TRADE & INDUSTRIAL POLICY STRATEGIES

POLICY BRIEF: 3/2024

Bridging the gap between aspiration and reality: What would it take to localise the renewable energy value chain in South Africa

OVERVIEW

Over its short history, the renewable energy and battery storage industrial value chain value chain has already gone through a boom and a bust. More recently, efforts have been underway to revive the value chain. This policy brief reviews the state of the renewable energy and battery storage value chain in South Africa, and looks at possible avenues to support increased localisation.

Trade & Industrial Policy Strategies (TIPS) supports policy development through research and dialogue. Its two areas of focus are trade and inclusive industrial policy; and sustainable development.

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INTRODUCTION

Renewable energy technologies, principally solar photovoltaic (PV) and wind energy along with battery storage, have had exponential growth over the last two decades. From virtually no solar and wind energy generation capacity worldwide in the 1990s, a total of 375GW of solar energy and 108GW of wind energy were installed in 2023, accounting for the vast majority of new generation capacity. As the cost of renewable energy further declines (and climate policy tightens), this trend is expected to continue for the foreseeable future (IEA, 2024).

While more haphazard, South Africa has also witnessed the rise of renewable energy and battery storage technologies. The share of renewable energy technologies (in terawatt-hours) rose from less than 1% in 2000 to 7% in 2022. The market is set to increase further with massive investment in utility-scale renewable energy generation capacity and the clear drive by the private sector as well as households to install and/or procure renewable energy for their own use and, increasingly, export to the grid.

Growing demand comes with growing supply, and a set of challenges, risks and opportunities. The renewable energy and battery storage industrial value chain has already gone through some restructuring (see for instance Carvalho, Dechezleprêtre, and Glachant, 2017 on the solar energy value chain). Initially dominated by Global North manufacturers, the renewable energy industry is now much more diversified and competitive. The entry of Chinese (and to some extent Indian) manufacturers to the market has notably reshuffled the cards. The scramble for access to the raw materials needed to manufacture solar panels, wind turbines, batteries and many other green products is also shifting power in the value chain. With virtually every major country witnessing a (rapid) increase in the demand for renewable energy, many have also attempted to capture a share of manufacturing production, at least for their domestic market, notably through extensive green industrial policy packages in support of local manufacturing in the United States (US), the European Union (EU) and China.

South Africa is no exception. The rise of renewable energy has created opportunities to drive industrial development in the value chain.

AN ARRAY OF OPPORTUNITIES

The renewable energy and battery storage value chain is made up of a wide range of inputs, parts and services. It is structured around key systems and components, such as panels and mounting structures, wind towers, nacelles and rotors, battery cells and packs, transformers, inverters, cables and fasteners. In turn, manufacturing such key elements requires a vast array of inputs (such as silver paste, copper wiring, glass, polysilicon, steel, aluminium, magnets, polymers, concrete, carbon fibre, manganese metal, nickel sulphate, and vanadium pentoxide), themselves dependent on a range of raw materials and fuels. Manufacturing-related services, such as

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testing and certification, research and development (R&D), and skills development, but also end-of-life management, support the growth of the value chain.

Combined with South Africa's broad industrial capabilities in connected or related value chains (such as mining, steel, aluminium, automotive, shipbuilding, capital equipment and electro-technical equipment), the historical rollout of renewable energy has displayed wide-ranging domestic capacity in supplying the solar energy, wind energy and battery storage sectors.

