GREEN AMMONIA AND E-FERTILISER IN SOUTH AFRICA AND THE SADC REGION: OPPORTUNITIES FOR PRODUCTION AND CONSUMPTION

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ABBREVIATIONS AND ACRONYMS

AFAP	Africa Fertilizer and Agribusiness Partnership
AfDB	African Development Bank
CAN	Calcium Ammonium Nitrate
CIF	Climate Investment Funds
DAP	Diammonium Phosphate
DIF	Development Finance Institutions
ESG	Environmental, Social, and Governance
FOB	Free On Board
GH2	Green Hydrogen NPK blends
GHCS	Green Hydrogen Commercialisation Strategy
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IFC	International Finance Corporation
IKI	International Climate Initiative
JET	Just Energy Transition
LAN	Limestone ammonium nitrate
MAP	Monoammonium Phosphate
MT	Metric Tonnes
NPK	Nitrogen, phosphorous, potassium fertiliser
PtX	Power-to-X
RSA	Republic of South Africa
SADC	Southern African Development Community
SARS	South African Revenue Services

EXECUTIVE SUMMARY

Background

This study was commissioned by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH as part of its "Green Hydrogen South Africa" initiative to identify the opportunities for green ammonia and e- fertiliser production in South Africa for domestic consumption, as well as for export to the region and international markets. Green hydrogen, the key input in the production of green ammonia, is anticipated to be a crucial energy source in the future. South Africa is also looking for green hydrogen to play an important role in the decarbonisation of its domestic industries such as mining and manufacturing and to position the country as a major exporter of green hydrogen and its derivatives, particularly green ammonia, to the region and to global markets. The study also explores policy options for the increased production and consumption of green ammonia and e-fertiliser in South Africa.

Research Methodology

The study methodology was two-pronged, comprised of a literature review, which primarily entailed examining secondary data sources to identify key trends and research gaps, and primary data collection in four provinces in South Africa (Gauteng, Mpumalanga, Free State and Limpopo) to fill the knowledge and data gaps identified by the literature review. The data and information were derived from structured personal interviews, questionnaires, and qualitative data from the key stakeholders. The data sources were blenders (18); hub-agrodealers (3); farmers (3); and stakeholders (2).

Key Findings

Fertiliser Demand

South Africa consumes 2,4 million metric tonnes of fertiliser annually, comprised of various blends of NPK (nitrogen-phosphorus-potassium) and nitrogenous and phosphate fertilisers. The average fertiliser consumption is 91 kg/ha of arable land, and the most commonly used form of ammonia-based fertilisers is urea, ammonium nitrate, and a whole range of fertiliser blends. The maize industry accounts for 53% of the total fertiliser consumed and large-scale farmers account for over 90% of fertiliser consumption; smallholder farmers only account for 10% of the total fertiliser use.

Fertiliser Supply

South Africa imports over 50% of its demand for fossil-fuel based fertiliser. The fertiliser industry in South Africa is comprised of a range of large, medium and small players running the gamut from manufacturers, importers, traders, blenders, wholesale distributors or hub-agrodealers and retailers. However, the value chain is highly forward vertically integrated with market actors at each level also being active at subsequent levels.

Fertiliser Trade

The main origins of the imports are Saudi Arabia, Russia, Quatar, and China, and the main export destinations are Zambia, Zimbabwe, and the Democratic Republic of Congo. Almost half of the fertiliser imported into the SADC region arrives via South Africa via relatively expensive road and rail transport.

Opportunities for Production Distribution of Green Ammonia and E-Fertiliser for the Domestic Market

Currently, there is no production of green ammonia and e-fertiliser in South Africa, although there are plans in the pipeline, most notably by the COEGA Green Ammonia (CGA) Project. The project aims to produce 1 million metric tonnes of low-cost green ammonia every year for marine fuel, industrial, mining, and agricultural purposes. Plans are at advanced stages and the first green ammonia is expected to be produced in 2029.

The simulated cost comparison of grey and green ammonia in South Africa reveals that grey ammonia derivatives remain cost-competitive in the market. The main reason is that the CAPEX for a green ammonia production plant ($486 million), which is mainly determined by the cost of the electrolyser, is over double that for grey ammonia ($ 183 million). However, it is modelled to reach cost-competitiveness as early as 2030.[1]

[1] Hydrogen Tech World (11/2023) Green ammonia production: harnessing green hydrogen., Green ammonia production: harnessing green hydrogen; IRENA (2022) Ammonia Energy Association, Innovation Outlook Renewable Ammonia, p.46 f, https://www.irena.org//media/Files/IRENA/Agency/Publication/2022/May/IRENA_Innovation_Outlook_Ammonia_2022.pdf

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With regards to potential distribution storage and distribution infrastructure for green ammonia, the infrastructure for transportation and field application of anhydrous ammonia is well advanced in South Africa. The infrastructure includes Transnet tank cars, mother tanks, nurse tanks, road tankers, tractors, and application equipment. This infrastructure could be used for the storage and distribution of green ammonia.

With regards to decentralised storage and distribution of green ammonia, most towns in South Africa are served by blenders and this presents opportunities to distribute green ammonia to farmers. The production of high-value commodities using furrow and drip irrigation for fertiliser distribution provides another opportunity. Furthermore, there are existing public and private storage facilities for grey ammonia in South Africa, which could easily be used for green ammonia. South Africa also has manufacturing capacity for ammonia bullets, a transport vehicle. With regards to distribution of green ammonia to small-scale farmers, however, the aqueous form presents a challenge due to the specialised application and handling that ammonia requires. Small-scale farmers currently mostly use fertiliser in granular form.

However, the literature delineates five pathways that can be used to reach the smallholder farming segment: distribution of aqua ammonia to smallholder farmers using knapsacks; direct injection of anhydrous ammonia using shanks for both small- and medium-scale farmers; direct injection of aqua ammonia to paddy rice fields using flood irrigation systems; direct injection of aqua ammonia using drip irrigation systems; application of aqua ammonia through mixing with farmyard manure.

Opportunities for Consumption of Green Ammonia and E-Fertiliser for the Domestic Market

South Africa is a large consumer of conventional, fossil fuel-based fertilisers and the drivers of this demand offer opportunities for the consumption of e-fertilisers. In particular, the country boasts a highly advanced industrial agricultural sector producing in-demand, high-value commodities year-round, meaning that demand for e-fertilisers, if accepted by the market, would be substantial and consistent. Furthermore, there is extensive adoption of various forms of fertiliser in South Africa – granular, liquid and gas – , so market acceptance of green ammonia and e-fertiliser, in whichever form, is expected to be quite high. The main bottleneck to the adoption of e-fertiliser by the majority of farmers in South Africa would be the higher price of e-fertiliser in compared to the fossil fuel-based fertilisers they are currently using.

Key Risks and Barriers to Increased Production and Consumption of Green Ammonia

The main barriers to increased production are the high initial capital expenditure required for the development of the production facilities and infrastructure; the deficiencies in South Africa's infrastructure which may drive up the costs of production of green hydrogen, an essential component of the production green ammonia and hence, e-fertiliser; the heavy reliance of green ammonia production on water resources, while South Africa is classified as water-scarce; and the lack of the requisite skills and qualifications necessary for the success of the green hydrogen economy in South Africa. The key barrier to uptake is the lack of cost competitiveness of e-fertiliser vis-à-vis traditional ammonia-based fertiliser (anhydrous and aqueous). Another barrier is market acceptance since at present the level of awareness about green ammonia and e-fertiliser is quite low.

Socio-economic Concerns

There are potential socio-economic benefits from the domestic production of green ammonia and e-fertiliser in South Africa. Locally produced e-fertiliser in South Africa can reduce import dependence, stabilise supply chains, and lower costs of production of nitrogenous fertilisers, which can result in increased food security. It can also create green jobs contributing to rural development and economic growth.

Nevertheless, there are socio-economic concerns that will still need to be addressed. First, the application of e-fertiliser has the same environmental problems as conventional ammonia-based fertilisers (use must be efficient to avoid overfertilisation leading to environmental and climate issues such as e.g. increase in greenhouse gas emissions from agricultural land after application and leaching of excess nitrogen into water systems causing eutrophication). Second, there is a concern that e-fertiliser will perpetuate the focus on synthetic fertilisers, which will detract from agroecological solutions, which prioritise soil health and reduced reliance on global markets by farmers in Africa. Third, a significant drawback of all forms of ammonia is its high toxicity to human health, which presents a significant barrier to its broader adoption in a pure form, particularly by smallholder farmers. Finally, a significant social concern is the substantial amount of land use associated with the production of green hydrogen.

Policy Background

South Africa's green ammonia policy is largely driven by its broader "Green Hydrogen Commercialisation Strategy" (GHCS), which was released in 2022 and which aims to develop a domestic green hydrogen economy by utilising renewable energy sources to produce green hydrogen and green ammonia for use in various sectors including power generation, fertiliser production, and maritime fuel. South Africa plans to develop local capacity for producing green hydrogen and ammonia equipment. Therefore, South Africa has major ambitions to develop a green hydrogen economy, and the sector is receiving significant attention from policymakers and private companies. Therefore, there is an elaborate policy framework in place to promote the green hydrogen and green ammonia economy. However, to date the policies mainly focus on green hydrogen and furthermore the emphasis is on industry rather than the agriculture sector.

Policy Incentives to Increase Production of Green Ammonia and E-Fertiliser

Policy Instruments to De-risk Private Sector Investment in Green Ammonia
De-risking is about guarantees, credits and other incentives provided by the state to mobilise private capital for development purposes. Potential policy instruments include: price guarantees or long-term contracts for producers of green ammonia and e-fertiliser; tax incentives such as potential exemptions on VAT and customs duties to help reduce costs for developers and operators, and grants or technical assistance to cover early-stage project preparation.

Apply a Carbon Tax
South Africa has adopted a carbon tax, which penalises carbon-based activities. The price gap between conventional fertilisers and e-fertilisers, due to the higher costs of production of the latter, can be addressed by a carbon tax which will ensure internalising of climate pollution externalities for emission intensive products like conventional urea and make e-fertilisers more attractive to producers and offtakers.

Apply a Plastic Use Levy
South Africa has made significant advancements in implementing levies to curtail plastic use, particularly in the food sector. However, there is currently no levy on plastic in the agricultural input sector. Introducing a levy that reflects relative price signals could effectively reduce plastic usage at the fertiliser production stage and promote the adoption of green ammonia, which requires minimal or no plastic.

Repurpose Agricultural Inputs Subsidies for the Establishment of Decentralised Ammonia Production Units
This could be introduced to communities that are currently not served by the vertically integrated fertiliser supply chain skewed towards well established commercial farmers.

High Adoption of Renewable Energy
There is an extensive adoption of solar panels, which can be used to produce e-fertilisers, and there is zero-rated VAT for solar panels lowering the barriers to entry. This could be used by green ammonia producers to their advantage to lower their costs of production.

Policy Incentives to Increase Consumption of Green Ammonia and E-Fertiliser

Introduce Farm Subsidies for E-Fertilisers in Liquid Form (Aqueous Ammonia)
Input subsidies for aqueous ammonia could improve its affordability, hence encouraging the purchase and application of these technologies by farmers.

Pursue Fair Trade Certification for E-fertiliser
Crops produced by South Africa (e.g. sugarcane) are in demand in international markets, which place a premium on goods that have been produced in a sustainable manner (fair trade). South African commodities which have been produced using e-fertilisers would qualify for fair trade certification on the international market.

Conclusion and Recommendation

Currently, there is no production of green ammonia and e-fertiliser in South Africa; however, the opportunities exist and are promising, as exemplified for example in the COEGA project in Nelson Mandela Bay, which is set to come online in 2029. However, there is a need to reduce the cost of production of green ammonia to at least $800 per tonne for it to be cost competitive to urea and below the $600 per tonne for it to be cost competitive to locally-centrally produced grey ammonia. This can be achieved through the introduction of production policy incentives aimed at reducing the costs of production of green ammonia to make it more cost-competitive. This could take the form of a carbon tax to increase the cost of production of grey ammonia to reduce its attractiveness to producers and off-takers. The key bottleneck to the adoption of green ammonia and e-fertiliser by off-takers in South Africa is the higher price of green ammonia and e-fertiliser in comparison to the fossil fuel-based grey ammonia and nitrogen-based fertilisers, which are currently in use.

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This implies the need for consumption incentives to promote the adoption of green ammonia and e-fertilisers. In the literature, the most common policy instrument applied by governments worldwide to promote the adoption of fertilisers is input subsidies.

Recommendations

- It would be useful to assess the opportunities for the only current supplier of ammonia in South Africa, Sasol Chemicals, to retrofit its equipment to supply the domestic and eventually regional markets with green ammonia.
- A policy dialogue can assess the interest to create an enabling environment for green ammonia and e-fertiliser production and usage, e.g. through including grey ammonia production into the scope of the South African carbon tax, supplemented by additional policy instruments such as tax incentives to de-risk private sector investment.
- The conditions under which an input subsidy for aqueous ammonia for small-scale farmers growing high-value crops to introduce e-fertilisers to the South African market can be implemented in South Africa should be assessed.
- The opportunity for fair trade certification on farm products produced in South Africa using e-fertiliser can be analysed. This could result in a "green premium" for farmers who grow their crops using e-fertiliser. This could benefit farmers and their communities and increase market acceptance of e-fertiliser.

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1 INTRODUCTION

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Chapter 1. Introduction

1.1 Background

Ammonia is a versatile chemical compound of nitrogen and hydrogen, which presents as a colorless gas. It has wide-ranging applications from agriculture to the chemical industry and the mining sector: it is used to produce plastics, explosives, textiles, dyes, and other chemicals. [2] Global demand for ammonia comes in large part from the agricultural sector, with 77% of total global production used to produce fertiliser, while only 23% is used for other industrial purposes. Furthermore, 70 % of global ammonia production is used to produce nitrogenous fertiliser such as urea, ammonium nitrate and nitric acid, which account for 55%, 26% and 13% respectively of current global synthetic nitrogeneous fertilisers.[3] However, traditional ammonia production processes result in the emission of carbon dioxide, a greenhouse gas, which is heavily implicated in global warming; the production of one tonne of traditional or "grey" ammonia emits approximately 2.4 metric tonnes of carbon dioxide.[4] As a result, there is growing global interest in a novel production process, which relies on renewable energy rather that fossil fuels as a power source to produce hydrogen. This so-called "green" hydrogen can then be combined with nitrogen in a more environmentally friendly process to produce "green" ammonia and "e"-fertilisers.[5] South Africa is familiar with the Haber-Bosch process for fertiliser production, making it well-positioned to be an important producer of green hydrogen, and the resulting green products such as green ammonia and e-fertiliser.

