Briefing Note: Unlocking the potential of South African green hydrogen in trade

Globally, countries are mobilising sizeable resources towards dealing with the climate crisis and with the COVID-19 pandemic, many countries and regions have attached sustainability criterion to their recovery packages. EU Member States, for example, have attached strict mitigation regulations to COVID-19 rescue packages and state recovery support in sectors with limited options for decarbonisation, such as aviation. Further, as part of the transition to sustainable production, trade barriers against high carbon exporters through policy tools such as border carbon adjustments are expected from large trading blocs such as the EU from as early as 2023. The climate policy responses by countries to changing trade policies differ, however, what is certain is that the nature of trade, production and investment will change in this transformation.

South Africa has to consider improving resilience to the direct physical and transition impacts of climate change, and consider the impacts of its high-carbon intensity on its competitiveness in global markets. Part of the country's response involves transforming notorious, high carbon-emitting industries, such as energy and petrochemicals, towards cleaner production. Countries that contribute heavily to emissions and make no substantial mitigation and adaptation efforts stand to be isolated internationally and incur severe costs on growth and development.

The hydrogen economy offers a potential and complementary pathway to a sustainable future and can be linked to decarbonisation in a number of value chains. For some sectors, such as aviation and shipping, green hydrogen is the only feasible decarbonisation option currently available. There is increasing international interest and investment directed towards hydrogen as an energy carrier, with a number of countries and regions indicating their intent to develop hydrogen value chains and engage in the international hydrogen market as producers and consumers. It is an important time for South Africa to position itself as a key supplier of green hydrogen into the international hydrogen market.

South Africa has vital and competitive resources to leverage which place it in good stead to competitively supply green hydrogen. These resources include:

- *Renewable energy resources:* South Africa has ideal weather conditions for solar and wind generation, which are the renewable energy options typically deployed in green hydrogen production. High solar and wind availability factors increase the utilisation factors of the hydrogen electrolysers, ultimately lowering the cost of clean hydrogen production and make investments attractive to investors. South Africa's combined solar and wind power could provide a hydrogen production capacity factor of almost 100% during daylight hours. In the evening, wind generation could be harnessed to produce hydrogen at a capacity factor of about 30%, which exceeds the international norm of about 22.
- *Fischer-Tropsch (FT) skills and capabilities:* Hydrogen can be combined with CO_2 to produce synthetic hydrocarbons, such as methane, diesel, or jet fuel. South Africa has a unique with the patented FT process owned by Sasol. The technical expertise and skills which have

developed around the Sasol processes provide South Africa with an edge in the production of liquid fuels based on the hydrogen production route.

- *Platinum resources:* South Africa is the largest producer of platinum-group metals (PGMs) in the world, and accounts for about 71% of global supply. PGMs are a key component of electrolysers in hydrogen production and as catalysts in fuel cells.

South Africa has a key window of opportunity to develop hydrogen production to meet the demands of countries which have developed policies around growing downstream hydrogen activities. By mid-2019, a combined total of 50 targets, mandates and policy incentives were in place globally in support of the hydrogen economy.

In the medium to long term (10 years and beyond), Japan, South Korea and the European Union emerge as the main potential export destinations for South African green hydrogen, given the advancement of policies in these destinations. Japan expects to develop commercial-scale supply chains by 2030 to procure 300 000 tons of hydrogen annually. In March 2019, the first import of green hydrogen into Japan was sourced from Australia in a proof of concept test between the Queensland University of Technology and a large Japanese petroleum conglomerate, JXTG.

South Korea has also laid out ambitious plans for the development of fuel cell technologies and hydrogen, focusing on developments in power, transport, industry, buildings, and industrial feedstock applications. Demand for hydrogen in South Korea is expected to rise to 5.26 Mt in 2040, from a current base of 0.13 Mt. Demand is anticipated to slowly rise until 2030, followed by a sharp rise after 2030, driven by investments, technological advancement, customer adoption and cumulative end-user equipment purchases.

Developments in the EU also point towards the region being a potential off-taker of green hydrogen. The recently released Hydrogen Roadmap Europe (2020) sets the scene for the development of the hydrogen economy in Europe. The Roadmap plans to install 6 GW of renewable energy-based hydrogen electrolysers by 2024 and 40 GW by 2030. The EU has identified Africa as a region with high renewable energy potential and a potential supplier.

Developing the green hydrogen value chain in South Africa will require co-ordination between the most important stakeholders, from state departments to industry, labour unions and civil society. Opportunities for development will have to be identified, taking into account the impact of investments on the final price of hydrogen and competitiveness, lock-in and pathway dependence on a specific technology, demand markets and transport costs, and the overall impact on South Africa's development trajectory. To this end, green hydrogen development can potentially be aligned with other economic development initiatives, such as just transition policies and frameworks, for example. Options for green hydrogen deployment include greenfield investments into new production and the retrofitting of existing carbon-intensive production.

Resources and incentives on the supply side can assist in the formulation of pilot projects that feed into existing processes and set up independent production that can be scaled as commercial viability is proven. Engagements by policymakers with key carbon-intensive producers such as Sasol and PetroSA are also vital to decarbonise existing process and leverage existing assets. The Hydrogen Roadmap being developed by Department of Science and Innovation and HySA is expected to be completed in the next year. This policy document should set the stage for a new and sustainable industry that can assist in the long-run recovery from the COVID-19 recession.

* *The case study on green hydrogen forms part of a research project for the Department of Trade, Industry and Competition examining the vulnerability of South African trade to evolving climate change legislation. The project reports will be published on the TIPS website.*