South Africa's Trade in Environmental Goods: Investigating Bilateral Potential Exports to select developed and emerging countries (2007 to 2013)

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By

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PLAGIARISM STATEMENT

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ABSTRACT

Climate change is one of the greatest problems confronting the world today. It threatens many economies, health systems, and livelihoods, especially for the rural poor in many developing countries. As a consequence, climate change is increasingly generating global concerns and receiving global attention. This emergent trend is accompanied by rising recognition of the role played by international trade in environmental goods (EGs) as a means to deal with the environmental pressures associated with climate change.

Trade liberalization in EGs plays an important role in the diffusion of cost effective environmental goods and services, thus advancing global climate change action and sustainable development. Paragraph 31 (iii) of the Doha Ministerial Declaration of 2001 provides a mandate to WTO members to enter into multilateral negotiations on 'the reduction, or the elimination of tariffs and non-tariff barriers (NTBs) to environmental goods and services. To this end, some WTO members are currently negotiating a plurilateral pact (Environmental Goods Agreement) with the view to move beyond the long impasse in the Doha Round of negotiations. The impasse in the Doha round of negotiations is attributed to a number of contentious issues, with the lack of a universally agreed definition on what constitutes environmental goods and services being the most sensitive one.

In light of the increasing global demand for EGs, most emerging economies are experiencing higher growth rates relative to developed countries and are expected to grow even faster in the future. Furthermore, emerging economies, including South Africa, are increasingly becoming important exporters and importers of EGs and stand to benefit from existing and potential export opportunities in the global market.

The South African environmental goods and services industry is strong yet small in terms of international standards. However, considering its growth rate over the past few years, it is interesting to note that it is considered as an important exporter and importer of some environmental goods and services.

Against this background, the aim of the study is to examine if South Africa is currently exploiting potential bilateral trade opportunities in select developed (United States of America, United Kingdom and Germany) and emerging (Brazil, India and China) economies or trade is limited due to high MFN tariffs. The results of the trade-chilling analysis indicate that trade between South Africa and the select group of economies is limited. However, the

limited or lack of bilateral trade cannot be attributed to high tariffs and may be as a result of Non-Tariff Barriers (NTBs). The analysis also revealed areas of export opportunities for South Africa to explore and expand future exports to the selected markets. Although there were few areas where high tariffs were responsible for the limited bilateral trade, the results of the study suggest that low tariffs are imposed in most of the EGs exported by South Africa. For trade policy practitioners and negotiators, the implication of this study is that NTBs are important obstacles to EGs trade and should be given close attention in the context of WTO negotiations. For this reason, further studies aimed at identifying NTBs responsible for limited bilateral trade is important as this will enable international trade policy practitioners to enhance their understanding and to effectively address them, thus improving South Africa's export prospects in the selected markets. For businesses, the study results provide valuable export market information which identifies areas of export opportunities to focus on in the future.

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GLOSSARY OF TERMS

AGOA	Africa Growth and Opportunity Act
APEC	Asia-Pacific Economic Cooperation
BRICS	Brazil, Russia, India, China and South Africa
COMESA	Common Market of the Eastern and Southern Africa
EAC	Eastern African Communities
EGA	Environmental Goods Agreement
EGs	Environmental Goods
GW	Gigawatt
HS	Harmonised system of Classifications
ICTSD	International Centre for Trade and Sustainable Development
IPAP	Industrial Policy Action Plan
IPCC	Intergovernmental Panel on Climate Change
ITC	International Trade Centre
LDCs	Least Developed Countries
MFN	Most-Favoured Nation
MW	Megawatt
NGP	New Growth Path
NTBs	Non-Tariff Barriers
OECD	Organization for Economic Cooperation and Development
Solar PV	Solar Photovoltaic
SACU	Southern African Custom Union

SADC	Southern African Development Communities
SPS	Sanitary and Phytosanitary Measures
TBT	Technical Barriers to Trade
TDCA	Trade Development and Cooperation Agreement
UNFCCC	United Nations Framework Convention on Climate Change
UNCTD	United Nations Conference on Trade and Development
UNEP	United Nations Environmental Programme
WTO	World Trade Organisation

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Chapter One: Introduction

This study examines bilateral trade flows between South Africa, select developed (United States of America, United Kingdom and Germany) and emerging (India, China, and Brazil) economies with the objective to establish whether South Africa is fully exploiting current bilateral trade opportunities in environmental goods (EGs) in these markets. Also, this study seeks to establish if the lack or minimum bilateral trade is accounted to high average Most Favoured Nation (MFN) tariffs imposed by select developed and emerging countries on exports. To do this, the study will use a quantitative methodology (trade-chilling analysis) to examine bilateral trade flows between 2007 and 2013 and average MFN tariffs imposed on South African exports into the selected economies. It will use two sources to obtain research data, one from the International Trade Centre (ITC) and the other from the World Trade Organisation (WTO) to source trade flow and average MFN tariff statistics, respectively.

1.1 Background

Climate change presents one of the greatest global challenges today, characterised by far-reaching socio-economic and development challenges and vulnerabilities. Some of the challenges include, increased temperatures causing more frequent or intense natural disasters such as floods, and significant loss of biodiversity (Mulemba, 2010). Vulnerabilities associated with climate change include, but are not limited to, severe water shortages and/or flooding due to potential changes in rainfall patterns and food insecurity resulting from changing temperatures which leads to shifts in crop growing seasons (Stewart, 2014).

According to the 2014 report by the Intergovernmental Panel on Climate Change (IPCC), the effects of climate change are already occurring on all continents and across the different oceans. In North America, for example, extreme coastal storm events have caused excess mortality and morbidity, particularly along the east coast of the United States, and the gulf coast of both Mexico and the United States.

Although climate change is an inherently global challenge, its negative impact is not felt equally across the world. For instance, whilst developed countries continue to experience mild effects of climate change, the same cannot be said for developing and least-developed countries (LDCs) because of their high vulnerability to the negative effects of climate change (UNFCCC, 2009). For instance, the rural section of the population in these economies heavily relies on rain-fed agriculture and other natural resource-based activities to sustain

their livelihood. Consequently, this exposes them to long-term droughts in the event of climatic stress which in turn reduces agricultural output and food availability. The 2014 IPCC report further indicates, for example, that one third of African people already live in drought-prone areas and approximately 220 million people are exposed to droughts each year. The high vulnerability of these countries to climate change is further compounded by lack of or inadequate resources necessary for the implementation of appropriate adaptation[1] and mitigation[2] measures to address climate change (Mbirimi, 2010). According to the Climate Action of the European Commission, examples of adaptation measures include, but are not limited to: using scarce water resources more efficiently; and building flood defences (European Commission, 2015).

In light of the damaging effects of climate change, there's growing global recognition of the importance to keep a balance between economic growth and environmental sustainability as well as the need to switch to cleaner and low carbon environmental goods and services. Accordingly, many economies around the world are increasingly exploring and implementing different adaptation and mitigation measures or programmes as a means to address climate change. These include adoption and use of environmental goods and services. For that reason, global demand for environmental goods and services has been increasing steadily over the past few years. In this connection, international trade (accompanied by appropriate regulations) in environmental goods (EGs) is deemed as an important means to alleviate the damaging effects of climate change on the environment as well as achieving a balance between economic growth and environmental sustainability. In addition, trade policy in EGs is considered important as it can facilitate the reduction or elimination of trade barriers such as tariffs and NTBs which can improve global market access to more efficient and affordable environmental goods and services (Vossenaar, 2014).

Common examples of trade barriers currently inhibiting the cross-border diffusion of EGs include a lack of fiscal incentives for clean energy production; weak environmental regulation and enforcement, and tariffs on environmental goods. Other trade barriers include

[1] Anticipation of adverse effects related to climate change and taking the appropriate action to prevent or minimise potential damage, or taking advantage that may arise.

[2] Mitigation refers to the efforts to reduce or prevent emissions of greenhouse gases. Mitigation can mean using new technologies and renewable energies (UNEP, 2015).

NTBs and subsidies levied on fossil fuels and other conventional energy sources (Viljoen, 2012).

According to Sugathan (2013), there is currently no agreement among WTO Members on the definition and scope of EGs, despite a reference to definition of environment industry by the OECD as "activities which produce goods and services to measure, prevent, limit or minimise or correct environmental damage to water, air, soil, as well as problems related to waste, noise, and ecosystems".

The WTO provides a negotiating framework and platform for the reduction or elimination of trade distortive barriers to trade in EGs among its members. However, not much progress has been made thus far in these negotiations.

The growing global demand in EGs, presents export opportunities for many emerging countries, including South Africa. The South African EGs industry is estimated at £2.5 billion, about R18.7 billion (Department of Trade and Industry in the United Kingdom, 2010). According to Bucher *et al* (2014), South African exports, between 2001 and 2014, almost doubled from just US$2 billion to about US$4 billion. In addition, South Africa was among the major exporters of EGs such as, but limited to, Chlorine (HS 280110) and purifying machinery for gases (HS 842139). In the SADC region, South Africa is the leading exporter of EGs. This is a good indication that South Africa is actively participating in the global trade of EGs.

In order to ensure that South African producers of EGs benefit from potential export opportunities, industry information should be made available to inform both business and policy (trade and industrial development) decisions. However, the challenge is little is understood about the South African EGs industry, let alone its trade performance in global market owing to insufficient sector-specific literature, thus making it challenging for EGs producers and exporters to identify existing opportunities in the global market.

1.2 Research problem

Over the past few years, there has been a significant growth in the global demand for environmental goods. This growth trend is propelled by increasing global trade in EGs and efforts aimed at addressing effects associated with climate change. This presents export opportunities for emerging countries given the significant growth rate of their domestic

environmental goods and services industries over the past few years. However, the current challenge is that little is known about the South African EGs industry, due to insufficient literature on the industry. This is because existing literature has been biased by exclusively focusing on developed economies thus overlooking emerging countries. It is envisaged that the study will broaden the scope of existing literature by identifying export opportunities for South Africa EGs producers in the selected developed and emerging economies.

Through the provision of new information on the South African environmental goods and services sector, the final results of the research is expected to benefit the domestic business community to develop a better understanding of the sector. This is will enable them to make informed and better decisions, and to identify priority environmental goods for trade promotion and development in the market of select economies. From a policy perspective, it is envisaged that the research will inform and assist the public sector to monitor the general and trade performance of the EGs sector in order to provide adequate industrial and trade policy support. Moreover, the research will benefit trade negotiators involved in EGs negotiations by providing them with relevant information that can be used as a basis for negotiation positions.

1.3 Research questions

The main research question is:

- Is South Africa fully exploiting current bilateral trade opportunities in EGs in the markets of select developed and emerging economies?

From the main question, a number of other questions the study attempted to answer include:

- Has the global demand for EGs, according to the three EGs classification lists, been on the rise between 2007 and 2013?
- What are the potential export market opportunities for EGs exported by South African in select developed and emerging markets?

1.4 Overview of research methodology

This study employs a quantitative method on EGs trade flows and average MFN tariffs on imports of the select economies known as “trade-chilling” analysis. In short, trade chilling analysis entails:

- select countries import a product in large values/quantity, but not from South Africa; and
- South Africa globally exports the same product in large values/quantities, but not to one of the countries selected above.

The International Trade Centre (ITC) statistical database "TradeMap" is used to source international trade flow data (between 2007 and 2013), expressed in US$ million, between South Africa and the selected developed and emerging countries. Information on applied average MFN tariffs is sourced from the WTO's tariff database. The scope of data coverage is as follows: (i) WTO 153 environmental products list, (ii) APEC list of environmental products; and (iii) list of specific single-use environmental goods.

1.5 Delimitations of the study

The researcher recognises that using the "trade-chilling" analysis comes with limitations. According to Viljoen (2012) the limitations associated with the trade-chilling analysis include the inability to account for NTBs, consumer tastes and preferences and product classification systems that may not be comparable at a detailed level. Other limitations relate to data restrictions relating to lack of a universally agreed definition on EGs. In addition, the challenge of dual-use on some EGs also presents additional limitations. Viljoen (2012) further noted that the issue arose in the discussions pertaining to tariff cuts on EGs. These discussions are based on the Harmonised System (HS) Codes of commodity classification which are only harmonised up to the six digit-level. Any classification beyond the six-digit level is not standardised among the WTO Members. For this reason, most goods which can be classified as EGs are aggregated together with non-environmentally goods. For example, pumps for liquids, whether not fitted with a measuring device; other pumps (HS 831381) have a dual application because they can be used by wind turbines to store energy and in other applications. Thus, if tariffs are reduced at the HS 6 digit-level on dual-purpose goods, it would imply that tariffs are reduced on goods that have an environment application, but can also be used in non-environmental goods.

In order to achieve the best comparison of tariffs imposed on South African EGs exports by the selected economies, the trade-chilling analysis uses average MFN tariffs. Based on the nature of the trade-chilling analysis, it does not take into account preferential tariffs, therefore

requiring the researcher to keep in mind such trade agreements (if they exist) in the analysis. For this reason, the trade-chilling analysis is limited.

The research has a number of boundaries. These include the researcher not having used questionnaires as a means to gather information about the topic. The reason for this was based on the study being quantitative in nature thus not requiring the need to use questionnaires given that they are commonly an ideal research tool for conducting qualitative research projects.

A select number of economies were specifically chosen and purposely sampled in the study with the view to ensure that all the unique characteristics of the population were adequately represented and captured. The notable characteristics include, but not limited to, the different economic size and market shares of the sampled countries, especially between emerging and developed economies.

The selected developed economies include Germany, United Kingdom (UK) and United States of America (USA). These countries are among the world's largest and traditional exporters and importers of EGs. They are characterised by saturated markets and have been recently experiencing low growth rate over the past few years. It is important to note that South Africa is party to a number of preferential trade agreements that cover a portion of the list of EGs it exports to the selected developed economies. This includes the Trade Development and Cooperation Agreement (TDCA) and the African Growth and Opportunity Act (AGOA). The United King and Germany are party to the TDCA, whilst the USA is party to the AGOA. Under these international trade agreements, zero-import tariffs are applied by select developed and emerging economies on some South African exports of EGs.

The study's sample covering select emerging economies include China, Brazil and India which all three are South Africa's BRICS partners. The selected emerging economies are small players in the global EGs market, accounting for a smaller global market share relative to the traditional players (e.g. UK and USA). However, they have demonstrated significant export growth over the past few years. Since South Africa is not party to a preferential treatment agreement with its Brazil-Russia-India-China-South Africa (BRICS) counterparts, all its EGs exports into the selected emerging economies are imported at average MFN tariffs.

The time period used in the study covers a series of seven years between 2007 and 2013. The researcher chose to use a long-term continuous time interval with the aim to facilitate for an effective trade trend analysis.

Chapter two: Literature review

2.1 Introduction

This section reviews existing and related literature to the topic of the study with the view to ensure a clear formulation of the research question as advised by Welman and Kruger (2001).

The literature review begins by discussing the remedial role of international trade on the effects associated with climate change. To get a better understanding of the global EGs market, the researcher presents literature on the recent developments in the global EGs sector such as the (i) state of play in the multilateral trade negotiations on EGs and, (ii) current global trade patterns of EGs. The researcher proceeds further and presents literature on trade barriers levied on the importation of EGs.

2.1.1 Recent Developments in the Global EGs Industry

To understand whether South Africa is exploiting current potential trade opportunities, the researcher first needs to study global trade trends in EGs.

According to Bucher *et al* (2014), the size of the global market for EGS, irrespective of the classification used, has been growing significantly over the past decades, owing to increased global demand in EGS. For instance, the global market was estimated at US$866 billion in 2011 and is expected to rise to US$1.9 trillion by 2020. In terms of growth rates by region, the fastest growth rates are found in Asia, the Middle-East and Africa, which had growth rates between 9-10% in 2011. On the contrary, the EGs market in the developed regions had growth rates ranging between 5% and -1% during the same time period. A study by Bak (2015), found that the global exports in EGs are four times larger than global aerospace exports and two-thirds the size of global automotive exports.

Using the OECD classification list of EGs, global exports tripled from approximately US$231 billion in 2001 to US$656 billion in 2012. During the same period, the leading exporters were developed countries (e.g. Germany, UK and USA). Interestingly, some emerging countries especially those in Eastern Asia and BRICS have increasingly gained importance in the global export market of EGs. Notably, Malaysian and Thai exports, for example, increased from just below US$ 2 billion during 2001 to just over US$ 7 billion and US$ 6 billion, respectively, in 2012 (ITC, 2014).

Bucher *et al* (2014) identified the fastest growing EGs sub-sectors in terms of percentage growth in 2011 to include resource recovery; clean energy systems and power, and waste management equipment which accounted for 13%, 11% and 10% respectively. In terms of market size, the largest markets in 2011 were in solid waste management water utilities; clean energy systems as well as power and water treatment works accounting for US$145 billion, US$130 billion, and US$116 billion in spending, respectively.

Looking at the growth prospects of the global EGs and services industry, the market is predicting continued growth in the coming years. According to Blazejczak *et al* (2009), global spending, at 2004 prices and exchange rates, is predicted to rise from US$584 billion in 2004 to US$1, 209 billion in 2020.

2.1.2 Overview of the WTO multilateral trade negotiations on environmental goods

According to Vossenaar (2013), increasing market access to and use of EGs and services through international trade can yield a number of benefits including sound environmental protection, and improved energy and resource efficiency. According to predictions, complete elimination of tariffs and NTBs can increase trade by an average of 7% (Sugathan, 2009). Against this background, the launch of the Doha Round of negotiations in 2001 singled-out EGs and services in Paragraph 31 (iii) of the Doha Ministerial Decision for progressive multilateral trade liberation (Sugathan, 2013).

According to Melo and Vijil (2014), the anticipated outcome of the Doha multilateral negotiations is to facilitate for a more liberalised trading system for EGs and services. This is essential for the diffusion of cost-effective environmentally friendly goods. To date, there has been limited progress in these negotiations. The deadlock is attributed to a number of contentious issues with the most significant challenge being the lack of a common definition on EGs and the criteria to be applied in defining these goods. At the centre of the definitional challenge is the issue on "dual use" EGs under the six-digit Harmonized System (HS) Codes of commodity classification[3]. The problem with this classification system is that it covers products that are considered as "dual use" environmental goods i.e. goods that are normally used for environmental purposes (e.g. photovoltaic cells, HS 854140) and those that have

[3] The HS classification system is an international standardised system of names for the classification of goods that are traded among partner countries. The system also serves as the basis for tariff reduction negotiations on EGs in the context of the Doha Declaration (Steenblik, 2005)

non-environmental application (e.g. pumps, HS 841861). The issue of "dual use" poses great difficulties in these negotiations because tariff liberalization may imply that tariff reduction/elimination may potentially go beyond EGs to also cover non-environmental goods. As a result, some WTO Members are reluctant to reduce or eliminate tariffs on any dual use products at the six-digit level (Sugathan, 2013).

In light of the deadlock in the negotiations, numerous negotiation proposals have been tabled for Members' consideration on the question of what should constitute EGs and services. This includes proposals made by the Friends of environmental goods and services Group; and Asia-Pacific Economic Cooperation (APEC). Other proposals made outside the context of the WTO were tabled by the OECD, and the World Bank.

(a) WTO 153 list of EGs

The proposal by the Friends of environmental goods and services Group consists of a list of products and product categories with a total of 153 HS-codes as EGs. These products are identified at HS 6 level and categorised into twelve (12) groups, namely: air pollution control; management of solid waste, hazardous waste and recycling systems; remediation of soil and water; renewable energy plant; heat and energy management; waste water management and potable water treatment; environmentally preferable products; resource efficient technologies; natural risk management; natural resource protection; noise and vibration abatement; and environmental monitoring, analysis and assessment equipment (Steenblik, 2005).

(b) APEC list of EGs

According to Viljoen (2012), the Asia-Pacific Economic Cooperation (APEC) economies proposed a list of candidate EGs consisting of 54 products at HS six (6) level. The list contains EGs divided into a number of categories, such as renewable energy generation; environmental monitoring, analysis and assessment equipment, air pollution control; management of solid and hazardous waste and water treatment, and waste-water management.

(c) OECD list of EGs

The EGs list proposed by the OECD is purely illustrative and not exhaustive, developed for analytical purposes and not trade negotiations. The list of EGs is divided into three (3) broad

categories, namely: pollution management; cleaner technologies and products, and resource management (Sugathan, 2013).

(d) World Bank list Of 43 environmental goods

The World Bank list of 43 environmental goods was derived from a broader list of 153 EGs proposed by the Friends of Environmental Goods. The World Bank list identifies a variety of climate-friendly goods which include solar collectors and system controllers, wind-turbine parts and components, stoves, grates and cookers, and hydrogen fuel cells, among others (Sugathan, 2013).

(e) Specific-Single Use EGs

According to Vossenaar (2005), specific single-use EGs are those that are used exclusively or predominantly for environmental purposes. It is important to note that this definition excludes "dual-use" goods, which may have both environmental and non-environmental applications.

Vossenaar (2010) has identified some EGs that can be seen as single-use. These include wind turbines (HS 850231); solar PV devices and light-emitting diodes (HS 854140); solar water heaters (HS 841919); biofuels (HS 220710 and (HS 220720); hydraulic turbines (HS 841011 and HS 841012); heat pumps (HS 841861); thermostat (HS 903210); compact fluorescent lamps (HS 853931) and electric cars and certain hybrid vehicles (HS 870390).

Since the tabling of proposals by WTO Members, the WTO Doha negotiations on the liberalisation of EGs suffered a longstanding impasse at some stage. However, the impasse has been recently resolved under the Environmental Goods Agreement (EGA) negotiations. The EGA is a standalone agreement negotiated between about a quarter of the WTO Membership, together accounting for more than 86% of global trade in EGs[4]. Negotiations on EGA were formally launched on 8 July 2014. By taking the next step of eliminating tariffs and expanding product coverage to include additional environmental technologies, these negotiations intend to build on the initial commitment taken under the Asia-Pacific Economic Cooperation (APEC) to reduce tariffs (by 5% or less) on a list of 54 EGs. These products include those related to (i) renewable and clean energy generation, (ii) air pollution control,

[4] These include the United States of America, Australia, Canada, China, Costa Rica, the European Union, Hong Kong, Japan, Korea, New Zealand, Norway, Singapore, Switzerland, Chinese Taipei, Iceland, Turkey and Israel.

(iii) water and wastewater treatment, among others. Given that this Agreement is negotiated as plurilateral arrangement, it is envisaged that once a critical mass is achieved, the benefits of this Agreement will be applied to all WTO Members on the MFN basis.

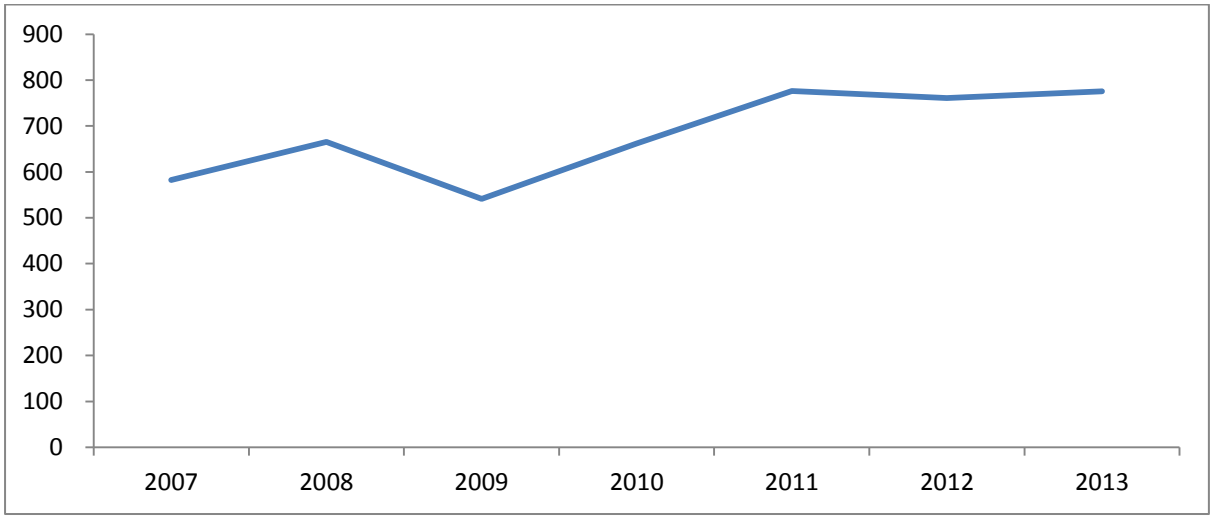
At the time of writing this research paper, EGA participating Member States were engaged in discussions focused on proposals made on various product nominations, considered as EGs, based on the draft list of 650 tariff lines compiled by the Chairperson (ICTSD, 2016).

2.1.3 Overview of Global International Trade Trends on EGs

The growth experienced in the global EGs market over the past decade has led to a significant increase in international trade on EGs. A study conducted by International Trade Centre (2014) found that EGs exports (using the OECD classification list) in value have tripled from approximately US$231 billion in 2001 to US$656 billion in 2012. During the same period, the leading exporters were predominantly developed countries. The study further established that some emerging countries especially those in Eastern Asia and BRICS have increasingly gained importance in the global export market of EGs. Notably, Malaysian and Thai exports, for example, increased from just below US$ 2 billion during 2001 to just over US$ 7 billion and US$ 6 billion, respectively, in 2012.

Global export trend of EGs between 2007 and 2013 is reflected in figure 1 below. It is evident from the figure below that the global export market experienced significant growth during the seven year period.

Figure 1: Global exports of environmental goods 2007-2013 (Unit: US$ billion)

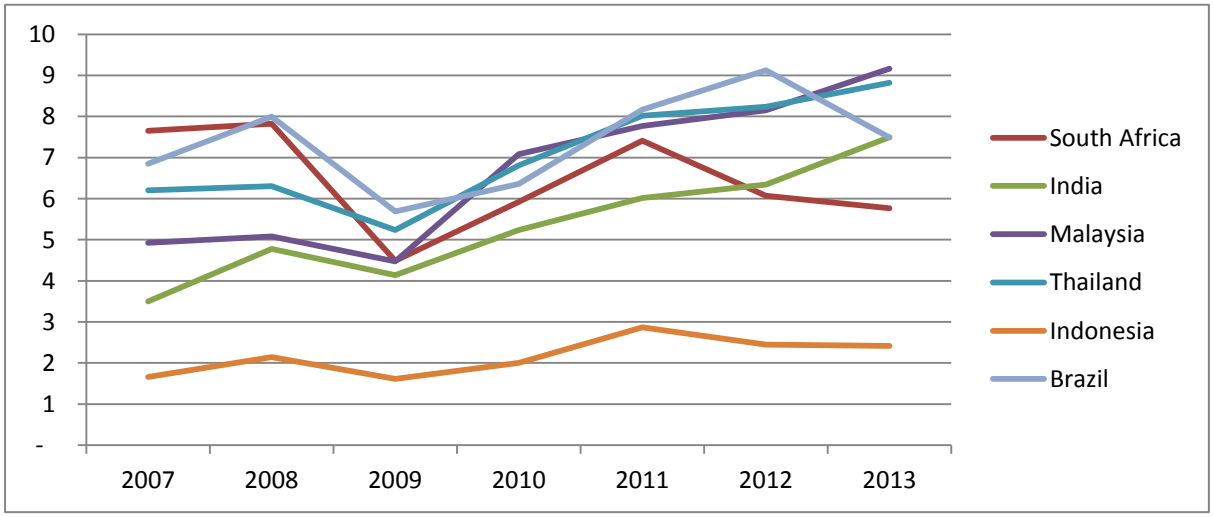


Source: International Trade Centre (2014), Using the OECD classification of EGs list.