Ammonia is produced by combining atmospheric nitrogen with hydrogen under high pressures and temperatures using the Haber–Bosch process. The production of this "grey" ammonia is based on the use of fossil fuels (natural gas, coal) as the energy source and feedstock to produce the hydrogen. This process, while economically efficient, emits significant amounts of carbon dioxide as noted above. Considering the havoc being wreaked by climate change, particularly the threat it poses to global food security, there is huge and growing interest globally in a more environmentally friendly way of producing this important industrial chemical. This new production process uses renewable energy such as solar or wind as the power source for water electrolysis instead of fossil fuels to split the water to produce green hydrogen. Since it does not involve the use of fossil fuels, it does not emit carbon dioxide during the production process. When combined with nitrogen, this green hydrogen produces green ammonia which can be used to produce e-fertilisers (Yohannes, B., 2022). It is worth pointing out that green ammonia is chemically the same product as the grey ammonia currently produced from fossil fuels, the only difference is the power source. Therefore, upon application, these e-fertilisers share the same environmental and socio-economic issues as their fossil-fuel based counterparts.[6] Hence the preference to call this fertiliser "e-fertiliser" rather than "green fertilisers" as the latter implies a completely environmentally friendly fertiliser in both production and application, which is not the case.[7]

Currently, South Africa relies heavily on imported fossil fuel-based ammonia fertilisers, which are produced using the traditional energy- and emissions-intensive processes. However, South Africa is particularly well-positioned to leverage the growing global interest and demand for green ammonia and e-fertiliser. It has abundant renewable resources (wind, air), available land area, and existing Haber-Bosch production facilities and substantial experience in the same. Therefore, South African is a potential global player in the production and export of green ammonia to the global market (Scholvin, S., et al. 2024).

However, there is significant uncertainty with regards to how the international market for green ammonia will unfold and how competitive South African green products will be given that several countries (e.g., Australia, Canada, Chile, Morocco, Namibia, and Saudi Arabia) are also positioning themselves to export green ammonia and other Power-to-X products to Europe and Asia, so the competition for market share promises to be intense. A more compelling case may be for South Africa to produce green ammonia and e-fertiliser for the domestic and regional markets, for the following reasons.

First, over the past five years, South Africa has been facing an energy shortage due to the limitations associated with coal usage as the energy source (Hamukoshi S.S., et al. 2022). As a result, the country has shifted its focus from using fossil fuels to renewable energy sources (solar, wind, geothermal, biomass, hydroelectric, and ocean energy) (Adeniyi A. et al, 2023). The South African government in partnership with the private sector is investing significant resources in green hydrogen energy production to meet the growing energy crises in the country (Koshikwinja P.M. et al., 2023). There are already established companies like HyShiFT, Hive Energy, SMEC, and HySA, among

[2] Ammonia as an Alternative. Available at: https://doi.org/10.1016/B978-0-323-99213-8.00008-4
[3] Cost-Competitive Decentralized Ammonia Fertilizer Production Can Increase Food Security. Available at: https://www.nature.com/articles/s43016-024-00979-y
[4] ESG Economist - What is the role of green ammonia in decarbonizing the world? Available at: https://www.abnamro.com/research/en/our-research/esg-economist-what-is-the-role-of-green-ammonia-in-decarbonizing-the-world
[5] Decarbonization frameworks to industrial-scale ammonia production: Techno-economic and environmental implications. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0360319924025527
[6] "Green" Synthetic Fertilisers: Solution for Soil, Climate, Water and Communities or a Dead End?". https://www.inkota.de/sites/default/files/2024/12/greenfertilzer_discussionpaper_Final_%20ENG.pdf
[7] "E-fertilisers" such anhydrous ammonia and nitrates are fertilisers produced using green ammonia. "Green" ammonia is a form of ammonia produced with green hydrogen, which is produced from renewable resources using a production process that is free of carbon dioxide emissions. So " e-fertilisers" does not refer to " green fertilisers", which is often used for and implies environmentally friendly, non-synthetic fertilisers such as organic fertilisers.

others, leading the race of green hydrogen fuel production intending to meet the energy demand in the country and introducing decarbonised fuel production processes (Kweinor T.E., 2024).

Secondly, South Africa imports above 50 % of its requirements for nitrogeneous fertilisers. In 2022, South Africa imported nitrogenous fertilisers from Saudi Arabia, Qatar, Oman, China and Russia.[8] However, this heavy dependency on imports exposes the agricultural sector to international market volatility, fluctuating prices, and supply chain disruptions. Third, South Africa is a price taker in these markets and the financial burden on farmers is substantial, impacting their profitability and sustainability. These three factors, the desire for the government to invest in green hydrogen energy production to abate the energy shortage, the likelihood of facing intense competition on global markets for its green products, and the need to reduce import dependency on the other, makes the exploration of the opportunities for local production of green ammonia and e-fertiliser for the domestic market and for export to the region a more viable proposition.

South Africa is already a regional trade and production hub for nitrogenous fertiliser in the Southern African Development Community (SADC). In 2024, RSA exported nitrogenous fertilisers to Zambia, Zimbabwe, Namibia, the Democratic Republic of Congo, and Botswana.[9] In fact, almost half of the fertiliser imported into the SADC region arrives via South Africa, mostly via road and rail transport.

Therefore, the aim of this study is to identify the opportunities for green ammonia and e-fertiliser production in South Africa for the domestic and regional SADC markets, and to explore policy options for the increased production and consumption of e-fertiliser in South Africa.

1.2 Research methodology

This section will provide information of the approach that was undertaken and the methodologies employed to conduct the study. The study methodology was two-pronged, comprised of a literature review, which primarily entailed examining secondary data sources to identify key trends and research gaps, and primary data collection.

Literature Overview

A literature overview on the status of the production and consumption of green ammonia and e-fertiliser globally and in South Africa, on key insights and experiences that could guide the study was conducted and identified research gaps that needed to be addressed.

Fieldwork and Data Collection

Primary data collection was carried out in four provinces in South Africa to fill the knowledge and data gaps identified by the literature review. The data and information were derived from structured personal interviews, questionnaires, and qualitative data from the key stakeholders. The questionnaire was more of a tool that was used to standardise the questions asked rather than to conduct an in-depth quantitative analysis.

The methodology for the data collection entailed: a) sampling of existing fertiliser market actors, where both purposive and snowball sampling techniques were used to identify the respondents; b) administration of a semi-structured questionnaire to the pool of respondents, which covered the five themes of the study (production, consumption, opportunities, risks and barriers, and socio-economic impacts of green ammonia and e-fertiliser; c) qualitative data collection through focus group discussions targeting focus groups located in the main fertiliser use belts and key crops such as citrus, maize, potatoes, sugarcane and sunflower. The data sources were blenders (18); hub-agrodealers (3); farmers (3); and stakeholders (2) and are presented in Table 1.

Table 1. Summary of Stakeholders Interviewed

Type of Stakeholder	Number of Stakeholders
Blenders	18
hub-agrodealers	3
Farmers	3
Fertiliser Associations	1
Agriculture Research Council	1

The study is organised as follows. Section 2 presents the current status of the fertiliser market in South Africa covering demand, supply and trade. It also presents the status of fertiliser production and consumption the SADC region. Section 3 discusses the opportunities for the production and consumption of green ammonia and e-fertiliser in South Africa and SADC. Section 4 presents the risks and barriers to increased production and consumption of green ammonia and e-fertiliser in South Africa and SADC. Section 5 presents the policy options for increased production and consumption of green ammonia and e-fertiliser in South Africa.

[8] Nitrogeneous Fertilisers in South Africa. Available at: https://oec.world/en/profile/bilateral-product/nitrogenous-fertilizers/reporter/zaf
[9] Ibid

2 FERTILISER MARKET IN SOUTH AFRICA

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Chapter 2. Fertiliser Market in South Africa

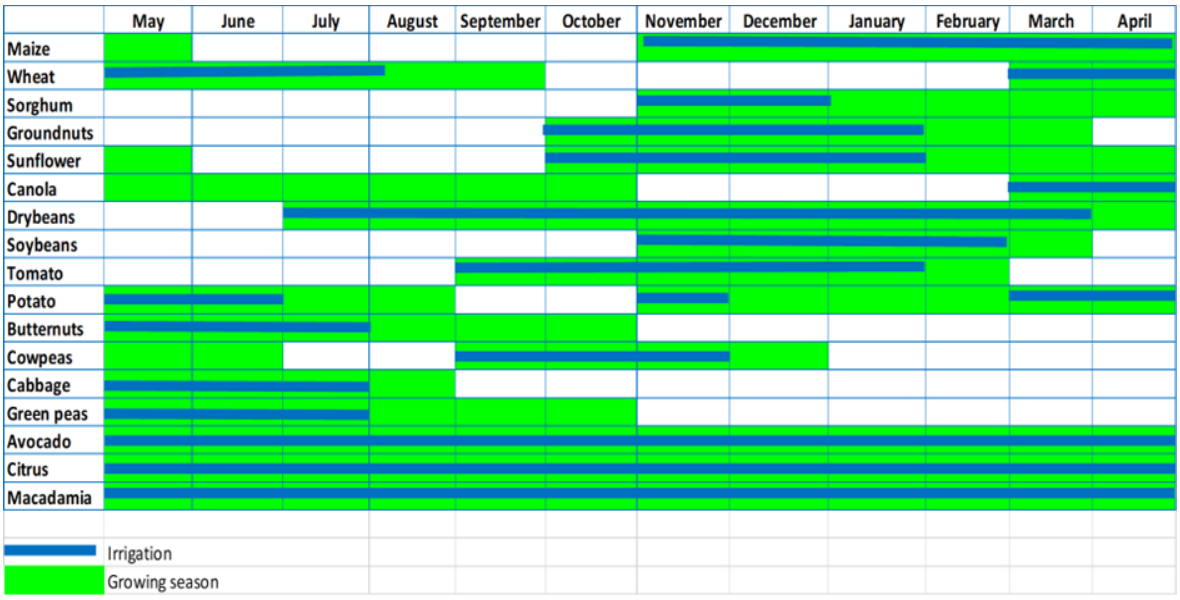
2.1 Demand

The main nutrients that plants require in significant quantities for plant growth and development are nitrogen (N), phosphorus (P) and potassium (K). Nitrogen is vital for plant growth and photosynthesis; phosphorus is needed for healthy root formation, and potassium is important for regulation of the amount of water retention by the crop. These three nutrients comprise the majority of manufactured fertilisers globally. Nitrogenerous fertiliser accounts for 58% of global fertiliser nutrient consumption.[10] A key ingredient in the production of nitrogenous fertiliser for agricultural use is ammonia. South Africa consumes approximately 2,425 million metric tonnes of physical product of fertiliser annually, which is disaggregated by elements as follows: 414 800 metric tonnes of nitrogen, 129 200 metric tonnes of phosphorus, and 183 400 metric tonnes of potassium (Louw, 2025).

A large variety of fertilisers are consumed in South Africa, including various blends of nitrogen, phosphorus and potassium (NPK) fertiliser, urea, limestone ammonium nitrate (LAN), ammonium nitrate, ammonium sulphate, diammonium phosphate (DAP), monoammonium phosphate (MAP), and potassium chloride. Average fertiliser consumption is 91 kg/ha of arable land which is close to world average of 100 kg/ha. The most commonly used form of ammonia-based or nitrogeneous fertiliser in South Africa are urea, ammonium nitrate, and a whole range of fertiliser blends. The maize industry accounts for approximately 53.11% of the total volume of fertiliser consumed in South Africa, followed by sugarcane (12.64%), pastures (4.42%) and wheat. More than 84% of total fertiliser usage is by field crops followed by horticulture (9%) and vegetables (6.3%). Fertiliser consumption in South Africa is mainly in large-scale production systems; smallholder producers only account for 9.51% of the total estimated fertiliser usage in South Africa and most of this fertiliser is used on maize (6.2%).

Whilst demand for fertiliser is seasonal for field crops, there are two crops per year in winter and summer, reflecting the intensity of fertiliser use. For example, maize is grown in summer, and wheat in winter. On the other hand, horticultural commodities such as macadamias, citrus, and avocados have operations throughout the year, so their demand remains quite consistent. Potatoes are grown intermittently throughout the year in Limpopo and some parts of Mpumalanga, but mostly in winter. In the Orange Free State and part of Mpumalanga, potatoes are a summer crop and follow the maize calendar from November to April. All cereals, apart from wheat, are summer crops. Sugarcane fertiliser application occurs for nine months, from March/April to November/December, avoiding the rainy season as it presents harvesting challenges. So, essentially, fertiliser demand is high and steady year-round, although this does vary geographically. Figure 1 depicts the temporal demand for fertiliser in South Africa by commodity.

Figure 1. Temporal Demand Of Fertiliser By Commodity



Source: Cai, 2017

[10] "Fertiliser Industry Worldwide – Statistics and Facts." https://www.statista.com/topics/8956/fertilizer-industry-worldwide/

2.2 Supply

The fertiliser market in South Africa trades approximately 2,425 million metric tonnes of physical product annually. Table 2 presents the breakdown of the total amount of fertiliser consumed in 2024 by type of product.

Table 2. Fertiliser Market in South Africa by Type of Product, 2024

Summary	Volume (Ton)	Note
Diammonium phosphate (DAP)	36 338	Grain SA: Foskor and imports
Triple super-phosphate	42 201	FOSKOR Volume unknown - own estimate
Mono-Ammonium Phosphate (MAP) - Straight	84 000	Grain SA: Foskor
NPK blends	727 326	Unknown volume - own estimate - Ton NPK
Limestone ammonium nitrate (LAN) - 28%	100 000	Grain SA: Sasol and Omnia
Calsium Amonium Nitrate (CAN)- 26%	375 024	Net Imports Exports: SARS
Urea straight	463 598	Estimated straight sales - Imports SARS
Ammonium sulphate	291 183	Net Imports Exports: SARS
Potassium chloride (KCL) - Straights	267 167	Estimated straight sales - Imports SARS
Potassium sulphate straights	38 122	Net Imports Exports: SARS
Total (ton)	**2 424 959**	

Source: AFAP, 2025

Although the nutrient concentration of fertiliser has increased over the years, there has not been much growth in the fertiliser industry in the past few decades. Currently, South Africa relies heavily on imported fossil-fuel based fertilisers, and due to the decrease in local production since the 1990s, the country imports more than 50 % of its plant nutrient requirements (see Table 3 for the main ports of entry). South Africa produces nitrogen-based fertiliser products in the form of calcium ammonium nitrate (CAN) and nitrate- based NPK blends and can cover all its phosphate requirements with its own production, but all the country's potassium and urea requirements are imported. Due to this heavy dependency on imports, the agricultural sector is exposed to the volatility of international markets due to fluctuating prices and disruptions in supply chains.

