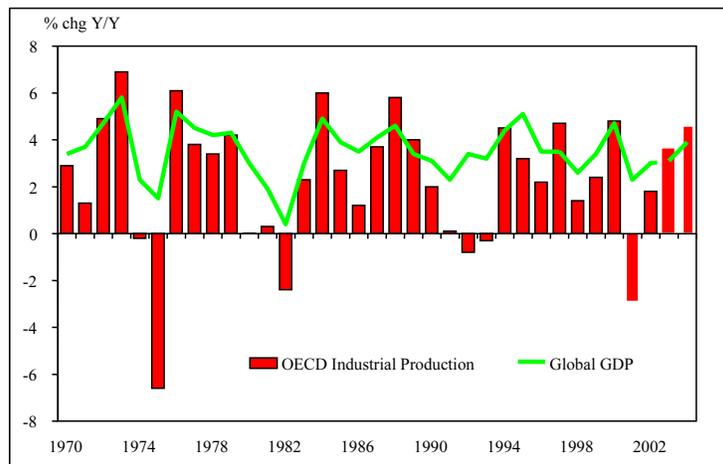


Figure 5. Correlation between GDP and Industrial Production (IP)

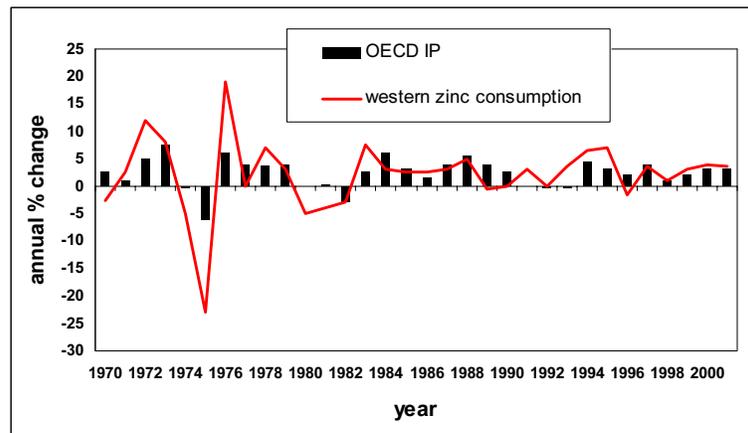


Figure 6. OECD Industrial Production relationship to zinc sales

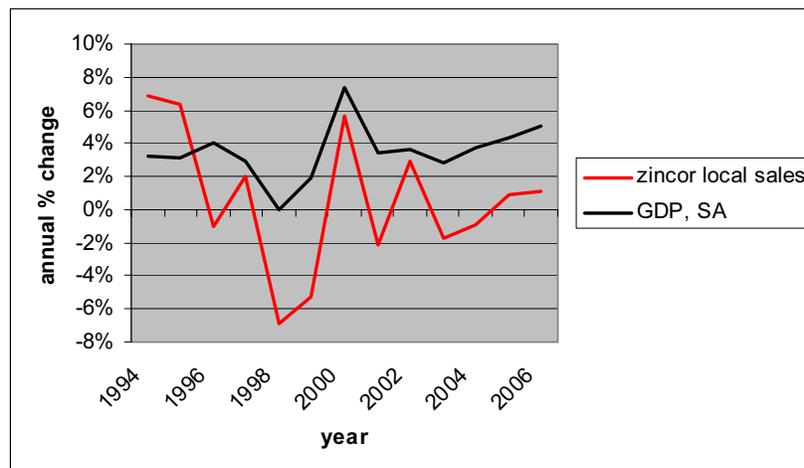


Figure 7. Domestic Zinc Sales and Economic Growth in South Africa

figures. It should be noted that successful trading countries such as Germany and Korea generally lie above the trend line. Although simplified, this analysis indicates that South Africa should be able to achieve a consumption value of 3 kg per head. This would translate into an overall zinc consumption figure of 165 000 tonnes per annum for South Africa or over 500 000 tonnes for the region as a whole taking into account only those countries with a significant industrial base. However, the key requirement for this growth is an overall growth in the economy. Reference to Figure 8 also indicates that the metals situation in South and Southern Africa appears to be close to those of Brazil and Mexico. Therefore, any market development interventions in Brazil that have shown promise could reasonably be assumed to have success regionally. The IZA has active market development programmes in Mexico, Brazil, India and China. Through careful first user selection, market development strategies which will satisfy the economic growth in the region need to be encouraged to develop the local zinc market.