According to Bucher *et al* (2014), global exports in EGs have risen from approximately US$582 billion in 2007 to US$775 billion 2013. On average, global exports grew by 33% during the same time period. Bucher *et al* (2014) further found that the global export market is dominated by developed countries such as Germany (US$112 billion in exports), United States (US$65 billion in exports), Japan (US$52 billion in exports), Italy (US$38 billion in exports) and France (US$26 billion in exports). China (US$61 billion in exports), Republic of Korea (US$18 billion in exports), Mexico (US$16 billion in exports) and Chinese Taipei (US$12 billion in exports) were some of the leading emerging countries who are among the leading global exporters of EGs during the same time period. South Africa also featured among these countries and ranked at the 28th position.

Similar to the global export market, the global import market remains dominated by developed countries including the USA (US$85 billion in imports), Germany (US$56 billion in imports), France (US$28 billion in imports) and Japan (US$21 billion in imports) during the same time period. In terms of export growth, emerging countries is significantly growing, notably since 2007. For example, Indian and Malaysian exports increased from just below US$5 billion during 2007 to over US$7 billion and US$9 billion, respectively, in 2013. Brazilian, Indonesian and Thai exports increased from just below US$7 billion during 2007 to just over US$7 billion, US$2 billion and US$8 billion respectively in 2013 (see figure 2).

Figure 2: Select emerging economies exports of environmental goods 2007-2013 (US$ billion)



Source: International Trade Centre (2014), Using WTO classification of environmental goods.

Looking at EGs export growth prospect, Stewart (2014) predicts that by 2017, China and the European Union will realise growth in exports of more than US$200 billion and would be running surpluses of US$41 billion and US$59 billion, respectively. At the same time, the United States of America is predicted to reach exports of US$70 billion also resulting to surpluses. Similarly, Japan's and Korea's exports are expected to match those of the United States of America and would reach trade surpluses between US$45 and US$50 billion.

According to 2014 statistics from the International Trade Centre and using the WTO 153 list of EGs, the top five (5) global EGs exports in 2013 are (HS 848180) taps, and valves (US$51 billion in exports); (HS 392690) articles of plastics (US$50 billion in exports); (HS 854140) Solar PV devices (US$47 billion in exports); (HS 840999) parts for diesel and semi-diesel engines (US$35 billion in exports); and (HS 847989) machines & mechanical appliances (US$34 billion in exports). The top five (5) imports were (HS 854140) Solar PV devices (US$ 52 billion in imports); (HS 392690) articles of plastics of other materials (US$51 billion in imports); (HS 848180) taps, and valves (US$50 billion in imports); (HS 847989) machines & mechanical appliances (US$35 billion in imports); (HS 840999) parts for diesel and semi-diesel engines (US$33 billion in imports). During the same time-period, the global market was estimated to have grown by an annual average of 35%.

2.1.4 Overview of the South African EGS industry

In light of the adverse implications of climate change on the environment and economy, governments across the world are increasingly recognising the potential of a green economy in facilitating broad-based economic development. A green economy can potentially create substantial new employment opportunities, facilitate skills development, energy efficiency improvement and address the effects of climate change on the environment. Similarly, the South African government has jumped on the bandwagon and is taking part in this global initiative through a number of policies such as the 'New Growth Path' (NGP) strategy document. The NGP has identified the EGs industry as one of the main employment drivers in the country. The other government's policy instrument includes the 'Industrial Policy Action Plan' (IPAP) which spells out government's strategic plan to develop the EGS industry and improve energy efficiencies in the country (Maia *et al*, 2011).

Bucher *et al* (2014), suggests that South Africa has a strong domestic EGs industry, which developed around the domestic mining industry and is considered as a prominent global competitor. Owing to a strong environmental regulatory framework and growing public

environmental concerns, the demand for EGs and services has been on the rise, particularly in the mining and energy sector. This has created an enabling climate for domestic environmental firms to develop strong expertise in this area to an extent that some are already exporting EGs and services to the global market. These include, for example, Metago Engineering Pty Ltd and Team Maroc which specialises in EGs and services in the area of mining, and mineral processing. Consequently, the strong domestic expertise developed over the past few years has significantly improved South Africa's export competitiveness in global markets. For this reason, the domestic industry is recognised as a world leader in specific niche areas such as management of mine waste; mine rehabilitation and conservation and bio-diversity management services.

According to a study conducted by the Department of Trade and Investment in the United Kingdom (2010), the size of the South African EGs and services industry is relatively small compared to other international industries and is estimated to be £2.5 billion (about R18.7 billion).

A study by Bucher *et al* (2014) indicates that between 2001 and 2014, South African exports almost doubled from just US$ 2 billion to about US$4 billion. During the same period, South Africa was the 3rd largest exporter of purifying machinery (HS 842139), and exported approximately US$ 1 867 million (accounting for 11.3 % share in global exports) in 2013. Moreover, South Africa was the biggest exporter of Chlorine (HS 280110) during the same year and secured the 7th position among the top global Chlorine exporters. This translated to exports of approximately US$ 6 million and accounted for 4% share in the total global exports of Chlorine (Bucher *et al*, 2014).

Van Niekerk and Viviers (2014) evaluated a consolidated list of 39 low-carbon EGs from 2006 to 2012, using various qualifying criteria[5], with the aim to identify new areas of export opportunities for South Africa in the global market, as well as, identifying EGs that have a positive economic and environmental effect on the economy.

The study results indicated that the top-five (5) EGs with a positive effect on both the economic and the environment were: photosensitive semiconductors (HS 854140); towers and lattice masts (HS 730820); electrical control and distribution boards > 1kW (HS

[5] Using Relative Comparative Advantage (RCA), and Decision Support Model (DSM).

853710); torque converters (HS 848340); and static converters (HS 850440). Using the Decision Support Model (USM), the best overall intensive export opportunities according to their export value were: (HS 854140) photosensitive semiconductors to Germany (USD 922.3 million) and (HS 853710) electrical control and distribution boards > 1kW to USA (USD 838.6). The best overall extensive opportunities, according to their potential export value, were (HS 854140) photosensitive semiconductors to China (USD 953.2 million) and Hong Kong (USD 363.2 million). Although the study focuses on economic and export potential of 39 low-carbon environmental goods that South Africa produces, the study has some limitations. One limitation is that the methodology used to identify areas of export opportunities for South Africa only focuses on EGs trade flows and does not take into account the trade distortive effect of tariffs and NTBs imposed by importing trading partners. As a result, the study has not been able to effectively estimate new export opportunities for South African EGs producers, taking into account existing trade barriers. Another limitation relates to limited product coverage of the study since it exclusively focuses on low-carbon[6] EGs rather than considering the wider scope of EGs.

In a research article by Viljoen (2012), a quantitative study, using the trade chilling analysis on three EGs product categories, investigated the effect of tariffs on trade in EGs in southern and eastern Africa. Two questions that were addressed in the study are relevant to the topic of this research paper. First, are countries in the region fully exploiting potential trade opportunities among each other or are high tariffs on EGs limiting trade? Second, where do potential export opportunities lie for EGs exported by South Africa?

The results of the study by Viljoen (2012) indicate that the lack of trade cannot be attributed to high tariffs on most EGs in the majority of the countries in southern and eastern Africa. In other words, tariffs have not been the main barrier to trade in EGs in the region. One limitation to the study is that it is limited in terms of coverage as it only focuses on countries in the region. In that connection, the current research paper aims to close the gap by expanding the scope of coverage to cover select developed and emerging countries as destination markets for South African exports.

[6] Low carbon environmental goods are defined as those goods that emit low or zero greenhouse gases during end use.

2.1.5 Tariff and Non-Tariff Barriers to EGs

International trade in EGs is affected by various obstacles in the form of tariffs and non-tariffs barriers (NTBs). These obstacles indirectly increase the cost of accessing relevant inputs to facilitate environmentally sustainable production methods and consumption patterns (Bucher *et al*, 2014).

2.1.5.1 Tariffs impacting trade on EGs

A tariff[7], also called customs duty, is a tax levied upon goods as they cross national boundaries, usually by the government of the importing country. Most EGs are not exempted from tariffs unless in the case where an importing country applies zero duty on them, usually under an existing preferential treatment agreement. A number of previous research studies arrive at a common conclusion that trade in EGs are generally not significantly impeded by tariffs, in comparison to NTBs. However, according to Alavi (2007), tariff rates for EGs are generally lower in developed countries than in emerging economies. This can be explained by the persistent imposition of high tariff rates by importing countries. This is normally done with the intention to protect and develop their domestic EGs production capacities. For instance, some large emerging economies have used tariff protection to support the development of their domestic capacity to manufacture EGs associated with renewable energy deployment, as in the case of wind-energy in India. In China, tariffs on EGs can be as high as 40 percent. Viljoen (2012) evaluated the level of average MFN tariffs and NTBs on EGs traded amongst select countries involved in Southern African Development Community (SADC), Common Market of the Eastern and Southern Africa (COMESA), Eastern African Community (EAC) trade negotiations with the objective to establish if these trade measures are a hindrance to bilateral trade on EGs among these regions. The study found that despite protectionist behaviour exhibited by some countries in the regions, average MFN tariffs are not accountable for the limited bilateral trade. In that sense, the study assumes that NTBs may have been the factor for constrained bilateral trade in the region.

De Melo and Vijil (2014) measured and compared tariffs applied on EGs against those of 120 countries at HS-6 level by country income group using the combined list of 411 EGs

[7] A tariff, also called customs duty, is tax levied upon goods as they cross national boundaries, usually by the government of the importing country.

classification list by the WTO. Tariffs were measured based on MFN applied tariff rate and ad-valorem tariff equivalents (AVEs), respectively. Two elements emerge from the findings of the study: (i) where EGs were compared with 'other' goods; tariffs prove to be usually lower on average, and (ii) tariffs imposed on EGs are highest for low-income countries and are very low for high-income countries.

2.1.5.2 Non-tariff barriers impacting trade in EGs

In the context of WTO EGs negotiations, non-tariff barriers (NTBs) are considered to be the most challenging and complex trade barriers[8]. Interestingly, these barriers are prevalent in many economies irrespective of size (Alavi, 2007). Some common examples of NTBs include certification and local content requirements; sanitary and phytosanitary measures (SPS); subsidies and differential industrial standards.

International trade in wind turbines, for instance, are affected by local content requirements, certification and standards attributed to the fact that the wind turbine industry receives substantial government support in most countries, thus, to some degree, limiting wind turbine trade. According to Alavi (2007), currently there are no universal standard rules for certification and approval of wind turbine installation at the international level. As such, diverse rules or practices for certification and approval procedures applied in different countries effectively act as a barrier to trade. This is because of the high and prohibitive costs associated with compliance requirements. Another type of NTB affecting international trade of wind turbines includes local content requirements. This policy measure requires manufacturers to either shift their foreign manufacturing bases to the host country or procure a certain percentage of intermediate inputs from local parts manufacturers to meet the local content percentage set by the regulators. Consequently, such policy measure can be an obstacle for wind turbine exports, especially those who have not established local manufacturing facilities in the host country or trading partner.

As for international trade in biofuels, the major NTBs facing biofuels are varying product standards, tax incentives and subsidies implemented to support domestic producers (Alavi, 2007). These measures are commonly noted to be present in emerging economies because

[8] NTBs, in the context of EGs, refer to international trade measures other than tariffs that restrict the importation of EGs.

most biofuel producers are too small to develop, hence warranting domestic support and protectionism. Product standards, for example, restrict and in some cases completely curtail international suppliers from competing with domestic producers. For instance, standard regulation governing the quality of fuels in the EU, limit the use of ethanol blends in fuels to only 5 percent. Europeans use "B5", a standard diesel blended with 5 percent biodiesel made from rapeseed oil. In contrast, "B25" is common in Brazil whilst "B20" is used in the US and Canada. Furthermore, E10 gasohol which is a blend of 10 percent ethanol and 90 percent petrol is commonly used in the US, while a 25 percent to 75 percent blend is standard in Brazil.

NTBs confronting EGs such as wood and wood products include quantitative restrictions, SPS standards and technical barriers to trade (TBT), as well as environmental-related barriers (Alavi, 2007). Quantitative restrictions include measures such as total import bans, import quotas, and import licensing procedures. The EU, for instance, imposes import quotas on board and panel products. The US and Canada imposes stringent inspection and control requirements on solid wood packing material consisting of pallets, crating and dunnage. The US imposes these measures on the claim that there is high risk of pests in solid wood packing material. Forest certification is another trade barrier on timber products, particularly imposed on exports originating from developing countries. This measure is imposed with the objective to ensure that imported products into the market originate from sustainably managed forests. As a consequence, only products that satisfy the prescribed standards will qualify and be labelled as certified forest products.

Another trade barrier affecting trade on EGs is tied-aid bilateral arrangements. The main idea behind tied-aid bilateral assistance is enabling donor countries to build business networks and linkages in the host country. Usually under such arrangements, the host country is required to give priority to EGs or hire personnel originating from the donor country. Therefore, tied-aid can be a barrier for exporters who do not have such arrangements or programmes in the host country (Alavi, 2007).

Fliess and Kim (2008) surveyed 136 exporting firms from ten OECD and non-OECD countries with the view to document the incident and impact of non-tariff measures that are perceived to act as barriers to trade in seven sectors of EGs and associated services. The study found that exporting firms in Australia, Brazil, Canada, Chile, France, Germany, India, Japan, Korea, and the United States certainly faced a variety of obstacles when traded abroad.

The trade barriers include, among others, problems associated with product testing and certification requirements, customs procedures, regulations on payment, challenges with intellectual property protection, government procurement procedures, technical regulations and standards. The study further found that certain types of reported barriers appeared to be more prevalent in certain markets. For example, customs procedures pose a problem predominantly in developing and transition economies with e.g. stringent intellectual property protection were particularly witnessed in China.

2.1.6 Conclusion

The purpose of the literature review was to build an understanding of the global and South African EGs industries.

According to previous studies, the global market of EGs is exponentially growing due to increasing demand and trade in EGs. International trade plays a pivotal role in facilitating the diffusion of cost-effective EGs and addressing the negative effects associated with climate change, particularly for emerging and least developed countries. Moreover, trade in EGs facilitates for investment in EGs and promotes growth and development. However, various trade barriers in the global market have to the potential to compromise the role of trade in EGs. These trade barriers refer to tariffs and non-tariffs. There is increasing academic consensus that tariffs are commonly higher in developing countries compared to those in developed countries.

Paragraph 31 (iii) of the 2001 Doha Ministerial Declaration provides for WTO members to enter into negotiations on the reduction or elimination of tariff and NTBs to environmental goods and services. To this end, a quarter of the WTO membership are currently negotiating a separate trade in environmental goods pact-Environmental Goods Agreement (EGA). Frustrated with the longstanding deadlock in the Doha Round negotiations, some Members of the WTO have opted to move ahead to attempt on concluding a plurilateral agreement for further liberalization of trade in EGs.

The global market continues to be dominated by countries in the developed world. However, emerging countries have had steady growth rates over the past few years, interestingly higher than those of developed countries. The growth presents potential export opportunities for emerging countries.

Chapter Three: Research Methodology

3.1 Introduction

As mentioned in Chapter 1, the purpose of this study is to investigate whether South Africa is fully exploiting potential bilateral trade opportunities on EGs in select developed and emerging economies or whether exports from South Africa are limited due to high average MFN tariffs.

This chapter describes the methods and procedures used, including the research design, research questions, and sample population. In addition, the conceptual framework and data collection are presented and a discussion on the data analysis is also provided.

3.2 Research design

This research project was conducted utilizing a quantitative research design. According to Penman (2006) "research design is a plan for selecting the sources and types of information used to answer research questions", the results of which provide a framework for assessing the results and presenting relationships between variables being considered. A literature review was done to ensure a clear formulation of research questions as advised by Welman and Kruger (2001). The review of literature (see Chapter 2) demonstrated that average MFN tariff and/or NTBs may be responsible factors for limited bilateral trade in EGs between trading partners. Also, the literature review revealed that trade in EGs is on the rise and that the role of most emerging countries in global EGs trade is increasingly becoming significant. However, from the review of literature it was noted that current literature in this field tended to be biased in terms of scope which only focused on EGs trade in or among developed countries, with the exception of the EAC-COMESA-SADC study conducted by Viljoen in 2012.

In order to answer the research question of whether South Africa is exploiting potential bilateral trade opportunities in the markets of select developed and emerging economies, or whether trade is limited on the account of high average MFN tariffs, the trade-chilling analysis needed to be conducted. Accordingly, this paper employs the 'trade-chilling' analysis on exports and imports between 2007 and 2013.

The trade-chilling concept, according to Sandrey and Fundira, (2008) and Fundira *et al*. (2009), refers to a quantitative research approach that identifies new bilateral trade

opportunities between trading partners, but most importantly, it is useful because it assists in determining whether countries are fully exploiting potential trade opportunities among each other or whether bilateral trade flows are limited due to high average MFN tariffs. A trade-chilling analysis would take the follow approach, for example, between South Africa and Egypt trade flows in a specific product category: South Africa exports a specific product in large quantities and Egypt imports the same product in large quantities, but there is little or no bilateral trade of this product between South Africa and Egypt. In that case, bilateral trade may be 'chilled' between the two countries and one of the reasons for the lack of trade might be high average MFN tariffs.

Other quantitative and qualitative analyses and projections of the welfare effects of tariff liberalisation, which could have been used in this study, only focus on trade flows excluding MFN average tariff analysis. For this reason, such research approaches are unable to estimate new trade opportunities that might open up as result of trade liberalisation. Since the trade-chilling exercise goes beyond trade flow analysis by incorporating tariff analysis applied on imported goods, it is the most suitable research methodology for this research project.

The researcher employs average MFN tariffs as part of the trade-chilling analysis. The rationale behind this is that average MFN tariffs provide the best possible means to conduct a tariff comparison between South Africa and the selected trading partners. However, it is important to point out that the researcher took into account existing preferential trade agreements (e.g. TDCA and AGOA) with the view to identify areas of export opportunities beyond those identified using average MFN tariff analysis (trade-chilling).

Due to the nature and length of this research project, observations, surveys and personal interviews would have not provided the accuracy and consistency that trade flow and average MFN tariff data provided for such statistical analysis (trade-chilling).

3.2.1 Population, Sampling and Unit analysis

The population relevant to this research project consists of the EGs global market from the perspective of select developed and emerging economies as importers and/or exporters of EGs. These economies are at different levels of economic development. As such, it is important to note that they demonstrate different characteristics in terms of (i) market share in the total global EGs trade market, and (ii) the size and growth rate of their respective domestic EGs sectors, among others. For example, despite having demonstrated low growth

rates over the past few years, developed economies are characterised by large EGs markets. In contrast, emerging economies have been characterised by significant growth rates, indicative of the growing demand in EGs and increased participation of emerging economies in the global EGs market. It is on this basis that these countries have been selected as the focus of this study.

According to Welman and Kruger (2001), researchers rely on their experience, ingenuity and or previous research findings to deliberately obtain units of analysis in such a manner that the sample they obtain may be regarded as being representative of the relevant population. To ensure this degree of representation, the sample was derived from the population of relevance. As such, non-probability sampling in the form purposive sampling (Buksh, 2006) was used in this study since the researcher opted to focus on a specific group of countries as the basis for the data collection and trade-chilling analysis. This kind of sampling consisted of the following select country groupings: (i) developed countries which consisted of the United States of America (USA), United Kingdom (UK) and Germany; and (ii) emerging countries consisting of Brazil, China and India. The rationale of sampling in the study was to deal with a smaller and manageable sample size which represented the population, thus enabled the researcher to reduce the time and cost of the study. The same reasons also applied when the researcher was sampling specific-use environmental goods.

3.2.2 Data collection

The time-series trade flow data (between 2007 and 2013) contained within this research project and used in the trade-chilling analysis were sourced using the International Trade Centre (ITC) database "TradeMap", at 6 HS-digit level, and expressed in US$ (million). ITC provides on-line access to the world's largest trade database and presents indicators on export performance, international demand, alternative markets, among others. The "TradeMap" covers international trade flows of over 220 countries and 5 300 products defined at 2, 4 and 6 digit level of Harmonised System. Furthermore, this on-line database platform operates in an interactive environment thus allowing users to create various and desired product groups or classifications e.g. APEC list of EGs goods (ITC website). For these reasons, the "TradeMap" database lends itself the role to achieve the objectives of this research project.

The trade flow data on EGs were collected for South Africa; and select developed and emerging countries in accordance to the (i) WTO 153 environmental products list, (ii) APEC

list of EGs; and (iii) specific single-use EGs list. The EGs classification for the 153 by the WTO is contained in Annex 1, whilst the APEC list of EGs and specific single-use EGs lists are contained in Annex 2 and 3, respectively.

Data on average MFN tariffs applied on imports from South Africa when exported to the selected country groups were collected from the WTO Tariff database. The WTO Tariff database contains comprehensive information on average Most-Favoured-Nation (MFN) applied tariff regimes for all Members (WTO website).

In order to respond to research questions (a) and (b), as described in Chapter 1, trade flow data was collected with the aim to give an overview of global trade flows in EGs, as well as, in select developed economies and emerging economies according to the each of the three EGs lists. Thereafter, trade data on imports and exports of each select country group were collected from the ITC "TradeMap" database.

With regards to data collection on single-use EGs list, time- series data (from 2011 to 2013) on global market, as well as, on select country groups was collected in accordance to imports, exports and average MFN applied tariffs for four select specific single-use EGs: (i) solar water heaters; (ii) wind turbines; (iii) compact fluorescent lamps; and (iv) solar PV. In order to avoid the data collection process from being unnecessarily lengthy and cumbersome, the researcher opted to focus on only four single-use EGs. The researcher used Windows Excel to capture, organise and manipulate the data. Similarly, data on average MFN applied tariffs for the other EGs lists were sourced from the WTO statistical tariff database. From this, the researcher considered the data with the view to analyse trade flows from 2011 to 2013, percentage of world trade in 2013; the average applied tariffs on single-use environmental in the respective selected country groups; and to identify the main global exporters of the select single-use EGs.

Prior to the collecting data process, the researcher registered an account and created product groups on the ITC Trade Map database according to the (i) WTO 153 EGs list, (ii) APEC list of EGs; and (iii) specific single-use EGs list.

3.2.3 Data analysis

In the first step of the data collection process, the researcher collected trade flow data according to the following headings on a separate Excel spreadsheet: (i) each country's

imports from the world to denote demand for EGs; (ii) each country's imports from South Africa to denote export market opportunities; (iii) South Africa's exports to the world to establish supply potential; (iv) South Africa's exports to each country according to the selected country group to denote existing bilateral trade opportunities. From this, the researcher calculated an average under each heading (e.g. South Africa's exports to the world etc.) based on a seven year time period starting from 2007 to 2013. This was done with the view to get values that are a typical representation of the data sets. In addition, the researcher collected data on average MFN applied tariffs corresponding with each heading.

In order to facilitate the trade-chilling analysis and minimise any possibility of error, the researcher consolidated each of the calculated averages derived from each spreadsheet into a single data spreadsheet for each selected country. To do this, the researcher used the "VLOOKUP" function to ensure consistency between the various spreadsheets. This step is important for the trade-chilling exercise because it ensures consistency during the consolidation stage of the final results of the EGs traded with the world but not those traded on a bilateral basis.

The consolidated data spreadsheet was then sorted, and narrowed down. This way, the researcher was able to identify a number of EGs that are exported to the world but not traded amongst South Africa, select developed and emerging economies. It is important to note that different thresholds and cut-offs levels were generated at the end of this process. This is because among the three EGs product lists and select economies used to narrowing down the data, some demonstrated EGs with higher trade values than others. Accordingly, the methodology used to narrow down the field in each EGs classification is as follows:

Considering the WTO 153 EGs at HS 6 level

- the threshold was set at US$ 90,000 i.e. (a) select developed and emerging economies imports from the world averaged at least US$ 90,000 over seven years to denote the demand side and (b) South African exports to the world averaged at least US$ 90,000 over seven years to denote the supply-side potential for South Africa. In total, this left us with 100 HS EGs from the total of 105 EGs.
- The second threshold was set at US$ 20,000 where (a) imports into select developed and emerging economies from South Africa and (b) exports from South Africa into select developed and emerging economies were below US$ 20,000 over the seven

years to indicate the existence of trade between South Africa and these countries. In total, this left us with 71 EGs at HS six.

- The third threshold narrowed the data selection further by examining EGs where (a) global exports from South Africa over seven years in total were US$3 million and (b) global imports into select developed and emerging economies over the last seven years were at least US$3 million in order to highlight the EGs where the trade opportunities are significant. This left us with 35 EGs at HS 6 (see table 7).

With regards to the APEC and single-use environmental goods list (HS 6):

- The first threshold for UK, Germany, USA, and China was set at US$ 500, 000 i.e. (a) imports of these countries from the world over the seven years denote the demand side. For India and Brazil the first threshold was set at US$ 400, 000 i.e. (a) imports of India and Brazil countries from the world over seven years denote the demand side and (b) South African exports to the world averaged at least US$ 400, 000 over seven years to denote the supply-side potential.
- The second threshold was set at US$ 20, 000 where (a) imports into UK, Germany, USA, and China from South Africa. Threshold was set at US$ 10, 000 over seven years where imports into India and Brazil from South Africa and (b) exports from South Africa to the above countries were below US$ 20, 000 and 10, 000, respectively, to indicate the existence of trade between South Africa and the select economies.
- The third threshold narrowed the data selection further where (a) global exports from South Africa over seven years in total were at least US$ 500,000 and (b) global imports into UK, USA, Germany and China were at least US$ 3 million, highlighting the EGs where the export opportunities lie. Global imports into India and Brazil were at least US$ 2 million to highlight EGs where the export opportunities are significant (see tables 9, 10 and 11). From this, the researcher analysed the research results.

3.2.4 Data interpretation

The results of the trade-chilling analysis, including MFN import tariffs, were analysed and interpreted with the view to answer to the research questions according to the:

(i) Supply potential: where South Africa's exports to the world are high;

(ii) Demand side: where importer's imports from the world are high;

(iii) Limited or no bilateral trade between the countries: where South Africa's exports to select importing countries are low or non-existent; and

(iv) Bilateral trade opportunities: where South Africa's exports to the world and global imports by select importing countries are high (Nhyondo *et al.* 2010).

The interpretation of results on the average MFN applied tariffs of the select importing economies is as follows:

(i) Low MFN average applied tariffs on EGs, ranging between 0% and 5%, indicate that tariffs are not the main factor prohibiting current bilateral trade ;

(ii) Moderate MFN average applied tariffs, ranging between 5% and 10%, indicate that the lack or limited bilateral trade is not attributed to high tariffs;

(iii) High MFN average applied tariffs on EGs above 10% indicate that tariffs are the main factor prohibiting bilateral trade.

3.3 Conclusion

The purpose of this Chapter was to describe the research methodology used to answer the research questions. To do this, the researcher formulated a research design for the study with the view to select the appropriate sources and types of information used to assess the study results and present the relationships between variables being considered. In terms of sampling, the researcher used non-probability sampling or purposive sampling on the population. The trade data used in the study project was collected from the ITC and WTO Tariff databases, respectively. In order to respond to the main research question, the researcher used the "Trade-Chilling" analysis to narrow down the field in each of the three EGs classifications. With regards to data analysis and interpretation, the results of the trade flows including MFN import tariffs, were analysed and interpreted in accordance to the procedure as explained above.