Table 3. Main Ports of Entry in South Africa

Port of Entry	Average (5-years) - Ton	%
Durban	1 938	81%
Cape Town	350	15%
Richards Bay	26	1%
Mananga (Eswatini)	24	1%
Port Elizabeth	19	1%
Other	27	1%
Total tons imported	**2 384**	**100%**

Source: AFAP, 2025

The fertiliser industry in South Africa is comprised of a range of large, medium and small players running the gamut from manufacturers, importers, traders, blenders, wholesale distributors or hub-agrodealers and retailers (see Figure 2). However, the value chain is highly forward vertically integrated with market actors at each level also being active at subsequent levels. The first level is comprised of the four manufacturers, Foskor, Sasol, Impala Platinum and Omnia. With the exception of Sasol, these manufacturers supply the two subsequent levels of the value chain (importers and blenders). Sasol is the only local manufacturer of ammonia to the fertiliser industry and Omnia is the only manufacturer that also imports fertilisers.

The second level is comprised of importers and traders. The two main importers are Yara and Kynock/ETG and the main traders are SQM, ICH and Gavilon. These importers and traders import from the international market and also procure fertilisers from local manufacturers. The third level is comprised of blending companies. There are at least 50 blenders in South Africa producing a large variety of fertilsers. Some of these actors only produce fertiliser blends, while others blend as well as granulate their fertiliser. In addition, some only source from local suppliers while some source locally and import raw materials to do their blending. Two of the main blenders in terms of market share are Constantia and Greenspan.

The final level of distribution is wholesale "hub" distributors of which there are approximately 250 registered across the country and 450 retailers.

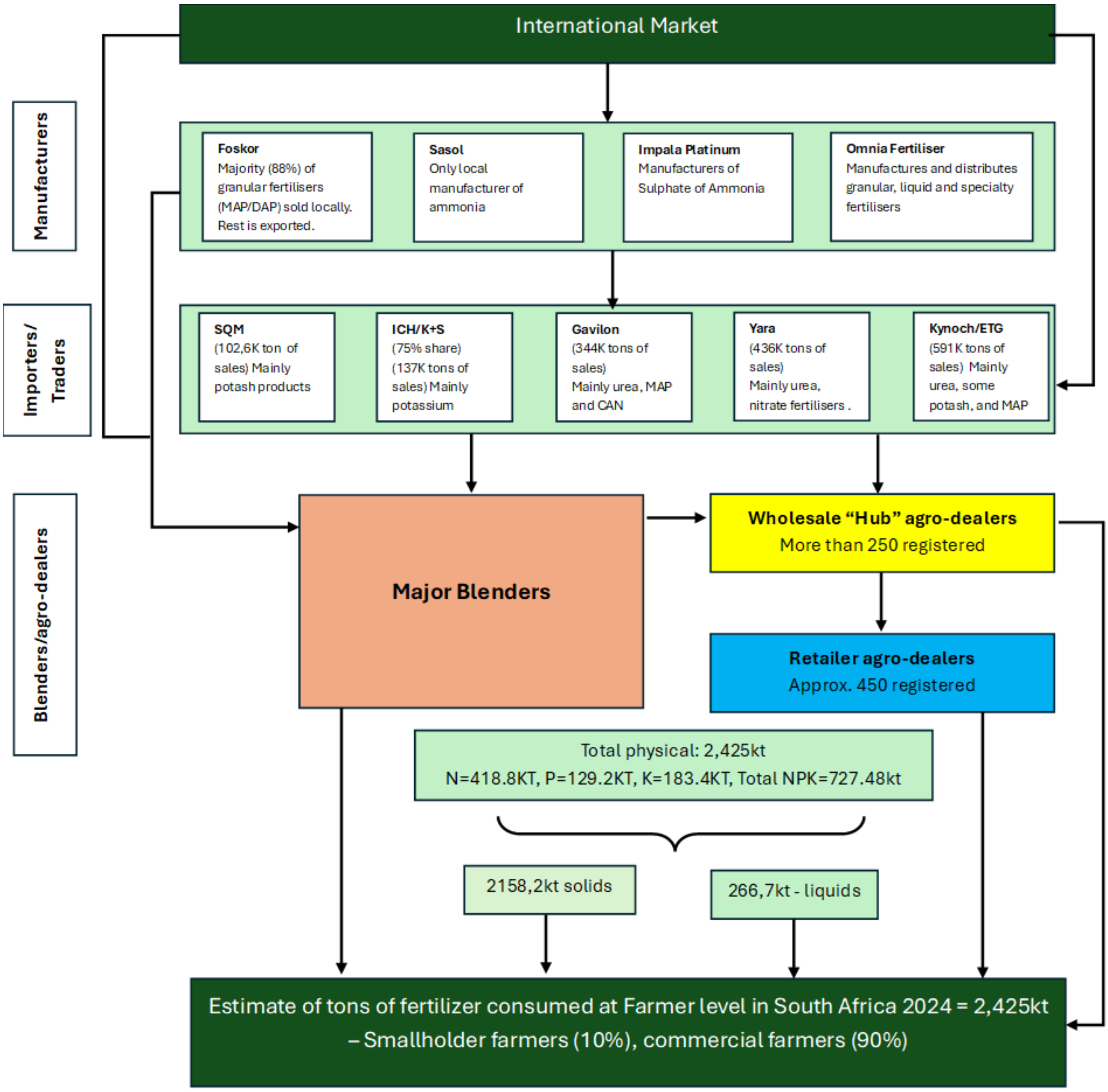
Fertiliser distribution to large scale farmers who consume 90% of the fertiliser in the country is done by importers and blenders as well as some hub distributors. Hub distributors and retailers supply fertilisers to small-scale farmers.

Table 4 illustrates the main trading activities of the first three levels of fertiliser suppliers in South Africa.

Table 4. Main Trading Activities of the First Three Levels of Fertiliser Suppliers In South Africa

Name	Manufacturer	Importer	Trader	Blender	Wholesale "Hub"Distributor
Sasol	X				
Foskor	X	X			
Impala Platinum	X	X			
Omnia	X	X		X	
Yara		X		X	
Kynoch/ETG		X		X	X
Constantia		X		X	X
Greenspan		X		X	X
Nitrophoska		X		X	X

Figure 2. Fertiliser Market Structure – South Africa



2.2.1 Manufacturers

Three companies dominate the fertiliser industry in South Africa at the manufacturer level: Sasol, Omnia Fertiliser, and Foskor. All of these companies supply raw materials to other fertiliser manufacturers, importers and blenders. In addition, they are vertically integrated forward, as they also have downstream processing facilities for blending and granulation, and are therefore able to directly supply end-users such as large commercial farmers, distributors and hub-agrodealers.[11]

[11] Although having a presence at more than one level of the value chain places companies in a good strategic position, in 2017 the Competition Commission of South African determined that it constituted uncompetitive behaviour in the market and some restrictions were put in place, such as the prohibition on Sasol from selling fertilisers to end-users (Competition Tribunal, 2017) (Steenkamp, 2018).

Sasol

Sasol Chemicals is a global chemicals and energy company, which harnesses its knowledge and expertise to integrate sophisticated technologies and processes into world-scale operating facilities. It sources, produces and markets a range of high-quality products in 22 countries, creating value for stakeholders.

In South Africa, Sasol is the largest producer of raw chemicals for fertiliser production. Ammonia is the main feedstock for nitrogenous fertiliser in South Africa, and Sasol produces and sells more than 540 000 tonnes of ammonia annually, which is used to make a variety of fertilisers and industrial chemicals for the agriculture sector, as well as for the mining, textile, and metalworking industries. Although Sasol supplies most of the country's ammonia, with some produced by Mittal Steel (Exarro), the rest of the ammonia demand is imported. Most of South Africa's ammonia imports come from Middle East countries like Saudi Arabia, Kuwait, Bahrain, and Oman and when exporting ammonia, it is mainly to African countries.[12]

Omnia

Omnia's agriculture division, Omnia Nutriology, is the market leader in Southern Africa and comprises Omnia Fertiliser and Omnia Specialities. The division produces granular, liquid and speciality fertiliser for a broad customer base of farmers, co-operatives, and wholesalers throughout Southern and East Africa, Australia, New Zealand, and Brazil. Omnia is a powerful player in the South African market, commanding 32.4% market share.

Foskor

Foskor is the largest producer of phosphates and phosphoric acid in South Africa. Foskor supplies phosphate concentrates to both local and foreign fertiliser manufacturers and blenders; and it can provide enough phosphates to meet the total demand for it in South Africa. Foskor is the only vertically integrated phosphate producer in South Africa. From phosphate-bearing ores, the operations in the Mining Division process phosphate rock concentrate, which is crucial for stimulating and raising crop yields. The Acid Division Plant manufactures sulphuric acid, phosphoric acid, and phosphate-based granular fertiliser (MAP and DAP) by using phosphate rock as a raw material.

About 84% of the Mining Division's phosphate rock concentrate is railed to Acid Division and the rest is sold externally. Foskor mines and beneficiates phosphate rock at Phalaborwa in South Africa's Limpopo Province, from there it is carried by rail to the production facility in Richards Bay in KwaZulu-Natal. The Acid Division exports phosphoric acid to India, Japan, Bangladesh, the Netherlands, Mexico, and Dubai. Phosphoric acid has agricultural, industrial, medical, and retail applications.

Table 5 illustrates the suppliers in the fertiliser industry in South Africa in terms of role (manufacturer, importer and blenders) and type of fertiliser products supplied to the market (Steenkamp, 2018).

Table 5. Main Suppliers in the South African Fertiliser Industry in Terms of Product Range and Role

RAW MATERIALS AND INTERMEDIATES		
AMMONIA Sasol Imports	**PHOSPHATE ROCK** Foskor	**SULPHUR** Sasol Imports
NITRIC ACID Sasol Omnia AECI/Triomf	**PHOSPHORIC ACID** Sasol Agri Phalaborwa Omnia Foskor Richards Bay	**SULPHURIC ACID** Sasol Agri Phalaborwa Sasol SSF Secunda Foskor Richards Bay Chemical initiatives Impala Anglo Zincor Imports
STRAIGHT AND CHEMICAL COMPOUNDS		
UREA Imports only	**SINGLE SUPER PHOSPHATE** Omnia	**KCl** Imports only

[12] Although Sasol is a key actor in the fertiliser industry, it is no longer allowed to sell the end-product. This follows a Competition Commission intervention in an attempt to ensure competitive pricing in the manufacture of fertilisers.
Source:
https://www.whoownswhom.co.za/store/info/4507#:~:text=Although%20a%20range%20of%20large,with%20an%20estimated%2015%25%20each

LAN Sasol Omnia Imports	**MAP** Omnia Foskor Richards Bay Imports	**K2SO4** Imports only
AMMONIUM SULPHATE Sasol Exarro Impala Imports	**DAP** Foskor Richards Bay Imports	**KNO3** Imports only
N	**P**	**K**
DOWNSTREAM NPK COMPOUNDS AND BLENDS		
GRANULAR SOLIDS (e.g. Urea, CAN) Omnia Sasol (LAN only) Imports	**LIQUIDS** Sasol Omnia Kynoch Sidi Parani Other Smaller Companies	**BLENDED SOLIDS (e.g. NPK 10:20:10)** Sasol Omnia Kynoch Profert Sidi Parani Other Smaller Companies

Source: Steenkamp (2018)

The first product group comprises raw materials and intermediates used to produce the actual fertilisers. The second product group are straight (meaning single nutrient) fertilisers, that are created from the raw materials and intermediates in group one. The third and final product group are the downstream NPK compounds and blends that are sold to the end-users (farmers). In some cases, end users/farmers make use of the same chemical compounds used to manufacture the final product and therefore these are sometimes sold directly to the market as well as used to create the final product.[13]

2.2.2 Importers and Traders

Importation of fertiliser in South Africa takes place in two forms. First, importation by subsidiaries of two global manufacturers, *Yara* and *Kynoch/ETG* and in fact these are the two largest importers in terms of market share.

The second form, which accounts for a substantial percentage of the amount imported, entails private sector bulk procurement, where a sizeable number of global trading houses aggregate demand for different blenders from South Africa. These trading houses coordinate international procurement of fertiliser as well as the shipping lines. Most of them have storage capacity at the major ports, which allows inland blenders to send their trucks to pick their respective consignments.

These companies include *SQM,* which is the global market leader in producing potassium nitrate of natural origin; *Industrial Commodities Holdings (ICH),* which trades in a variety of commodities including fertilisers, supplying both the South African and the world market; and *Gavilon Fertiliser,* a wholesale distributor of crop nutrients around the world, whose products are distributed countrywide from Gavilon's main storage facility in Durban. These companies source the product by importing via the global trading houses and/or buying from the local manufacturers and then selling these products as received or blend and then sell new formulations.

Yara

Yara has been present and operational in Africa for more than 30 years. With a clear focus on agricultural development, Yara supports customers ranging from smallholders to full scale commercial enterprises. Yara fertilisers, solid or liquid, supply all crop nutrients including nitrogen, sulphur, phosphate, potassium, and a full range of micronutrients. In South Africa, Yara commands 7.5% of the market share.

Kynoch[14]/ETG[15]

Kynoch Fertiliser is a leading importer, blender, and retailer of a complete range of granular, liquid and speciality fertilisers (Optimizers™) in Southern Africa. Kynoch operates warehouses as well as import and blending facilities in all the major ports in the Southern Africa region and several inland locations. Kynoch has developed its range of enhanced efficiency fertiliser products which includes its foliar range (OEMFF®) that is both crop and growth stage specific. In South Africa, Kynoch commands 21.5% of the market share.

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[13] Straight fertiliser are single nutrient fertiliser, such as urea, which is 46% N. Compounds and blends contain more than one of the macro nutrients (N,P,K) and may also contain some micronutrients (Boron, Zinc, etc).Bblends are created when various straight products such as urea and DAP are blended to create a mixture of NPK products: these mixtures contain various granules of urea, DAP, etc. and micronutrients can also be included in the mixture. With compound or granulated fertiliser, various fertilisers are dissolved into a homogeneous slurry and then granulated, so that each granule contains all the nutrients.
[14] https://www.etgworld.com/about-etg.html
[15] https://www.kynoch.co.za/

During 2014 Kynoch became a member of the Export Trading Group (ETG) through ETG Inputs Holdco Ltd (EIHL), one of the fastest growing agricultural conglomerates globally, operating in Africa for more than 50 years. Kynoch is now a subsidiary of the ETG group of companies. Kynoch services over 2 200 customers, distributing over 290 000 metric tonnes of fertiliser per year across Southern Africa.

2.2.3 Blenders

There are over 50 blenders of various sizes located across South Africa, serving South Africa as well as neighbouring countries such as Namibia, Botswana, Zambia and Eswatini. These companies provide conventional granular fertiliser, liquid fertiliser, premium granular products, starter fertiliser, foliar fertiliser, water soluble products, biostimulants, and prescription blends for clients. Their products include a wide range of nitrogen-based, phosphate-based and potassium-based products, as well as a variety of NPK blends.