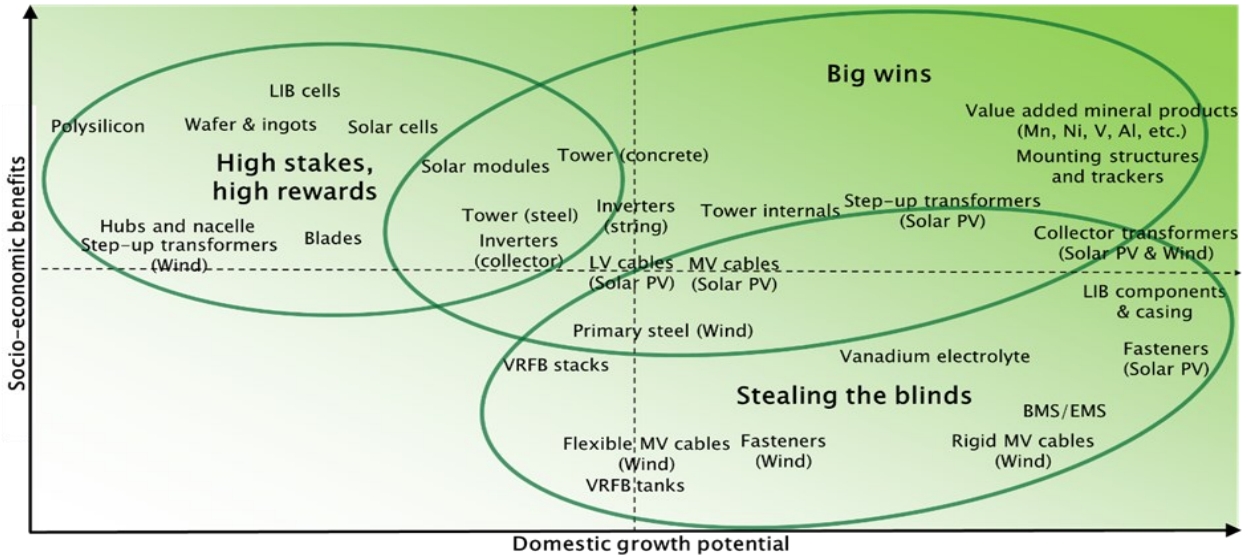
In the solar PV value chain, local industries have capabilities in the assembly of mounting structures and trackers (e.g. ModeTech Services, K2 Systems, Lumax Energy) as well as modules (ARTsolar, Seraphim, Ener-G-Africa). Production capacity is, however, often limited and at times mothballed. Cell and wafer productions, which are heavily dependent on raw materials sourcing and economies of scale, are at exploratory stages while the production of green polysilicon, leveraging South Africa's silica deposit, be investigated in the future.

In the wind energy value chain, the manufacturing of both steel and concrete towers (GRI Towers, Concrete Units, Nordex/WBHO) as well as some internals (ModeTech) and the assembly of rotors can be provided locally. As with the solar PV value chain, much of these capabilities have been idle due to lack of demand. These can be supplied by local steel manufacturers (ArcelorMittal), although at a premium. The production of blades, which existed previously (I-WEC), constitutes the next frontier while hub manufacturing and the production and assembly of nacelles could be considered in the medium term.

Apart from battery cells (mainly imported from China), the lithium-ion battery (LIB) value chain is well developed, with capabilities in mineral beneficiation (Manganese Metal Company, Thakadu, Hulamin), casing and assembly and electrical systems, including battery and energy management systems (e.g. Balancell, BlueNova, Freedom Won, Maxwell and Spark, Polarium, Rubicon, Solar MD). Whether cell production for stationary storage would be economically viable in South Africa remains to be established.

The vanadium-based battery value chain, although nascent domestically, also boasts material local capabilities, including vanadium mining and refining, electrolyte production and vanadium-redox flow battery (VRFB) assembly (Bushveld Minerals).

Figure 1: Short-term prioritisation matrix for renewable energy and battery storage industrial development opportunities for South Africa



Source: Author, based on Rivett-Carnac, 2022a; 2022b; Moshikaro, 2023; Montmasson-Clair, Moshikaro and Monaisa, 2020; Barnes et al., 2023; Urban-Econ Development Economists, Urban-Econ:NIKELA and Blue Horizon Energy Consulting Services, 2022; Blueprint Group 2023; DMRE, the dtic and DSI, 2022; and key informant interviews. Notes: While individual component manufacturing would benefit from domestic value chain integration, most can be developed independently of each other. A few stages, such as wafers to cells or step-up transformers to nacelles, require integration. Opportunities related to end-of-life management are not included due to the lack of information on their domestic economic viability.

A clear zone of opportunity is present across technologies, ranging from the beneficiation of South Africa's minerals (such as refining manganese to battery grade) and the manufacturing of mounting structures, trackers and tower internals, to the production of certain transformers, cables and inverters.

The manufacture of stacks, dependent on intellectual property, would be a logical next step.

Across the value chains, local capabilities also exist in the manufacturing of inverters (e.g. Rubicon, Microcare), civil works (e.g. Aveng, Murray & Roberts, Aurex), balance of plant, such as cables (Aberdare Cables, CBI African Cables, SOEW, M-TEC) and fasteners (CBC Fasteners, Impala Bolt & Nut, SA Bolt Manufacturers), as well as numerous services, such as some testing and certification. Transformers (e.g. ACTOM, ArmCoil Afrika), combiner boxes (e.g. HellermannTyton, Weidmuller) and switchgears (e.g. RWW Engineering, Switchgear Unlimited) are additional components that can be procured locally.