Chapter 4: Results of the Study and discussions

4.1 Introduction

Over the past few years, the global environment goods and services industry has seen a significant growth. What's interesting to note is that whilst emerging economies are experiencing strong market growth rates, market growth in developed countries remains low.

The high global market growth rates present positive export prospects for emerging economies, including South Africa. However, current literature can't indicate with clarity whether South Africa is fully exploiting potential bilateral trade opportunities or whether high tariffs are an obstacle to bilateral trade? Furthermore, existing literature does not reveal much about the nature of trade barriers inhibiting South African EGs exports. In this regard, Chapter four (4) sets out to present the research results, including relevant quantitative data (tables and figures) that address the research question and discusses these results. Finally, a summary identifying the main points of the research findings are provided.

4.1.1 WTO 153 EGs list

The table below shows trade in EGs, according to the WTO 153 classification list, by select developed and emerging countries between 2007 and 2013. According to table 1, global trade of EGs grew between 2007 and 2013. For instance, global imports and exports on EGs increased by 35.1% and 33.3%, respectively, over the seven year period (see table 1 and 2).

According to the trade data, exports by select developed and emerging countries declined by 0.11% and 0.3, respectively, during the same time period, whilst imports increased by 25.3% and 81.9%, respectively.

In 2013, select developed economies accounted for 7% and 23% share of global exports and imports, respectively. Conversely, trade by select emerging economies is insignificant and accounted for a low share of global exports (1.5%) and imports (13.5%).

Table 1: Exports and imports of 153 WTO EGs list (US$ million)

Exports							
	2007	2008	2009	2010	2011	2012	2013
World	1 868 363.42	2 137 489.62	1 733 754.94	2 115 399.29	2 488 828.75	2 442 428.60	2 491 067.29
Select	190 226.73	211 771.18	171 705.92	199 048.93	232 103.50	229 430.40	168 616.90

developed economies							
Germany	102 514.88	118 191.98	92 195.99	106 200.48	126 163.01	118 453.18	123 218.66
United Kingdom	22 692.03	23 303.10	17 935.16	20 390.53	23 051.33	22 870.19	24 352.93
United States of America	65 019.83	70 276.10	61 574.77	72 457.92	82 889.15	88 107.03	21 045.32
Select emerging economies	**60 276.67**	**78 687.65**	**66 349.46**	**96 176.38**	**114 196.52**	**110 734.22**	**38 350.68**
China	42 273.44	58 089.53	52 032.34	78 657.69	92 597.30	89 205.65	17 602.23
India	3 500.75	3 500.75	4 135.66	5 238.02	6 016.66	6 339.02	7 493.44
Brazil	6 850.23	7 993.26	5 691.54	6 358.64	8 168.73	9 122.35	7 487.26
Imports							
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
World	**596 846.99**	**684 257.56**	**557 232.20**	**681 913.21**	**793 536.90**	**779 655.91**	**806 560.33**
Select developed economies	**148 252.07**	**163 680.41**	**126 152.15**	**157 688.45**	**187 639.62**	**183 306.67**	**185 837.62**
Germany	46 843.23	57 036.91	46 594.23	59 103.95	67 626.82	58 125.97	58 144.21
United Kingdom	24 108.86	24 303.62	17 713.59	20 953.77	25 546.64	23 291.68	25 803.12
United States of America	77 299.99	82 339.88	61 844.33	61 844.33	77 630.74	94 466.16	101 889.02
Select emerging economies	**59 996.41**	**74 866.03**	**67 798.83**	**88 858.47**	**104 283.44**	**104 033.70**	**109 141.80**
China	41 691.34	50 862.12	47 792.49	63 476.78	73 009.90	71 663.124	75 301.84
India	7 970.18	10 185.83	8 864.72	10 483.88	14 264.32	15 078.38	14 016.23
Brazil	7 024.28	10 057.34	8 283.08	11 417.37	12 733.99	13 072.58	14 752.46

Source: TradeMap, International Trade Centre (2014)

In 2013, Germany was the major exporter and accounted for 73% of the total EGs exported by select developed economies. Among the select emerging economies, China was the leading exporter and accounted for 45% of the total EGs exported by select emerging economies.

4.1.2 APEC list of EGs

Table 2 shows global trade in EGs by select developed and emerging countries in accordance to the APEC list of EGs. The table shows that global trade in EGs grew between 2007 and 2013. For instance, global imports grew from approximately US$431 billion in 2007 to US$575 billion in 2013. At the same time, global exports grew from approximately US$426 billion to US$599 billion.

Total exports by select developed economies grew from approximately US$152 billion in 2007 to US$186 billion in 2013, whilst total imports increased from approximately US$109 billion in 2007 to US$132 billion in 2013. Exports by select emerging countries also increased from US$31 billion in 2007 to US$71 billion in 2013, whilst imports declined from approximately US$383 billion to US$74 billion during the same time period.

In terms of global market share, select developed economies accounted for 33.3% and 22% of global exports and imports, respectively in 2013. Select emerging economies accounted for a low share of total global exports (12.8%) and imports (13.1%) during the same time period.

By comparison, the export growth of select emerging economies (130%) outstripped that of select developed economies (21.9%) between the period under review. This implies that emerging economies are increasingly integrating themselves into EGs global value chain.

Among the select developed countries, Germany was the major exporter of EGs and accounted for 52.4% of total exports in 2013. At the same time, China was the major exporter of EGs and accounted for 88.1% of total exports among the select emerging countries.

Table 2: Exports and imports of APEC EGs list (US$ million)

Exports							
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
World	**426 081.76**	**482 096.92**	**397 321.12**	**498 115.76**	**576 368.32**	**562 728.15**	**559 020.84**
Select developed economies	**152 969.29**	**167 761.54**	**132 686.61**	**156 088.40**	**179 685.33**	**176 385.99**	**186 492.58**
Germany	82 133.87	93 140.85	72 789.24	85 709.06	101 031.77	94 217.07	97 864.25
United States of America	51 749.00	54 965.73	44 936.59	54 078.71	59 807.71	63 954.65	69 382.89
United Kingdom	19 086.43	19 654.96	14 960.78	16 300.63	18 845.86	18 214.27	19 245.44
Select emerging economies	**31 153.24**	**45 068.73**	**40 626.96**	**63 201.79**	**74 633.95**	**69 833.08**	**71 773.36**
China	25 167.68	37 851.24	34 892.64	56 540.43	66 372.30	61 139.74	63 279.12
India	2 672.35	3 786.73	3 278.29	3 576.20	4 131.99	4 216.69	4 870.12
Brazil	3 313.22	3 430.76	2 456.03	3 085.16	4 129.66	4 476.66	3 624.12
Imports							
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
World	**431 215.65**	**491 435.97**	**405 062.22**	**503 971.23**	**580 330.40**	**564 987.41**	**575 543.93**
Select developed economies	**109 269.16**	**120 540.56**	**99 122.11**	**119 523.76**	**141 924.31**	**135 381.96**	**132 233.85**
United States of	52 000.92	55 530.20	45 229.20	53 782.15	65 460.43	69 441.17	67 120.77

America							
Germany	39 387.44	47 036.54	40 462.89	49 688.29	56 519.49	47 858.39	45 575.58
United Kingdom	17 880.80	17 973.83	13 430.03	16 053.32	19 944.39	18 082.39	19 537.50
Select emerging economies	**383 888.57**	**51 829.84**	**46 658.22**	**61 228.85**	**71 439.79**	**72 722.54**	**74 828.63**
China	32 576.84	38 535.76	34 668.50	47 051.62	53 745.14	54 702.72	56 558.08
India	306 192.39	6 902.54	6 637.06	7 070.47	9 493.01	9 778.57	9 088.26
Brazil	45 119.34	6 391.55	5 352.66	7 106.76	8 201.64	8 241.25	9 182.28

Source: TradeMap, International Trade Centre (2014)

4.1.3 Specific single-use EGs list

This section focuses on the analysis of trade flows and average MFN applied tariffs of four select single-use EGs: (i) solar water heaters (HS 841919), (ii) wind turbines (HS 850231), (iii) compact fluorescent lamps (HS 853931); and (iv) solar photovoltaic (HS 854140).

(i) Solar water heaters (HS 841919)

Solar water heater systems use solar energy to deliver hot water. They are increasingly becoming a popular option for efficient and inexpensive source of renewable energy. Over the past decade, the global market of solar water heaters has seen significant developments in terms of production and consumption. In line with the global developments, solar water heater industries in developing countries are increasingly becoming important producers of such technologies.

The table 3 indicates that global imports in solar water heaters decreased from approximately US$2 billion in 2011 to US$1 billion in 2013. The top five (5) importing countries of solar water heater were developed countries such as USA, Germany, Canada, and Switzerland, accounting for 53% of total global solar water heater imports. It is interesting to note that Russia, accounted for 5.05% of global imports in 2013, and was the only developing country among the top five (5) importers of solar water heaters. At the time of writing this paper, the USA was the leading importer of solar water heaters, followed closely by Germany, accounting for 18.13% and 16.66%, respectively, of the total global imports in 2013.

Table 3: Imports, percentage of world imports and average applied tariff

	2011	**2012**	**2013**	**Percentage of world trade (2013)**	**Average MFN applied tariff**
	US$ (million)			**%**	**%**
World	2 006.45	1 906.78	1 820.84		

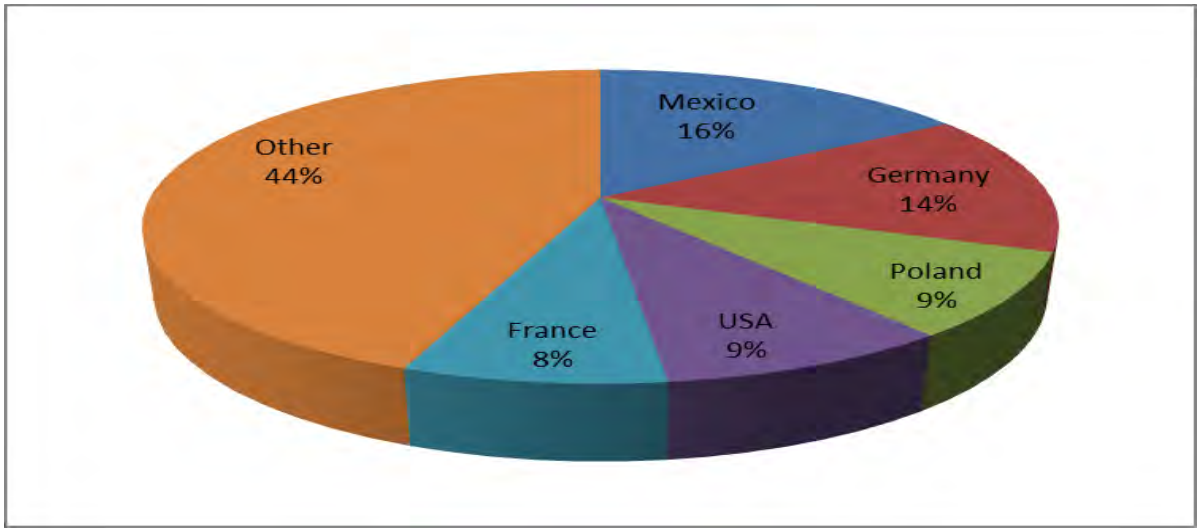
Top importers of (HS 841919)					
USA	391.18	385.11	330.18	18.13	0.0
Germany	406.27	346.15	303.40	16.66	2.6
Canada	112.21	136.14	151.94	8.34	5.0
Russian Federation	77.67	90.58	92.05	5.05	0.0
Switzerland	85.55	85.81	59 85.73	4.70	[40 Fr./51 Fr./10 Fr./100 kg brut]
Select developed & emerging economies					
USA	391.18	385.11	330.18	18.13	0.0
Germany	406.27	346.15	303.40	16.66	2.6
United Kingdom	48.092	37.176	59.69	3.27	2.6
India	8.66	9.29	8.61	0.47	10
Brazil	3.88	4.35	6.70	0.36	20

Source: TradeMap, International Trade Centre (2014); WTO statistical database (2014)

India and Brazil were the leading importers of solar water heaters among the selected emerging countries. Both countries accounted for a meagre share (0.8%) of total global imports during the same time period.

The WTO database on average MFN applied tariffs show that solar water heaters can be imported duty-free into the USA and Russia, whilst Brazil (20%) has the highest average MFN applied tariff, followed by India (10%). It is interesting to note that despite the high tariff (20%) imposed on imports of solar water heaters; Brazil was the second largest importer in 2013. Possibly, this may be explained by Mexico's (leading exporter) close geographical proximity to Brazil which might have translated to inexpensive trade costs.

Figure 3: Leading exporters of solar water heaters (HS 841919), 2013



Source: TradeMap, International Trade Centre (2014); author's calculations

Figure 3 shows the top five (5) exporting economies of solar water heaters in 2013. These economies; Mexico (16%), Germany (14%), followed by Poland (9%), USA (9%), and France (8%) together accounted for 56% of the total global exports of solar ware heaters. Interestingly, Mexico, despite being an emerging economy, is the leading exporter.

(ii) Wind turbines (HS 850231)

Wind turbine technology is an alternative means of generating electricity and it is less harmful to the environment because it emits zero carbon dioxide (CO_2) while operating (Alavi, 2007).

The Wind turbine industry is dominated by European manufacturers (Denmark, Germany, and Spain). Asia, India and China have also emerged as key manufactures over the past few years.

The global industry for wind turbines has seen exponential growth over the past few years. Annual global installations of wind-energy turbines increased from approximately 38 Gigawatt[9] (GW) in 2009 to over 369.6 GW at the end of 2014. Total investments into the global wind sector grew from US$ 80.9 billion in 2012 to US$99.5 billion in 2014. The majority of wind-energy turbines instillations globally were in Asia, followed by Europe in the second position, and North America in a third position (Global Wind Energy Council, 2014).

Table 4: Imports, percentage of world trade and average applied MFN tariff

	2011	2012	2013	Percentage of world trade	Average MNF applied tariff
	US$ (million)			%	%
World	7 314.33	6 205.92	6 806.95		
Top importers of (HS 850231)					
Russian Federation	2.63	6.76	1 073.65	15.77	0.0
United Kingdom	816.35	929.38	753.85	11.07	0.0
Canada	546.21	657.57	631.92	9.28	0.0
South Africa	0.66	1.10	579.81	8.51	7.5
Turkey	353.63	288.14	473.71	6.95	0.0
Select developed & emerging economies					
United Kingdom	816.35	929.38	753.85	11.07	0.0

[9] According to a business dictionary, a gigawatt is a unit of power equal to one billion.

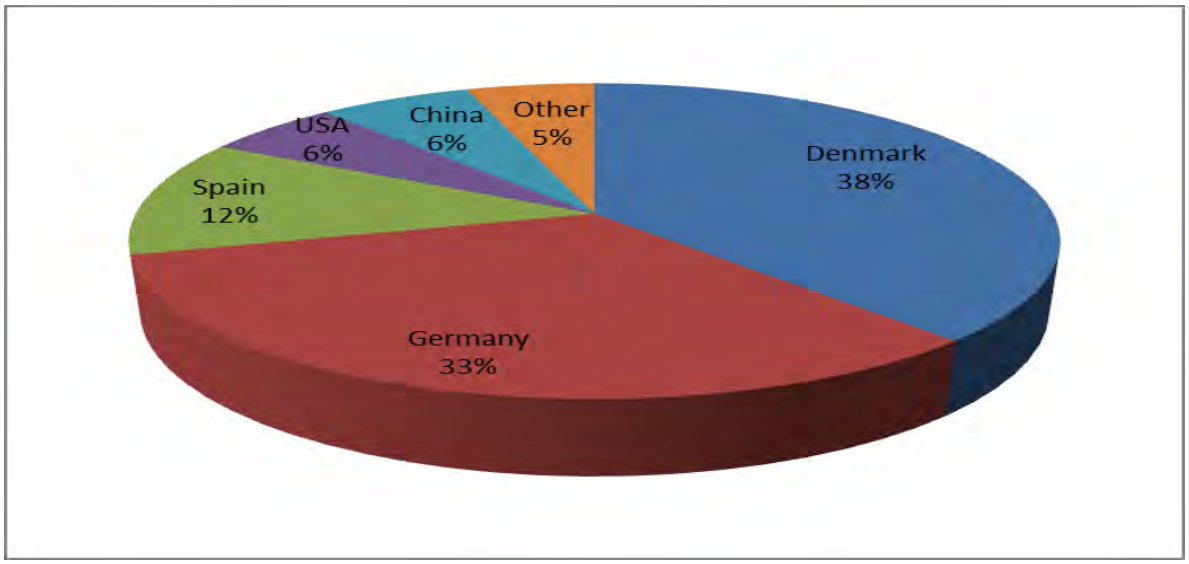
Brazil	456.28	307.14	376.68	5.53	14.0
Germany	932.80	187.82	237.72	3.49	0.0
USA	1 289.92	990.55	15.64	0.22	1.3
China	11.75	3.29	9.87	0.14	8

Source: TradeMap, International Trade Centre (2014)

Table 4 shows that the global imports in wind turbines decreased by 6.9% from 2011 to 2013. The top five (5) importing economies accounted for 24.2% of total global imports in 2013. Russia was the leading importer of wind turbines, accounting for 15.7% of the total global imports in 2013. Russia was followed by the UK (11%), Canada (9.2%) and South Africa (8.5%). Russia and South Africa were the only emerging economies among the top five (5) importing countries. UK (11% of total imports) and Germany (3.4% of total imports) were the major importers in the select developed economies in 2013. South Africa and Brazil were the main importing countries in the select emerging economies, accounting for 8.51% and 5.53%, respectively of the total global wind turbine imports during the same time period.

Looking at the average MFN applied tariffs imposed by the top five (5) importing countries in 2013, wind turbines can be imported duty-free into Russia, the UK, Canada and Turkey. South Africa (7.5%) and China (8%) applied moderate tariffs, respectively, on the importation of wind turbines.

Figure 4: Main exporters of wind turbines (HS 850231), 2013



Source: TradeMap, International Trade Centre (2014)

The five (5) leading exporters of wind turbines in 2013 were Denmark, Germany, Spain, USA and China. Denmark (38%) and Germany (33%) accounted for a larger share of the

total global exports on wind turbine. Interestingly, China was the only emerging economy among the five (5) leading exporters and accounted for 6% of total global exports of wind turbines.

(iii) Compact fluorescent lamps (HS 853931)

Compact Fluorescent lamps (CFLs) are energy efficient light bulbs which are less harmful to the environment because they can reduce greenhouse gas emissions. By way of comparison, CFLs have far less energy consumption requirements than traditional light bulbs (incandescent lights) that consume more energy to provide the same level of light. Moreover, incandescent lamps are not friendly to the environment since they emit some level of carbon dioxide (CO_2) emissions (Lefèvre, 2014).

Table 5: Imports, percentage of world trade and average MFN applied tariff

	2011	2012	2013	Percentage of world trade (2013)	Average MFN applied tariff
	US$ (million)			%	%
World	5 413.46	5 321.11	5 307.60		
Top importers of (HS 853931)					
USA	819.63	892.21	916.52	17.26	2.4
Brazil	265.87	254.39	355.47	6.69	18
France	351.97	318.98	300.27	5.65	2.7
Germany	299.16	269.36	273.84	5.15	2.7
United Arab Emirates	147.58	168.00	180.44	3.39	5.0
Select developed emerging economies					
USA	819.63	892.21	916.52	17.26	2.4
Brazil	265.87	254.39	355.47	6.69	18
Germany	299.16	269.36	273.84	5.15	2.7
United Kingdom	149.56	119.34	132.95	2.50	2.7
China	33.48	35.15	30.74	0.57	8.0

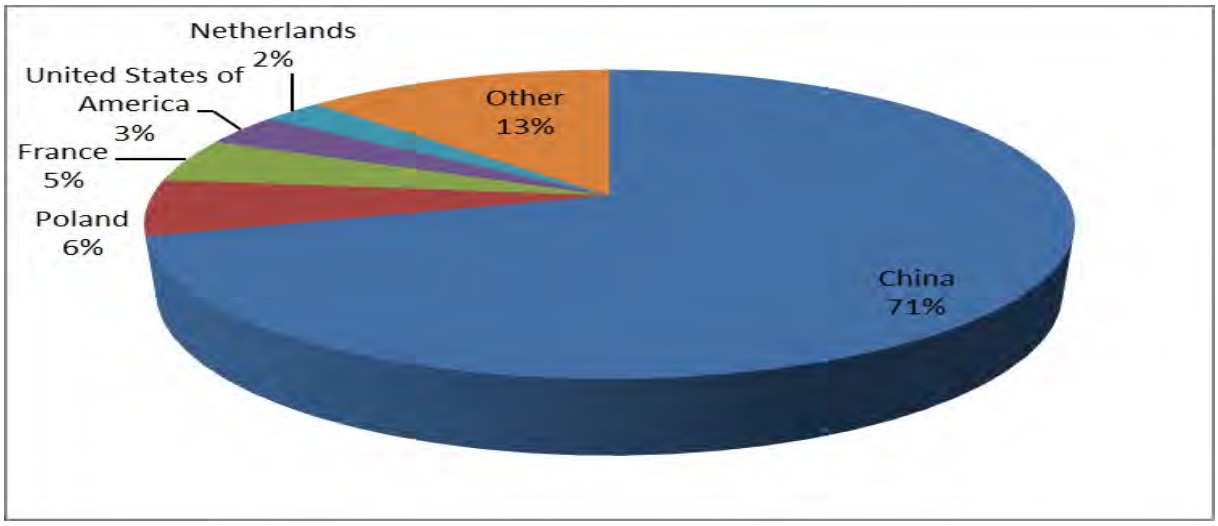
Source: TradeMap, International Trade Centre (2014); WTO statistical database (2014)

According to table 5, global imports in CFLs decreased by 1.9% between 2011 and 2013. In 2013, USA was the leading importer of CFLs and accounted for 17.2% of the total global imports, followed by Brazil (6.6%), France (5.6%), Germany (5.1%), and the United Arab Emirates (3.3%). What is interesting to note is that Brazil is among the top five (5) importing economies despite of the high tariff (18%) it imposes on CFLs imports. In contrast, USA (2.4%), France (2.7%), Germany (2.7%), and the United Arab Emirates (5.0%) impose low tariffs on the importation of CFLs.

In 2013, Brazil and China were the leading importing countries in the select emerging economies and accounted for a combined share of 7.2% of the total global imports in CFLs.

According to figure 5, China (75%) exported the largest share of global CFLs in 2013, followed by Poland (6%), France (5%), USA (3%), and Netherlands (2%). Together, the leading exporters of CFLs accounted for 87% of the total global exports during the same period.

Figure 5: Main exporters of compact fluorescent lamps (HS 853931), 2013



Source: TradeMap, International Trade Centre (2014); WTO statistical database (2014)

(iv) Solar Photovoltaic (HS 854140)

Like most single-use EGs, the Solar Photovoltaic (PV) industry has been experiencing exponential growth over the past few years. By end of 2014, total global solar installation rose from about 140 Gigawatt (GW) in 2013, to at least 170 GW in 2014. These global installations are now producing more than 1% of the total electricity used the world over. The global market for solar PV in terms of installation capacity is currently dominated by European countries: Italy, Greece, and Germany with solar power of up to 7.92%, 7.6% and 7.0% of their markets, respectively. However, Asia's share in total global solar power installations has realised significant growth over the past few years. Case in point is the Chinese solar market which has reached approximately 10.6 GW in 2014. The Middle-East, led by Israel, is starting to gain momentum with approximately 250 megawatts of solar power installations (Sharma, 2015).

Table 6: Main importers of solar PV, percentage of world trade and average MFN applied tariff

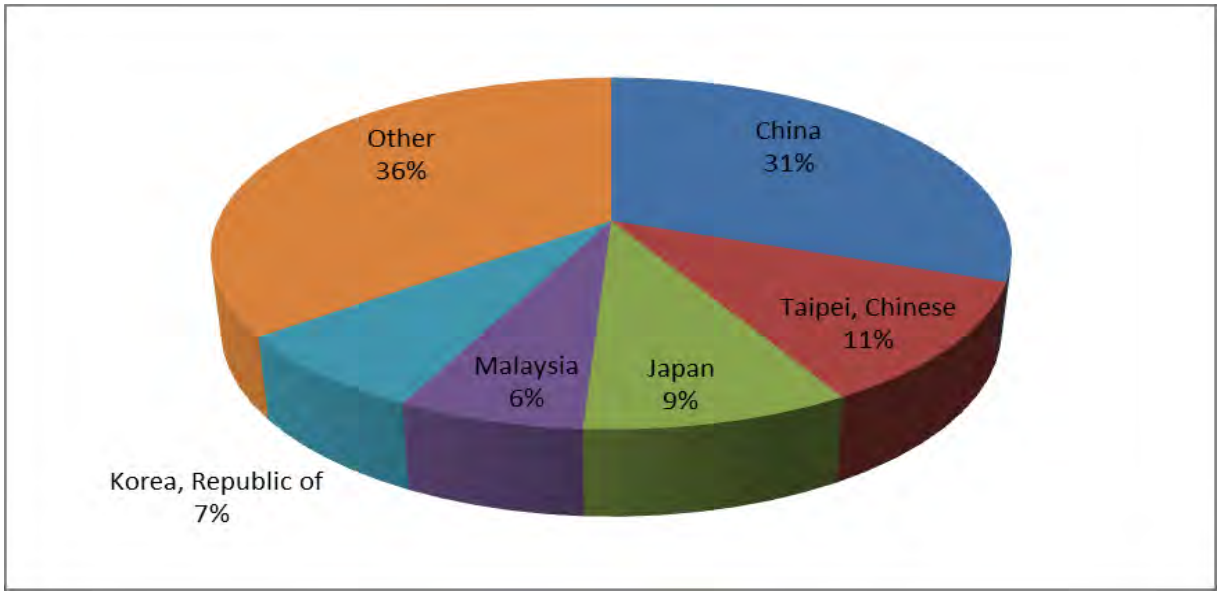
	2011	2012	2013	Percentage of world trade (2013)	Average MFN applied tariff
	US$ (million)			%	%
World	78 938.43	58 530.14	52 919.93		
Top importers of (HS 854140)					
China	8 009.44	7 865.76	8 994.11	16.99	0.0
Japan	2 305.88	3 099.95	7 006.55	13.23	0.0
USA	7 193.09	7 259.86	5 791.22	10.94	0.0
Hong Kong, China	3 636.99	3 524.72	3 890.60	7.35	0.0
Germany	13 652.72	7 217.94	3 682.93	6.95	0.0
Top importers in select developed & emerging economies					
USA	7 193.09	7 259.86	5 791.22	10.94	0.0
Germany	13 652.72	7 217.94	3 682.93	6.95	0.0
United Kingdom	1 706.33	954.31	1 273.08	2.40	0.0
China	8 009.44	7 865.76	8 994.11	16.99	0.0
India	1 332.84	871.94	1 069.46	2.02	0.0

Source: TradeMap, International Trade Centre (2014); WTO statistical database (2014)

According to Table 6, global imports of solar PV devices declined from US$78 billion in 2011 to US$52 billion in 2013. China (16.9%), Japan (13.2%), USA (10.9%), Hong Kong China (7.3%), and Germany (6.9%) were the leading importers of solar PV devices during the same time period. These countries accounted for 55.2% of total global imports of solar PV devices. USA and Germany were the leading importers in the select developed economies and accounted for a combined share of 17.8% of the total global imports in 2013. Exports of solar PV to these countries are imported at zero-duty.