The largest blending companies in terms of market share are *Constantia* and *Greenspan*, followed by other large companies such as *Nutri-Flo, Nitrophoska and Greenlands*. These are typically bulk blenders that either import raw materials or source them from the local manufacturing companies.

These blending companies typically work closely with farmers to determine their unique requirements, thus providing them with rapid access to tailor-made fertiliser blended according to their choice. They supply, blend, and distribute a complete range of specialised fertilisers, bio-stimulants, pesticides, and bio-pesticides to large, medium, and small enterprises.

Constantia

Constantia Fertiliser has an extensive infrastructure consisting of blending facilities in Richards Bay, Pietermaritzburg, Secunda, Wellington, Nelspruit (Alkmaar) and Port Elizabeth. It sources raw materials from the manufacturers and traders and produce bulk blends of a wide variety of products including urea, calcium ammonium nitrate, NPK and customs blends as per the client's request in 50 kg or 500 kg bags. Constantia commands 8.3% of market share.

Greenspan

Greenspan has established itself as probably South Africa's foremost supplier of fertiliser blending and bagging systems. In 2011, Greenspan expanded its business into the supply of bulk blending and granular fertiliser blends by establishing an in-house production facility. Today, they are highly experienced in the production of fertiliser bulk blended products as well as trade in fertiliser and fertiliser-related products. Their products include a wide variety of NPK blends, a fertiliser blend combination of nitrogen and ammonium sulphate, and NBPT UREA. Their coated urea minimises nitrogen losses due to volatilisation.

2.2.4 Hub-Agrodealers and Retail Agrodealers

The majority of fertiliser in South Africa (approximately 90%) is used by large-scale farmers growing commercial crops. The importers, manufacturers and blenders mix and supply directly to these farmer clients. There are also approximately 250 registered independent hub-agrodealers and 450 retailers in South Africa.[16]

2.2.4 Fertiliser Cost Build-Up in South Africa

The fertiliser cost build up for South Africa is comprised of several components, namely Free on Board (FOB), Cost, Insurance Freight (CIF), port charges, price excluding port storage and bagging, port storage and bagging, importer finance cost, overheads and margins, free on truck (FOT) (importer/blender), blender warehousing, distributor finance cost, overheads and margins, free on truck (distributor), retailer transport, finance and local taxes, free on truck (retailer) and retail margins, which subsequently result in the farmgate price of fertiliser. The number and size of these cost components depends on whether the product is sourced from international markets or manufactured domestically.

Imported fertiliser is procured from international markets at negotiated FoB prices. Long-term contracts for fertiliser procurement often result in favorable FoB rates. Additionally, timing the procurement strategically can help reduce FOB costs. For example, FOB prices tend to rise when significant buyers like Brazil are active in the market.

Freight cost depends on the type of cargo, whether it is bulk or containerised, with the latter being expensive and depending on the availability of containers. These costs vary from $35 to $55, depending on the product. Insurance also adds to these costs. In addition, distance matters in determining the costs. Most importantly, the vessel size has a bearing on the freight price, with bigger vessels being cheaper; for instance, freight cost on a 30 000 tonnes ship is around $25 per tonne, whereas a 15 000 tonnes ship would cost almost double that price. Moreover, these ships require a specific port depth for them to dock. Furthermore, the efficiency of the port of destination when it comes to offloading plays a crucial role in determining freight costs. Most of South Africa's imported fertiliser are handled by the Port of Durban, which accounts for 81% of the volume, followed by the Port of Cape Town, which handles 15% of the volume. The remaining 4% are handled by the Port of Richards Bay, Port of Mananga, Port of Elizabeth, and others.

Once the ship has docked, there are a number of port charges and levies, which amount to $1,31/ tonne of fertiliser. Value-adding processes such as storage and bagging also add to the fertiliser price. Bagging alone adds from $11 to $17 per tonne, depending on the product. Before selling to the next level of value chain players, the importer adds their margin, which also varies from $11-$17 per tonne

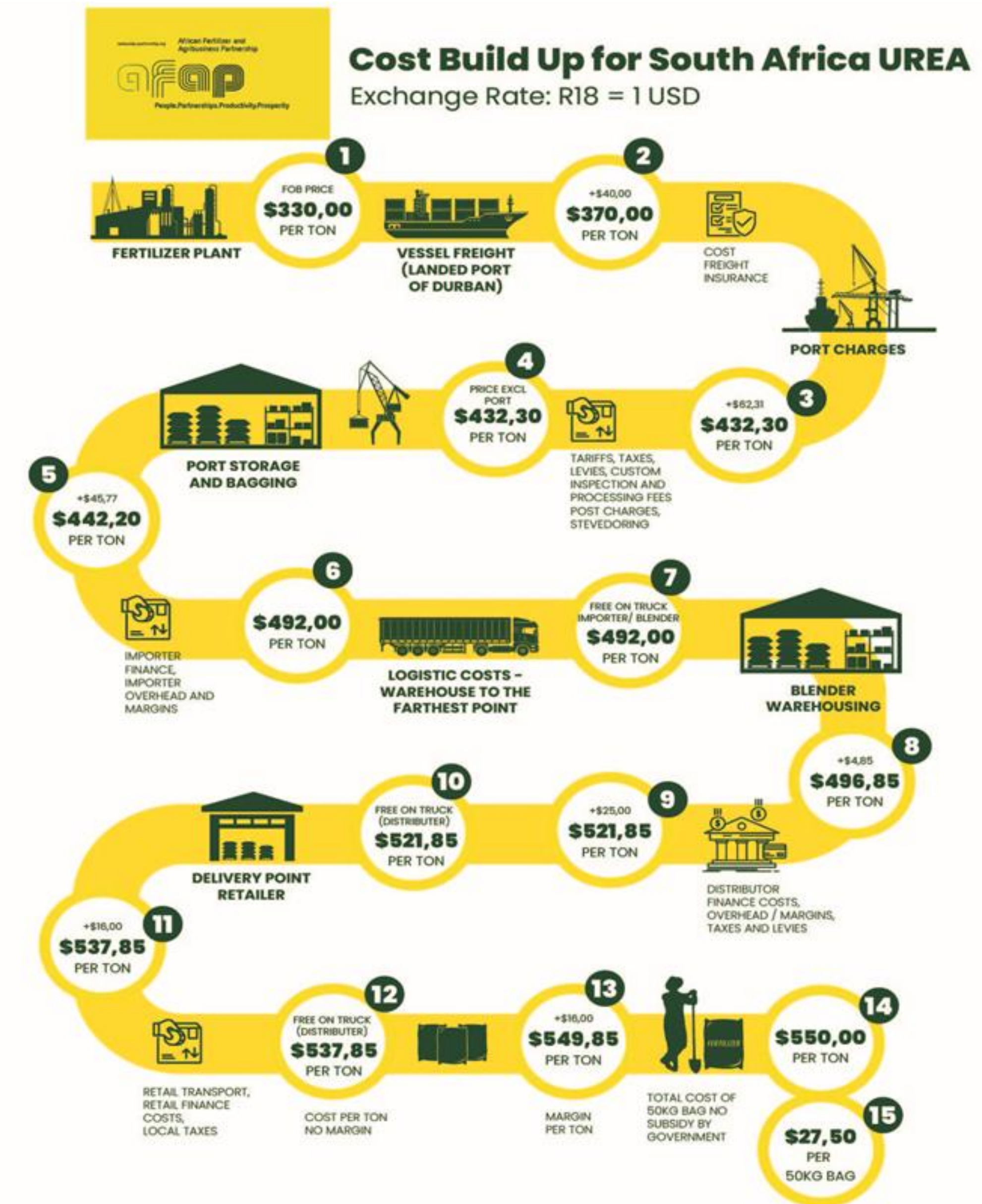
[16] https://agrodealersa.org/history/

of fertiliser. In many cases, these importers use borrowed finances, which they need to service, hence additional finance is also added to the price of fertiliser.

Fertilisers are transported into the interior of South Africa to several blenders located in agricultural production zones across the country for the production of specialty blends. These blenders incur additional transport costs from the port to their warehouse of approximately 0.59 cents per tonne per kilometer. This implies that the further into the interior the blender is located from the port of entry, the more they pay for road transport. For instance, a blender located in Limpopo ends up paying an additional $28,7/tonne, in Mpumalanga, $21,5/tonne; in Gauteng $18,9/tonne; in North West $26,6/tonne; and Free State $19,8/tonne. In addition, the blenders have to service the loans acquired to purchase the fertiliser consignments, and they also incur storage costs.

Once it reaches the blender stage, the fertiliser can be directly sold to farmers or be sold to Hub-agrodealers, who then sell to farmers directly or via the retail agrodealers' networks. The latter route will attract storage, finance, transportation, and retail margin costs. Figure 3 illustrates the cost build-up of urea in South Africa.

Figure 3. Fertiliser Cost Build-Up for Urea in South Africa



1. Free on Board (FOB)
2. Cost Insurance Freight (CIF)
3. Port charges
4. Price excluding port storage & bagging
5. Port storage & bagging
6. Importer finance cost, overheads & margins
7. Free on Truck (FOT) (Importer/Blender)
8. Blender warehousing
9. Distributor finance cost, overheads & margins
10. Free on Truck (Distributor)
11. Retailer Transport, finance & local Taxes
12. Free on Truck (Retailer)
13. Retail Margins
14. Farmgate price per ton
15. 50kg bag price

2.3 Trade - Fertiliser Import and Export Volumes and SARS FOB Values

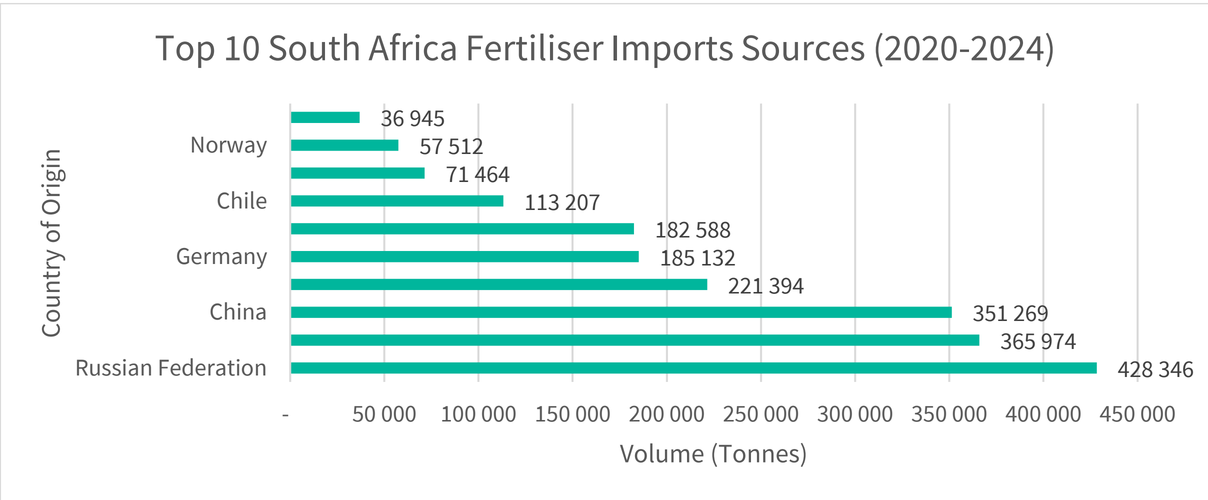
2.3.1 Trade Flows

In 2024, South Africa imported 8,86 billion worth of nitrogeneous fertilisers. The main origins of the imports were Saudi Arabia (22%); Russia (16%); Quatar (15%); China (15%), and Oman (13%). During the same year, South Africa exported nitrogenous fertilisers to Zambia (46 %), Zimbabwe (18 %), Namibia (10 %), the Democratic Republic of the Congo (9%), and Botswana (7 %).[17] Almost half of the fertiliser imported into the SADC region arrives via South Africa, and mostly via relatively expensive road and rail transport.

2.3.2 Imports

Figure 4 indicates fertiliser imports into South Africa from the top 10 countries during 2020-2024, which totalled just over 1.8 million tonnes. The Russian Federation, Saudi Arabia and China account for the over 50% of total import volumes. On average, more than 75% of the imports flow through Durban harbour, followed by Cape Town (15.7%).

Figure 4. Top 10 Fertiliser Imports Sources (2020-2024)



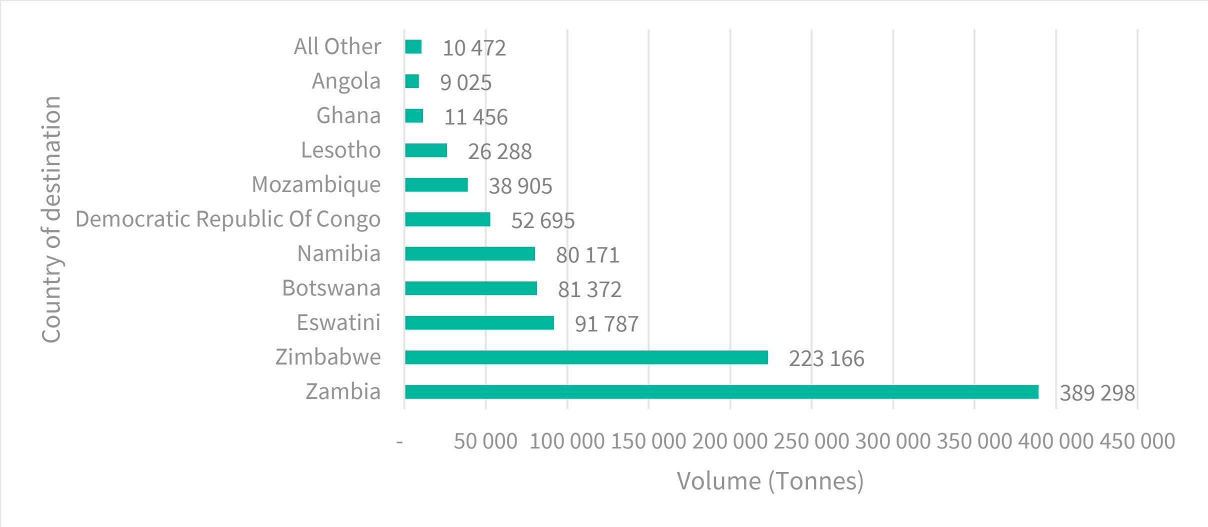
Urea (46%), Ammonium Phosphate (11%), Potassium Chloride (11.6%), Ammonium Sulphate (10%) and Potassium Sulphate (6%) contributed to more than 86% of the 5-year average import volumes.