In the future, existing capabilities could also be leveraged to develop opportunities around end-of-life management (reuse, remanufacturing and recycling) of components, such as batteries, panels and blades. Some companies already operate in second-life LIBs (Revov) as well as recycling (Circular Energy, Reclite, EWaste Africa).

As illustrated in Figure 1, considering market dynamics and existing capabilities, select industrialisation opportunities can be identified for short-term prioritisation. To be viable, the majority of component manufacturing investments require a minimum annual demand ranging from 500MW to 1GW, for a period for five years (DMRE, the dtic and DSI, 2022). As such, a minimum demand of 3GW-5GW per annum of renewable energy and battery storage (across technologies) is deemed necessary to enable such opportunities.

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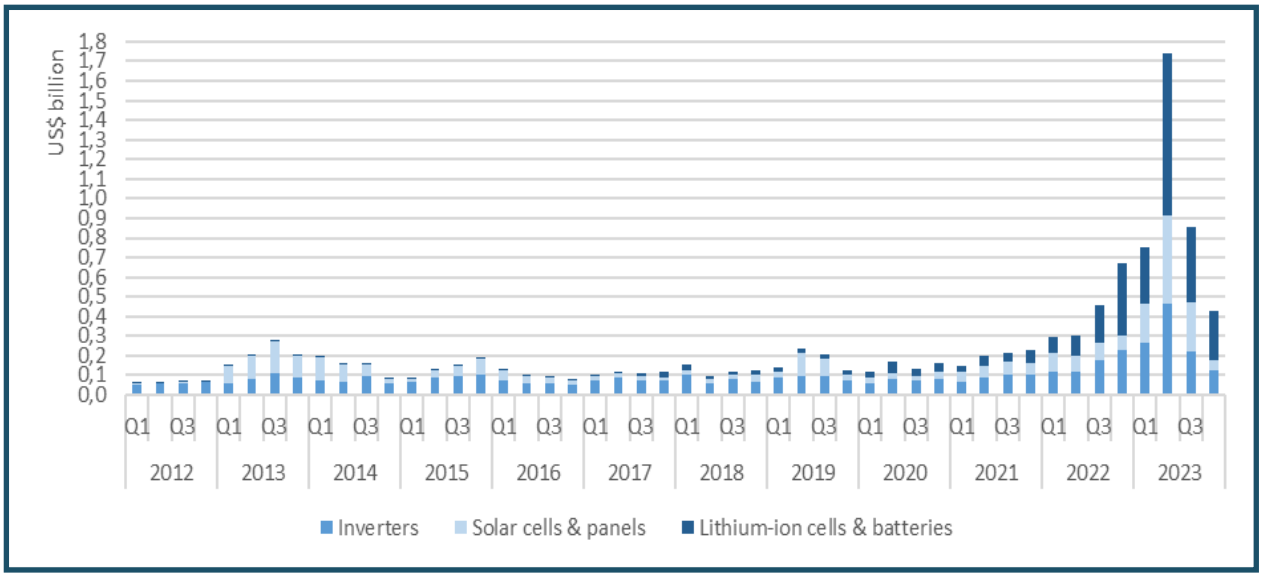
In addition, quick wins are present for some items, predominantly in the balance of plant, such as fasteners, VRFB tanks and cables. Again, existing capabilities could be leveraged to expand the industry going forward. Across these two groups, establishing or expanding input production locally could further support the industrial development of some components, increasing local content and competitiveness. This is, for example, the case of copper rods for transformers and cables.