China and India imposed duty-free tariff on solar PV devices imports and were the leading importing countries in the select emerging economies in 2013 and accounted for combined share of 19% of the total global imports of solar PV.

Figure 6: Main exporters of Solar PV (HS 854140), 2013



Source: TradeMap, International Trade Centre (2014); WTO statistical database (2014)

Figure 6 shows that China (31%) accounted the largest share of the world's solar PV export market in 2013, followed by Chinese Taipei (11%), Japan (9%), and Malaysia (6%). These countries together accounted for 64% of the total global exports in 2013.

4.2 Trade chilling analysis

This section of the research paper focuses on the "trade-chilling" analysis conducted on:

(i) South Africa as the exporting country; and
(ii) select developed and emerging economies as corresponding importing countries.

This exercise is important because it helps the researcher to identify areas of bilateral trade opportunities for South African EGs exports. Also, it indicates whether tariffs have been the main obstacle to limited or absence of bilateral trade.

Trade chilling analysis on WTO list of 153 EGs

4.2.1 Select developed economies

Table 7: Summary of South Africa's exports and imports by select developed countries with no or limited bilateral trade with South Africa.

United States of America (USA)						
HS Code	**Product label**	**MFN applied**	**USA imp World**	**USA imp S.A**	**S.A exp World**	**S.A exp USA**

		tariff (%)	7 yr average	7 yr average	7 yr average	7 yr average
283526	Calcium phosphates	0.0	12.71	0.00	41.57	0.00
731021	Cans<50 litres,	0.0	138.88	0.00	31.80	0.00
320990	Paints & varnishes	_	216.51	0.01	18.72	0.02
780600	Articles of lead	2.1	74.41	0.00	14.67	0.02
392020	Film and sheet	4.2	788.01	0.00	9.88	0.00
847439	Mixing machines	0.0	61.16	0.01	8.28	0.02
Germany						
HS Code	**Product label**	**MFN applied tariff (%)**	**Germany imp World** 7 yr average	**Germany imp S.A** 7 yr average	**S.A exp World** 7 yr average	**S.A exp Germany** 7 yr average
283526	Calcium phosphates	5.5	84.93	0.00	41.57	_
731021	Cans<50 litres	2.7	192.41	0.00	31.80	_
320910	Paints & varnishes	6.5	142.11	0.00	15.30	0.00
780600	Articles of lead	2.5	13.64	0.01	14.67	0.00
392020	Film and sheet	6.5	694.31	0.00	9.88	0.00
847439	Mixing machines	0.0	13.15	0.01	8.28	-
United Kingdom (UK)						
HS Code	**Product label**	**MFN applied tariff (%)**	**UK imp World** 7 yr average	**UK imp S.A** 7 yr average	**S.A exp World** 7 yr average	**S.A exp UK** 7 yr average
283526	Calcium phosphates	5.5	29.28	0.00	41.57	0.00
731021	Cans<50 litres	2.7	62.98	0.00	31.8	0.00
780600	Articles of lead	2.5	9.16	0.00	14.67	0.00
851490	Parts of industrial electric furnaces	2.2	24.86	0.00	9.7	0.02
847439	Mixing machines	0.0	16.43	0.00	8.28	0.01
841440	Air compressors	2.2	40.27	0.00	8.11	0.00

Source: TradeMap, International Trade Centre (2014); author's calculations

Table 7 provides a summary of the top six (6) EGs South Africa exports to the rest of the world, but which it exports limited amounts or values of to the USA, UK, and Germany.

Based on the value of South African exports to the world, South Africa can possibly increase exports of the following EGs to different country markets:

- Calcium phosphates (HS 283526) imported at zero-duty by USA, Germany (5.5%), and UK (5.5%);
- Cans<50 litres (HS 731021) imported at zero-duty by USA, Germany (2.7%), and UK (2.7%);

- Articles of lead (HS 780600) exported to the USA (2.1%), Germany (2.5%), and UK (2.5%);
- Film sheet (HS 392020) imported by USA (4.5%);
- Mixing machine (HS 847439) imported at zero-duty by USA, Germany and UK; and
- Parts of industrial electric furnaces (HS 851490) and Air compressors (HS 841440) imported at 2.2% tariff by UK

Discussion

The trade-chilling analysis indicates that bilateral trade between South Africa and select developed and emerging economies is limited across the three EGs product classifications. Also, the analysis gives EGs which are not currently traded with each other, but which have the potential for increased bilateral trade. South Africa's exports in the market of select developed markets accounted for an insignificant percentage. For instance, South Africa's top six (6) exports accounted for 0.05%, 0% and 0.02% imports by the USA, Germany and UK from the world in 2013, respectively. This is indicative of the intense export competition prevalent in the markets of the selected countries. For this reason, South Africa specifically faced competition from the global top exporters of (i) Mixing machines (HS 847439) imported from the USA by the UK market, (ii) Articles of lead (HS 780600) imported from Netherlands by the German market, and Cans<50 litres (HS 731021) imported from Mexico by the USA market in 2013. The strong competitiveness shown by the leading global exporters of the EGs can be explained by their close geographical proximity to these export markets, which translated to low transport costs.

According to the tariff data, most MFN tariffs applied on EGs were low, ranging between 0% and 4.2%, implying that tariffs are not the main factor prohibiting bilateral trade in EGs. Based on this reason, South Africa should take advantage of the low tariff duties imposed in these markets and consider increasing its exports of these EGs, especially in European countries and USA where some of its EGs exports receives preferential treatment under the Trade and Development and Cooperation Agreement (TDCA)[10] and African Growth

[10] The TDCA is a preferential bilateral arrangement between South Africa and European Union. Under the Agreement, South African goods exports are given preferential market access into EU markets.

Opportunity Act (AGOA)[11]. It is interesting to note that preferential tariff rates applied on South African exports are far more lower (normally at zero-duty) compared to the average MFN tariffs. This often translates to deeper market access for South African exports into the markets of selected economies.

However, there are, of course, other possible factors, such as NTBs, responsible for the limited or no bilateral trade taking place. Some examples of NTBs include stringent technical standards, labelling and local content requirements imposed on EGs such as articles of lead, paints and varnishes; and mixing machines which may be difficult for South African EGs exporters to conform to.

Labelling requirements often vary from country to country thus imposing high compliance costs for foreign exporters of EGs. In this case, the high compliance costs could explain the limited exports of cans, air compressors and mixing machine exported by South Africa to the markets of the selected countries. Local content requirements are implemented with the aim to encourage domestic industrial development for electric furnaces, for example. These may require projects to comply with the prescribed percentage of locally manufactured components and that they are locally assembled. Such type of NTB could have prohibited trade as it normally gives preference to domestically produced components whilst creating market access barriers for South African exporters of parts of industrial electric furnaces.

Previous studies have consistently found that transportation costs pose a barrier to trade, especially when there is significant distance between trading partners. Since South Africa is situated in far geographical proximity to its selected European export markets, the limited bilateral trade could be explained by high transport costs associated with the exportation of EGs.

The low average applied tariffs on EGs concerned and the limited bilateral trade between South Africa and select developed economies indicate that non-tariff barriers may be the main factors prohibiting current bilateral trade.

4.2.2 Select emerging economies

[11] AGOA is a United States Trade Act significantly enhances market access to the US for qualifying Sub-Saharan African (SSA) countries, including South Africa.

Table 8: Summary of South Africa's exports and imports by select emerging economies with no or limited bilateral trade with South Africa.

China						
HS Code	**Product label**	**MFN applied tariff (%)**	**China imp World** 7 yr average	**China imp S.A** 7 yr average	**S.A exp World** 7 yr average	**S.A exp China** 7 yr average
220710	Biofuel: ethyl alcohol	40	1.81	0.01	95.00	0.00
731029	Cans<50 litres	17.5	10.11	_	68.94	_
282010	Manganese dioxide	5.5	3.39	_	43.88	_
283526	Calcium phosphates	5.5	24.56	_	41.57	_
841370	Centrifugal pumps	8.7	803.80	_	32.60	_
731021	Cans, iron <50 litres	17.5	15.78	_	31.80	_
India						
HS Code	**Product label**	**MFN applied tariff (%)**	**India imp World** 7yr average	**India imp S.A** 7 yr average	**S.A exp World** 7yr average	**S.A exp India** 7 yr average
220710	Biofuel: ethyl alcohol	150	4.14	_	95.00	_
731029	Cans<50 litres	10	27.71	0.00	68.94	_
283526	Calcium phosphates	7.5	10.31	_	41.57	_
842131	Intake air filters for internal combustion engines	7.5	7.74	_	36.84	_
731021	Cans<50 litres,	10	7.59	_	31.80	_
841490	Parts of vacuum pumps	8.2	409.66	_	16.32	0.01
Brazil						
HS Code	**Product label**	**MFN applied tariff (%)**	**Brazil imp World** 7 yr average	**Brazil imp S.A** 7 yr average	**S.A exp World** 7 yr average	**S.A exp Brazil** 7 yr average
854140	Solar PV	10.4	131.00	0.00	107.42	_
220710	Biofuel: ethyl alcohol	10	24.52	_	95.00	_
841381	Pumps	14	34.38	_	88.64	_
848180	Taps, cocks, and valves	15.1	514.31	0.02	84.35	_
731029	Cans<50 litres	10	7.12	_	68.94	_
903180	Measuring instruments	10.7	319.26	0.01	43.53	_

Source: TradeMap, International Trade Centre (2014); author's calculations

Table 8 shows the top six (6) EGs South Africa exports to the world, as well as Chinese, Indian and Brazilian imports from the rest of the world with limited bilateral trade.

The top South African exports to the world, but which it exports in limited amounts or does not export to China, India and Brazil include biofuels (HS 220710), cans<50 litres (HS 731029), Solar PV devices (HS 854140), measuring instruments (HS 903180), manganese

dioxide (HS 282010) and pumps (HS 841381). Among these EGs, only a few EGs demonstrated opportunities for enhanced bilateral trade and they include:

- Centrifugal pumps (HS 841370) imported by China at a moderate tariff (8.7%) rate;
- Calcium phosphate (HS 283526) imported by China and India at a 5.5% and 7.5% tariff, respectively;
- Parts of vacuum pumps (HS 841490) exported to India at 8.2% import duty;
- Solar PV (HS 854140) exported to Brazil at 1.2% import duty;
- Manganese dioxide (HS 282010) exported to China (5.5%); and
- Intake air filters for internal combustion engines (HS 842131) imported by India (7.5%).

Discussion

For emerging economies, the trade-chilling analysis indicates that bilateral trade is limited in some EGs, whilst it is non-existent on others. For example, South Africa's exports of (HS 841490) parts of vacuum pumps, (HS 903180) measuring instruments and (HS 220710) biofuel accounted for 0.002%, 0.003%, 0.6% of Indian, Brazilian and Chinese total imports, respectively. South Africa faced export competition in 2013 from the leading exporters; China, USA, and Germany which are strategically located in close proximity to the markets of the selected emerging economies.

According to MFN tariff data, tariffs imposed on the importation of most South Africa's exports of EGs by the selected economies ranged between moderate to prohibitively high (between 6% and 150%) import duties. The high tariffs, in this case, served as an obstacle to trade in biofuel (HS 220710) and cans (HS 731029) imported into China (40% tariff and 17.5% tariff) and biofuel (HS 220710) imported into India (150% tariff). As a result, data on MFN tariffs suggest that the lack of bilateral trade can be attributed to the high tariffs. In light of the high tariffs, South African exports of biofuel were diverted to Singapore at duty-free, followed by USA which imported biofuels at a low import duty of 2.5% and Kenya, although at a high import duty of 25%. It is interesting to note that South Africa considered Kenya as a priority export destination despite the high import duty imposed on biofuels, possibly due to Kenya's close geographical proximity which may have translated to low transport costs relative to the other export markets (ITC TradeMap and WTO tariff database, 2016). By observing data on MFN tariffs, it appears that high tariffs are common in the selected

emerging markets. This may be due to the fact that their domestic EGs industries are at a developmental stage; hence import tariffs serve an important policy instrument to protect local manufacturers from foreign competition.

In light of the high and trade prohibitive tariffs imposed on South African exports of EGs, there are EGs where South Africa can increase its exports. These include, for example, (HS 282010) manganese dioxide and (HS 283526) calcium phosphate exported to Brazil facing low tariffs (5.5%). In this case, the implication is that limited bilateral trade can be attributed to NTBs which include, but are not limited to, varying product standards on biofuels which could have restricted South African exporters from competing with domestic producers in the importing countries. The use of production subsidies to promote domestic Ethanol production capacities serves as another example of NTBs. Subsidies are trade restrictive in nature given that they have the potential to alter the condition of market competition, thus affording protection to domestic producers at the expensive of foreign EGs suppliers. In addition, high transportation costs involved in the exportation of these EGs could have acted as a factor for the lack of bilateral trade due to South Africa's geographical proximity to the select emerging markets.

In order for South African manufacturers of EGs to exploit existing export opportunities beyond the ones identified above, identification of alternative export markets is required. From a regional perspective, for example, it will be opportune for South Africa, given its close proximity to SADC markets, to increase its exports of (HS 841381) pumps to Zambia, and Mozambique imported at zero duty and 5% tariff, respectively. South Africa can also increase its exports within the region on Solar PV (HS 854140) and (HS 841490) taps, cocks, and valves into Botswana, Lesotho, Namibia and Swaziland at zero import tariff (ITC TradeMap and WTO Tariff database, 2016). Outside the SADC region, areas of potential export markets include (HS 841381) pumps imported by the USA at zero duty, (HS 848180) taps, cocks, and valves into China at 6.1% tariff, and (HS 842131) intake air filters for internal combustion engines imported by Southern African Custom Union (SACU)[12] countries at zero import duty: Botswana, Lesotho, Namibia and Swaziland.

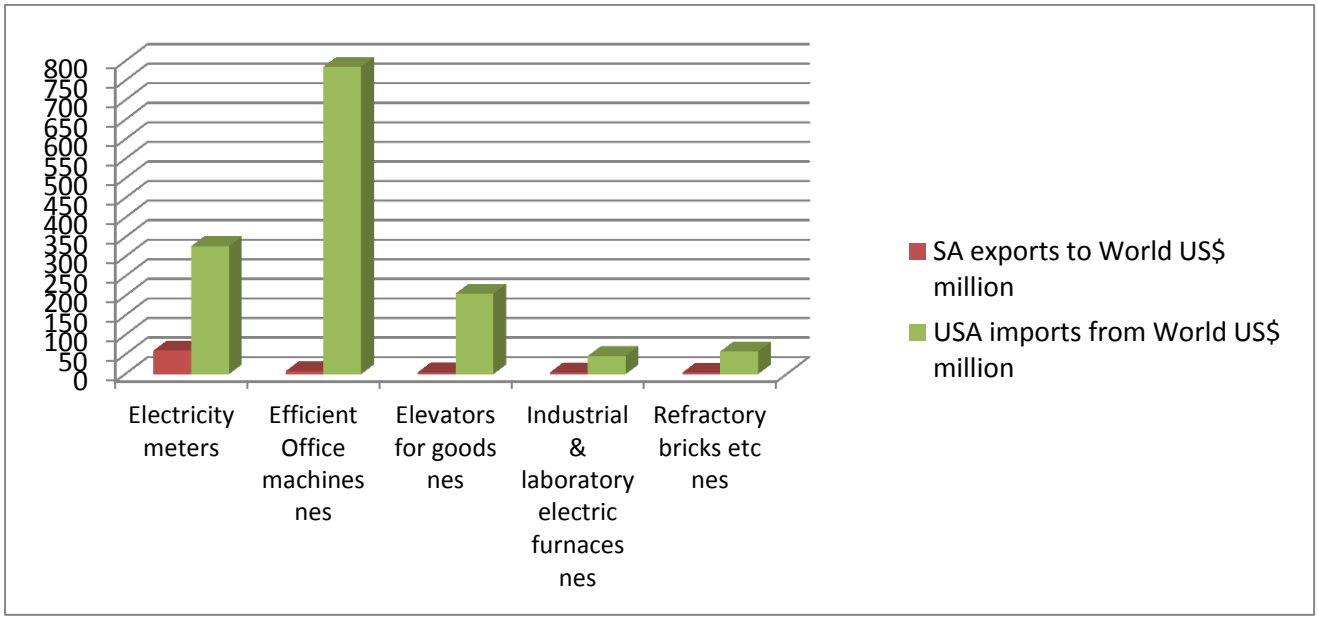
[12] SACU is custom union among South Africa, Botswana, Lesotho, Namibia and Swaziland. There are no internal tariffs between SACU Member States.

Trade chilling analysis on APEC list of EGs

4.2.3 Select developed economies

Figure 7-12 shows trade data and MFN applied tariff on: (a) top five (5) South Africa's EGs exports to the world (US$ million); (b) imports by USA, UK and Germany from the world.

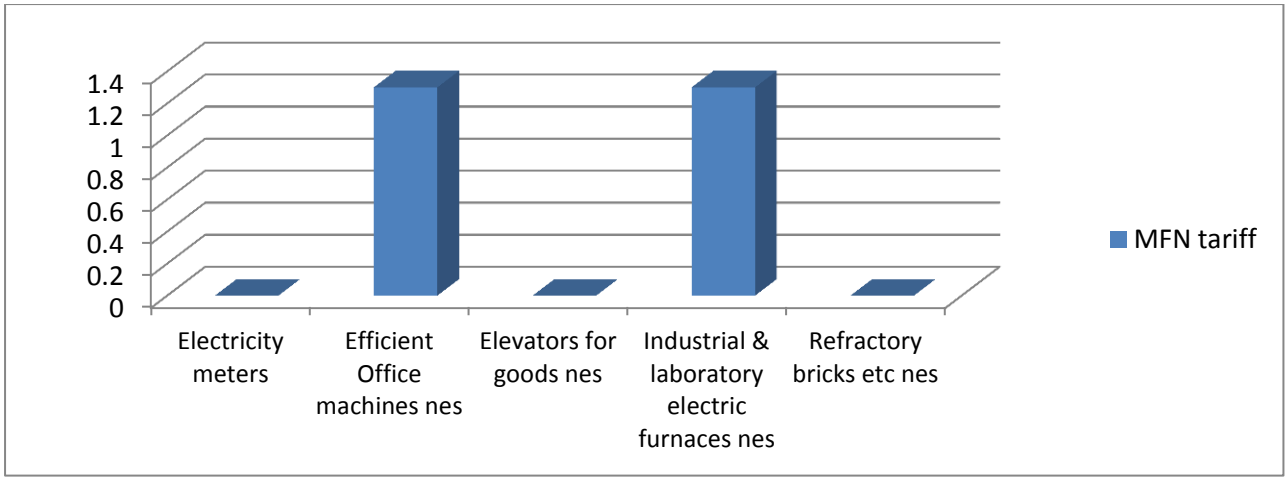
Figure 7: Summary of South Africa's top five (5) EGs exports, imports by USA



Source: TradeMap, International Trade Centre (2014); author's calculations

Figure 7 and 8 shows the top five EGs exported by South Africa to the world, but which the USA does not import. Also, EGs with the most potential for bilateral trade between South Africa and the USA are captured in figure 7.

Figure 8: MFN tariffs applied by the USA on South Africa's top five (5) exports

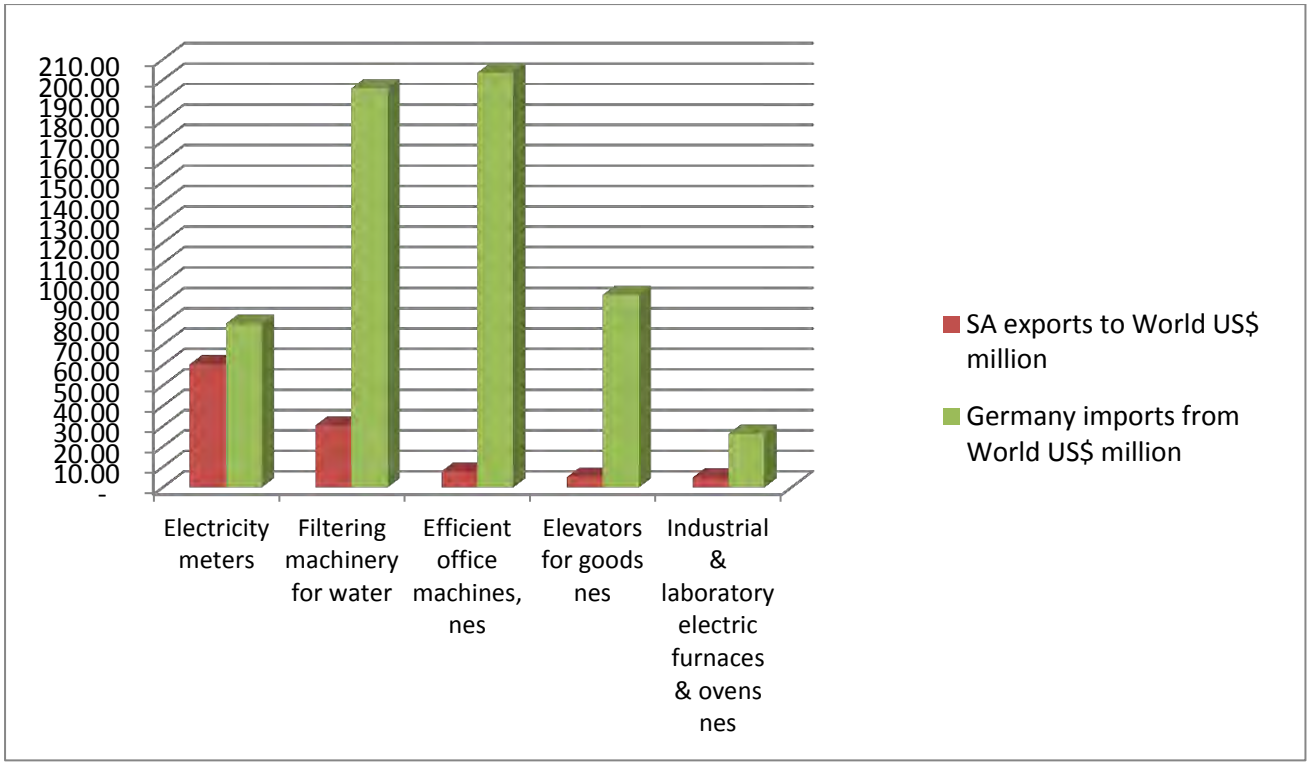


Source: World Trade Organization Tariff Database (2015)

According to trade data, the EGs imported by USA from the world, excluding South Africa are electricity meters (HS 902830); energy efficient office machines (HS 847290); elevators for goods (HS 842833); industrial electric furnaces (HS 851430); refractory bricks (HS 690290); and machine for mixing, crushing and grinding (HS 847982). According to the chilling analysis, there is potential for South Africa to expand exports of electricity meters (HS 902830) and energy efficient office machines (HS 847290) to the USA. These EGs are imported at low tariffs, ranging between 0% and 1.3%, thus implying that limited bilateral trade may be attributed to NTBs.

While the USA has been importing large amounts of EGs at low MFN tariff rates from the global market, South Africa only exported limited amounts of elevators for goods (HS 842833); industrial electric furnaces & ovens (HS 851430); refractory bricks (HS 690290); and machine for mixing, crushing and grinding (HS 847982). This indicates that South Africa may be experiencing supply-side constraints such as lack of financial, skills and manufacturing capacities in the respective EGs.

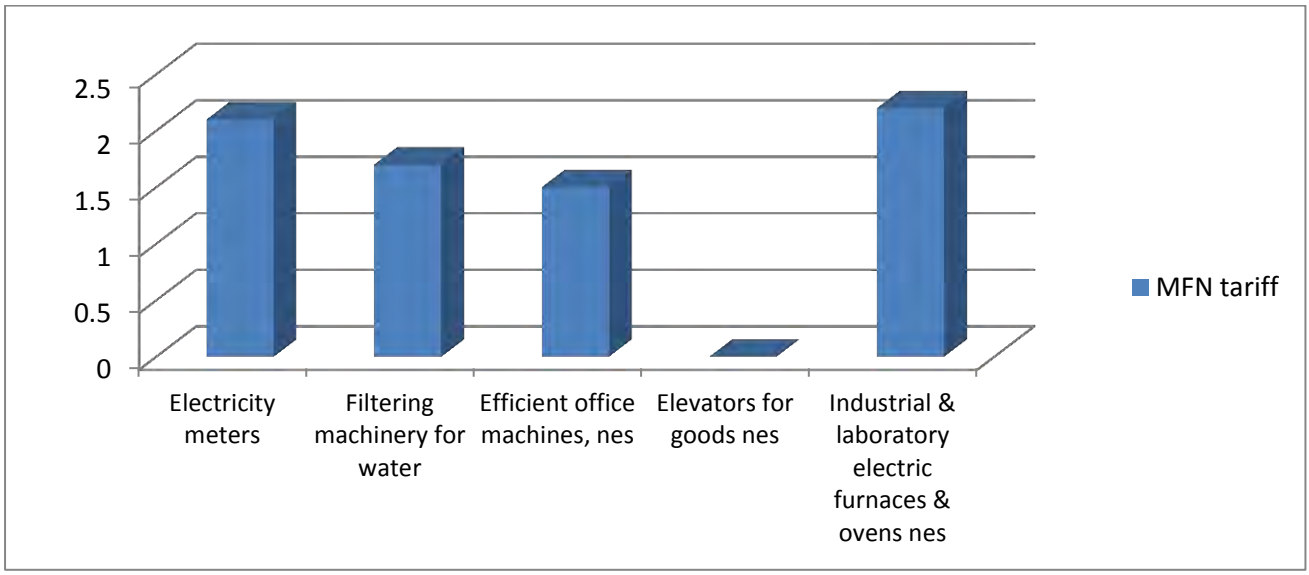
Figure 9: Summary of South Africa's top five (5) exports, imports by Germany and MFN applied tariffs APEC EGs



Source: TradeMap, International Trade Centre (2014); author's calculations

Figure 9 and 10 shows the top five (5) EGs South Africa exports to the world, but not Germany. The figures also show the following EGs to have potential bilateral trade opportunities for South African exports to the German market: electricity meters (HS 902830), filtering machinery (HS 84212) and energy efficient office machines (HS 847290) at preferential zero percent import tariff. This suggests that import tariffs have not been the major barrier to bilateral trade.