[17] Nitrogeneous Fertilisers in South Africa. Available at: https://oec.world/en/profile/bilateral-product/nitrogenous-fertilizers/reporter/zaf

2.3.3 Exports

Figure 5 indicates that exports to 11 African countries contribute more than 93% of all exports to Africa. Zambia, Zimbabwe, and Eswatini are South Africa's top three export partners.

Figure 5. Fertiliser Exports from South Africa to Countries in the SADC Region – 5 Years Average (2020 – 2024)



2.4 Fertiliser Market in SADC

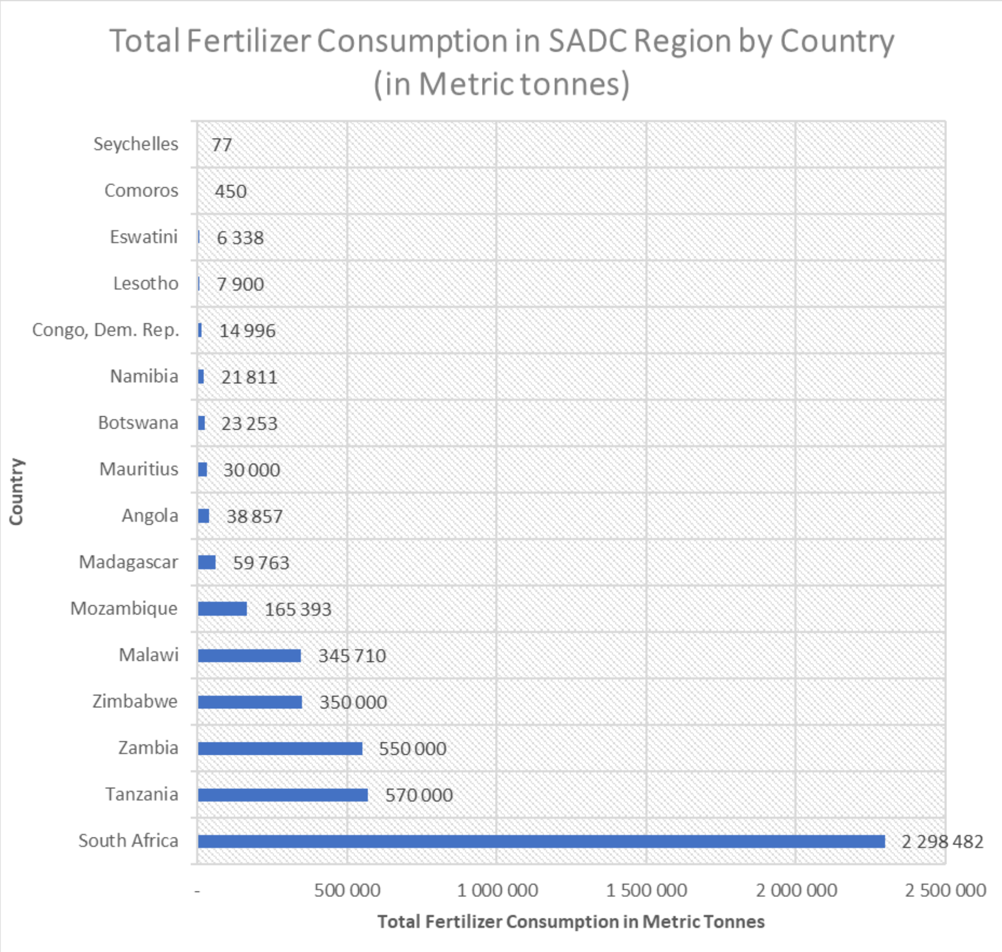
2.4.1 Fertiliser Consumption in SADC

The total fertiliser consumption in the SADC region is 4,5 million metric tonnes per annum. Figure 6 shows the fertiliser consumption in the 16 SADC countries in tonnes of nutrients. Consumption ranges from 2.3 million metric tonnes in RSA to a mere 77 metric tonnes in Seychelles.

Six countries use more than 200,000 tonnes of nutrients annually (South Africa, Tanzania, Zambia, Malawi, Zambia and Zimbabwe), while 9 countries use more than 50,000 nutrient tonnes annually. In fact, over 90% of the total fertiliser consumption in SADC is consumed in the 6 aforementioned countries. Although Mozambique has one of the lowest levels of fertiliser use, it is a pivotal country because the majority of fertiliser consumed in Zimbabwe, Zambia and Malawi comes via Mozambiquan ports. DAP, urea, and NPK compounds and blends are the most commonly used fertilisers in the region.

The majority of the fertiliser in these countries is used on maize (which is both a food and cash crop), followed by cash crops (horticulture in South Africa and Zambia; and tobacco in Tanzania). The exception is Mozambique, where the majority of fertiliser is used on tobacco and sugarcane; smallholder farmers growing maize in Mozambique hardly apply chemical fertilisers. In Mozambique and Eswatini, fertiliser is mainly used by large-scale farmers. In comparison, in Malawi and Zimbabwe, fertiliser is used equally by both large-scale industrial and smallholder farmers, whereas in Tanzania, fertiliser is mainly used by small-scale farmers (80%). In the rest of the SADC region, fertiliser use is mainly by large-scale farmers and use by smallholder farmers is negligible.

Figure 6. Total Fertiliser Consumption in SADC (MT)



2.4.2 Fertiliser Production in SADC

Southern Africa is well endowed with natural resources for fertiliser production. These resources include deposits of phosphate rock (in South Africa, Zimbabwe, Tanzania, and Mozambique), accumulations of natural gas and deposits of coal, which can be used to produce nitrogen fertilisers (Angola, Mozambique, Namibia, DRC, Madagascar and Tanzania) and potash deposits (DRC). The region is also blessed with abundant renewable energy resources (wind and solar) and vast land, which means it has the potential to become a key player in green hydrogen production, and therefore, green ammonia and e-fertiliser (Editor, A. M., 2025).

There are a number of fertiliser production plants in the SADC region producing various acids as well as straight fertilisers, compounds and blends. The region has also invested in blending plants for producing blended NPK product based on imported straight fertilisers such as urea, DAP, TSP, SSP and MOP. Bulk blending plants have been established in all the larger fertiliser using countries of the region: Malawi, Mozambique, Tanzania, Zambia and Zimbabwe. For example, one plant in Madagascar is producing ammonium sulphate, there are two blending plants in Malawi producing mineral fertiliser blends, mainly NPKs, and one of each in Mauritius producing mineral fertiliser compounds and blends.

In Tanzania, Minjingu Mines and Fertiliser Limited annually mines and beneficiates 40,000 tonnes of phosphate rock raw mate, which it uses to manufacture phosphate fertilisers and NP and NPK compounds (steam and wet granulated), and NPK blends. In Zimbabwe, three companies are involved in the primary production of raw materials. These are Dorowa Minerals, which mines phosphate rock in Buhera, which is in turn converted to fertiliser grade phosphates by ZimPhos in Harare. Sable Chemical in Kwekwe produces AN from imported ammonia following the decommissioning of its electrolysis plant three years ago. Sable Chemicals has a capacity to produce 240 000 MT of ammonium nitrate per annum. At secondary level, the Zimbabwe Fertiliser Company, Fertiliser, Seed and Grain (FSG) and Windmill companies produce granular fertiliser with a combined granulation capacity 390 000 MT.

In summary, although Southern Africa is endowed with natural gas and phosphate rock, with the exception of South Africa, it has not been able to convert these resources into substantive production facilities due to a number of factors. First, the small market sizes of the majority of countries makes production by individual countries non-viable economically. As illustrated by Figure 6, 10 of the 16 countries in SADC use less than 100,000 tonnes of product. In comparison, the typical ammonia/urea plant produces between 500,000 and 1 million tonnes of urea and requires an investment of at least $ 1 million. Furthermore, these countries use several different products (urea, DAP, CAN, TSP, and many different formulations of NPK blends) and have different fertiliser standards, which act as non-tariff barriers to trade, preventing the free movement of fertilisers between countries. However, a harmonised fertiliser regulatory framework for the region has just been approved by the SADC Ministers of Agriculture, boding well for the establishment of a regional market. For example, a private investor could invest in an ammonia/urea plant in Mozambique (using natural gas) and supply the whole SADC market, exporting the surplus to the rest of Africa and the global market. A second barrier is the insufficiently developed road infrastructure. While in countries such as South Africa, Zambia and Tanzania the main highways and inter-city roads are well-maintained, in the majority of cases the feeder roads linking secondary cities to the rural interior are in poor condition, resulting in high transport costs; these translate into high fertiliser prices for farmers, which in turn contributes to the small market size (low demand).

2.4.3 Fertiliser Trade in the SADC Region

Given that there is limited production within the SADC region, fertiliser trade plays an important role in meeting fertiliser requirements. Straight fertilisers such as urea and DAP are imported into the region to be used as an end-product and as raw material for local production and blends. In addition, several NPK products both granulated and blended are imported or blended for cash crops such as tea and sugarcane. Of importance is the plurality of NPK products that are traded in the region and have fragmented the market, adding to the costs of import and distribution. Some fertiliser is re-exported from the region, mainly from South Africa and Tanzania, and there is significant intra-regional trade.

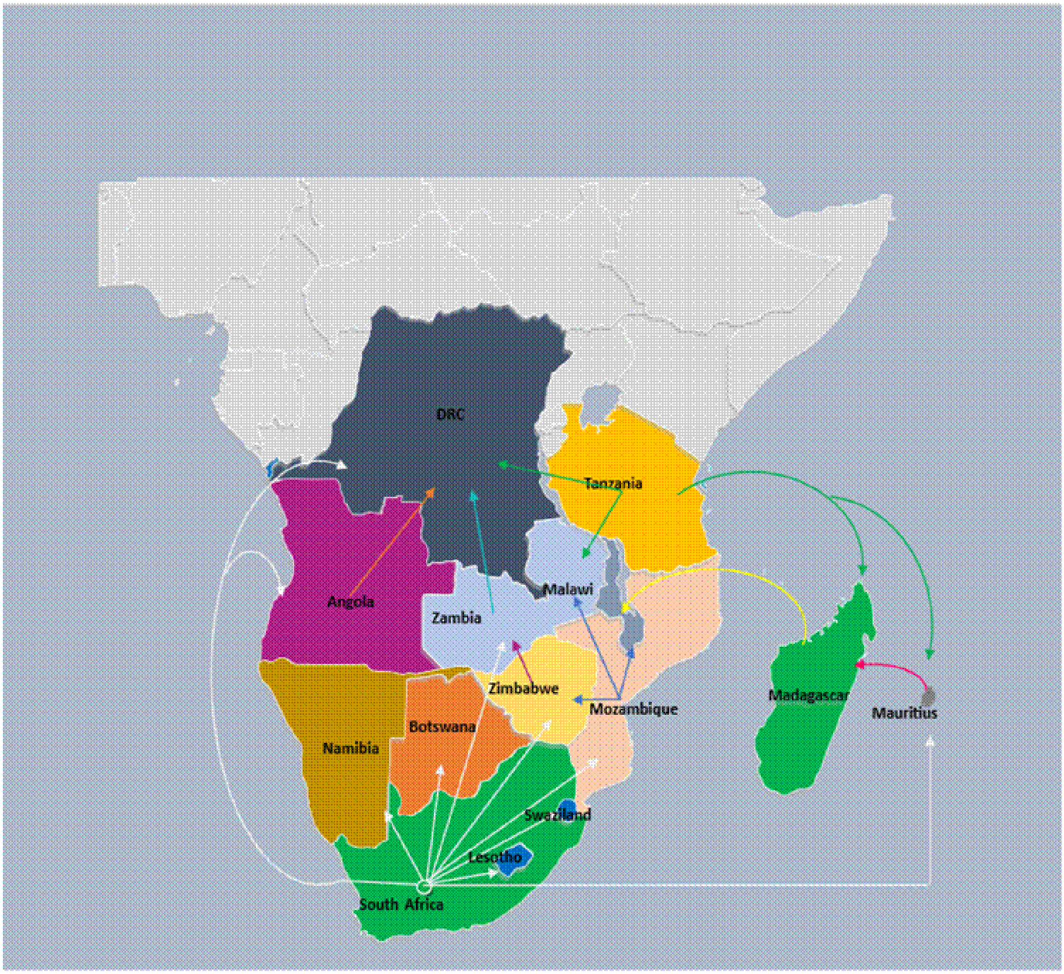
2.4.4 Intra-regional Trade

Although the majority of countries rely on imports from the global market, intra-regional fertiliser trade plays an indispensable role in satisfying fertiliser requirements in the SADC region, particularly for landlocked countries with small fertiliser markets (Namibia, Lesotho, Eswatini, and Botswana), which rely exclusively on South Africa to meet their fertiliser requirements. Also landlocked countries with larger markets (Zimbabwe, Zambia, and Malawi) import a considerable amount of their fertiliser from global markets via Mozambique and from South African manufacturers.

There are three main entry points for fertilisers in Mozambique, namely: a) the Port of Beira; b) the Port of Nacala and c) South Africa via Maputo (by trucks). A significant portion (over 90%) of the imports are earmarked for re-exportation to landlocked countries such Zimbabwe, Malawi, Zambia and DRC, making Mozambique a major trading hub for the region.

There is insufficient data on quantities traded to provide a comprehensive idea of trade, but countries did provide information on trade flows, that is, whether or not they import and/or export fertilisers to other countries in the SADC region. Figure 7 depicts the fertiliser trade flows within the SADC region. This provides a good idea of the potential for trade if the policy and regulatory environment was conducive, and it was justified by sufficient demand.

Figure 7. Fertiliser Trade Flows in the SADC Region



NB: Colours for both countries and arrows are for illustrative purposes of how the fertiliser trade flows.

3 OPPORTUNITIES FOR PRODUCTION AND CONSUMPTION OF GREEN AMMONIA AND E-FERTILISER IN SOUTH AFRICA AND SADC

African Fertilizer and Agribusiness Partnership
afap
People.Partnerships.Productivity.Prosperity.
International PtX Hub
Supported by:
Federal Ministry for Economic Affairs and Climate Action
IKI INTERNATIONAL CLIMATE INITIATIVE
on the basis of a decision by the German Bundestag
Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Chapter 3. Opportunities for Production and Consumption of Green Ammonia and E-Fertiliser in South Africa

3.1 Opportunities for Production of Green Ammonia and E-Fertiliser in South Africa

At present, there is no production of green ammonia and e-fertiliser in South Africa, although there are plans in the pipeline. This section discusses the status of production of green ammonia in South Africa and the opportunity for green ammonia production for South Africa and for the SADC region.