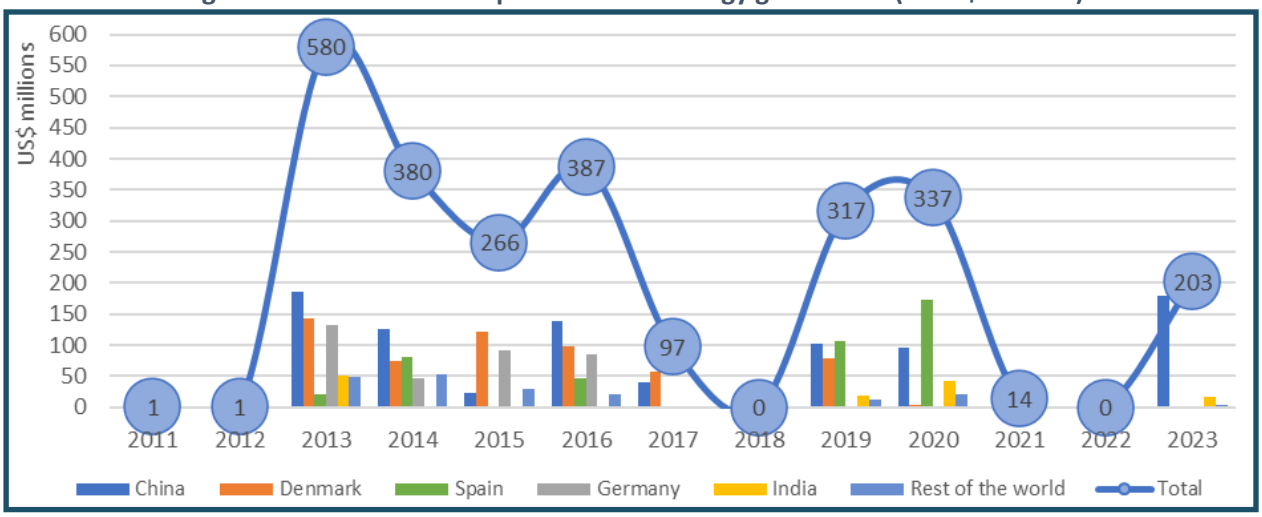
Beyond these opportunities boasting existing capabilities and a relatively strong growth potential, some high-value components, such as solar and LIB cells or blades, could potentially be localised in the medium term. Building local industrial capabilities in these components would, however, require material, sustained demand as well as strategic partnership with existing, foreign Original Equipment Manufacturers (OEMs).

Figure 2: South African imports of solar panels, lithium-ion batteries and inverters (in US$ billion)



Source: Author, based on SARS data extracted from Trade Map and Quantec.

Figure 3: South African imports of wind energy generators (in US$ billions)



Source: Author, based on SARS data extracted from Trade Map and Quantec.

In sum, opportunities abound. To date, though, South Africa's attempts at building industrial capabilities in renewable energy and storage have delivered mixed results. Much of the industrial capability built in the inception period of the state-led Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) (2011-2015) has been dormant or lost due to a lack of demand (GreenCape, 2021). This is visibly illustrated in Figure 3 by the import of wind turbines grinding to a halt in 2017-2018 and 2021-2022, like the rest of the value chain. As a result, besides balance of plants (e.g. civil works, electricals) and a few exceptions (such as towers for wind turbines), the sector has relied primarily on imports. In Bid Window (BW) 5 of the REIPPPP, local content commitments stood at 44% of total project value for construction and 41% for operations (IPPO, 2022), focusing again on balance of plants and a few localised inputs. At the same time, from 2014 to 2023, South Africa's imports of solar panels, inverters, LIBs and wind turbines respectively totalled R43 billion, R65 billion, R55 billion and R29 billion, including R18 billion (panels), R20 billion (inverters), R32 billion (LIBs), and R4 billion (turbines) in 2023.[1]

MUCH NEEDED POLICY MEASURES

Looking ahead, a pathway to industrialisation exists. Compared to its peers, South Africa is considered an attractive location for manufacturing investment in the value chain. Based on an assessment of operating costs (i.e. labour, utility and transport costs) and 10-year profitability, South Africa offers a competitive value proposition for renewable energy and battery storage manufacturing investment outside of China (IBM Plant Location International, 2023). Key advantages include an attractive local market as well as regional and global market access, competitive labour and utility costs along with a relevant labour pool of both experienced and non-experienced staff (especially in Gauteng), and an existing domestic supply base. Below average corporate taxation also compensates for relatively limited policy support (to date). And, although permitting procedures remain burdensome at times, the regulatory environment, specifically related to trade and the labour market, is comparatively conducive to business operations.

However, the extremely competitive nature of the global renewable energy and battery storage industry points to the need for South Africa to put forward a compelling investment case to the market. The existing demand profile and policy framework have not adequately supported the sustained growth of the sector. A mix of demand-side, supply-side and traversal ecosystem measures is required to unlock the potential of the local value chain.