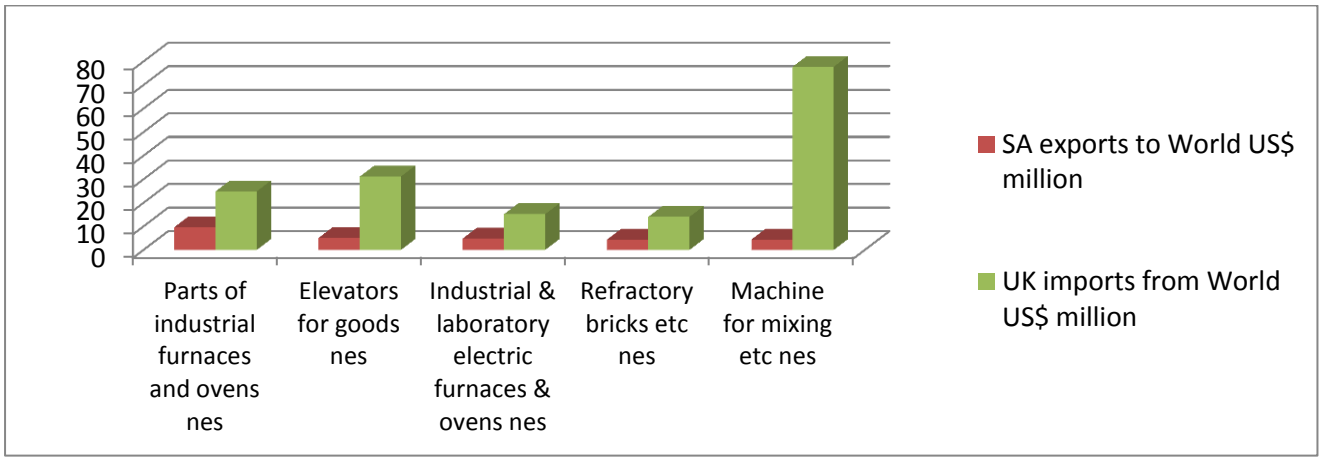
Figure 10: MFN tariffs applied by Germany on South Africa's top five (5) exports



Source: World Trade Organization Tariff Database (2015)

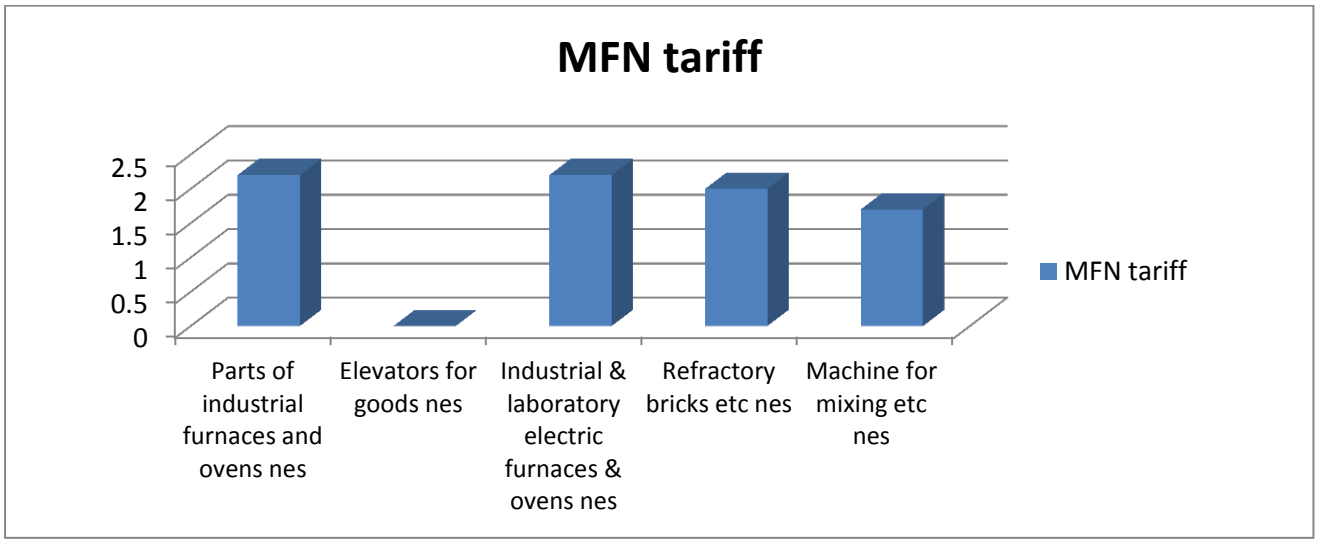
Despite the high demand and low MFN tariffs in Germany's market for elevators for goods (HS 842833) and industrial & laboratory furnaces & ovens (HS 851430), South Africa exported limited amounts of these EGs. This can be attributed to possible supply-side bottlenecks e.g. lack of investments in the South African industrial space.

Figure 11: Summary of South Africa's top five (5) exports, imports by UK and MFN applied tariffs



Source: TradeMap, International Trade Centre (2014); author's calculations

Figure 12: MFN tariffs applied by the UK on South Africa's top five (5) exports



Source: World Trade Organization Tariff Database (2015)

According to figures 11 and 12, the top five (5) EGs exported by South Africa to the world, but exported limited amounts to the United Kingdom include parts of industrial electric furnaces & ovens (HS 851490); elevators/ conveyors for goods (HS 842833); industrial

electric furnaces & ovens (HS851430); refractory bricks (HS 690290); and machine for mixing/crushing/grinding (HS 847982). The UK market presents possible opportunities for South Africa to export more of machine for mixing (HS 847982); parts of industrial electric furnaces & ovens (HS 851490); elevators for goods (HS 842833); industrial electric furnaces & ovens (HS 851430); refractory bricks not specified elsewhere (HS 690290) at preferential zero percent import tariff.

Discussion

According to the trade chilling analysis, select developed economies imported significant percentage of world EGs in 2013. In contrast, South Africa exported insignificant amounts of EGs to the world, owing to supply-side constraints such as lack of finance necessary to support domestic EGs industry development. This may serve as a good explanation for the limited or non-existent bilateral trade.

It is with no doubt that South Africa faced some level of competition in the export markets of select developed economies. In this context, South Africa's competitors for market share consisted of the leading global exporters of EGs in 2013. These were China's exports of (HS 847290) efficient office machines (not elsewhere specified) into the USA, (HS 902830) electricity meters exported by Slovenia into Germany, and (HS 851490) parts of industrial electric furnaces & ovens exported by the USA into by the UK. Given Slovenia's close proximity to Germany, as well as, Europe's efficient transport system, it is no surprise that Slovenia was among Germany's priority supplier of EGs.

According WTO's data on MFN tariffs, South Africa's exports of EGs faced low import tariffs (between 0% and 2.5%) in the markets of select developed economies, suggesting that tariffs were not an obstacle to bilateral trade. Against this background, South Africa should take advantage of the low tariffs and increase its exports of (HS 902830) electricity meters to the USA market at zero import duty, (HS 902830) electricity meters imported into Germany at 2% import tariff, and (HS 851490) electric furnaces & ovens imported into the United Kingdom at 2.5% tariff. Over and above these markets, South Africa can also diversify its export portfolio by exporting (HS 851490) parts of industrial or laboratory electric furnaces and ovens into the Malaysian market at zero import duty.

Since the trade-chilling analysis suggest that NTBs may be responsible for the limited bilateral trade, the possible non-tariff barrier that may be relevant in this regard include high

transport costs given South Africa's far geographical proximity to the markets of select developed economies, and lack of investment, skills development, and institutional support.

4.2.4 Select emerging economies

Table 9 below provides a summary of the top EGs exported by South Africa to the world, excluding China, India and Brazil.

Table 9: Summary of South Africa's exports and imports by emerging with no or limited bilateral trade with South Africa.

China						
HS Code	**Product label**	**MFN applied tariff (%)**	**China imp World**	**China imp S.A**	**S.A exp World**	**S.A exp China**
			7 yr average	**7 yr average**	**7 yr average**	**7 yr average**
902830	Electricity meters	10	69.15	_	60.46	0.02
841370	Centrifugal pumps	8.7	1 563.70	_	32.60	_
841480	Air or gas compressors	7.3	2 365.11	_	15.71	_
901580	Hydrographic instruments	5	841.14	_	12.83	_
842129	Filtering machinery and apparatus	5	1 113.72	0.01	11.66	_
851490	Parts of industrial electric furnaces and ovens	4	180.10	_	9.70	_
India						
HS Code	**Product label**	**MFN applied tariff (%)**	**India imp World**	**India imp S.A**	**S.A exp World**	**S.A exp India**
			7 yr average	**7 yr average**	**7 yr average**	**7 yr average**
841459	Fans	8.9	109.31	0.00	13.26	0.00
902620	Instruments and apparatus for measuring pressure	0.0	38.75	0.01	7.52	_
841950	Heat exchange units	7.5	109.42	0.00	6.89	_
902290	Parts & accessories for X-rays	7.5	118.38	0.00	6.11	_
903090	Parts for checking electrical quantities	7.5	57.79	0.00	5.89	_
842833	Elevators for goods	7.5	7.61	0.00	5.11	0.00
Brazil						
HS Code	**Product label**	**MFN applied tariff (%)**	**Brazil imp World**	**Brazil imp S.A**	**S.A exp World**	**S.A exp Brazil**
			7 yr average	**7 yr average**	**7 yr average**	**7 yr average**
854140	Solar PV	1.2	131.00	0.00	105.58	_
841381	Pumps	14	34.38	_	88.64	0.01
841480	Air or gas compressors	12.9	426.51	_	15.71	_
841459	Fans	7.0	116.28	0.00	13.26	0.00
901580	Hydrographic instrument	14.0	30.17	_	12.83	_
591190	Textile products for technical uses	26.0	19.76	0.00	10.43	_

Source: TradeMap, International Trade Centre (2014); author's calculations

According to the trade data, there is potential for South Africa to export more of the following EGs:

- Instruments and apparatus for measuring or checking pressure (HS 902620); elevators for goods (HS 842833); and parts for checking electrical quantities (HS 903090) imported by India at low tariffs 0.0%, 7.5%, and 7.5% respectively.
- Solar PV (HS 854140) imported by Brazil at 1.2% tariff.
- Parts of industrial electric furnaces and ovens (HS 851490), Filtering machinery and apparatus (HS 842129), Hydrographic instruments (HS 901580), Air or gas compressors (HS 841480) imported by China at 4%, 5% and 5% tariff, respectively.

Discussion

In the case of bilateral trade between South Africa and select emerging economies, the trade-chilling analysis shows that high tariffs did not play a major role in limiting bilateral trade in EGs. This suggests that NTBs were responsible for the limited bilateral trade. An NTB that may be relevant in this regard refers to inefficient transport infrastructure that is a common feature in the markets of select emerging economies. Inefficient transport infrastructure could have caused unnecessary delays and consequent high and trade prohibitive transport cost for South African exports in the selected emerging markets. Another NTB that could have possibly played a role in this regard include subsidies applied in the markets of select emerging economies which could have manipulated the conditions of market competition in favour of EGs manufactures in the importing countries.

Despite the limited bilateral trade owing to NTBs, there were high tariffs imposed on some EGs imported by select emerging economies. Such EGs include (HS 591190) textile products and articles for technical uses and (HS 901580) hydrographic instrument imported at 26% tariff, (HS 841381) pumps (not elsewhere specified) imported at 14%, (HS 841480) air gas compressors imported at 12.9% into the Brazilian market; and (HS 902830) electricity meters imported by China at 10% tariff. Against this background, South Africa may consider diversifying its export markets by increasing exports of (HS 591190) textile products and articles for technical uses into the Zambian (5% import duty) market, (HS 841381) pumps (not elsewhere specified) exported into the Mozambican market at 5% tariff, (HS 841480) air gas compressors exported into Germany at 2.2% tariff, and (HS 902830) electricity meters exported into Kenya at duty-free.

4.3 Trade chilling analysis on single-use EGs

This section of the research paper focuses on the "trade chilling" analysis in accordance to select single-use EGs. The analysis was focused on the following single-use products:

- Insulation material (HS 680610)
- Heat pumps (HS 841861);
- Electric and certain hybrid vehicles (HS 870390);
- Biofuels (HS 220710 and 220720);
- Solar PV devices (HS 854140); and
- Wind turbines (HS 850231).

4.3.1 Select developed economies

Table 10 provides a summary of the specific single-use EGs where there is limited or no trade between South Africa and select developed economies. The table below also highlights EGs with the most potential for enhanced bilateral trade.

Table 10: Summary of South Africa's exports and imports by developed economies with no or limited bilateral trade with South Africa.

United States of America (USA)						
HS Code	**Product label**	**MFN applied tariff (%)**	**USA imp World**	**USA imp S.A**	**S.A exp World**	**S.A exp USA**
			7 yr average	**7 yr average**	**7 yr average**	**7 yr average**
854140	Solar PV devices	0.0	4 594.76	0.17	105.58	0.13
220720	Biofuel	1.9	55.25	_	17.70	0.01
841861	Heat pumps	0.0	72.10	_	3.73	0.02
Germany						
HS Code	**Product label**	**MFN applied tariff (%)**	**Germany imp World**	**Germany imp S.A**	**S.A exp World**	**S.A exp Germany**
			7 yr average	**7 yr average**	**7 yr average**	**7 yr average**
870390	Electric and certain hybrid vehicles	10.0	58.15	0.00	13.45	0.20
680610	Insulating materials	0.0	128.40	0.06	6.27	0.00
841861	Heat pumps	2.2	170.10	0.01	3.73	0.00
United Kingdom (UK)						
HS Code	**Product label**	**MFN applied tariff (%)**	**UK imp World**	**UK imp S.A**	**S.A exp World**	**S.A exp UK**
			7 yr average	**7 yr average**	**7 yr average**	**7 yr average**

854140	Solar PV devices	0.0	992.24	0.17	105.58	0.19
220710	Biofuel: ethyl alcohol	0.0	218.30	0.00	95.00	0.08
220720	Biofuel: ethyl alcohol and other spirits	0.0	112.31	_	17.70	0.02

Source: TradeMap, International Trade Centre (2014); author's calculations

The trade chilling analysis shows potential for South Africa to increase exports of:

- Solar PV devices (HS 854140), and biofuel (HS 220720) exported into the USA market (zero-duty);
- Insulating materials (HS 680610) exported into Germany at zero import duty;
- Solar PV devices (HS 854140), biofuels (HS 220710 and 220720) exported into the UK market at zero import duty.

Discussion

Between 2007 and 2013, import tariffs on South African exports of single-use environmental goods were low and medium, ranging between 0% and 10%. The WTO tariff data suggest that tariffs on EGs exported by South Africa are not responsible for the limited bilateral trade. In other words, the 'chilling of bilateral trade' may be attributed to NTBs such as South Africa's far geographic position in relation to the export markets of select emerging economies, thus translating to high transportation costs. Another NTB that may have acted as an obstacle to bilateral trade in this regard includes differing and stringent standards governing biofuel industries from one export market to the other. As a result, this may have acted as a disincentive for South African manufactures to export EGs to the selected export markets, particularly in light of the high compliance costs associated with varying product standards.

According to trade data, South Africa faced competition against the leading exporters of single-use environmental goods imported into the markets of select emerging markets. Given its close proximity to the United States of America, Brazil, for instance, was the priority exporter of (HS 220720) ethyl alcohol and other spirits into the USA market. As a result, Brazil accounted for 56% of USA's market share in 2013. Other leading exporters of single-use EGs include France and Poland. In 2013, France exported (HS 841861) heat pumps into the United Kingdom, accounting 41%% of its market share. Poland's export destination of (HS 680610) insulating materials went into German and accounted for 20% of its market share.

According to trade data, Germany and the USA applied low tariffs (2.2% and 0.0%, respectively) on the importation of (HS 841861) heat pumps. Despite the low import tariffs, bilateral trade was limited which can be explained by supply-side constraints suffered by South African manufactures of (HS 841861) heat pumps.

Data on MFN tariffs indicate that Germany applied a high tariff rate (10%) on the importation of (HS 870390) electric and certain hybrid vehicles from South Africa. This serves as an explanation for the limited bilateral between South Africa and Germany in this regard. In light of the high tariff applied on South African exports of (HS 870390) electric and certain hybrid vehicles, South African manufactures may consider exporting their EGs into alternative markets such as the USA market, United Republic of Tanzania, Swaziland at zero-import tariff.

4.3.2 Select emerging economies

Table 11 shows single-use EGs South Africa and select emerging economies. In terms of South African exports to the world, South Africa exports significant amounts of solar PV devices (HS 854140), biofuels (HS 220710 and 220720); electric and certain hybrid vehicles (HS 870390), and insulating material (HS 680610). However, current bilateral trade between South Africa and the selected emerging countries is insignificant.

Table 11: Summary of South Africa's exports and imports by emerging economies with no or limited bilateral trade with South Africa.

China						
HS Code	**Product label**	**MFN applied tariff (%)**	**China imp World**	**China imp S.A**	**S.A exp World**	**S.A exp China**
			7 yr average	**7 yr average**	**7 yr average**	**7 yr average**
854140	Solar PV	0.0	6 382.43	0.04	105.58	0.04
220710	Biofuel: ethyl alcohol	40.0	1.81	0.00	95.00	0.00
220720	Biofuel: ethyl alcohol and other spirits	30.0	1.87	_	17.70	_
India						
HS Code	**Product label**	**MFN applied tariff (%)**	**India imp World**	**India imp S.A**	**S.A exp World**	**S.A exp India**
			7 yr average	**7 yr average**	**7 yr average**	**7 yr average**
854140	Solar PV	0.0	652.50	0.20	105.58	0.00
220710	Biofuel: ethyl alcohol	150.0	4.14	0.00	95.00	0.16
680610	Insulating materials	10.0	10.16	0.05	6.27	0.07
Brazil						

HS Code	Product label	MFN applied tariff (%)	Brazil imp World 7 yr average	Brazil imp S.A 7 yr average	S.A exp World 7 yr average	S.A exp Brazil 7 yr average
870390	Electric and certain hybrid vehicles	100	4.42	0.42	13.45	0.00

Source: TradeMap, International Trade Centre (2014); author's calculations

Discussion

According to the trade-chilling analysis, bilateral trade was limited on some EGs exported by South Africa to select emerging markets. The limited bilateral trade is attributed to high import tariffs. For instance, import tariffs were an obstacle to bilateral trade in biofuels (HS 220710 and 220720) imported into China (40% and 30% tariff duty respectively) and electric and certain hybrid vehicles (HS 870390) exported to Brazil (100%). In light of the high tariffs, the alternative export destination of biofuels and electric and certain hybrid vehicles for South Africa are Singapore (zero import duty for both EGs), USA (2.5% import duty for both EGs), Kenya (25% and 8.3% import duty, respectively) and Madagascar (zero duty and 20% import duty, respectively).

The trade chilling exercise suggests that South Africa has the potential to increase exports of Solar PV to India and China, imported duty-free. Since tariffs imposed on Solar PV in these markets were low, the trade chilling-analysis suggests that NTBs may be responsible for the limited bilateral trade in this regard. A common NTB that could have inhibited trade on Solar PV is local content requirements. Local content policies often requires manufacturers of Solar PV to either shift their foreign manufacturing bases to the host country or procure a certain percentage of intermediate inputs from local parts manufacturers to meet the local content percentage. Consequently, this policy measure acts as a barrier to trade for Solar PV exports, especially those who have not established local manufacturing facilities in the host country.

In 2013, South Africa faced competition from the top global exporters of (HS 854140) Solar PV which constituted of China, Taipei Chinese and Japan, accounting for 31%, 12% and 9% respectively. In addition, the trade-chilling analysis indicates potential for increased exports of (HS 680610) insulating material into the Indian market at 10% tariff. In this export market, South Africa is likely to face competition from India's leading exporters and neighbouring countries such as Netherlands, China and Republic of Korea.

Summary

In summary, the trade-chilling analysis suggests that the lack of current bilateral trade cannot be attributed to high tariffs applied on most EGs covered in this study project. However, the results indicate some areas where high tariffs were prevalent, although on limited product lines. In other words, NTBs may be considered as the main obstacle to bilateral trade between South Africa and select developed and emerging economies. Examples of NTBs include, but not limited, local content requirements, high transportation costs, lack of financial and manufacturing capacities; and varying and stringent product standards.

Based on the study results, it appears that imposing high tariffs on the importation of EGs is common practice in the selected emerging markets. The main reason for this is that most EGs industries in these countries are infant and vulnerable to external competition, especially from developed countries. The use of high tariffs can be seen as a justified policy objective by these economies to protect and allow their domestic industries to develop in the absence of foreign competition. On the contrary, tariffs in the selected developed economies appeared to be reasonably low and medium in most EGs. This is indicative of the developed and competitive EGs industries found in these economies which are capable to withstand foreign competition.

The trade chilling analysis also shows that potential exists for South Africa to increase bilateral trade in a wide variety of EGs. These areas are denoted by EGs where South Africa has strong export capacity (e.g. strong supply) to the global market, as well as high demand of specific EGs (imported at low tariffs) by select developed and emerging economies from the global market.

Chapter five: Conclusion and recommendations

This section discusses empirical findings and provides the contribution and theoretical implications of the paper with respect to the research questions. Furthermore, policy implications of the research key findings, as well as, recommendations for future actions and research are provided.

5.1 Conclusions

The research paper was set out to explore South Africa's trade in EGs with the view to investigate bilateral potential export opportunities to select developed and emerging economies. The study has also sought to know whether high tariffs resulted to the limited bilateral trade in EGs. Existing theoretical literature on this subject and specifically in the context of South Africa is very limited and inconclusive on a number of vital questions. As such, the study sought out to answer three of these questions:

- Has the global demand for EGs, according to the three EGs classification lists, been on the rise between 2007 and 2013?
- Is South Africa fully exploiting current bilateral trade opportunities in EGs in the markets of select developed and emerging economies?
- What are the potential export market opportunities for EGs exported by South Africa in the selected developed and emerging markets?

The main empirical findings lead the researcher to conclude that the global EGs market has grown significantly over the past few years, irrespective of the different product classification list used in the study. The bulk of global trade in EGs is mainly between developed countries. However, the demand for EGs is growing fastest in emerging economies, owing to increasing national response and mitigation measures to address the effects of climate change; and energy efficiency initiatives. The rapidly growing demand for EGs, accompanied by growing environmental regulation, is presenting growth potential and export opportunities for emerging economies to benefit from trade in EGs, as some emerging countries (e.g. China, India Brazil and South Africa) are already among the leading global importers and exporters of some EGs.

International trade barriers such as tariffs and NTBs have the potential to hinder trade in EGs and prevent emerging economies in taking advantage of existing export opportunities. Some

examples of trade restrictive NTBs include subsidies provided to domestic producers in the importing country and high export costs associated with inefficient backbone infrastructure (e.g. transport, telecommunication and energy services). The trade chilling analysis found that there is lack or limited bilateral trade between South Africa and the selected developed and emerging economies. This suggests that South Africa is not fully exploiting bilateral trade opportunities as there is potential to increase exports in a wide variety of EGs imported duty-free or at low tariff rates. Therefore, the limited or lack of bilateral trade cannot be attributed to high tariffs in most cases. Although there were EGs that are imported at very high tariffs, these only accounted for a fraction of the total number of EGs that were analysed in this study. Considering the above, this implies that the limited bilateral trade can be attributed to NTBs, which is likely to continue inhibiting South Africa from fully exploiting bilateral trade opportunities in the selected developed and emerging economies, unless addressed.

From the conclusions discussed above, several implications are identified and resulted in the following observations and recommendations.

- South Africa is exporting significant amount/value of EGs to the global market. However, South Africa's exports to select emerging and developed economies prove to be limited owing to high tariffs in some areas and NTBs on many EGs across the three classification lists. Tariffs appear to be a common challenge in the markets of emerging economies such as BRICS, whilst NTBs was a common trade barrier across both country groups. The implication for policy makers is that NTBs are an important trade barrier for most EGs exported by South Africa into select developed and emerging economies. In this context, policy makers should carefully evaluate NTBs that may have inhibited bilateral trade in order to develop a better understanding of the extent to which they affect bilateral trade. It is anticipated that this will contribute in the WTO process aimed at facilitating the diffusion of EGs, essential to curb the effects of climate change and promote sustainable development.
- The study has identified areas of export markets in select developed and emerging markets across the three EGs classification lists. This implies that the business community will need to incorporate the results of the study in their business decisions if they desire to increase their exports of EGs into the selected markets. Moreover, the government will need to focus resources towards the identified EGs for export

development. In doing so, it is expected that this will benefit domestic EGs manufacturers and promote economic development, job creation and assist in advancing governments' poverty alleviation initiative.

- High tariffs applied on the importation of EGs from South Africa are identified in the study, the implication for government is that they will need to develop South Africa's negotiation position on this basis, especially if the Doha Round negotiations on EGs resumes.

Based on the data in this study and the conclusions drawn, there is scope for an in-depth research to be conducted on:

(i) NTBs applied on EGs exported by South Africa. Identification and thorough assessment of these trade restrictive barriers is necessary for their elimination which in turn will enable South African firms to exploit the export benefits in the EGs markets of select developed and emerging economies. In addition, the removal of NTBs will assist with the diffusion of EGs essential for responding to the negative effects of climate change;

(ii) Broadening the scope of this study by exploring and identifying export opportunities in other markets, based on South Africa's existing competitive advantage on EGs;

(iii) Identification of existing supply-side constraints on South African EGs industrial base will be desirable in addressing bottlenecks and in the design of sector specific export development programmes. Such studies will place domestic firms in a better position to benefit from existing export potential opportunities.

5.2 Recommendations

South Africa stands to benefit from trade in EGs in the global market, particularly in select developed and emerging markets. However, in order to fully exploit existing bilateral trade opportunities, the following has to be done:

- Taking advantage of low tariffs in select developed and emerging markets

In order for South Africa to fully benefit from export opportunities, it should take advantage of opportunities already identified in this paper and focus on increasing exports of EGs into select markets that are imported duty-free or at very low tariffs.

- Take advantage of competitive domestic EGs sectors and diversify export markets

South Africa should consider conducting further research with the view to explore alternative export markets, preferably into SADC region given their close geographical proximity and preferential treatment given to South Africa under the SADC Protocol. Also, South Africa should work to increase its exports of EGs where it already has sufficient supply capacities.

- Developing domestic EGs industry and enhance export capacities

Like many economic sectors in emerging economies, the domestic EGs sectors, to some extent, suffer from lack of or poor export capacity. This can be attributed to numerous challenges associated with inefficiencies in the communication, energy, water and transport services sectors which in turn lead to high backbone infrastructure costs. In order to address these and other associated challenges, the government can strengthen policy instruments to generate the desired impact on the following areas of the EGs industry:

Investment promotion towards backbone infrastructure services: Efforts should also be focused in strengthening existing policy measures[13] aimed at promoting and facilitating domestic and foreign investment towards infrastructure development (e.g. transport, energy and telecommunications) in order to cut down unnecessary costs along the EGs value chain. It is envisaged that this will assist domestic firms to integrate themselves into the global value chains by participating in segments of the global production processes i.e. manufacture and supply of components (environmental goods) to foreign companies.

Small and medium enterprise development: The South African EGs industry is at its developmental stages relative to those in developed economies. As such, the industry, at enterprise level, faces difficulties associated with lack of access to capital. This can be best overcome by the provision of finance and strengthening of institutional capacity to support enterprise development, especially for start-ups. In addition, the provision of education and training is necessary as it will ensure skills transfer and a competitive skills base in the economy. It is envisaged that this policy stance may serve as an incentive for increased production and exports of EGs.

[13] This includes the Industrial Policy Action Plan (IPAP) aimed at upscaling the industrial-base in South Africa, and the Green Economy strategy, among others.

Research and Development: In comparison with developed countries, South Africa has limited budget to mobilise research and development (R&D) associated with environmental programmes. As such, it lags behind its global counterparts in terms of producing innovative environmental technology. For this reason, South African government has to allocate more of its budget in order to bridge the gap in R&D programmes. Also, incentives such as fiscal incentives (e.g. tax deductions/exemption) and programmes focused on the provision of grants, loans or subsidies should be made available in order to provide support to local firms involved in the development of innovative and clean technologies.

Procurement policy: Government procurement policy plays a vital role in shaping the domestic EGs industry. In this regard, it important that participation by small firms is encouraged within the domestic EGs value chain. This can be achieved through ensuring that government contracts are broken-up such that small firms are also given the chance to take part in the manufacturing and supply process of EGs.

Provision of export support services: Considerable attention is required from government in the form of export promotion for EGs, particularly where South Africa shows manufacturing capacities. These may include the following provision of export services: (i) market information and export opportunities, (ii) financing of environmental goods exports, and (iii) marketing and advisory services, among other things.