3.1.1 New Facilities in South Africa

COEGA Green Ammonia (CGA) Project

Hive Energy, a United Kingdom company with offices in 22 countries, founded the CGA project in 2020 and partnered with Built Africa in 2021 to establish Hive Hydrogen SA as the Project Developer for the CGA project. The project aims to produce 1 million metric tonnes of low-cost green ammonia every year for marine fuel, industrial, mining, and agricultural purposes. The capital investment is at USD 5.3 billion and the projected FOB price for green ammonia is between $550 and $750 per tonne. The project has received expressions of interest from a number of offtakers from various industries (chemical, fertilisers, oil and gas, steel) both within South Africa and from around the world (Japan, Denmark, Australia, United Kingdom, the EU). Plans are at advanced stages and the first green ammonia will be produced in 2029.[18]

Suiso

A South African company specialised in blue ammonia production is set to invest $1.7 billion in a state-of-the art coal-to-fertiliser facility in Kriel, Mpumalanga. The project is to produce 1.5 million tonnes of nitrogen-based fertiliser annually (Lourie, 2025b).[19]

3.1.2 Decentralised Production and Distribution of Green Ammonia

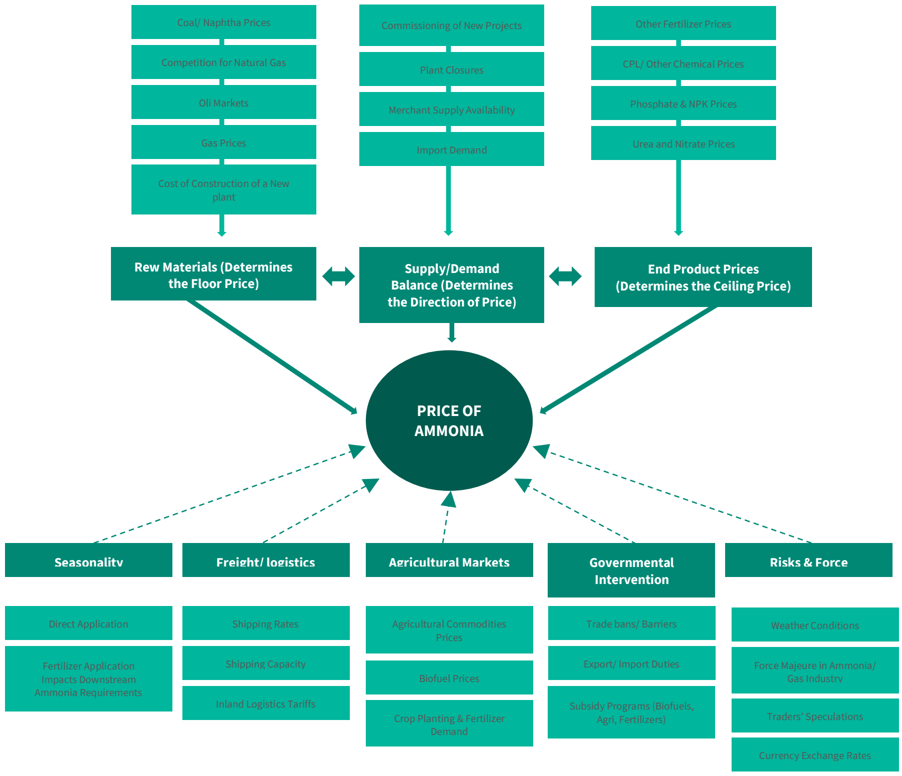
Decentralised production of green ammonia has several advantages, which includes a reduction in the carbon footprint while boosting agricultural productivity. However, the viability of a decentralised ammonia plant depends on several factors, which include its demand, availability of renewable energy and the cost of setting up the infrastructure (Alho et al., 2024).

2.2.5 Cost Comparison of Grey and Green Ammonia

The price of ammonia is driven by a number of factors, which include, among others: the availability of raw materials, supply and demand mechanics, price of output, freight and logistics, and government policies (Figure 8). These factors need to be interrogated to derive a cost build-up of ammonia for the South African fertiliser market.

[18] https://www.hiveenergy.co.uk/clean-futures/green-hydrogen/coega-green-ammonia-project/
[19] https://www.suiso.co.za/

Figure 8. Cost Drivers of Ammonia Production



Fertiliser transportation, logistics, taxes, and distribution account for 40% to about 57% of the final farm gate price. Compared to a simulation of green ammonia, other nitrogen-based fertiliser remain cost-competitive in the market. Table 6 shows the cost buildup of nitrogen-based fertiliser compared to a simulated green ammonia production.

Table 6. Cost Build-Up Comparison of Nitrogen-Based Fertilisers in South Africa

Cost Component Product	UREA		LAN		Ammonium Sulphate		Grey Ammonia		Grey Ammonia		Green Ammonia	
Origin	Saudi Arabia (Jedda)		Russian Federation St		China (Yantai Port)		Sasolburg		Middle East		Sasolburg	
Port of Entry (Specify)/ NPK blender location	Durban		Durban		Durban		Not applicable		Richards Bay		Not applicable	
Exchange Rate (Rand/USD)	18		18		18		18		18		18	
Destination (Specify)	Bothaville		Bothaville		Bothaville		Vrede		Bothaville		Vrede	
Cost Item	USD Per ton	% of retail price	USD Per ton	% of retail price	USD Per ton	% of retail price	USD Per ton	% of retail price	USD Per ton	% of retail price	USD Per ton	% of retail price
FOB Cost Incl. Pre-inspection	330	60%	316	60%	180	43%			365	54%		
Ocean Freight	35	6%	35	7%	55	13%			75	11%		
Insurance	5	1%	8	2%	12	3%			5	1%		
CIF price	370	67%	359	68%	247	59%			445	66%		
Taxes and Levies (Customs clearance)	61	11%	59	11%	41	10%			74	11%		
Port Charges	1	0%	1	0%	1	0%			1	0%		
Price ex-port	432	78%	419	79%	289	69%	350,0	74%	520	77%	1 400,0	92%
Bags, bagging and storage (blending for NPK) - Manufacturer cost for local grey ammonia	14	3%	11	2%	17	4%	0	0%	0	0%	0	0%
Importer / manufacturer Finance costs	8	1%	6	1%	9	2%	5	1%	3	1%	5	0%
Importer / manufacturer overhead	5	1%	4	1%	6	1%	6	1%	6	1%	6	0%
Importer / manufacturer Margin	13	2%	12	2%	18	4%	20	4%	20	3%	20	1%
Inland Transport Cost of importer/manufacturer	20	4%	20	4%	20	5%	11	2%	41	6%	0	0%
FOT Importer/blender	492	89%	471	89%	358	86%	391	82%	591	87%	1 431	94%
Distributor warehousing costs	5	1%	4	1%	5	1%	17	4%	17	2%	17	1%
Taxes and Levies	2	0%	2	0%	2	1%	3	1%	3	0%	3	0%
Distributor Finance Cost	3	1%	3	1%	2	1%	3	1%	4	1%	10	1%
Distributor Overhead	5	1%	4	1%	5	1%	6	1%	6	1%	6	0%
Distributor Margin	17	3%	17	3%	16	4%	17	4%	17	2%	17	1%
FOT Distributor	524	95%	500	95%	389	93%	436	92%	636	94%	1 482	97%
Retail transport	11	2%	12	2%	12	3%	14	3%	14	2%	14	1%
Retail Finance Cost	3	1%	3	1%	3	1%	3	1%	4	1%	10	1%
Other retailer costs (incl. local tax)	1	0%	1	0%	2	0%	3	1%	3	0%	3	0%
Total cost before retail margin	540	98%	516	98%	406	97%	455	96%	658	97%	1 509	99%
Average Retail Margin	12	2%	13	2%	11	3%	19	4%	19	3%	19	1%
Average Retail Price (USD)	552	100%	529	100%	417	100%	475	100%	677	100%	1 528	100%
Average Retail Price (Rand) - R18 to 1USD	9934		9 527		7 502		8 546		12 186		27 506	

The CAPEX for a green ammonia production plant is dominated by the cost of the electrolyser, if the electricity is procured, and not integrated. To date, the CAPEX for a green ammonia plant stands at $486 million as compared to $ 183 million for a grey ammonia Haber-Boch plant using fossil feedstock and fuels (Hydrogen Tech World 2023). This is prohibitively high. However, green ammonia is modelled to reach cost-competitiveness in South Africa exceptionally quickly, as early as 2030, far earlier than in any other region of the world except North America.

Availability of financing mechanisms to fund CAPEX for green ammonia and e-fertiliser production

At the global stage, the World Bank and the International Monetary Fund may be the candidates for funding initial CAPEX for decentralised production of ammonia. This aligns with their carbon footprint reduction mandate. In South Africa, the Industrial Development Corporation is considering extending credit to green ammonia. However, the details and terms are not yet clear. The sector development is at the nascent stage.

Based on the cost build-up presented in Table 6 above and the assumed cost of producing green ammonia at the high side of $1 400 per tonne, the cost per unit of nitrogen for green ammonia remains relatively high (see Table 7 below). The simulation analysis showed that green ammonia is cost-competitive in supplying a tonne of nitrogen as compared to ammonium sulphate fertiliser at $1 400. Furthermore, direct application of grey ammonia remains the cost-effective way of applying a tonne of nitrogen at the farm level at about $5,79 for locally manufactured grey ammonia and about $8,26 per tonne for imported grey ammonia. At about $800 per tonne (cost of production), green ammonia becomes cost-competitive with urea. This analysis underscores the need for the development of production incentives to make green ammonia cost-competitive. There is a need to reduce the cost of production of green ammonia to at least $800 per tonne for it to be cost competitive to urea and to anything below the $600 per tonne for it to be cost competitive to locally-centrally produced grey ammonia.

Table 7: Farmgate Cost of Unit Nitrogen from Different Sources of Nitrogenous Fertiliser

Component	UREA	LAN	Ammonium Sulphate	Grey Ammonia	Grey Ammonia	Green Ammonia ($1400)	Green Ammonia ($1200)	Green Ammonia ($1000)	Green Ammonia ($800)	Green Ammonia ($600)
Nitrogen content (%)	46	28	21	82	82	82	82	82	82	82
Cost per unit of N	$12,00	$18,90	$19,85	$5,79	$8,26	$18,64	$16,16	$13,69	$11,22	$8,75

Decentralised Storage and Distribution of Green Ammonia

Most towns in South Africa are served by blenders or are close to blenders and this presents opportunities for both commercial and smallholder farmers to access green ammonia and e-fertilisers. With the fertiliser blenders, there is an increase of logistic and transport services of varying sizes from 8 to 34 tonnes (horse and trailer). Short distances are serviced by the smaller trucks. The variety in the size of trucks enables different sizes of farms to benefit from the adoption of the technology.

The production of high-value commodities using irrigation provides another opportunity. For example, the production of irrigated sugarcane in Malelane uses grey ammonia extensively and could easily switch to e-fertilisers using the same equipment. In addition, in the maize belt of the Orange Free State, grey ammonia is directly applied to maize fields and could easily be replaced with green ammonia. Two companies present another opportunity, the VS Agri Group (Pro Gas and VS Kunsumis) and Omnia Group, which currently sell grey ammonia to farmers. These companies have invested in ammonia storage, transportation, and application equipment and provide in-field applications for farmers at an additional cost to the farmer. Nonetheless, some farmers have also invested in the same and can come and fill their canisters for use at their respective farms. In some cases, the companies will also apply the ammonia for farmers at an additional cost for the in-field application. The location of these blenders is consistent with the decentralisation approach, producing fertilisers close to where they are finally used.

Storage

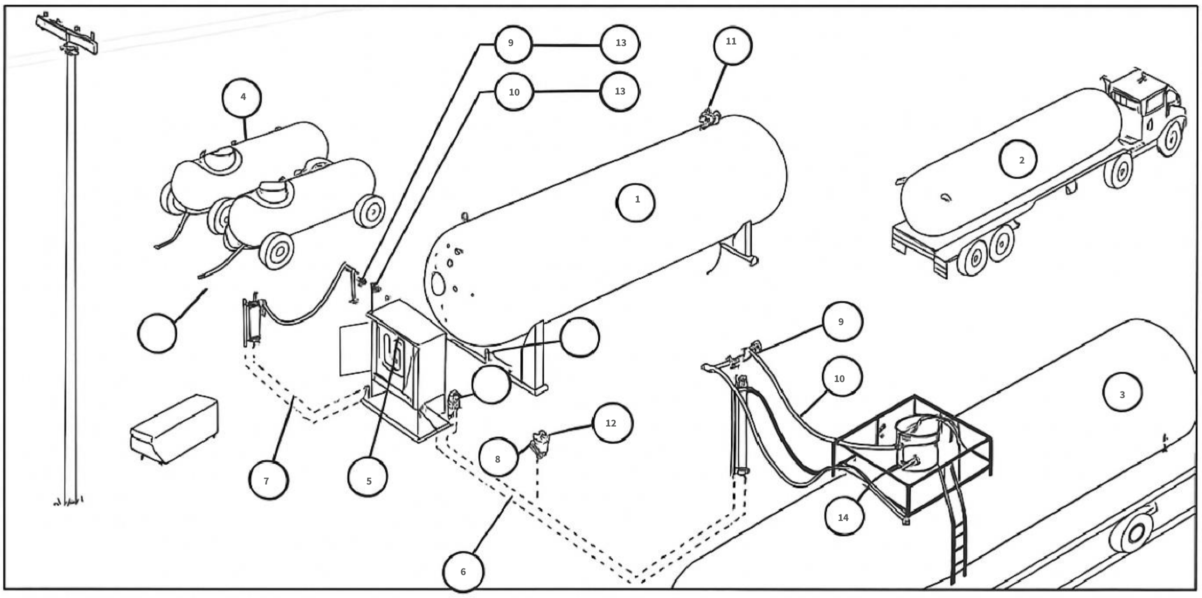
According to Talus[20], in order to break even on storage costs for e-fertiliser, there must be a sufficient storage for 8 000-10 000 tonnes. There are existing public and private storage facilities for grey ammonia in South Africa, which could easily be used for green ammonia. Specifically a) Pro-Gas has massive storage facilities for grey ammonia, which serves the Eastern part of the Orange Free State mainly for maize production; b) Omnia Fertiliser also has storage facilities which serves the Eastern Orange Free State; c) in the Eastern Orange Free State, some commercial farmers privately own storage facilities; d) South Africa also has a manufacturing capacity for ammonia bullets, stationed in Gauteng.

Distribution Infrastructure for Anhydrous Ammonia

The infrastructure for transportation and field application of ammonia is well advanced in South Africa. The infrastructure includes Transnet tank cars, mother tanks, nurse tanks, road tankers, tractors, and application equipment. Figure 9 shows the infrastructure requirements for ammonia transportation and application.