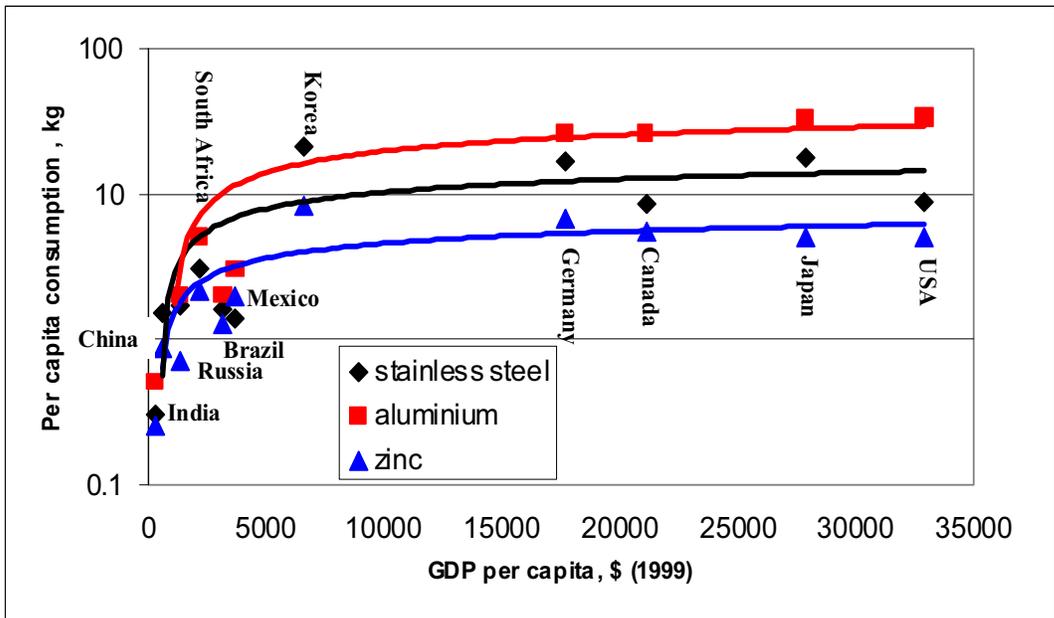


Figure 8. Per capita consumption of aluminium, stainless steel and zinc for various countries (source – Aluminium Statistical Review, Heinz Pariser, Kumba Resources)

2.3 Regional markets and zinc opportunities

South Africa, as the most developed country in the region has a distorted zinc market with around 65% of the market given over to galvanizing (wire, tube, general and continuous steel sheet) as shown in Figure 1. It can be assumed that the region as a whole is likely to show similar behaviour in that the use of galvanizing will dominate the market demand. This is not unexpected as infrastructure roll out (electricity, telecommunications and construction) is likely to dominate the opportunities available. In terms of electrification, the desire to have a regional power grid provides the sort of opportunity for galvanized transmission towers seen in South Africa some 30 years ago. Similarly, mobile phone communications are likely to dominate the telephone system as the region undergoes a technology leap, those countries having poor fixed line telephony moving straight towards mobile phone technology. Water is not particularly scarce in the region but its availability is localised. The need for water

reticulation systems will be a major focus of government expenditures. Decisions of this nature are strategic and have to be taken on a country basis. The north-south carrier pipeline built in Botswana during the 1990s is a prime example of such a strategy. Whilst much of the pipeline used GRP, many of the iron and steel feeder pipes were protected by galvanizing. Continuing in this vein, to develop communities further, the delivery of water to ensure that local needs are met (both in terms of potable supply and agricultural use) provides for significant opportunities for the galvanizing industry. Similarly, the demand for steel in construction will require galvanizing for corrosion protection.