- Facilitate imports of inputs required by the domestic EGs industry

The government, through appropriate trade policy, need to ensure that the domestic import tariff structure does not unnecessarily inhibit the importation of key inputs required in the production process of EGs in the country. To do this, tariffs on inputs will have to be eliminated in order to ensure cost effective diffusion of components necessary to enhance competitiveness of the domestic industry.

- Strengthen South Africa's trade relations with the BRIC economies

High average MFN tariffs have been identified to be a major trade in the BRIC markets. In light of these, South Africa may consider strengthening its trade relations with the BRIC countries with the view to explore ways to reduce high tariffs and leverage on the potential gains emanating from these markets.

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ANNEXURE

Annexure 1: 153 environmental goods classification by WTO Members

HS Code:	Product description	Additional product description
Renewable Energy		
730820	Towers and Lattice Masts for Wind Turbines	
840681	Steam and other vapour turbines (other than turbines for marine propulsion): Of an output exceeding 40 MW)	
841011	Hydraulic Turbines and water wheels of a power not exceeding 1,000 kW	
841090	Hydraulic turbines, water wheels, and regulators; parts, including regulators	
841181	Other gas turbines of a power not exceeding 5,000 kW	
841182	Other gas turbines of a power exceeding 5,000 kW	
841919	Instantaneous or storage water heaters, non-electric (other than instantaneous gas water heaters)	
850231	Other electric generating sets: Wind-Powered	
854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitted diodes	
850680	Other primary cells and primary batteries	
Waste-Management, Water Treatment and Remediation		

840290	Super-heated water boilers and parts of steam generating boilers	
840410	Auxiliary plant for use with boilers of heading84.02 or 84.03	
Environmental Technologies		
850680	Other primary cells and primary batteries	
840991	Parts suitable for use solely or principally with the engines of heading 8407 or 8408	
840999	Other Parts suitable for use solely or principally with the engines of heading No. 84.07 or 84.08	
901540	Photogrammeterical surveying instruments and appliances	
901580	Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, excluding compasses, not elsewhere specified in 90.15	
901590	Parts accessories of the instruments and appliances of 90.15	
903130	Profile projectors	
903180	Other instruments, appliances and machines	
903190	Parts and accessories of the instruments and appliances and machines of 90.31.	
903210	Thermostats	
903220	Manostats	
903281	Hydraulic and pneumatic instruments	

	and apparatus	
903290	Parts and accessories for nominated articles of subheading 9032	
903300	Parts and accessories	
901530	Levels: Hydrological, oceanographic, meteorological instruments and appliances	
902610	Instruments and apparatus for measuring or checking the flow or level of liquid	
902620	Instruments and apparatus for measuring or checking pressure	
902680	Other Instruments and apparatus for measuring and checking gases or liquids	
902690	Parts and accessories for articles of subheading 9026	
902830	Electricity meters	
902890	Parts and accessories: Gas, Liquid or Electricity Supply of Production Meters	
902810	Gas Meters	

Source: Sugathan, M. (2013).

Annexure 2: Asian Pacific Economic Community (APEC) environmental goods classification

HS 6 Code:	**Product description**	**Additional product specification**
1. Pollution management		
A. Air pollution control		
8404.10	Auxiliary plant for use with boilers	

8405.10	Producer gas or water gas generators, with or without their purifier	
1.1 Air-handling equipment		
8414.10	Vacuum pumps	
8414.80	Other air or gas compressors or hoods	
8421.39	Filtering or purifying machinery and apparatus for gases	
8421.99	Parts for filtering or purifying machinery	
1.2 Catalytic converters		
8421.39	Filtering or purifying machinery and apparatus for gases	
8421.99	Parts for filtering or purifying machinery	
1.3 *Chemical recovery systems*		
8421.39	Filtering or purifying machinery and apparatus for gases	
8421.99	Parts for filtering or purifying machinery	
1.4 Dust collectors		
8421.39	Filtering or purifying machinery and apparatus for gases	
8421.99	Parts for filtering or purifying machinery	
1.5 Separators/precipitators		
8419.60	Machinery for liquefying air or other gases	
8421.99	Parts for filtering or purifying machinery	

1.6 *Incinerators, scrubbers*		
8417.80	Other furnaces, ovens, incinerators, non-electric waste incinerators	
8421.39	Filtering or purifying machinery and apparatus for gases; other	
8421.99	Parts of filtering or purifying machinery and apparatus for liquids or gases	
8514.20 and 8514.20	Industrial or laboratory induction or dielectric furnaces	Waste incinerators or other waste treatment apparatus
8514.30	Other industrial or laboratory electric furnaces and ovens	Waste incinerators or other waste treatment apparatus
8514.90	Parts, industrial or laboratory electric furnaces	Parts of waste incinerators
2. Wastewater management		
2.1 Aeration systems		
8414.80	Other air or gas compressors or hoods	
8543.89	Electrical machines and apparatus, having individual functions, not specified or included elsewhere in this chapter; other	Ozone production system
2.2 Chemical recovery systems		
8421.21	Water filtering or purifying machinery and apparatus	
8421.99	Parts for filtering or purifying machinery	
2.5 Oil/water separation systems		
8421.19	Other centrifuges	
8421.21	Water filtering or purifying machinery and apparatus	

8421.29	Other machinery for purifying liquids	
8421.91	Parts of centrifuges	
8421.99	Parts for filtering or purifying machinery	
2.6 Screens/strainers		
3926.90	Other articles of plastics and articles of other materials of HS 3901 to 3914; other	Bio-film medium consisting of woven fabric sheets that facilitate the growth of bio-organisms
5603.14	Non-wovens, whether or not impregnated, coated, covered or laminated: of man-made filaments; weighing more than 150g/m2	Fabric of polyethylene, polypropylene, or nylon for filtering wastewater
8421.21	Filtering or purifying machinery and apparatus for liquids	
8421.29	Filtering or purifying machinery and apparatus for liquids; other	
8421.99	Parts for filtering or purifying machinery	
2.7 Sewage treatment		
5911.90	Textile products and articles, for technical uses, specified in note 7 to this chapter; other	
8410.11	Hydraulic turbines 11	
8410.12	Hydraulic turbines 12	

8410.13	Hydraulic turbines 13	
8410.90	Parts for hydraulic turbines	
8417.80	Incinerators, non-electric	
8428.33	Other continuous-action elevators and conveyors, for goods or materials; other, belt type	Belt-type aboveground conveyor used to transfer solids or slurries between plants
8479.82	Mixing, kneading, crushing, grinding, screening, sifting, homogenising emulsifying or stirring machines	Agitator for wastewater treatment
8514.10	Industrial/lab electric resistance furnaces	Waste incinerators or other waste treatment apparatus
8514.20	Industrial/lab electric resistance furnaces	Waste incinerators or other waste treatment apparatus
8514.30	Industrial/lab electric furnaces & ovens, n.e.s.	Waste incinerators or other waste treatment apparatus
8514.90	Parts, industrial/lab electric furnaces	Parts of waste incinerators
2.9 Water handling goods and equipment		
8413.60	Pumps for liquids, whether or not fitted with a measuring device	Submersible mixer pump to circulate water in wastewater treatment process; sewage pumps, screw type

8413.70	Pumps for liquids, whether or not fitted with a measuring device	Centrifugal pumps lined to Prevent corrosion; centrifugal sewage pumps
9026.10	Instruments for measuring the flow or level of liquids	
9026.20	Instruments for measuring or checking pressure	
3. **Solid waste management**		
3.3 Waste disposal equipment		
8462.91	Machine tools for working metal, other than punching or notching and combined punching and shearing	Shredders/balers for metals; hydraulic
8472.90	Other office machines	Paper shredders
8479.89	Machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Trash compactors
8479.90	Parts of machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Parts of trash compactors
3.5 Waste separation equipment		
8474.10	Sorting, screening, separating or washing machines	Machines of a kind for use in screening and washing coal
8505.90	Electromagnets; other, including parts	Electromagnet
3.6 Recycling equipment		

8422.20	Machinery for cleaning or drying bottles or other containers	
8474.10	Sorting, screening, separating or washing machines	Waste foundry sand reclamation equipment
8474.32	Machines for mixing mineral substances with bitumen	Asphalt recycle equipment
8479.82	Mixing, kneading, crushing, grinding, screening, sifting, homogenising emulsifying or stirring machines	
8479.89	Machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Radioactive waste press
3.7 Incineration equipment		
6902.10	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; containing by weight, singly or together, more than 50% of the elements Mg, Ca or Cr, expressed as MgO, CaO or Cr2O3	Industrial incineration
6902.20	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; containing by weight more than 50% of alumina (Al2O3), of silica (SiO2) or of a mixture or compound	Industrial incineration
6902.90	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; other	Industrial incineration

8417.80	Industrial or laboratory furnaces and ovens, including incinerators, non-electric; other than bakery ovens and furnaces for treatment of ores	Waste incinerators
8417.90	Parts of Industrial or laboratory furnaces and ovens, including incinerators, non-electric	Parts of waste incinerators
8514.10	Industrial or laboratory furnaces and ovens; electric, resistance heated	Waste incinerators or other waste treatment apparatus
8514.20	Industrial or laboratory furnaces and ovens; electric, induction or dielectric	Waste incinerators or other waste treatment apparatus
8514.30	Industrial or laboratory furnaces and ovens, electric, other	Waste incinerators or other waste treatment apparatus
8514.90	Parts of industrial or laboratory electric furnaces and ovens or other laboratory induction or dielectric heating equipment	Parts of waste incinerators
4. Remediation and clean-up		
4.1 Absorbents		
2302.10	Bran, sharps and other residues, whether or not in the form of pellets, derived from the sifting, milling or other working of corn	Booms or socks consisting of ground corn cobs contained in a textile covering
4.3 Water treatment equipment		
8543.89	Other electrical machines and apparatus with one function	Ozone production system
8907.10	Inflatable rafts	Inflatable oil spill recovery barges

8907.90	Other floating structures	Pollution protection booms
5. Noise and vibration abatement		
5.1 Mufflers/silencers		
8409.91	Parts suitable for use solely or principally with the engines of HS 8407 or 8408; suitable for use solely or principally with spark ignition internal combustion piston engines	Industrial mufflers
6. Environmental monitoring, analysis and assessment		
6.1 Measuring and monitoring equipment		
6903.10	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; containing by weight more than 50% of graphite or other carbon or of a mixture of these products	Laboratory refractory equipment
6903.20	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; containing by weight more than 50% of alumina (Al2O3) or of a mixture or compound of alumina and of silica (SiO2)	Laboratory refractory equipment
6903.90	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; other	Laboratory refractory equipment

6909.19	Ceramic wares for laboratory, chemical or other technical uses; other	Laboratory equipment
7017.10	Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; of fused quartz or other fused silica	
7017.20	Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; of other glass having a linear coefficient of expansion not exceeding 5 x 10-6 per Kelvin within a temperature range of 0 ºC to 300 ºC	
7017.90	Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; other	
8414.10	Vacuum pumps	
8414.80	Air or vacuum pumps, air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters; other	
8419.40	Distilling or rectifying plant	
8419.60	Machinery for liquefying air or other gases	
8421.19	Centrifuges, including centrifugal dryers, other than cream separators and clothes dryers	
8421.91	Parts of centrifuges, including centrifugal dryers	Centrifuges, accessories & parts; except clothes dryers and lothesdryer furniture

9015.40	Photogrammetric surveying instruments and appliances	
9015.80	Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, excluding compasses	
9015.90	Parts and accessories of surveying, hydrological, meteorological or geophysical instruments and appliances, excluding compasses	Photogrammetric instruments; parts and accessories for articles of HS 9015.40
9022.29	Apparatus based on the use of X-rays or of alpha, beta or gamma radiations for other than medical, surgical, dental or veterinary uses	
9022.90	Apparatus based on the use of X-rays or of alpha, beta or gamma radiations for other than medical, surgical, dental or veterinary uses	Parts and accessories for goods of HS 9022.29
9025.11 and 9025.19	Thermometers and pyrometers, not combined with other instruments: liquid-filled, for direct reading	
9025.80	Hydrometers and similar floating instruments, thermometers, pyrometers, barometers, hygrometers and psychrometers, recording or not, and any combination of these instruments	
9025.90	Parts and accessories for hydrometers and similar floating instruments, thermometers, pyrometers, barometers, hygrometers, and psychrometers, recording or not, and any combination of these instruments	
9026.10	Instruments and apparatus for measuring or checking the flow or level of liquid	

9026.20	Instruments and apparatus for measuring or checking pressure	
9026.80	Other instruments and apparatus	
9026.90	Parts and accessories for articles of HS 9026	
9027.10	Gas or smoke analysis apparatus	
9027.20	Chromatographs and electrophoresis instruments	
9027.30	Spectrometers, pectrophotometers and spectrographs using optical radiations (ultraviolet, visible, infrared)	
9027.40	Exposure meters [including sound-level meters]	
9027.50	Other instruments and apparatus using optical radiations (ultraviolet, visible, infrared)	
9027.80	Other instruments and apparatus for physical or chemical analysis	
9027.90	Microtomes; parts and accessories	
9028.10	Gas meters	
9028.20	Liquid meters	
9028.30	Electricity meters	
9028.90	Parts and accessories for articles of HS 9028	
9030.10	Instruments and apparatus for measuring or detecting ionising radiations	
9030.20	Cathode ray oscilloscopes and cathode-ray oscillographs	

9030.31	Multimeters	
9030.39	Other instruments and apparatus, for measuring or checking voltage, current, resistance or power, without a recording device	
9030.83	Other instruments and apparatus for measuring or checking electrical quantities, with a recording device	
9030.89	Other instruments and apparatus for measuring or checking electrical quantities	
9030.90	Parts and accessories (for nominated articles of HS 9030)	
9031.10	Machines for balancing mechanical parts	
9031.20	Test benches	
9031.30	Profile projectors	
9031.80	Other measuring or checking instruments, appliances and machines, not elsewhere specified in this chapter	
9032.20	Manostats	
9032.81	Hydraulic and pneumatic instruments and apparatus	
9032.89	Automatic regulating or controlling instruments, other	
9032.90	Parts and accessories	
9033.00	Parts and accessories (not specified or included elsewhere in this chapter) for machines, appliances, instruments or apparatus of Ch. 90	

6.3 Process and control equipment		
9032.10	Thermostats	
B. Cleaner Technologies and Products		
C. Resources Management Group		
2. Water supply		
2.2 Water purification systems		
8543.89	Electrical machines and apparatus, having individual functions, not specified or included elsewhere in this chapter; other	Ozone production system
4. Renewable energy plant		
4.1 Solar energy		
8419.19	Other instantaneous or storage water heaters, nonelectric	Solar water heaters
8541.40	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes	Solar cells
4.2 Wind energy		
8413.81	Pumps for liquids, whether or not fitted with a measuring device; other pumps	Wind turbine pump
8502.31	Generating sets, electric, wind-powered	
5. Heat/energy savings and management		
8404.20	Condensers for steam or other vapour power units	
8409.99	Parts suitable for use solely or principally with the engines of HS 8407 or 8408; other	Industrial mufflers

8419.50	Heat exchange units	
9028.10	Gas supply, production and calibrating metres	
9028.20	Liquid supply, production and calibrating metres	
6. Sustainable agriculture and fisheries		
4601.20	Mats, matting and screens of vegetable materials	Erosion control matting (biodegradable) and Ecologically safe ground covers (biodegradable)
8436.80	Other agricultural, horticultural, forestry, poultry keeping or beekeeping machinery	Hot-water weed killing system

Source: Sugathan, M. (2013).

Annexure 3: Specific single-use environmental goods classification

HS Code: **HS 6 level**	**Product description**	**Additional product description**
850231	Wind turbines	
854140	Solar PV devices and light-emitting diodes	
841919	Solar water heaters	
220710	Biofuels	
220720	Biofuels	
841011	Hydraulic turbines	
841012	Hydraulic turbines	
841861	Heat pumps	
903210	Thermostat	

853931	Compact fluorescent lamps	
870390	Electric cars and certain hybrid vehicles	

Viljoen, W. (2012)

Annexure 4: Trade chilling results-WTO environmental goods list

Developed economies: USA

Product code	Product label	SA exports to World US$ million (7 Yr average)	USA imports from World US$ million (7 Yr average)	SA exports to USA US$ million (7 Yr average)	USA imports from SA US$ million (7 Yr average)
'220710	Undenaturd ethyl alcohol of an alcohol strgth by vol of 80% vol/higher	95.00	20.67	19.91	22.53
'252100	Limestone flux;limestone & other calcareous stone,for lime or cement	2.72	50.82	0.00	0.00
'252220	Slaked lime	3.37	46.86	0.00	0.00
'280110	Chlorine	5.61	67.82	0.01	0.00
'281410	Anhydrous ammonia	4.57	27.97	0.00	0.00
'281511	Sodium hydroxide (caustic soda) solid	2.88	5.03	0.00	0.00
'281512	Sodium hydroxide (caustic soda) in aqueous solution	2.00	15.48	0.00	0.00
'281610	Hydroxide and peroxide of magnesium	0.10	52.15	0.00	0.00
'281830	Aluminium hydroxide	0.22	14.84	0.00	0.01
'282010	Manganese dioxide	43.88	8.05	28.69	27.30
'282410	Lead monoxide (litharge, massicot)	0.44	0.00	0.01	1.88
'283210	Sodium sulphites	5.57	1.65	0.00	0.00
'283220	Sulphites of metals nes	0.40	0.00	0.00	0.00
'283510	Phosphinates (hypophosphites) & phosphonates (phosphites) of metals	0.11	2.10	0.00	0.00
'283523	Trisodium phosphate	0.00	0.00	0.00	0.00
'283524	Potassium phosphates	0.33	8.35	0.00	0.00
'283525	Calcium hydrogenorthophosphate (dicalcium phosphate)	0.76	1.35	0.00	0.00
'283526	Calcium phosphates nes	41.57	12.71	0.00	0.01
'283529	Phosphates of metals nes	0.56	1.71	0.00	0.00
'285100	Inorgn compds nes;liquid air;compressd air;amalgams o/t of prec metals	0.00	37.55	0.00	0.00
'290511	Methanol (methyl alcohol)	5.89	1 551.25	0.26	0.31
'320910	Paints&varnishes basd on acrylic/vinyl poly,dspr in an aqueous medium	15.30	151.62	0.00	0.06
'320990	Paints&varnishes based on polymers,dispersed in an aqueous medium,nes	18.72	216.51	0.02	0.01
'380210	Activated carbon	1.97	15.34	0.00	0.00
'391400	Ion-exchangers basd on polymers of Nos 39.01 to 39.13 in primary forms	1.11	343.34	0.00	0.00
'392020	Film and sheet etc, non-cellular etc, of polymers of propylene	9.88	788.01	0.00	0.00
'392490	Household and toilet articles nes, of plastics	12.16	1 915.29	0.02	0.07
'392690	Articles of plastics or of other materials of Nos 39.01 to 39.14 nes	73.45	4 594.76	5.98	19.32
'580190	Woven pile fab&chenille fab of other tex mat,o/t terry&narrow fabrics	0.30	0.00	0.01	0.00
'681099	Articles of cement, of concrete or of artificial stone nes	6.73	24.35	0.00	0.04
'700800	Multiple-walled insulating units of glass	0.36	253.82	0.00	0.00
'701990	Glass fibres (including glass wool) and articles thereof nes	7.73	275.19	0.05	0.22
'730900	Reservoirs,tanks,vats&sim ctnr,cap >300L,i o s (ex liq/compr gas type)	31.42	19.26	1.02	0.71
'731010	Tanks,casks,drums,cans,boxes&sim contr,i or s,capac >=50L but <300L	14.07	14.99	0.20	0.19
'731021	Cans,iron o steel,cap <50 litres,to be closd by crimpg o soldering,nes	31.80	138.88	0.00	0.00
'731029	Cans, iron or steel, capacity <50 litres nes	68.94	365.31	0.05	0.04
'732510	Cast articles of non-malleable cast iron nes	0.55	270.71	0.00	0.02
'780600	Articles of lead nes	14.67	74.41	0.00	0.02
'840991	Parts for spark-ignition type engines nes	65.28	4 882.74	2.90	2.83
'840999	Parts for diesel and semi-diesel engines	186.46	2 862.35	59.48	61.01
'841011	Hydraulic turbines & water wheels of a power not exceeding 1000 KW	0.30	41.46	0.01	0.00
'841012	Hyd turbines&water wheels of a power exc 1000 KW but nt excedg 10000KW	0.03	40.63	0.00	0.00
'841013	Hydraulic turbines and water wheels of a power exceeding 10000 KW	0.10	41.36	0.00	0.00
'841090	Parts of hydraulic turbines & water wheels including regulators	0.81	95.65	0.02	0.06
'841320	Hand pumps nes, o/t those of subheading No 8413.11 or 8413.19	0.54	173.64	0.01	0.00
'841350	Reciprocating positive displacement pumps nes	2.11	1 561.42	0.11	0.10
'841360	Rotary positive displacement pumps nes	3.86	1 133.92	0.13	0.54
'841370	Centrifugal pumps nes	32.60	1 072.97	0.99	1.41
'841381	Pumps nes	88.64	429.45	0.88	0.21
'841410	Vacuum pumps	2.92	677.54	0.02	0.19
'841430	Compressors of a kind used in refrigerating equipment	6.36	1 711.81	0.01	0.01
'841440	Air compressors mounted on a wheeled chassis for towing	8.11	129.71	0.10	0.00
'841480	Air or gas compressors, hoods	15.72	1 768.57	0.71	0.43
'841490	Parts of vacuum pumps, compressors, fans, blowers, hoods	16.32	1 964.30	0.72	0.43
'841780	Industrial or lab furnaces & ovens, inc incinerators non-electric nes	2.97	61.21	0.02	0.00
'841790	Parts of industrial/lab furnaces&ovens inc incinerators non-electr nes	5.79	236.56	0.49	0.58
'841911	Instantaneous gas water heaters	1.61	343.07	0.00	0.00
'841919	Instantaneous or storage water heaters, non-electric, nes	1.85	383.64	0.01	0.03
'841950	Heat exchange units, non-domestic, non-electric	6.89	800.20	0.10	8.95

USA continued:

Product code	Product label	SA exports to World US$ million (7 Yr average)	USA imports from World US$ million (7 Yr average)	SA exports to USA US$ million (7 Yr average)	USA imports from SA US$ million (7 Yr average)
'841960	Machinery for liquefying air or gas	0.93	157.32	0.01	0.03
'841989	Machinery,plant/laboratory equip f treat of mat by change of temp nes	11.07	518.15	0.16	0.14
'841990	Parts of machinery, plant and equipment of heading No 84.19	10.73	1 049.03	0.73	0.27
'842119	Centrifuges nes	2.29	315.16	0.02	0.03
'842121	Filtering or purifying machinery and apparatus for water	30.49	1 058.57	0.55	0.24
'842129	Filtering or purifying machinery and apparatus for liquids nes	11.67	915.25	0.04	0.22
'842131	Intake air filters for internal combustion engines	36.84	15.50	3.66	2.56
'842139	Filtering or purifying machinery and apparatus for gases nes	0.00	2 541.00	215.38	206.26
'842191	Parts of centrifuges, including centrifugal dryers	1.81	198.75	0.03	0.02
'842199	Parts for filterg or purifyg mchy & apparatus for liquids or gases,nes	36.31	1 074.76	0.90	6.31
'842220	Machinery for cleaning or drying bottles or containers nes	0.67	88.56	0.00	0.09
'842381	Weighg machinery havg a maximum weighg capacity not exceed 30 kg nes	0.40	187.30	0.00	0.00
'842382	Weighg mach havg a maximum weighg cap > 30 kg but <=5000 kg nes	0.68	239.24	0.00	0.01
'842389	Weighing machinery, nes	5.24	53.43	0.01	0.01
'842490	Pts of mech app (hand-op or not) for proj/disp or spray liq or powders	9.27	850.38	0.23	4.52
'847439	Mixg or kneadg machines nes for earth or other mineral substances etc	8.28	61.16	0.02	0.01
'847982	Mach f mixing/kneading/crushing/grindg etc nes havg individ function	4.41	403.90	0.02	0.19
'847989	Machines & mechanical appliances nes having individual functions	65.30	3 198.53	3.74	1.36
'848110	Valves, pressure reducing	11.12	381.78	0.06	0.08
'848130	Valves, check	5.82	376.06	0.03	0.05
'848140	Valves, safety or relief	7.05	507.52	0.11	0.03
'848180	Taps, cocks, valves and similar appliances, nes	84.34	6 201.72	3.33	3.46
'851410	Industrial & laboratory electric resistance heated furnaces & ovens	0.41	230.01	0.00	0.02
'851420	Industrial&laboratory electric induction o dielectric furnaces&ovens	2.92	133.13	0.00	0.00
'851430	Industrial & laboratory electric furnaces & ovens nes	4.87	83.26	0.05	0.06
'851490	Parts of industrial or laboratory electric furnaces and ovens nes	9.70	231.07	0.20	0.09
'851629	Electric space heating apparatus & electric soil heating apparatus,nes	8.76	743.39	0.79	0.61
'853931	Fluorescent lamps, hot cathode	2.05	726.18	0.00	0.00
'854140	Photosensitive semiconduct device,photovoltaic cells&light emit diodes	107.42	4 966.09	0.13	0.17
'854389	Electrical machines and apparatus nes	0.00	37.39	0.00	0.00
'870892	Mufflers and exhaust pipes for motor vehicles	204.57	23.94	20.16	22.65
'901320	Lasers, other than laser diodes	0.74	521.31	0.15	0.37
'902511	Thermometers, not combined with other instruments, liquid-filled	0.13	50.44	0.00	0.00
'902519	Thermometers, not combined with other instruments, nes	0.83	451.84	0.01	0.02
'902610	Instruments&apparatus for measurg o checkg the flow o level of liquids	9.46	668.47	0.63	0.67
'902620	Instruments and apparatus for measuring or checking pressure	7.52	25.85	0.19	0.16
'902680	Instruments&apparatus for measurg o check variables of liq o gases,nes	9.90	357.92	0.48	0.31
'902690	Parts of inst&app for measurg or checkg variables of liq or gases,nes	3.03	622.39	0.18	0.10
'902710	Gas or smoke analysis apparatus	2.24	722.03	0.03	0.12
'902720	Chromatographs and electrophoresis instruments	0.44	312.73	0.00	0.00
'902730	Spectrometers,spectrophotometers&spectrographs usg optical radiations	3.56	372.07	0.18	0.06
'902740	Exposure meters	0.00	33.91	0.00	0.00
'902780	Instruments and apparatus for physical or chemical analysis, nes	13.20	1 344.47	0.19	0.45
'902790	Microtomes;parts&access of inst&app for physical or chem analysis,nes	3.29	1 373.39	0.12	0.04
'902810	Gas supply, production and calibrating meters	0.43	70.82	0.00	0.00
'902820	Liquid supply, production and calibrating meters	4.67	236.33	0.02	0.00
'903010	Instruments & apparatus for measuring or detecting ionising radiations	1.06	247.45	0.10	0.02
'903149	Optical instruments and appliances nes	2.45	644.84	0.26	0.73
'903180	Measuring or checking instruments, appliances and machines, nes	43.53	2 293.89	2.44	0.91
'903210	Thermostats	1.68	965.43	0.02	0.03
'903220	Manostats	0.05	87.94	0.00	0.00
'903281	Hydraulic or pneumatic automatic regulating or controlling inst & app	0.48	99.90	0.03	0.03
'903289	Automatic regulating or controlling instruments and apparatus, nes	25.41	2 754.09	1.75	0.68
'960310	Brooms/brushes of twigs/oth veg mat bound together,with/w/o handles	1.68	57.45	0.01	0.00
'960350	Brushes nes, constituting parts of machines, appliances or vehicles	0.91	153.53	0.00	0.01