Ammonia is transported from the port of entry (if imported) or from the manufacturer (Sasol or Omnia) through specialised rail tank cars and road tankers. These truckers will discharge the liquid ammonia into the mother tanks, which also act as storage at the blender or ammonia distributor. In most cases, these distributors are located within intensive farming regions. To date, these ammonia distributors are located in the commercial maize, soybeans, sunflower, and sugarcane growing areas of the Free State and Mpumalanga. Ammonia is then transported to farmers' fields with Nurse Tank Wagons, for field application (see Picture 1). In some case, ammonia is further discharged into the applicator tanks. Applicator tanks are usually attached to a Ripper and drawn by a tractor for field application.

Figure 9. Infrastructure Requirements for Ammonia Transportation and Application



[20] Talus offers new pathways to chemicals, fertilisers, and fuels with its modular ammonia production technology. https://www.talusag.com/#Uses

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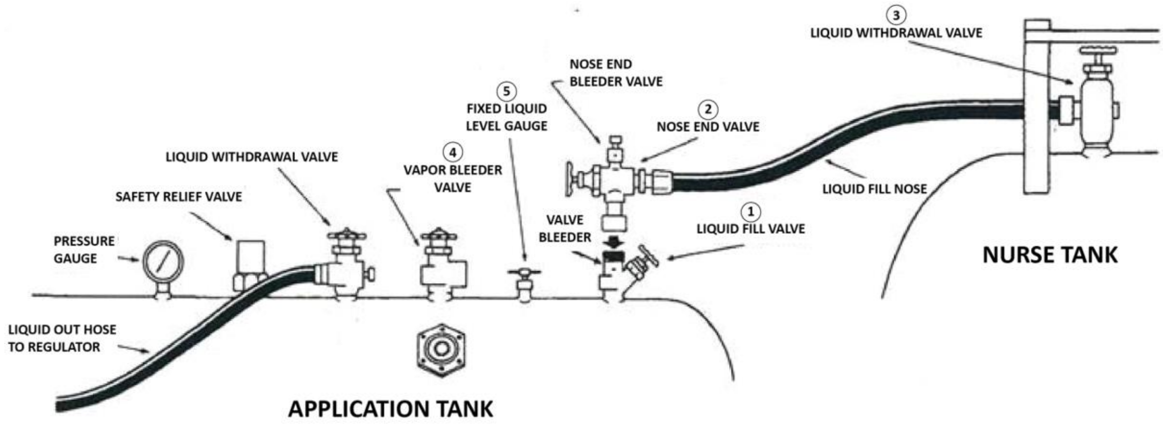


1. Mother Tank
2. Road Tanker
3. Tank Car
4. Nurse Tank Wagons
5. Compressor Cabinet
6. Extra Heavy Liquid Piping
7. Extra Heavy Vapour Piping
8. Transport Connections
9. Liquid Hoses
10. Vapour Hose
11. Relief Valve Manifold
12. Transport Coupling
13. Hose end Valve and Couplings
14. Bleeder *Valve*

Source: Proceedings of South African Sugar Technologists' Association

Picture 1: A Nurse Tank Wagon connected to a Ripper with ammonia application tines being pulled by a tractor

Please note that these are computer-generated images for illustration purposes only and may not faithfully represent real-life application

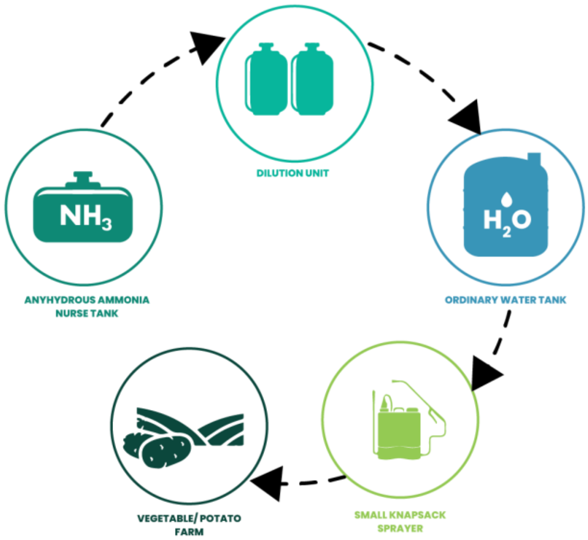
Other Distribution Channels for Ammonia

From the literature review, one can conclude that at this stage, application of anyhydrous ammonia to small-scale farmers is theoretically feasible, but practically not possible due to the specialised application and handling that ammonia requires. Wanjiru and Kimani (2024) developed five pathways that can be used to reach the smallholder farming segment as highlighted in the following section:

Pathway 1: Aqueous Ammnonia

In the first pathway, aqua ammonia will be used to produce vegetables and annual crops like potatoes and beans. In this pathway, anhydrous ammonia is initially stored in a pressurised tank. This pressurised ammonia is passed through dilution equipment, where it is mixed with water at required levels ranging from 8-20%. This diluted aqua ammonia can then be stored in normal water tanks available at local smallholder markets. The aqua ammonia can then be transported to smallholder farms in small knapsacks.

Figure 10. Pathway 1 – Distribution of Aqua Ammonia Using Knapsacks



Pathway 2: Direct Injection Using Shanks

The second pathway would relate to both small- and medium-scale farms, who would use the anhydrous ammonia in the production of fruit trees, for example macadamia and avocado. This would require a pressurised tank to store the anhydrous ammonia. In addition, tractor-driven nurse tanks would be required to take the ammonia to the application points at planted fruit trees. The anhydrous ammonia is directly injected using motorised equipment to a depth of at least 10 to 20 cm (4 to 8 inches) below the soil surface. The ammonia then rapidly reacts with soil water to form ammonium (NH_4^+), which is retained on the soil cation exchange sites.

Figure 11. Pathway 2 – Direct Injection of Anhydrous Ammonia Using Shanks

Pathway 3: Flood Irrigation Systems

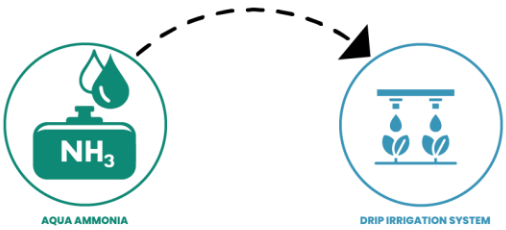
A third pathway would be the application of anhydrous ammonia to paddy rice fields. Globally, rice crops consume around 21–25% of the total world N fertiliser (Prasad et al., 2017). A study conducted in the Nile Delta, Egypt resulted in higher grain yield under anhydrous ammonia, which showed around 21.64% and 52.75% yield increases over urea and no nitrogen treatments, respectively. In addition, the injection of a full dose of anhydrous ammonia at basal was higher in terms of total revenue and net return on investment (Prasad et al., 2017).

Figure 12. Pathway 3 – Direct Injection of Aqua Ammonia to Paddy Rice Fields Using Flood Irrigation Systems

Pathway 4: Drip irrigation systems

Another way aqua ammonia can be applied is by mixing it with irrigation water, for instance in furrow and drip irrigation systems, but not in sprinkler systems. Notably, the ratio of anhydrous ammonia to water should not exceed 100 parts per million (ppm). In some highly alkaline water, this ratio should not exceed 50 ppm (Grubaugh, 1996).

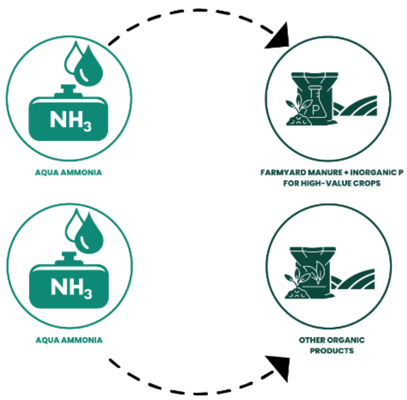
Figure 13. Pathway 4 – Direct Injection of Aqua Ammonia Using Drip Irrigation Systems



Pathway 5: Blended Fertiliser (with both Organic and Mineral Fertiliser)

The fifth pathway involves applying aqua ammonia together with farmyard manure and other organic manure sourced within the farm locality.

Figure 14. Pathway 5 – Application of Aqua Ammonia Through Mixing with Farmyard Manure



3.2 Opportunities for Consumption of Green Ammonia and E-Fertiliser in South Africa and SADC

South Africa is a large consumer of conventional, fossil fuel-based fertilisers, including various forms of grey ammonia. The drivers of this demand may offer a multitude of opportunities for the consumption of e-fertilisers.

First, the country boasts a highly advanced industrial agricultural sector producing in-demand, high-value commodities year-round (maize, sugarcane, potatoes, wheat, macadamia, horticulture and vegetables), which means demand for e-fertilisers, if accepted by the market, would be substantial and consistent.

Second, the crops produced by South Africa are in demand in international markets, which place a premium on goods that have been produced in a sustainable manner (e.g. fair trade certification). South African commodities, which have been produced using e-fertilisers, would qualify for fair trade certification on the international market.

Third, South Africa has a well-developed grey ammonia market, and the current suppliers of grey ammonia possess the requisite skills for the application, storage, and transportation of ammonia. This storage and distribution infrastructure can be redeployed to make green ammonia and e-fertiliser available to farmers, if demanded by the market.

Fourth, there is extensive adoption of various forms of fertilisers in South Africa – granular, liquid and gas – , so market acceptance of green ammonia and e-fertiliser, in whichever form, should be quite high for at least two reasons. First, farmers who are already used to using liquid fertilisers (for example farmers using drip or sprinkler irrigation), would have no difficulty using e-fertiliser in liquid form. Second, farmers are used to using ammonia-based fertiliser and so, presumably, acceptance of e-fertiliser would not face a barrier since the source of ammonia, whether from grey or green energy, should not present a barrier to acceptance by the market.

Therefore, the key bottleneck to the adoption of e-fertiliser by the majority of farmers in South Africa (who are mainly large, commercial farmers) would be the higher price of e-fertiliser in comparison to the current fossil fuel-based fertilisers they are currently using.

Furthermore, there is potential to leverage the opportunities for exporting green ammonia and e-fertiliser from South Africa to the SADC region. The region is connected by a functional rail system, which can be used to transport green ammonia from South Africa to other parts of the region. Secondly,the potential exists to export green ammonia using the existing 'bullets' or 'vessels' containers specifically manufactured for the transportation and storage of ammonia. In addition, the crops grown in the Southern African region are similar to those grown in South Africa, where grey ammonia is already used and therefore, these countries can replicate the South African evolution and have multiple fertiliser blenders. For example, Mozambique has high-value crops such as macadamia, cashew nuts and bananas. These crops, if grown beyond a certain size of land, can sustain a fertiliser blender.

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4 RISKS AND BARRIERS TO INCREASED PRODUCTION AND CONSUMPTION OF GREEN AMMONIA AND E-FERTILISER IN SOUTH AFRICA

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Chapter 4. Risks and Barriers to Increased Production and Consumption of Green Ammonia and E-fertiliser in South Africa

Despite the opportunities delineated in the previous chapter, there are several risks and barriers to the seamless transition to the increased production and consumption of green ammonia and e-fertiliser in South Africa.

4.1 Risks and Barriers to Increased Production

The first and most important barrier to the increased production of green ammonia and e-fertiliser is the high initial capital expenditure required for the development of the production facilities and infrastructure.

Second, green hydrogen is an essential component of the production green ammonia and hence, e-fertiliser. However, green hydrogen projects all require considerable investment in infrastructure (e.g., transport, logistics, electricity). Green hydrogen production processes require substantial amounts of electricity.

Third, green ammonia production is both energy-intensive (such as grey ammonia production) and heavily reliant on water resources. A significant environmental challenge is a dependence on high-purity water for the electrolysis process. This is particularly relevant in South Africa, classified as water-scarce (Industrial Development Corporation, 2023). To reduce the demand for freshwater and support offshore operations, it will be crucial to develop effective technology for seawater electrolysis. Demonstrations have confirmed the feasibility of large-scale seawater electrolysis, which is promising for future projects (Liu et al., 2024) that South Africa can tap into.

Fourth, there is a lack of the requisite skills and qualifications necessary for the success of the green hydrogen economy in South Africa. To address this, the Department of Science and Innovation and the Department of Higher Education and Training has launched programmes at universities and vocational institutions to facilitate the partnership of South Africans for job opportunities in the green hydrogen industry. Furthermore, a recent report by the Department of Higher Education and Training (2024) identifies the skills needed in the country to produce green hydrogen and explains how to meet them (Scholvin et al., 2024).

4.2 Risks and Bariers to Increased Consumption

As is the case for production, the first and most important barrier to increased consumption is the price. The research indicates a high modelled retail price (at present) of e-fertiliser in comparison to the current grey ammonia alternatives on the market, which is rendering it non-competitive. This barrier may be mitigated by policy incentives, which will be discussed in the next section.

Second, as discussed earlier, large-scale farmers in South Africa and the rest of the region, are in theory ready to adopt green ammonia and e-fertiliser, if the price is competitive. The same cannot be said for smallholder farmers, who produce the majority of the food in the region, for a number of reasons. Smallholder farmers are not used to handling fertiliser in liquid and gaseous forms. However, at least initially, this is the form in which green ammonia and e-fertiliser will be made available to farmers, unless and until the demand for granular forms makes their production for the market viable.

A third barrier to adoption is market acceptance, since at present the level of awareness about green ammonia and e-fertiliser is quite low. There is a scarcity of research focused on the demonstration and adoption of green ammonia and e-fertilisers by farmers, which is primarily due to the nascent stage of this technology. Therefore farmers, even large-scale farmers, who are used to dealing with anhydrous ammonia, may be hesitant to transition from conventional fossil-fuel based fertiliser to green ammonia-based products without concrete evidence of their effectiveness and reliability.

4.3 Socio-economic Concerns

There are potential socio-economic benefits, but also concerns, from the domestic production of green ammonia and e-fertiliser in South Africa. Locally produced e-fertiliser in South Africa can reduce import dependence, stabilise supply chains, and lower costs of production of nitrogeneous fertilisers, which can result in increased food security. It can also create green jobs contributing to rural development and economic growth. This shift will mean South Africa is more closely aligned with global sustainability trends and consumer demand for environmentally responsible farming practices. Nevertheless, there are some socio-economic concerns that will need to be addressed as these green technologies are introduced to the local market.

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First, although e-fertiliser is more environmentally friendly production process, its application has the same environmental problems as conventional ammonia-based fertilisers. That is, the use of nitrogenous fertilisers, regardless of their source, has the following negative externalities: a) a disruption of nutrient balances in the soil, which can result in soil acidification and reduced microbial diversity; b) increase in greenhouse gas emissions from agricultural land after application; c) excess nitrogen from fertiliser, which leaches into water systems causing eutrophication and ground water contamination with potentially significant public health implications.