The use of zinc in batteries is still a major market in the SADC region and Africa as a whole. It is estimated that the battery market in Africa is of the order of 15000 Zn tonnes per annum. The use of these batteries in non-grid locations is still the major market in Africa. Key battery manufacturers in South Africa and Kenya still focus on the zinc chloride cell. Although the alkaline cell lasts longer, its expense precludes its use in many areas. This market will continue for the foreseeable future.

In 2006 it was estimated that Southern African zinc consumption was of the order of 150 000 tonnes. The majority of demand remains largely driven by GDP growth and, as with South Africa, GDFI (or Government Capital Formation which is easier to measure in these countries) will largely dictate where opportunities exist. Table 1 shows the economic indicators for the SADC countries.

Figure 8 showed that real metals consumption growth is only achieved once GDP per capita figures of \$5000 are exceeded. From Table 1, it is clear that only 4 SADC countries reach this figure, although Namibia comes close. The disproportionate distribution of wealth (as represented by the Gini Index) requires some circumspect interpretation of the real growth opportunities. However, this measure should be viewed with care as South Africa is now considered to have one of the worst Gini values globally but still provides opportunities for the industry. Recent visits into Africa have indicated that growth continues as the impact of the global financial crisis has had little impact upon largely cash societies in Africa. Recent investments into Africa (primarily by China to ensure energy supply in Nigeria and Angola and food from Kenya) have been shown to provide opportunities for the industry in further supporting infrastructure growth. The continued high GDP growth in Angola is worth noting.

As a whole, 33 countries in Africa have GDP growth rates that exceed 4.5% with 10 countries coming close to 7% GDP growth in 2008 - significantly higher than the United States, Canada, Japan, the European Union, and Latin America. Only China, India and Russia have higher growth rates.

Seventeen countries carry a budget surplus forward annually; with very few carrying an enormous debt burden – of the 25 countries providing data, in only half of the countries did debt exceed 30% of GDP. Africa does not have a great debt burden currently, with the whole continent carrying approximately \$300 billion in debt. Only seven countries have debt in excess of \$3 billion (Egypt, Morocco, South Africa, Sudan, DRC, Cote d' Ivoire and Angola), carrying in excess of 50% of the debt of the whole continent. It is because of this that the 2008 financial meltdown left Africa largely unaffected. Only in Nigeria (and for a combination of unrelated issues) has banking stress been noted. Public spending continues in line with the growth in GDP.

Table 1. Some selected economic data on the SADC countries

Country	Pop., m (2005)	Size, square km	GDP (\$m) 2005	Annual change in GDP (00-04)	Change in GDP, 2005	Change in GDP, 2008	Per capita GDP, \$, 2008 ⁴	Gini Index
Angola ¹	15,9	1 246 700	14 305	7.0	15.6	15.1	5054	-
Botswana ¹	1,8	582 000	6 727	6.1	3.9	2.9	7554	63
DR Congo	57,5	2 345 095	5 222	1.4	6.2	10.2	185	-
Kenya						2.0	838	
Lesotho	1,8	30 355	983	2.9	0.8	3.5	660	63
Madagascar	18,6	587 041	4 331	2.6	4.4	5.0	468	47
Malawi	12,9	118 484	1 889	1.4	1.9	10.7	313	50
Mauritius ¹	1,2	2 040	1 221	5.2	5.4	6.6	6872	37 ²
Mozambique ¹	19,8	799 380	5 667	7.7	7.7	6.2	477	39 ²
Namibia ¹	2,0	823 114	4 235	4.4	3.6	2.9	4278	70
South Africa ¹	47,4	1 123 260	159 738	3.6	4.9	-1.8	5685	77 ³
Swaziland	1,0	17 364	1 547	2.2	2.0			-
Tanzania	38,3	945 087	12 650	6.5	6.9	7.5	520	38
Uganda						9.5	455	
Zambia ¹	11,6	752 614	4 060	4.4	4.5	6.0	1248	52
Zimbabwe	13,0	390 759	5 959	-6.0	-7.1		268	56

1. countries with some industrial base

2. index dated (1990s)