United Kingdom:

Product code	Product label	SA exports to World US$ million (7 Yr average)	UK imports from World US$ million (7 Yr average)	SA exports to UK US$ million (7 Yr average)	UK imports from SA US$ million (7 Yr average)
'220710	Undenaturd ethyl alcohol of an alcohol strgth by vol of 80% vol/higher	95	218.3	0.08	0
'252100	Limestone flux;limestone & other calcareous stone,for lime or cement	2.72	2.66	0	0
'252220	Slaked lime	3.37	1.09	0	0
'280110	Chlorine	5.61	1.53	0	0
'281410	Anhydrous ammonia	4.57	29.78	0	0
'281511	Sodium hydroxide (caustic soda) solid	2.88	11.22	0	0.01
'281512	Sodium hydroxide (caustic soda) in aqueous solution	2	49.19	0	0
'281610	Hydroxide and peroxide of magnesium	0.1	6.58	0	0
'281830	Aluminium hydroxide	0.22	50.2	0	0
'282010	Manganese dioxide	43.88	0.67	0	0
'282410	Lead monoxide (litharge, massicot)	0.44	1.58	0	0.19
'283210	Sodium sulphites	5.57	4.78	0	0
'283220	Sulphites of metals nes	0.4	0.42	0	0
'283510	Phosphinates (hypophosphites) & phosphonates (phosphites) of metals	0.11	4.38	0	0
'283523	Trisodium phosphate	0	0	0	0
'283524	Potassium phosphates	0.33	5.24	0	0
'283526	Calcium phosphates nes	41.57	29.28	0	0
'283529	Phosphates of metals nes	0.56	9.44	0	0
'285100	Inorgn compds nes;liquid air;compressd air;amalgams o/t of prec metals	0	0.8	0	0.09
'290511	Methanol (methyl alcohol)	5.89	70.54	0	0
'320910	Paints&varnishes basd on acrylic/vinyl poly,dspr in an aqueous medium	15.3	153.05	0	0.11
'320990	Paints&varnishes based on polymers,dispersed in an aqueous medium,nes	18.72	104.11	0.06	0.04
'380210	Activated carbon	1.97	37.81	0	0
'391400	Ion-exchangers basd on polymers of Nos 39.01 to 39.13 in primary forms	1.11	34.22	0	0
'392020	Film and sheet etc, non-cellular etc, of polymers of propylene	9.88	506.03	0	0.05
'392490	Household and toilet articles nes, of plastics	12.16	191.85	0.12	0.23
'392690	Articles of plastics or of other materials of Nos 39.01 to 39.14 nes	73.45	1610.92	1.71	1.83
'580190	Woven pile fab&chenille fab of other tex mat,o/t terry&narrow fabrics	0.3	9.31	0	0.01
'681099	Articles of cement, of concrete or of artificial stone nes	6.73	77.86	0	0.01
'700800	Multiple-walled insulating units of glass	0.36	29.17	0	0
'701990	Glass fibres (including glass wool) and articles thereof nes	7.73	80.57	0.41	0.13
'730900	Reservoirs,tanks,vats&sim ctnr,cap >300L,i o s (ex liq/compr gas type)	31.42	62.35	0.15	0.07
'731010	Tanks,casks,drums,cans,boxes&sim contr,i or s,capac >=50L but <300L	14.07	66.58	0.06	0.03
'731021	Cans,iron o steel,cap <50 litres,to be closd by crimpg o soldering,nes	31.8	62.98	0	0
'731029	Cans, iron or steel, capacity <50 litres nes	68.94	110.09	0.07	0
'732510	Cast articles of non-malleable cast iron nes	0.55	137.36	0.04	0.09
'780600	Articles of lead nes	14.67	9.16	0	0
'840991	Parts for spark-ignition type engines nes	65.28	2212.54	17.63	12.32
'840999	Parts for diesel and semi-diesel engines	186.46	1400.79	21.38	20.76
'841011	Hydraulic turbines & water wheels of a power not exceeding 1000 KW	0.3	1.04	0	0.03
'841012	Hyd turbines&water wheels of a power exc 1000 KW but nt excedg 10000KW	0.03	0.07	0	0
'841013	Hydraulic turbines and water wheels of a power exceeding 10000 KW	0	0.17	0	0
'841090	Parts of hydraulic turbines & water wheels including regulators	0.81	10.96	0.01	0
'841320	Hand pumps nes, o/t those of subheading No 8413.11 or 8413.19	0.54	23.61	0	0
'841350	Reciprocating positive displacement pumps nes	2.11	153.15	0	0.07
'841360	Rotary positive displacement pumps nes	3.86	188.61	0	0.09
'841370	Centrifugal pumps nes	32.6	242.93	0	0.28
'841381	Pumps nes	88.64	147.34	0.56	0.05
'841410	Vacuum pumps	2.92	121.61	0.01	0.02
'841430	Compressors of a kind used in refrigerating equipment	6.36	168.91	0	0
'841440	Air compressors mounted on a wheeled chassis for towing	8.11	40.27	0	0
'841480	Air or gas compressors, hoods	15.72	668.16	0.06	0.21
'841490	Parts of vacuum pumps, compressors, fans, blowers, hoods	16.32	398.51	0.31	1.07
'841780	Industrial or lab furnaces & ovens, inc incinerators non-electric nes	2.97	11.8	0.06	0.05
'841790	Parts of industrial/lab furnaces&ovens inc incinerators non-electr nes	5.79	36.61	0	0.43
'841911	Instantaneous gas water heaters	1.61	12.37	0.02	0
'841919	Instantaneous or storage water heaters, non-electric, nes	1.85	50.29	0.03	0.01
'841950	Heat exchange units, non-domestic, non-electric	6.89	181.61	0.09	0.18
'841960	Machinery for liquefying air or gas	0.93	21.87	0	0

United Kingdom continued:

Product code	Product label	SA exports to World US$ million (7 Yr average)	UK imports from World US$ million (7 Yr average)	SA exports to UK US$ million (7 Yr average)	UK imports from SA US$ million (7 Yr average)
'841989	Machinery,plant/laboratory equip f treat of mat by change of temp nes	11.07	108.88	0.29	1.06
'841990	Parts of machinery, plant and equipment of heading No 84.19	10.73	155.94	0.28	0.09
'842119	Centrifuges nes	1.42	37.36	0.09	0
'842121	Filtering or purifying machinery and apparatus for water	30.49	163.92	1.26	0.9
'842129	Filtering or purifying machinery and apparatus for liquids nes	11.67	134.89	0.09	0.07
'842131	Intake air filters for internal combustion engines	36.84	118.24	2.69	0.21
'842139	Filtering or purifying machinery and apparatus for gases nes	0	565.94	210	202.15
'842191	Parts of centrifuges, including centrifugal dryers	1.81	28.57	0.02	0
'842199	Parts for filterg or purifyg mchy & apparatus for liquids or gases,nes	36.31	366.86	0.29	0.72
'842220	Machinery for cleaning or drying bottles or containers nes	0.67	18.84	0.15	0.02
'842381	Weighg machinery havg a maximum weighg capacity not exceed 30 kg nes	0.4	22.45	0	0.01
'842382	Weighg mach havg a maximum weighg cap > 30 kg but <=5000 kg nes	0.68	7.83	0.01	0.01
'842389	Weighing machinery, nes	5.24	17.26	0.02	0
'842490	Pts of mech app (hand-op or not) for proj/disp or spray liq or powders	9.27	180.91	0.14	0.14
'847439	Mixg or kneadg machines nes for earth or other mineral substances etc	8.28	16.43	0.01	0
'847982	Mach f mixing/kneading/crushing/grindg etc nes havg individ function	4.41	77.74	0.02	0.02
'847989	Machines & mechanical appliances nes having individual functions	65.3	586.47	1.26	0.71
'848110	Valves, pressure reducing	11.12	116.21	0.36	0.1
'848130	Valves, check	5.82	86.99	0.05	0.03
'848140	Valves, safety or relief	7.05	109.53	0.11	0.05
'848180	Taps, cocks, valves and similar appliances, nes	84.34	1816.93	1.2	2.66
'851410	Industrial & laboratory electric resistance heated furnaces & ovens	0.41	19	0	0
'851420	Industrial&laboratory electric induction o dielectric furnaces&ovens	2.92	11.07	0	0
'851430	Industrial & laboratory electric furnaces & ovens nes	4.87	15.17	0.01	0
'851490	Parts of industrial or laboratory electric furnaces and ovens nes	9.7	24.86	0.02	0
'851629	Electric space heating apparatus & electric soil heating apparatus,nes	8.76	171.48	1.9	0.33
'853931	Fluorescent lamps, hot cathode	0.99	213.36	0	0
'854140	Photosensitive semiconduct device,photovoltaic cells&light emit diodes	107.42	992.24	0.19	0.17
'854389	Electrical machines and apparatus nes	0	0.67	0	0
'870892	Mufflers and exhaust pipes for motor vehicles	204.57	311.34	0	2.72
'901320	Lasers, other than laser diodes	0.74	115.19	0.05	0.03
'902511	Thermometers, not combined with other instruments, liquid-filled	0.13	5.32	0	0
'902519	Thermometers, not combined with other instruments, nes	0.83	67.22	0	0.02
'902610	Instruments&apparatus for measurg o checkg the flow o level of liquids	9.46	203.56	0.14	0.18
'902620	Instruments and apparatus for measuring or checking pressure	7.52	185.9	0.8	0.79
'902680	Instruments&apparatus for measurg o check variables of liq o gases,nes	9.9	176.68	0.16	0.22
'902690	Parts of inst&app for measurg or checkg variables of liq or gases,nes	3.03	202.51	0.09	0.04
'902710	Gas or smoke analysis apparatus	2.24	143.63	0.12	0.12
'902720	Chromatographs and electrophoresis instruments	0.44	54.48	0	0.01
'902730	Spectrometers,spectrophotometers&spectrographs usg optical radiations	3.56	107.56	0.11	0.12
'902740	Exposure meters	0	0	0	0
'902780	Instruments and apparatus for physical or chemical analysis, nes	13.2	233.81	0.15	0.21
'902790	Microtomes;parts&access of inst&app for physical or chem analysis,nes	3.29	415.27	0.04	0.17
'902810	Gas supply, production and calibrating meters	0.43	28.79	0	0
'902820	Liquid supply, production and calibrating meters	4.67	35.78	0.04	0
'903010	Instruments & apparatus for measuring or detecting ionising radiations	1.06	47.53	0.21	0.02
'903149	Optical instruments and appliances nes	2.45	105.26	0.05	0.08
'903180	Measuring or checking instruments, appliances and machines, nes	43.53	417.2	2.4	1.39
'903210	Thermostats	1.68	127.42	0.13	0.01
'903220	Manostats	0.05	26.94	0	0
'903281	Hydraulic or pneumatic automatic regulating or controlling inst & app	0.48	23.42	0	0
'903289	Automatic regulating or controlling instruments and apparatus, nes	25.41	1006.29	1.45	1.13
'960310	Brooms/brushes of twigs/oth veg mat bound together,with/w/o handles	1.68	14.72	0	0
'960350	Brushes nes, constituting parts of machines, appliances or vehicles	0.91	16.1	0.01	0.01

Germany:

Product code	Product label	SA exports to World US$ million (7 Yr average)	Germany imports from World US$ million (7 Yr average)	SA exports to Germany US$ million (7 Yr average)	Germany imports from SA US$ million (7 Yr average)
'392690	Articles of plastics or of other materials of Nos 39.01 to 39.14 nes	73.45	3 515.82	4.55	2.06
'840999	Parts for diesel and semi-diesel engines	186.46	3 361.78	46.48	48.83
'840991	Parts for spark-ignition type engines nes	65.28	2 364.44	8.13	20.82
'854140	Photosensitive semiconduct device,photovoltaic cells&light emit diodes	107.42	9 180.81	1.27	1.63
'848180	Taps, cocks, valves and similar appliances, nes	84.34	2 594.13	0.43	1.02
'842139	Filtering or purifying machinery and apparatus for gases nes	-	1 747.28	788.83	567.85
'903289	Automatic regulating or controlling instruments and apparatus, nes	25.41	1 807.34	1.72	2.88
'847989	Machines & mechanical appliances nes having individual functions	65.30	1 739.31	2.95	1.94
'903180	Measuring or checking instruments, appliances and machines, nes	43.53	1 546.08	3.62	2.77
'841480	Air or gas compressors, hoods	15.72	1 164.68	0.11	0.33
'841490	Parts of vacuum pumps, compressors, fans, blowers, hoods	16.32	1 031.39	0.55	0.38
'902790	Microtomes;parts&access of inst&app for physical or chem analysis,nes	3.29	1 005.81	0.13	0.13
'841430	Compressors of a kind used in refrigerating equipment	6.36	1 032.41	0.02	0.01
'902780	Instruments and apparatus for physical or chemical analysis, nes	13.20	762.67	0.18	0.09
'842199	Parts for filterg or purifyg mchy & apparatus for liquids or gases,nes	36.31	817.47	8.49	33.65
'841370	Centrifugal pumps nes	32.60	866.78	0.37	0.54
'392020	Film and sheet etc, non-cellular etc, of polymers of propylene	9.88	694.31	0.00	0.00
'841950	Heat exchange units, non-domestic, non-electric	6.89	730.69	0.10	0.19
'290511	Methanol (methyl alcohol)	5.89	544.63	0.06	0.02
'842129	Filtering or purifying machinery and apparatus for liquids nes	11.67	372.15	0.03	0.09
'902710	Gas or smoke analysis apparatus	2.24	367.05	0.11	0.09
'732510	Cast articles of non-malleable cast iron nes	0.55	450.39	0.09	0.17
'901320	Lasers, other than laser diodes	0.74	252.95	0.10	0.03
'903149	Optical instruments and appliances nes	2.45	352.19	0.17	0.63
'902690	Parts of inst&app for measurg or checkg variables of liq or gases,nes	3.03	335.65	0.04	0.05
'902610	Instruments&apparatus for measurg o checkg the flow o level of liquids	9.46	420.31	0.08	0.12
'841990	Parts of machinery, plant and equipment of heading No 84.19	10.73	378.40	0.05	0.51
'842490	Pts of mech app (hand-op or not) for proj/disp or spray liq or powders	9.27	324.00	0.06	0.05
'392490	Household and toilet articles nes, of plastics	12.16	318.14	0.17	0.01
'903210	Thermostats	1.68	301.44	0.02	0.14
'841360	Rotary positive displacement pumps nes	3.86	314.68	0.08	0.13
'841350	Reciprocating positive displacement pumps nes	2.11	248.21	0.05	0.09
'841989	Machinery,plant/laboratory equip f treat of mat by change of temp nes	11.07	243.88	0.04	0.03
'841410	Vacuum pumps	2.92	280.55	0.02	0.05
'841919	Instantaneous or storage water heaters, non-electric, nes	1.85	369.42	0.00	0.00
'841381	Pumps nes	88.64	232.68	0.59	0.35
'902519	Thermometers, not combined with other instruments, nes	0.83	241.77	0.05	0.11
'842121	Filtering or purifying machinery and apparatus for water	30.49	195.90	0.23	0.13
'853931	Fluorescent lamps, hot cathode	2.05	296.49	0.02	-
'848140	Valves, safety or relief	7.05	208.85	0.08	0.18
'731021	Cans,iron o steel,cap <50 litres,to be closd by crimpg o soldering,nes	31.80	192.41	-	0.00
'902680	Instruments&apparatus for measurg o check variables of liq o gases,nes	9.90	182.48	0.25	0.09
'902730	Spectrometers,spectrophotometers&spectrographs usg optical radiations	3.56	275.99	0.05	0.17
'847982	Mach f mixing/kneading/crushing/grindg etc nes havg individ function	4.41	174.26	0.03	0.39
'320990	Paints&varnishes based on polymers,dispersed in an aqueous medium,nes	18.72	217.45	0.02	0.03
'848110	Valves, pressure reducing	11.12	151.09	0.05	0.05
'851629	Electric space heating apparatus & electric soil heating apparatus,nes	8.76	150.01	0.03	0.00
'902720	Chromatographs and electrophoresis instruments	0.44	126.51	0.01	0.00
'320910	Paints&varnishes basd on acrylic/vinyl poly,dspr in an aqueous medium	15.30	142.11	0.00	0.00
'731029	Cans, iron or steel, capacity <50 litres nes	68.94	123.95	0.09	0.03
'701990	Glass fibres (including glass wool) and articles thereof nes	7.73	164.76	0.19	0.05
'902820	Liquid supply, production and calibrating meters	4.67	92.17	0.00	0.01
'848130	Valves, check	5.82	105.17	0.05	0.03
'903281	Hydraulic or pneumatic automatic regulating or controlling inst & app	0.48	74.77	0.00	0.11
'841790	Parts of industrial/lab furnaces&ovens inc incinerators non-electr nes	5.79	110.93	0.01	0.02
'903220	Manostats	0.05	102.92	0.00	0.09
'391400	Ion-exchangers basd on polymers of Nos 39.01 to 39.13 in primary forms	1.11	63.89	0.00	0.01
'842191	Parts of centrifuges, including centrifugal dryers	1.81	73.64	0.34	0.42

Germany continued:

Product code	Product label	SA exports to World US$ million (7 Yr average)	Germany imports from World US$ million (7 Yr average)	SA exports to Germany US$ million (7 Yr average)	Germany imports from SA US$ million (7 Yr average)
'851490	Parts of industrial or laboratory electric furnaces and ovens nes	9.70	83.22	0.26	0.02
'960350	Brushes nes, constituting parts of machines, appliances or vehicles	0.91	52.15	0.01	0.18
'842119	Centrifuges nes	2.29	68.35	0.25	0.12
'841320	Hand pumps nes, o/t those of subheading No 8413.11 or 8413.19	0.54	42.37	0.00	0.03
'841911	Instantaneous gas water heaters	1.61	37.91	0.01	-
'903010	Instruments & apparatus for measuring or detecting ionising radiations	1.06	42.48	0.03	0.03
'700800	Multiple-walled insulating units of glass	0.36	24.52	0.00	-
'841090	Parts of hydraulic turbines & water wheels including regulators	0.81	56.24	0.01	-
'851410	Industrial & laboratory electric resistance heated furnaces & ovens	0.41	39.59	-	0.01
'842381	Weighg machinery havg a maximum weighg capacity not exceed 30 kg nes	0.40	37.09	0.00	-
'842220	Machinery for cleaning or drying bottles or containers nes	0.67	35.15	0.00	0.00
'281610	Hydroxide and peroxide of magnesium	0.10	14.70	-	-
'842382	Weighg mach havg a maximum weighg cap > 30 kg but <=5000 kg nes	0.68	19.67	0.00	0.00
'252100	Limestone flux;limestone & other calcareous stone,for lime or cement	2.72	19.19	0.00	0.00
'851420	Industrial&laboratory electric induction o dielectric furnaces&ovens	2.92	19.23	0.01	0.00
'841960	Machinery for liquefying air or gas	0.93	15.66	0.00	-
'841440	Air compressors mounted on a wheeled chassis for towing	8.11	19.69	0.01	0.00
'902810	Gas supply, production and calibrating meters	0.43	10.86	0.00	0.01
'841780	Industrial or lab furnaces & ovens, inc incinerators non-electric nes	2.97	18.08	0.02	0.00
'851430	Industrial & laboratory electric furnaces & ovens nes	4.87	26.32	0.01	0.00
'847439	Mixg or kneadg machines nes for earth or other mineral substances etc	8.28	13.15	-	0.01
'780600	Articles of lead nes	14.67	13.64	-	0.01
'252220	Slaked lime	3.37	7.65	3.37	-
'280110	Chlorine	5.61	9.03	-	-
'841012	Hyd turbines&water wheels of a power exc 1000 KW but nt excedg 10000KW	0.03	0.34	-	-
'902511	Thermometers, not combined with other instruments, liquid-filled	0.13	7.40	0.01	-
'842389	Weighing machinery, nes	5.24	3.71	0.00	0.00
'960310	Brooms/brushes of twigs/oth veg mat bound together,with/w/o handles	1.68	3.25	0.00	-
'841011	Hydraulic turbines & water wheels of a power not exceeding 1000 KW	0.30	1.91	-	0.00
'841013	Hydraulic turbines and water wheels of a power exceeding 10000 KW	0.10	0.03	-	-
'285100	Inorgn compds nes;liquid air;compressd air;amalgams o/t of prec metals	-	-	-	-
'854389	Electrical machines and apparatus nes	-	-	-	-
'902740	Exposure meters	-	-	-	-
'870892	Mufflers and exhaust pipes for motor vehicles	204.57	786.53	47.68	15.45
'902620	Instruments and apparatus for measuring or checking pressure	7.52	636.25	0.11	0.26
'220710	Undenaturd ethyl alcohol of an alcohol strgth by vol of 80% vol/higher	95.00	744.88	0.01	2.14
'281410	Anhydrous ammonia	4.57	233.49	-	-
'842131	Intake air filters for internal combustion engines	36.84	219.94	2.60	79.39
'730900	Reservoirs,tanks,vats&sim ctnr,cap >300L,i o s (ex liq/compr gas type)	31.42	187.72	0.07	0.01
'380210	Activated carbon	1.97	97.01	0.00	0.43
'731010	Tanks,casks,drums,cans,boxes&sim contr,i or s,capac >=50L but <300L	14.07	102.01	0.10	0.00
'681099	Articles of cement, of concrete or of artificial stone nes	6.73	99.39	0.05	0.00
'283526	Calcium phosphates nes	41.57	84.93	-	0.00
'281512	Sodium hydroxide (caustic soda) in aqueous solution	2.00	58.56	-	-
'281830	Aluminium hydroxide	0.22	70.50	-	-
'282010	Manganese dioxide	43.88	27.72	-	1.13
'283510	Phosphinates (hypophosphites) & phosphonates (phosphites) of metals	0.11	16.77	-	-
'281511	Sodium hydroxide (caustic soda) solid	2.88	14.03	-	0.00
'283529	Phosphates of metals nes	0.56	14.22	-	-
'283524	Potassium phosphates	0.33	7.26	-	0.00
'283525	Calcium hydrogenorthophosphate (dicalcium phosphate)	0.76	13.42	-	-
'580190	Woven pile fab&chenille fab of other tex mat,o/t terry&narrow fabrics	0.30	3.54	-	-
'283210	Sodium sulphites	5.57	2.14	-	-
'283220	Sulphites of metals nes	0.40	0.40	-	-
'282410	Lead monoxide (litharge, massicot)	0.44	0.66	-	0.02
'283523	Trisodium phosphate	-	-	-	-

Emerging economies: China

Product code	Product label	SA exports to World US$ million (7 Yr average)	China imports from World US$ million(7 Yr average)	SA exports to China $ million (7 Yr average)	China imports from SA US$ million (7 Yr average)
'854140	Photosensitive semiconduct device,photovoltaic cells&light emit diodes	107.42	6 382.43	0.00	2.51
'847989	Machines & mechanical appliances nes having individual functions	65.30	5 931.77	4.00	0.52
'903180	Measuring or checking instruments, appliances and machines, nes	43.53	2 769.93	0.00	1.13
'848180	Taps, cocks, valves and similar appliances, nes	84.34	3 108.97	0.07	0.48
'903289	Automatic regulating or controlling instruments and apparatus, nes	25.41	3 185.27	2.42	0.46
'840991	Parts for spark-ignition type engines nes	65.28	2 271.89	0.13	6.93
'392690	Articles of plastics or of other materials of Nos 39.01 to 39.14 nes	73.45	2 275.81	0.46	1.42
'902780	Instruments and apparatus for physical or chemical analysis, nes	13.20	1 603.69	0.06	0.10
'903149	Optical instruments and appliances nes	2.45	1 128.43	-	2.81
'841480	Air or gas compressors, hoods	15.72	1 743.99	-	-
'290511	Methanol (methyl alcohol)	5.89	1 333.07	0.08	0.02
'841430	Compressors of a kind used in refrigerating equipment	6.36	1 012.64	-	-
'842199	Parts for filterg or purifyg mchy & apparatus for liquids or gases,nes	36.31	794.39	0.01	0.16
'841490	Parts of vacuum pumps, compressors, fans, blowers, hoods	16.32	930.73	0.01	0.00
'842139	Filtering or purifying machinery and apparatus for gases nes	-	836.95	29.66	0.17
'901320	Lasers, other than laser diodes	0.74	509.52	-	-
'842129	Filtering or purifying machinery and apparatus for liquids nes	11.67	697.63	-	22.64
'841989	Machinery,plant/laboratory equip f treat of mat by change of temp nes	11.07	896.83	0.04	-
'841370	Centrifugal pumps nes	32.60	803.80	-	-
'841350	Reciprocating positive displacement pumps nes	2.11	766.97	-	0.01
'902720	Chromatographs and electrophoresis instruments	0.44	563.63	-	-
'841360	Rotary positive displacement pumps nes	3.86	598.71	-	0.04
'840999	Parts for diesel and semi-diesel engines	186.46	770.48	0.11	0.17
'841950	Heat exchange units, non-domestic, non-electric	6.89	854.19	-	-
'902710	Gas or smoke analysis apparatus	2.24	322.22	0.80	-
'902790	Microtomes;parts&access of inst&app for physical or chem analysis,nes	3.29	449.95	-	-
'851410	Industrial & laboratory electric resistance heated furnaces & ovens	0.41	723.87	-	0.01
'847982	Mach f mixing/kneading/crushing/grindg etc nes havg individ function	4.41	481.92	0.16	0.01
'902730	Spectrometers,spectrophotometers&spectrographs usg optical radiations	3.56	375.15	-	-
'841410	Vacuum pumps	2.92	328.20	0.01	-
'902610	Instruments&apparatus for measurg o checkg the flow o level of liquids	9.46	412.07	0.02	0.06
'392020	Film and sheet etc, non-cellular etc, of polymers of propylene	9.88	529.81	-	-
'902690	Parts of inst&app for measurg or checkg variables of liq or gases,nes	3.03	418.65	-	0.01
'848140	Valves, safety or relief	7.05	321.57	0.01	0.05
'842121	Filtering or purifying machinery and apparatus for water	16.37	234.65	0.03	-
'848110	Valves, pressure reducing	11.12	268.97	0.01	0.01
'848130	Valves, check	5.82	325.62	-	0.76
'842119	Centrifuges nes	2.29	430.41	-	-
'701990	Glass fibres (including glass wool) and articles thereof nes	7.73	292.69	-	0.01
'841990	Parts of machinery, plant and equipment of heading No 84.19	10.73	333.94	0.00	0.54
'841381	Pumps nes	88.64	326.69	0.04	0.00
'902680	Instruments&apparatus for measurg o check variables of liq o gases,nes	9.90	181.60	0.00	-
'842490	Pts of mech app (hand-op or not) for proj/disp or spray liq or powders	9.27	240.05	-	0.03
'903210	Thermostats	1.68	205.27	0.00	-
'902519	Thermometers, not combined with other instruments, nes	0.83	89.66	-	0.34
'903281	Hydraulic or pneumatic automatic regulating or controlling inst & app	0.48	136.90	-	-
'841780	Industrial or lab furnaces & ovens, inc incinerators non-electric nes	2.97	219.75	-	-
'320990	Paints&varnishes based on polymers,dispersed in an aqueous medium,nes	18.72	127.99	0.05	-
'841960	Machinery for liquefying air or gas	0.93	58.12	-	-
'851430	Industrial & laboratory electric furnaces & ovens nes	4.87	211.19	-	-
'903010	Instruments & apparatus for measuring or detecting ionising radiations	1.06	86.66	-	-
'841790	Parts of industrial/lab furnaces&ovens inc incinerators non-electr nes	5.79	110.95	-	-
'391400	Ion-exchangers basd on polymers of Nos 39.01 to 39.13 in primary forms	1.11	64.68	-	-
'851420	Industrial&laboratory electric induction o dielectric furnaces&ovens	2.92	112.84	-	-
'392490	Household and toilet articles nes, of plastics	12.16	53.33	0.00	-
'851490	Parts of industrial or laboratory electric furnaces and ovens nes	9.70	115.84	-	-
'847439	Mixg or kneadg machines nes for earth or other mineral substances etc	8.28	77.21	-	-
'842191	Parts of centrifuges, including centrifugal dryers	1.81	64.26	-	0.50
'320910	Paints&varnishes basd on acrylic/vinyl poly,dspr in an aqueous medium	15.30	53.99	-	-