Second, the literature indicates that, generally speaking, the increased use of conventional fertiliser has had little impact on food security, and there is no reason to expect the use of e-fertiliser to be any different, if it is not introduced with other supporting mechanisms for increased efficiency and sustainability of farming.

Third, there is a concern that e-fertiliser will perpetuate the focus on synthetic fertilisers, which will detract from holistic, agroecological solutions which prioritise soil health, biodiversity, long-term sustainability and reduced reliance on global markets by farmers in Africa (Heinrich Böll Foundation 2024, GIZ/PtX Hub 2025).

Fourth, a significant drawback of ammonia in comparison to alternative fertilisers is its high toxicity to human health, which presents a significant barrier to its broader adoption in a pure form, particularly by smallholder farmers. Anhydrous ammonia is classified as a hazardous substance in the US as its emissions can pose the following hazards: skin blisters and burns within seconds, irritation of nose and throat, coughing, and severe eye irritation which could lead to loss of sight, and serious lung damage leading to death unless treated (Wanjiru, L and Kimani, S, 2024).

Fifth, a significant social concern is the substantial amount of land use associated with the production of green hydrogen. The production process requires large areas of land, for example wind farms, and large quantities of water. Insecure land tenure and access to water is one of the drivers of insufficient soil protection and low investments in agriculture by smallholder farmers. Hence, the Africa Fertilizer and Soil Health Action Plan[21] calls for strengthening security of land use rights and tenure to encourage land users to adopt soil health restoration practices. However, if the production of green hydrogen for the production of e-fertiliser is not properly managed, it could lead to land and water grabs which could threaten rural livelihoods (Heinrich Böll Foundation 2024, GIZ/PtX Hub 2025).

[21] The Africa Fertilizer and Soil Health (AFSH) Summit, organised by the African Union Commission, took place from 7 - 9 May 2024 in Nairobi, Kenya and ended with the endorsement by African Heads of State and Government of the Nairobi Declaration on Fertilizer and Soil Health, which contains 13 commitments. Additionally, the Summit endorsed a 10-year Action Plan for Fertilizer and Soil Health, the Africa Fertiliser Financing Mechanism (AFFM) for the Action Plan, and the Soil Initiative for Africa framework, all of which recognise that healthy soils are the cornerstone of productive agricultural systems and are essential to safeguarding fresh water sources and preserving biodiversity.

5 POLICY OPTIONS

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Chapter 5. Policy Options

The South African government is actively promoting the development of a green hydrogen economy through policy frameworks and support for research and development. South Africa's green ammonia policy is largely driven by its broader "Green Hydrogen Commercialisation Strategy" (GHCS), which was released in 2022 and which aims to develop a domestic green hydrogen economy by utilising renewable energy sources like solar and wind to produce green hydrogen and green ammonia, thus ensuring low carbon emissions. The country aims to leverage its existing port infrastructure, geographic location and expertise to create an export market for green hydrogen and ammonia products, while also decarbonising domestic sectors like heavy industry and transport. The policy aims to utilise green ammonia in various sectors including power generation, fertiliser production, and maritime fuel. South Africa plans to develop local capacity for producing green hydrogen and ammonia equipment, including electrolysers and ammonia cracking units.

The green ammonia projects are expected to generate significant employment opportunities in South Africa and the region. The strategy sets targets for export (2 to 8 million tonnes a year by 2050) and for domestic consumption (3 to 6 million tonnes a year by 2050). Although the strategy suggests that first applications will be heavy-duty vehicles especially for the mining industry, by 2030 energy-intensive industries are expected to begin to decarbonise by switching to green hydrogen. In the case of ammonia, the use of grey hydrogen in ammonia will be replaced by green hydrogen (Minister of Trade, Industry and Competition Green Hydrogen (GH2) Commercialisation Panel, 2022 and 2024; Scholvin et al., 2024).

Therefore, South Africa has major ambitions to develop a green hydrogen economy and the sector is receiving significant attention from policymakers and private companies. In 2007, the Hydrogen South Africa (HYSA) initiative was launched to undertake research and development. This was followed by a number of initiatives, including the 2021 Hydrogen Society Roadmap involving private and public stakeholders and organised civil society. The roadmap outlines targets such as the creation of an export market for green hydrogen and its derivatives, the implementation of a centre of excellence in manufacturing of green hydrogen products, and the development of domestic supply chains (Scholvin et al., 2024).

Therefore, there is an elaborate policy framework in place to promote the green hydrogen and green ammonia economy. However, the government can design policies that are specifically intended to increase the production and consumption of green ammonia and e-fertilisers. Governments can give the private sector incentives such as *tax breaks* to invest in the production of green ammonia and e-fertilisers and provide a license to operate. It can improve the operating environment by providing guidelines for the manufacturing, distribution, transportation, storage and use/application of these commodities. Governments can protect the environment by putting *regulations* in place that require green ammonia and e-fertiliser producers to reduce or eliminate their carbon emissions by using technologies that control or clean these emissions. In the case of agriculture, governments can also introduce subsidies for these products to improve their affordability, hence encouraging the purchase and application of these technologies by farmers and introduce safety in use regulations to protect farmers and the environment.

This section focuses on potential production and consumption incentives that the Government of South Africa can consider to incentivise the production and use of green ammonia and e-fertiliser.

5.1 General Policy Options

5.1.1 Potential Production Incentives

Policy Instruments to De-risk Private Sector Investment in Green Ammonia

De-risking is about guarantees, credits and other incentives provided by the state to mobilise private capital for development purposes by reducing the risk that private investors take when making capital available for investments. Due to the high CAPEX requirements to produce green ammonia and e-fertiliser, the policy instruments that are required to de-risk production entail financial and fiscal support for first movers to overcome capital and operational cost barriers as well as technical barriers, which result from insufficient investment in research and development. These include:

- Price guarantees or long-term contracts for producers of green ammonia and e-fertiliser
- Tax incentives such as potential exemptions on VAT and customs duties to help reduce costs for developers and operators
- Grants or technical assistance to cover early-stage project preparation, low interest loans with longer and more flexible repayment terms, and currency exchange protection mechanisms
- The government can partner with international financial institutions to provide concessional development finance to lower and de-risk the cost of capital and make e-fertiliser project development viable. This could include (subsidised) interest rates that make the cost of producing domestically produced ammonia-based fertiliser from renewable resources (wind, solar, geothermal, purchased green power) lower than the costs of imported conventional urea. The government can give fertiliser manufacturers and blenders *tax breaks or exemptions* to encourage investment in the production of green ammonia and e-fertilisers. Sources of finance include a) the Green Climate Fund (GCF), which provides concessional financing for climate-friendly projects; b) the World Bank Climate Investment Funds (CIFs), which co-finances clean energy and agriculture projects; c) and Development Finance Institutions (DFIs) such as the International Finance Corporation (IFC) and African Development Bank (AfDB) soft loans for green infrastructure.

Apply a Carbon Tax

There is a price gap between conventional fertilisers and e-fertilisers due to the higher costs of production of the latter, which can be addressed by a carbon tax, which would internalise climate change externalities for emission-intensive products like conventional urea. Governments can introduce a carbon tax and essentially charge grey ammonia producers for each tonne of grey ammonia imported or produced. There is a carbon tax currently in place in South Africa but is not applied to the agriculture sector. South Africa, unlike its SADC counterparts, has adopted this carbon tax, which penalises carbon-intensive activities. South Africa has an overarching Climate Change Act 2024, which provides the framework for climate change adaptation and mitigation for the country. It is even considered an innovator in climate change adaptation and mitigation, despite many challenges. In November 2025, South Africa is hosting a G20 Summit and is advocating for resilient climate change economies across the globe. These could take the form of a) *Voluntary Carbon Markets:* Sell carbon credits for avoided CO_2 emissions from e-fertiliser production; b) *Guarantees of Origin (GO) for green ammonia:* Allow fertiliser buyers to certify low-carbon sourcing.

Apply a Plastic Use Levy

The use of plastic is essential in the agricultural and food sectors, but it often reaches socially and economically undesirable levels. South Africa has made significant advancements in implementing levies to curtail plastic use, particularly in the food sector. However, there is currently no levy on plastic in the agricultural input sector. Introducing a levy that reflects relative price signals could effectively reduce plastic usage at the fertiliser production stage and promote the adoption of green ammonia, which requires minimal or no plastic. This policy may lead to the establishment of small modular green ammonia production near the areas of demand (farmers), resulting in very short supply chains which are more resilient to geopolitical and other exogenous negative shocks.

Repurpose Agricultural Input Subsidies for the Establishment of Decentralised Green Ammonia Production Units

This could be introduced to communities that are currently not served by the vertically integrated fertiliser supply chain skewed towards well-established commercial farmers.

High Adoption of Renewable Energy

The electricity load-shedding has accelerated the adoption of renewable energies on a large scale, especially solar and wind energies. The government already provides incentives like the exemption of solar photovoltaic energy from taxes to accelerate adoption of renewable technologies. Other favourable factors are dedicated programmes such as Just Energy Transition Investment Plan (JET-IP), which seeks to increase the use of renewable energy. There is an extensive adoption of PV capacity, which is critical in the adoption of e-fertilisers, incentivised by the zero-rated VAT for solar panels lowering the barriers to entry. This could be used by green ammonia producers to their advantage to lower their costs of production.

5.1.2 Potential Consumption Incentives

There are two main potential economic incentives on the consumption side discussed here:

Introduce Farm Subsidies for E-Fertilisers in Liquid Form (Aqueous Ammonia)

Input subsidies for aqueous ammonia could improve its affordability, hence encouraging the purchase and application of the product by farmers. This policy option is explored in more detail in Appendix 3.

Pursue Fair Trade Certification for E-Fertiliser

There is already fair trade certification taking place for grey ammonia production in South Africa, specifically, for sugarcane in Secunda and within a 500-kilometre radius from there. Farmers are incentivised to adopt sustainable environmental practices and are then rewarded with premium prices. In fact, the fair trade incentives are common in the sugarcane sector in South Africa. Fairtrade South Africa supports small-scale sugarcane producers, like those in KwaZulu-Natal, by providing certification and promoting fair trade practices. This benefits farmers through access to Fairtrade premiums, which can be used for community projects and improvements. Key benefits of Fairtrade certification of South African sugarcane are the following: a) Fairtrade certification verifies that sugarcane is grown according to social and environmental standards, ensuring fair prices for farmers and workers; b) Fairtrade has led to increased sugarcane yields, reduced child labour, and the elimination of dangerous pesticides in some areas; c) Fairtrade plays a crucial role in empowering small-scale farmers by giving them access to Fairtrade premiums and a voice in the industry; d) Fairtrade labels on products help consumers identify and purchase Fairtrade-certified sugar, contributing to the sustainability of the industry; e) Fairtrade promotes sustainable farming practices, including the reduction of chemical inputs and the protection of natural resources. The existence of fair trade certification for sugarcane indicates that there may be an opportunity to explore the same for green ammonia and e-fertiliser.

6 CONCLUSION AND RECOMMENDATIONS

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Chapter 6. Conclusion and Recommendations

6.1 Conclusion

The aim of this study was to identify the opportunities for green ammonia and e-fertiliser production in South Africa for the domestic and regional (SADC) markets, and to explore policy options for the increased production and consumption of e-fertiliser in South Africa.

Currently, there is no production of green ammonia and e-fertiliser in South Africa; however, the opportunities exist and are quite promising. First, there are plans in the pipeline to produce green ammonia, the most advanced being the COEGA project in Nelson Mandela Bay, which is set to come online in 2029 with annual planned production of green ammonia of 1 million metric tonnes.

Second, there is currently production of grey ammonia in South Africa by Sasol Chemicals, which is sold to local hub agrodealers and blenders, who have the requisite storage, distribution, and application infrastructure. While the simulated cost comparison of grey and green ammonia indicates that grey ammonia-based nitrogenous fertilisers remain more cost-competitive in the market, primarily due to the higher cost of CAPEX for a green ammonia production plant, green ammonia production is modelled to reach cost-competitiveness as early as 2030.

Our analysis indicates that there is a need to reduce the cost of production of green ammonia to at least $800 per tonne for it to be cost competitive to urea and to anything below $600 per tonne for it to be cost competitive to locally-centrally produced grey ammonia. This can be achieved through the introduction of production policy incentives aimed at reducing the costs of production of green ammonia to make it more cost-competitive, such as subsidies on solar panels and tax breaks on imported equipment for green ammonia production. Alternatively, they could take the form of taxes to increase the cost of production of grey ammonia to reduce its attractiveness, such as an extended carbon tax. This latter option is elaborated in Appendix 2.

With regards to the opportunities for consumption of green ammonia and e-fertilisers such as aqueous ammonia, South Africa is a large consumer of conventional, fossil fuel-based grey ammonia and its derivatives. Furthermore, there is high acceptance of liquid fertilisers, particularly among citrus and other high value crops. The drivers of this demand, which include extensive adoption of various forms of fertiliser (granular, liquid and gas), bode well for market acceptance of green ammonia and e-fertiliser. The key bottleneck to the adoption of green ammonia and e-fertiliser by off-takers in South Africa includes the higher price of green ammonia and e-fertiliser in comparison to the current fossil fuel-based grey ammonia and nitrogen-based fertilisers. This implies the need for consumption incentives to promote the adoption of green ammonia and e-fertilisers. In the literature, the most common policy instrument applied by governments worldwide to promote the adoption of fertilisers is input subsidies. This option is presented and elaborated on in Appendix 3 as a policy option to promote the adoption aqueous ammonia by small-scale farmers growing high-value crops in South Africa.

6.2 Recommendations

First, it would be useful to assess the requirements for the only current supplier of ammonia in South Africa, Sasol Chemicals, to retrofit its equipment to supply the domestic and eventually regional markets with green ammonia.

Second, the potential to apply the South African carbon tax to grey ammonia production should be assessed, supplemented by additional policy instruments such as tax incentives to de-risk private sector investment in green ammonia in South Africa.

Third, the detailed conditions under which an input subsidy for aqueous ammonia for small-scale farmers growing high-value crops to introduce e-fertilisers to the South African market can be implemented in South Africa can be analysed.

Fourth, the opportunity for fair trade certification on farm products produced in South Africa using e-fertiliser could be assessed in more detail. This could result in a "green premium" for farmers who grow their crops using e-fertiliser. This could benefit farmers and their communities and increase market acceptance of e-fertiliser.

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APPENDIX 1. Potential of Green Ammonia and E-Fertilisers for Greenhouse Gas Emissions Reduction

Click here to access appendix 1.

APPENDIX 2. South African Carbon Pricing to Enhance E-Fertiliser Production

Click here to access appendix 2.

APPENDIX 3. Subsidies to Encourage Adoption of Aqueous Ammonia as E-Fertiliser by Small-Scale Farmers Growing High-Value Crops in South Africa

Click here to access appendix 3.

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