3. index dated 2001

4. World Bank, 2008

The heavy dominance of galvanizing as a percentage of zinc demand in South Africa is reflected in the region as a whole. Infrastructure development will continue and with Foreign Direct Investment (FDI) in the region increasing this will continue to be a good market opportunity. FDI into Africa had a record year in 2008, with the region showing the strongest growth of all world regions. It achieved above-average growth in terms of project numbers (114%), capital investment (136%) and jobs created (101%). The 820 FDI projects that were established in Africa during 2008 represented a doubling of 2007 figures. Although Nigeria led the league table (growing by a staggering 743% on 2007 figures and accounting for 16% of total investment into Africa) regionally other countries that had notably high growth rates in capital investment were Mozambique (459%) and South Africa (173%). Likely opportunities will continue to be in the areas of:

- Electricity transmission and distribution. Access to power is a significant problem throughout Africa. However, cooperative schemes are being developed requiring massive infrastructure spend.
- Telecommunications (towers). Most African countries have 10 times the number of cells phone users than fixed line users. Growth is exploding and providing exceptional opportunities for galvanized towers.
- Water reticulation. There is enough water in Africa it is just in the wrong place. As development proceeds new reticulation systems will be established.
- General construction (and roads and rail). Huge possibilities exist. In total, Africa has approximately 80 000 kilometres of railway lines, 20 000 kilometres of which are in South Africa with 35 other African countries having 1 000 kilometres or less.

Likewise Africa has 560 000 kilometres of paved roadways, 73 000 of which is in South Africa, with only 12 other African countries having more than 10 000 kilometres of paved roads and 13 having less than 1 000 kilometres. China has just signed a multi-billion dollar agreement with the Kenyan government (September 2009) to develop a port and transport corridor for access to Sudanese oil. In addition, China is funding oil exploration in the northern region of Kenya. Similar developments are underway in Nigeria with discussions underway in Angola.

Outside of South Africa, in the SADC region only Mauritius, Mozambique, Zambia and Zimbabwe are known to have galvanizing plants. Wider afield, there are plants in Kenya, Uganda and Tanzania. Economic development in Namibia and Angola may well provide opportunities for future plant expansion. It is unlikely that a growth rate of less than 7% in galvanized steel uptake will be experienced for the foreseeable future.

The use of light gauge galvanized steel framed buildings is gaining acceptance throughout the region. This is not just good for real zinc demand but offers the advantage that a wider awareness of galvanizing regionally should spin off into greater general galvanizing demand.

The largest opportunity for increasing zinc demand in the region lies with the adoption of zinc in fertilizers to assist with better crop yield and better crop nutrition properties.

The World Health Organisation has stated that some 800 000 deaths per year are attributable to zinc deficiency and this can be avoided. In 2008, a group of the 8 leading economists, including Nobel Laureates stated that in terms of cost-effective solutions to the world's most pressing problems (including global warming), providing zinc and vitamin A should be the first priority. Known as the Copenhagen Consensus, it showed that provision of vitamin A and zinc to 80% of the estimated 140 million undernourished children for \$60m annually, provided for benefits (in terms of better health fewer deaths and increased future earnings) of over \$1bn – a return of \$17 per dollar spent. However, food security requires more than this. Despite a population of 850m, only 2m tpy of fertilizers (or 1.2% of the global total) is consumed in Sub-Saharan Africa (excluding South Africa). As a result depletion of all soil nutrients is at crisis level. Farmers are mining nutrients rather than enhancing food productivity. Key are the Millennium Development Goals as supported at the Abuja Conference to increase fertilizer usage from an average of 8 kg/ha to 50kg/ha. However, of real importance is the need for nutritional security rather than the Green Revolution experienced in Asia. Food quality is the prerequisite for sustainable agriculture freeing Africa from the yoke of poverty. The World Bank estimates that, given present growth trends, Africa will have a food shortage of at least 250 million tonnes of grain equivalent by 2020; moreover, the region will not have the necessary foreign exchange to import such large amounts of food or the required infrastructure of ports, roads, grain stores, distribution networks etc to overcome the food shortage.

Clearly, the focus on nutrition security will become a major force in the coming years. The need for zinc (either as a supplement or to provide sustainable food security through agriculture) will grow regionally over the short term. IZASA is now active through its trade outreach programs. To date, Zambia and Kenya have been visited and significant development opportunities identified.