China continued:

Product code	Product label	SA exports to World US$ million (7 Yr average)	China imports from World US$ million(7 Yr average)	SA exports to China $ million (7 Yr average)	China imports from SA US$ million (7 Yr average)
'960350	Brushes nes, constituting parts of machines, appliances or vehicles	0.91	40.25	-	-
'842220	Machinery for cleaning or drying bottles or containers nes	0.67	43.71	-	-
'732510	Cast articles of non-malleable cast iron nes	0.55	42.81	-	-
'903220	Manostats	0.05	21.13	-	-
'841320	Hand pumps nes, o/t those of subheading No 8413.11 or 8413.19	0.54	22.43	-	-
'851629	Electric space heating apparatus & electric soil heating apparatus,nes	8.76	22.40	-	-
'853931	Fluorescent lamps, hot cathode	0.99	55.75	0.03	-
'731021	Cans,iron o steel,cap <50 litres,to be closd by crimpg o soldering,nes	31.80	15.78	-	-
'902820	Liquid supply, production and calibrating meters	4.67	22.10	-	-
'842382	Weighg mach havg a maximum weighg cap > 30 kg but <=5000 kg nes	0.68	8.45	-	-
'731029	Cans, iron or steel, capacity <50 litres nes	68.94	10.11	-	-
'902810	Gas supply, production and calibrating meters	0.43	19.99	-	-
'700800	Multiple-walled insulating units of glass	0.36	13.11	-	-
'841090	Parts of hydraulic turbines & water wheels including regulators	0.81	72.83	-	-
'841440	Air compressors mounted on a wheeled chassis for towing	8.11	24.62	-	-
'842381	Weighg machinery havg a maximum weighg capacity not exceed 30 kg nes	0.40	5.92	0.00	-
'281610	Hydroxide and peroxide of magnesium	0.10	4.48	-	-
'780600	Articles of lead nes	14.67	11.46	0.00	-
'842389	Weighing machinery, nes	5.24	7.10	-	0.00
'280110	Chlorine	5.61	3.01	-	-
'841911	Instantaneous gas water heaters	1.61	2.64	-	-
'902511	Thermometers, not combined with other instruments, liquid-filled	0.13	3.66	-	-
'252220	Slaked lime	3.37	0.55	0.01	-
'841919	Instantaneous or storage water heaters, non-electric, nes	1.85	2.20	-	-
'841013	Hydraulic turbines and water wheels of a power exceeding 10000 KW	-	2.33	-	-
'252100	Limestone flux;limestone & other calcareous stone,for lime or cement	2.72	0.61	-	-
'960310	Brooms/brushes of twigs/oth veg mat bound together,with/w/o handles	1.68	0.17	-	-
'841011	Hydraulic turbines & water wheels of a power not exceeding 1000 KW	0.30	0.96	-	-
'285100	Inorgn compds nes;liquid air;compressd air;amalgams o/t of prec metals	-	-	-	-
'841012	Hyd turbines&water wheels of a power exc 1000 KW but nt excedg 10000KW	0.03	0.12	-	-
'854389	Electrical machines and apparatus nes	-	-	-	-
'902740	Exposure meters	-	-	-	-
'902620	Instruments and apparatus for measuring or checking pressure	7.52	416.08	-	0.07
'870892	Mufflers and exhaust pipes for motor vehicles	204.57	235.44	-	42.71
'730900	Reservoirs,tanks,vats&sim ctnr,cap >300L,i o s (ex liq/compr gas type)	31.42	127.04	-	-
'281410	Anhydrous ammonia	4.57	143.74	-	-
'380210	Activated carbon	1.97	55.57	-	-
'842131	Intake air filters for internal combustion engines	36.84	47.46	-	0.04
'281830	Aluminium hydroxide	0.22	29.05	-	-
'731010	Tanks,casks,drums,cans,boxes&sim contr,i or s,capac >=50L but <300L	14.07	35.94	-	-
'283510	Phosphinates (hypophosphites) & phosphonates (phosphites) of metals	0.11	18.93	-	-
'681099	Articles of cement, of concrete or of artificial stone nes	6.73	7.32	-	-
'283529	Phosphates of metals nes	0.56	8.34	-	-
'281511	Sodium hydroxide (caustic soda) solid	2.88	8.31	-	-
'283526	Calcium phosphates nes	41.57	24.56	-	-
'283524	Potassium phosphates	0.33	2.31	-	-
'281512	Sodium hydroxide (caustic soda) in aqueous solution	2.00	5.91	-	-
'283210	Sodium sulphites	5.57	1.16	-	-
'283525	Calcium hydrogenorthophosphate (dicalcium phosphate)	0.76	0.64	-	-
'220710	Undenaturd ethyl alcohol of an alcohol strgth by vol of 80% vol/higher	95.00	1.81	-	0.01
'580190	Woven pile fab&chenille fab of other tex mat,o/t terry&narrow fabrics	0.30	1.54	-	-
'283220	Sulphites of metals nes	0.40	0.23	-	-
'282010	Manganese dioxide	43.88	3.39	-	-
'282410	Lead monoxide (litharge, massicot)	0.44	0.09	-	-
'283523	Trisodium phosphate	-	-	-	-

Brazil:

Product code	Product label	SA exports to World US$ million (7 Yr average)	Brazil imports from World US$ million (7 Yr average)	SA exports to Brazil US$ million (7 Yr average)	Brazil imports from SA US$ million (7 Yr average)
'220710	Undenaturd ethyl alcohol of an alcohol strgth by vol of 80% vol/higher	95.00	24.52	-	-
'252100	Limestone flux;limestone & other calcareous stone,for lime or cement	2.72	3.87	-	-
'252220	Slaked lime	3.37	0.32	-	-
'280110	Chlorine	5.61	0.98	-	-
'281410	Anhydrous ammonia	4.57	161.47	-	-
'281511	Sodium hydroxide (caustic soda) solid	2.88	16.70	-	-
'281512	Sodium hydroxide (caustic soda) in aqueous solution	2.00	319.84	-	-
'281610	Hydroxide and peroxide of magnesium	0.10	1.37	-	-
'281830	Aluminium hydroxide	0.22	4.31	1.96	-
'282010	Manganese dioxide	43.88	3.28	-	1.67
'282410	Lead monoxide (litharge, massicot)	0.44	1.16	-	-
'283210	Sodium sulphites	5.57	13.00	0.00	-
'283220	Sulphites of metals nes	0.41	1.25	-	-
'283510	Phosphinates (hypophosphites) & phosphonates (phosphites) of metals	0.11	4.54	-	-
'283523	Trisodium phosphate	-	0.00	-	-
'283524	Potassium phosphates	0.33	1.68	-	-
'283525	Calcium hydrogenorthophosphate (dicalcium phosphate)	0.76	15.96	-	-
'283526	Calcium phosphates nes	41.57	13.51	-	-
'283529	Phosphates of metals nes	0.56	2.72	-	-
'285100	Inorgn compds nes;liquid air;compressd air;amalgams o/t of prec metals	-	0.38	-	-
'290511	Methanol (methyl alcohol)	5.89	198.72	-	-
'320910	Paints&varnishes basd on acrylic/vinyl poly,dspr in an aqueous medium	15.30	9.57	-	-
'320990	Paints&varnishes based on polymers,dispersed in an aqueous medium,nes	18.72	23.62	-	-
'380210	Activated carbon	1.97	17.21	-	-
'391400	Ion-exchangers basd on polymers of Nos 39.01 to 39.13 in primary forms	1.11	14.71	-	-
'392020	Film and sheet etc, non-cellular etc, of polymers of propylene	9.88	129.94	-	-
'392490	Household and toilet articles nes, of plastics	12.16	21.92	0.10	-
'392690	Articles of plastics or of other materials of Nos 39.01 to 39.14 nes	73.45	459.18	-	0.10
'681099	Articles of cement, of concrete or of artificial stone nes	6.73	12.93	-	-
'700800	Multiple-walled insulating units of glass	0.36	0.48	0.07	-
'701990	Glass fibres (including glass wool) and articles thereof nes	7.73	31.09	0.50	-
'730900	Reservoirs,tanks,vats&sim ctnr,cap >300L,i o s (ex liq/compr gas type)	31.42	31.93	-	-
'731021	Cans,iron o steel,cap <50 litres,to be closd by crimpg o soldering,nes	31.80	5.72	-	-
'731029	Cans, iron or steel, capacity <50 litres nes	68.94	7.12	-	-
'732510	Cast articles of non-malleable cast iron nes	0.55	4.13	-	-
'780600	Articles of lead nes	14.67	1.40	7.41	-
'840991	Parts for spark-ignition type engines nes	65.28	690.47	3.01	1.17
'840999	Parts for diesel and semi-diesel engines	186.46	663.81	-	0.03
'841011	Hydraulic turbines & water wheels of a power not exceeding 1000 KW	0.30	0.29	0.00	-
'841012	Hyd turbines&water wheels of a power exc 1000 KW but nt excedg 10000KW	0.04	0.12	-	-
'841013	Hydraulic turbines and water wheels of a power exceeding 10000 KW	-	7.42	-	-
'841090	Parts of hydraulic turbines & water wheels including regulators	0.81	27.98	-	-
'841320	Hand pumps nes, o/t those of subheading No 8413.11 or 8413.19	0.54	5.00	-	-
'841350	Reciprocating positive displacement pumps nes	2.11	135.17	-	-
'841360	Rotary positive displacement pumps nes	3.86	111.38	-	0.00
'841370	Centrifugal pumps nes	32.60	128.01	0.01	0.01
'841381	Pumps nes	88.64	34.38	-	-
'841410	Vacuum pumps	2.92	31.00	-	-
'841430	Compressors of a kind used in refrigerating equipment	6.36	288.88	-	-
'841440	Air compressors mounted on a wheeled chassis for towing	8.11	13.15	-	-
'841480	Air or gas compressors, hoods	15.72	426.51	0.03	-
'841490	Parts of vacuum pumps, compressors, fans, blowers, hoods	16.32	154.03	-	-
'841780	Industrial or lab furnaces & ovens, inc incinerators non-electric nes	2.98	56.04	-	-
'841790	Parts of industrial/lab furnaces&ovens inc incinerators non-electr nes	5.79	45.45	-	-
'841911	Instantaneous gas water heaters	1.62	24.18	-	-
'841919	Instantaneous or storage water heaters, non-electric, nes	1.85	3.36	-	-
'841950	Heat exchange units, non-domestic, non-electric	6.89	171.14	-	-
'841960	Machinery for liquefying air or gas	0.93	5.41	0.55	-
'841989	Machinery,plant/laboratory equip f treat of mat by change of temp nes	11.07	247.53	0.04	-

Brazil continued:

Product code	Product label	SA exports to World US$ million (7 Yr average)	Brazil imports from World US$ million (7 Yr average)	SA exports to Brazil US$ million (7 Yr average)	Brazil imports from SA US$ million (7 Yr average)
'841990	Parts of machinery, plant and equipment of heading No 84.19	10.73	82.09	-	-
'842119	Centrifuges nes	2.29	37.67	0.06	-
'842121	Filtering or purifying machinery and apparatus for water	30.49	52.04	0.04	-
'842129	Filtering or purifying machinery and apparatus for liquids nes	11.67	160.98	0.07	0.09
'842131	Intake air filters for internal combustion engines	36.84	42.03	0.79	0.24
'842139	Filtering or purifying machinery and apparatus for gases nes	-	174.96	-	2.74
'842191	Parts of centrifuges, including centrifugal dryers	1.81	19.72	0.03	-
'842199	Parts for filterg or purifyg mchy & apparatus for liquids or gases,nes	36.31	149.57	-	0.11
'842220	Machinery for cleaning or drying bottles or containers nes	0.67	10.12	-	-
'842381	Weighg machinery havg a maximum weighg capacity not exceed 30 kg nes	0.40	4.89	-	-
'842382	Weighg mach havg a maximum weighg cap > 30 kg but <=5000 kg nes	0.68	2.56	-	-
'842389	Weighing machinery, nes	5.24	2.90	-	-
'842490	Pts of mech app (hand-op or not) for proj/disp or spray liq or powders	9.27	67.80	-	-
'847439	Mixg or kneadg machines nes for earth or other mineral substances etc	8.28	17.94	0.02	-
'847982	Mach f mixing/kneading/crushing/grindg etc nes havg individ function	4.41	73.63	1.04	-
'847989	Machines & mechanical appliances nes having individual functions	65.30	666.79	0.01	0.09
'848110	Valves, pressure reducing	11.12	60.72	-	-
'848130	Valves, check	5.82	46.78	0.13	-
'848140	Valves, safety or relief	7.05	68.23	0.29	-
'848180	Taps, cocks, valves and similar appliances, nes	84.35	514.31	-	0.02
'851410	Industrial & laboratory electric resistance heated furnaces & ovens	0.41	30.60	-	-
'851420	Industrial&laboratory electric induction o dielectric furnaces&ovens	2.92	12.08	0.28	-
'851430	Industrial & laboratory electric furnaces & ovens nes	3.22	12.85	-	0.04
'851490	Parts of industrial or laboratory electric furnaces and ovens nes	9.70	14.66	0.04	0.01
'851629	Electric space heating apparatus & electric soil heating apparatus,nes	8.76	10.93	-	-
'853931	Fluorescent lamps, hot cathode	2.05	220.07	-	-
'854140	Photosensitive semiconduct device,photovoltaic cells&light emit diodes	107.42	131.00	-	0.00
'854389	Electrical machines and apparatus nes	-	0.68	1.68	-
'870892	Mufflers and exhaust pipes for motor vehicles	204.57	75.69	-	10.22
'901320	Lasers, other than laser diodes	0.74	7.74	-	-
'902511	Thermometers, not combined with other instruments, liquid-filled	0.13	2.90	0.00	-
'902519	Thermometers, not combined with other instruments, nes	0.83	14.50	0.01	-
'902610	Instruments&apparatus for measurg o checkg the flow o level of liquids	9.46	78.51	-	0.00
'902620	Instruments and apparatus for measuring or checking pressure	7.52	85.27	0.03	-
'902680	Instruments&apparatus for measurg o check variables of liq o gases,nes	9.90	23.67	0.01	-
'902690	Parts of inst&app for measurg or checkg variables of liq or gases,nes	3.03	34.09	-	-
'902710	Gas or smoke analysis apparatus	2.24	103.75	-	0.01
'902720	Chromatographs and electrophoresis instruments	0.44	64.00	-	-
'902730	Spectrometers,spectrophotometers&spectrographs usg optical radiations	3.56	52.83	-	-
'902740	Exposure meters	-	-	-	-
'902780	Instruments and apparatus for physical or chemical analysis, nes	13.20	170.97	-	0.01
'902790	Microtomes;parts&access of inst&app for physical or chem analysis,nes	3.29	101.43	-	-
'902810	Gas supply, production and calibrating meters	0.43	11.87	-	-
'902820	Liquid supply, production and calibrating meters	4.67	13.25	-	-
'903010	Instruments & apparatus for measuring or detecting ionising radiations	1.06	7.42	-	-
'903149	Optical instruments and appliances nes	2.45	55.11	0.54	-
'903180	Measuring or checking instruments, appliances and machines, nes	43.53	319.26	-	0.01
'903210	Thermostats	1.68	23.02	-	-
'903220	Manostats	0.05	18.26	-	-
'903281	Hydraulic or pneumatic automatic regulating or controlling inst & app	0.48	4.90	0.51	-
'903289	Automatic regulating or controlling instruments and apparatus, nes	25.88	702.03	-	0.39
'960310	Brooms/brushes of twigs/oth veg mat bound together,with/w/o handles	1.68	0.08	-	-
'960350	Brushes nes, constituting parts of machines, appliances or vehicles	0.91	5.71	0.00	-

India:

Product code	Product label	SA exports to World US$ million (7 Yr average)	India imports from World US$ million(7 Yr average)	SA exports to India $ million (7 Yr average)	India imports from SA US$ million (7 Yr average)
'854140	Photosensitive semiconduct device,photovoltaic cells&light emit diodes	107.42	652.50	-	0.20
'847989	Machines & mechanical appliances nes having individual functions	65.28	782.10	1.40	0.83
'848180	Taps, cocks, valves and similar appliances, nes	84.34	589.29	0.37	0.40
'392690	Articles of plastics or of other materials of Nos 39.01 to 39.14 nes	73.45	450.32	0.15	1.28
'841480	Air or gas compressors, hoods	15.72	395.16	-	-
'840999	Parts for diesel and semi-diesel engines	186.46	454.07	0.07	0.15
'290511	Methanol (methyl alcohol)	5.89	339.36	-	-
'903180	Measuring or checking instruments, appliances and machines, nes	43.53	434.99	2.87	0.47
'841490	Parts of vacuum pumps, compressors, fans, blowers, hoods	16.32	409.66	0.01	-
'903289	Automatic regulating or controlling instruments and apparatus, nes	25.41	297.61	0.13	0.14
'252100	Limestone flux;limestone & other calcareous stone,for lime or cement	2.72	156.33	-	-
'902780	Instruments and apparatus for physical or chemical analysis, nes	13.20	185.43	0.04	0.09
'842199	Parts for filterg or purifyg mchy & apparatus for liquids or gases,nes	36.31	192.70	0.01	0.55
'840991	Parts for spark-ignition type engines nes	65.28	218.00	2.51	0.96
'841989	Machinery,plant/laboratory equip f treat of mat by change of temp nes	11.07	222.67	0.18	0.32
'902790	Microtomes;parts&access of inst&app for physical or chem analysis,nes	3.29	178.05	0.00	0.05
'842139	Filtering or purifying machinery and apparatus for gases nes	-	157.12	5.01	13.20
'841950	Heat exchange units, non-domestic, non-electric	6.89	109.42	-	-
'902720	Chromatographs and electrophoresis instruments	0.44	127.34	0.01	-
'841990	Parts of machinery, plant and equipment of heading No 84.19	7.13	144.33	-	0.35
'841370	Centrifugal pumps nes	32.60	116.89	0.11	0.08
'902730	Spectrometers,spectrophotometers&spectrographs usg optical radiations	3.56	122.07	-	-
'841430	Compressors of a kind used in refrigerating equipment	6.36	96.02	-	-
'841381	Pumps nes	88.64	135.49	0.13	0.07
'841440	Air compressors mounted on a wheeled chassis for towing	4.07	142.64	-	-
'842490	Pts of mech app (hand-op or not) for proj/disp or spray liq or powders	9.27	85.06	0.00	0.01
'842129	Filtering or purifying machinery and apparatus for liquids nes	11.67	76.72	-	0.06
'842121	Filtering or purifying machinery and apparatus for water	30.49	62.44	0.12	-
'847982	Mach f mixing/kneading/crushing/grindg etc nes havg individ function	4.41	52.11	-	-
'392020	Film and sheet etc, non-cellular etc, of polymers of propylene	9.88	63.22	-	-
'841790	Parts of industrial/lab furnaces&ovens inc incinerators non-electr nes	5.79	120.29	0.54	0.06
'841360	Rotary positive displacement pumps nes	3.86	47.57	-	0.02
'902710	Gas or smoke analysis apparatus	2.24	43.00	-	-
'903149	Optical instruments and appliances nes	2.45	47.10	0.01	-
'842119	Centrifuges nes	2.29	48.50	-	-
'841350	Reciprocating positive displacement pumps nes	2.11	41.75	-	0.04
'902610	Instruments&apparatus for measurg o checkg the flow o level of liquids	9.46	72.80	0.06	0.09
'731029	Cans, iron or steel, capacity <50 litres nes	68.94	27.71	-	0.00
'902690	Parts of inst&app for measurg or checkg variables of liq or gases,nes	3.03	48.45	-	-
'841960	Machinery for liquefying air or gas	0.93	20.33	-	-
'701990	Glass fibres (including glass wool) and articles thereof nes	7.73	34.66	0.40	0.40
'851430	Industrial & laboratory electric furnaces & ovens nes	4.87	42.20	-	-
'841780	Industrial or lab furnaces & ovens, inc incinerators non-electric nes	2.97	94.53	-	-
'841410	Vacuum pumps	2.92	28.03	-	-
'320990	Paints&varnishes based on polymers,dispersed in an aqueous medium,nes	18.72	43.19	0.31	0.10
'851629	Electric space heating apparatus & electric soil heating apparatus,nes	8.76	6.34	-	-
'903210	Thermostats	1.68	15.65	0.01	0.00
'902680	Instruments&apparatus for measurg o check variables of liq o gases,nes	9.90	30.87	0.00	-
'901320	Lasers, other than laser diodes	0.74	15.51	0.07	-
'848130	Valves, check	5.82	14.53	0.00	-
'848140	Valves, safety or relief	7.05	21.65	0.02	0.01
'853931	Fluorescent lamps, hot cathode	2.05	30.04	-	-
'392490	Household and toilet articles nes, of plastics	12.16	12.91	-	-
'903010	Instruments & apparatus for measuring or detecting ionising radiations	1.06	7.93	-	-
'902519	Thermometers, not combined with other instruments, nes	0.83	10.28	-	-
'847439	Mixg or kneadg machines nes for earth or other mineral substances etc	8.28	29.50	-	-
'848110	Valves, pressure reducing	11.12	17.18	0.00	-
'903281	Hydraulic or pneumatic automatic regulating or controlling inst & app	0.48	10.03	0.01	-
'391400	Ion-exchangers basd on polymers of Nos 39.01 to 39.13 in primary forms	1.11	11.26	-	-

India continued:

Product code	Product label	SA exports to World US$ million (7 Yr average)	India imports from World US$ million(7 Yr average)	SA exports to India $ million (7 Yr average)	India imports from SA US$ million (7 Yr average)
'851490	Parts of industrial or laboratory electric furnaces and ovens nes	9.70	28.67	0.61	0.56
'841911	Instantaneous gas water heaters	1.61	7.79	-	-
'851410	Industrial & laboratory electric resistance heated furnaces & ovens	0.41	9.42	-	-
'320910	Paints&varnishes basd on acrylic/vinyl poly,dspr in an aqueous medium	15.30	9.57	0.01	-
'842191	Parts of centrifuges, including centrifugal dryers	1.81	12.25	0.00	-
'842220	Machinery for cleaning or drying bottles or containers nes	0.67	7.06	0.00	-
'903220	Manostats	0.05	6.03	-	-
'841090	Parts of hydraulic turbines & water wheels including regulators	0.81	19.19	0.00	-
'700800	Multiple-walled insulating units of glass	0.36	5.77	-	-
'841919	Instantaneous or storage water heaters, non-electric, nes	1.85	6.82	-	-
'731021	Cans,iron o steel,cap <50 litres,to be closd by crimpg o soldering,nes	31.80	7.59	-	-
'842381	Weighg machinery havg a maximum weighg capacity not exceed 30 kg nes	0.40	4.30	-	-
'960350	Brushes nes, constituting parts of machines, appliances or vehicles	0.91	4.10	0.00	-
'252220	Slaked lime	3.03	2.66	-	-
'842389	Weighing machinery, nes	5.24	5.09	-	-
'851420	Industrial&laboratory electric induction o dielectric furnaces&ovens	2.92	4.50	-	0.00
'902810	Gas supply, production and calibrating meters	0.43	4.57	-	-
'960310	Brooms/brushes of twigs/oth veg mat bound together,with/w/o handles	1.68	1.72	-	-
'902511	Thermometers, not combined with other instruments, liquid-filled	0.13	2.68	-	-
'732510	Cast articles of non-malleable cast iron nes	0.55	4.78	-	-
'780600	Articles of lead nes	14.67	1.91	-	-
'902820	Liquid supply, production and calibrating meters	3.91	3.67	-	-
'842382	Weighg mach havg a maximum weighg cap > 30 kg but <=5000 kg nes	0.68	1.68	-	-
'841320	Hand pumps nes, o/t those of subheading No 8413.11 or 8413.19	0.54	0.80	0.00	-
'281610	Hydroxide and peroxide of magnesium	0.10	0.89	-	-
'841013	Hydraulic turbines and water wheels of a power exceeding 10000 KW	-	1.65	-	-
'280110	Chlorine	5.61	0.26	-	-
'841011	Hydraulic turbines & water wheels of a power not exceeding 1000 KW	0.30	0.70	-	-
'841012	Hyd turbines&water wheels of a power exc 1000 KW but nt excedg 10000KW	0.03	2.77	-	-
'285100	Inorgn compds nes;liquid air;compressd air;amalgams o/t of prec metals	-	1.01	-	-
'854389	Electrical machines and apparatus nes	-	36.78	-	0.00
'902740	Exposure meters	-	-	-	-
'281410	Anhydrous ammonia	4.57	816.04	-	-
'281512	Sodium hydroxide (caustic soda) in aqueous solution	2.00	73.87	-	-
'870892	Mufflers and exhaust pipes for motor vehicles	204.57	18.48	0.04	-
'902620	Instruments and apparatus for measuring or checking pressure	7.52	38.75	0.01	-
'380210	Activated carbon	1.97	19.34	-	0.02
'730900	Reservoirs,tanks,vats&sim ctnr,cap >300L,i o s (ex liq/compr gas type)	20.24	20.14	0.31	-
'281511	Sodium hydroxide (caustic soda) solid	2.88	8.35	0.01	-
'281830	Aluminium hydroxide	0.22	8.91	-	-
'282010	Manganese dioxide	43.88	9.38	0.32	-
'283526	Calcium phosphates nes	41.57	10.31	-	-
'842131	Intake air filters for internal combustion engines	36.84	7.74	-	-
'283529	Phosphates of metals nes	0.56	4.94	-	-
'283210	Sodium sulphites	5.57	5.55	-	-
'283525	Calcium hydrogenorthophosphate (dicalcium phosphate)	0.76	3.65	-	-
'731010	Tanks,casks,drums,cans,boxes&sim contr,i or s,capac >=50L but <300L	14.07	6.96	-	-
'283510	Phosphinates (hypophosphites) & phosphonates (phosphites) of metals	0.11	2.07	-	-
'282410	Lead monoxide (litharge, massicot)	0.44	2.68	-	-
'283524	Potassium phosphates	0.33	2.11	-	-
'283220	Sulphites of metals nes	0.40	0.62	-	-
'220710	Undenaturd ethyl alcohol of an alcohol strgth by vol of 80% vol/higher	95.00	4.14	-	-
'681099	Articles of cement, of concrete or of artificial stone nes	6.73	4.01	-	-
'281610	Hydroxide and peroxide of magnesium	0.10	0.89	-	-
'280110	Chlorine	5.61	0.26	-	-
'580190	Woven pile fab&chenille fab of other tex mat,o/t terry&narrow fabrics	0.30	0.35	-	-
'283523	Trisodium phosphate	-	0.01	-	-