The lack of access to power is a major contributor to poverty. In Malawi, it is estimated that in urban areas only 7% of the population have grid power and in the rural areas this falls to less than 1%. Even in South Africa, it is stated that there are 1.6m households that will not get electric power in the foreseeable future. Zinc Air projects which provide for a light-weight battery system with sufficient power for a month for rural households have been established in various neighbouring countries as well as South Africa.

It is anticipated that the two projects above can be tied together with the spent (pure) zinc oxide from the batteries being available for use as input material into community fertilizer use. Used as demonstration projects widespread adoption is possible through direct example and experience.

Consumption figures for zinc in Africa are impossible to gather. However if a per capita consumption of 2kg per head was reached this would represent 350 000 tonnes of annual zinc consumption taking only those countries which show a significant industrial base. Of interest, is that this figure can be extended further since publication of the 2006 market report as agricultural use could add an additional 100 000 tonnes direct zinc use. It is clear that a market potential of around 500 000 tonnes should be achievable over the long term. Growth will at least track double digits as infrastructure development continues. The wild card of fertilizer use offers a real opportunity to permit more rapid consumption growth. Assuming drought conditions do not impede agricultural productivity, the key countries would be Kenya, Tanzania and Uganda.

3. Hot Dip Galvanizing in the Mining industry

As the SAIMM conference is a Mining conference, it would be remiss to not mention the use of Hot Dip Galvanizing (HDG) in the Mining Industry. South Africa has led the way globally in developing the market for HDG in the mining environment. The HDG industry is well positioned to take full advantage of serving the needs of the mining industry provided that it can showcase the merits of using HDG.

HDG is used in surface plant structural steelwork, shaft headgear, underground shaft steelwork, flooring, hand-railing, piping and conveyor systems. In South Africa, around 50% of the tonnage allocated to construction is said to be consumed by the mining industry. This would represent 6000 tonnes (of zinc or around 100 000 tonnes of steel) in 2006.

The first known use of HDG in mining shaft steelwork was at the Kinross Gold Mine in 1975. This performed well for the working duration of the mine.

Mining projects tend to be large and this is a market where the industry has developed good working partnerships. One example would be the delivery of over 8000 tonnes of HDG structural steelwork to site over an 18 month period during the construction of the Anglo Platinum Rassimone Mine in 2000. Use of HDG and the Partnership Programme allowed the mine to be commissioned 3 months ahead of schedule allowing an additional revenue generation of \$50m (2000 prices).

Whilst HDG is first prize for the zinc industry in terms of corrosion protection, the ubiquity of zinc for corrosion protection ensures that zinc is used. Typically, where paint systems are used, a zinc primer or paint coat of some sort is used. Whether it is Inorganic Zinc (with a typical thickness of 80µm and 85% solids as zinc), Epoxy Zinc or Zinc rich epoxy, zinc finds its way into the corrosion protection system.

4. Conclusions

It can be stated that simple analysis of zinc consumption per capita provides no guidance for market development opportunities within the SADC region.

The opportunities provided by the rapid economic expansion of the region cannot be over-emphasised. Whilst it is difficult to estimate predictive figures for zinc consumption growth, it is likely to be in double digit numbers for the foreseeable future. This could be further ramped up by investment in HDG plant in countries such as Angola and Zambia where significant industrial opportunities exist. The development of a HDG industry will result in a profile and awareness of the zinc business which can provide for future opportunities in other market sectors such as electroplating and chemicals (fertilizers).

Beyond this, new technologies such as Zinc Air batteries can support community sustainability and development programmes and ensure retention of African culture. The use of light-weight galvanized steel frame housing provides a ubiquitous solution to rural housing pressures and the traditional residential building market. This opportunity is being driven with various partners and will provide for real tonnes and develop a whole new industry within the next few years.

The IZA has demonstrated the need to have market development programs despite the often heard cry that zinc is a commodity. Without the IZA's intervention, the substitution of galvanized steel for aluminium would be widespread within the auto industry.

The unique opportunities posed by the region are wide and encompassing with the key properties of zinc, in terms of its essentiality as an element essential for human development and well-being, able to offer a contribution to the development of the region.

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