Demand-side measures

Crucially, market demand has, so far, been too inconsistent to support industrialisation. Stable demand is a fundamental pre-requisite for any successful industrial development strategy. Historically concentrated on the REIPPPP, large-scale demand from the public sector, meant to play an anchor role, has proven haphazard and erratic since 2015. Other public demand streams from national, provincial and municipal governments and state-owned enterprises, such as the Department of Public Works and Infrastructure's (DPWI) 4-GW Integrated Renewable Energy and Resource Efficiency Programme (iREREP) programme or the Garden Route Municipality's initiatives, have

[1] Data from Trade Map. Available at :https://www.trademap.org. Data for lithium-ion battery from 2012 only.

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only recently started to gain traction. Demand from the private sector was suppressed until the regulatory reforms of 2021-2022, which relaxed and then lifted the licensing requirements for power generation projects. Since then, following a one-off exponential surge in the first half of 2023, demand has started to consolidate but remains volatile and restricted by deficiencies in physical and market infrastructure. Demand from the residential sector has also grown but remains constrained by affordability issues and the lack of an enabling Small-Scale Embedded Generation (SSEG) framework in most distribution areas.

Public sector procurement and policy support are also insufficiently or inadequately connected to localisation objectives. Several renewable energy products (solar PV modules, frames, combiner boxes, mounting structures, inverters, cables, transformers, switchgears) have been earmarked ("designated" in South African terms) for local procurement by public entities, and initial REIPPPP rounds included bespoke localisation objectives (such as for wind steel towers in BW5). However, implementation has been problematic, with local content rules often out of sync with market dynamics, and a lack of consistency in their implementation (see Makgetla, 2018 and 2023 for a discussion on localisation in South Africa). Furthermore, the ability of the Department of Trade, Industry and Competition (the dtic) to enforce a minimum local content threshold was rescinded in November 2022 following a Constitutional Court judgement. Until the publication of a new Public Procurement Act, organs of state must determine their own preferential procurement policies, as done by the DPWI's iREREP. Some programmes, such as BW6 of the REIPPPP and the initial rounds of the Energy Storage Independent Power Producer Procurement Programme (ESIPPPP), have, however, not included any meaningful localisation objectives. National Treasury's tax incentives (for households and businesses) for the rollout of renewable energy systems are also not conditional on any local procurement.

Enabling a smooth demand profile requires a consistent rollout of renewable energy and battery storage technologies across market segments. This calls for a redesign of public procurement (both utility and smaller scales) to enable continual, anchor demand from the public sector. An ongoing rollout, with a procurement system including local value addition as a competitive element, would foster competition (minimising volatility as well as disincentivising predatory pricing) while opening the door for smooth demand for local manufacturing operations. Public procurement programmes from all spheres of government and organs of state, as well as government support programmes (such as incentives, subsidies and funding schemes), should integrate localisation objectives in their design. This should be targeted through fit-for-purpose design, not to hamstring the rollout of such programmes as a result of a lack of domestic supply. For instance, additional and/or more advantageous support could be awarded to beneficiaries procuring locally.

It also requires easing the bottlenecks hindering investment in renewable energy and battery storage technologies, particularly physical and market infrastructures, and establishing a conducive framework to incentivise demand, at least in the short term. Grid constraints have already limited the rollout of renewable energy projects in the country (as illustrated by the partial failure of BW5 of the REIPPPP) and will continue to do so until addressed by the implementation of the Transmission Development Plan and alternative operating models, such as curtailment. The implementation of national market infrastructure (for trading and wheeling notably), and an overarching SSEG framework allowing prosumers to sell back into the grid (as already implemented by some municipalities), should also be fast-tracked.

Supply-side measures

Complementary to demand-side mechanisms, ambitious supply-side support is paramount to enhance the competitiveness of locally-manufactured products (IEA, 2023; SEforALL, 2023). In a highly competitive global environment, securing manufacturing in the renewable energy and battery storage value chains must be underpinned by a compelling value proposition (UNCTAD, 2023b; 2023a). In addition, structural blockages in the access to energy, water and transport must be addressed to enable sustainable economic activity.

While a set of cross-cutting industrial policy measures provides a degree of support to existing and prospective manufacturers in the country (such as industrial financing provided by development

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finance institutions, and the dtic's Black Industrialist and Manufacturing Competitiveness Enhancement programmes), dedicated policy support for greentech manufacturing value chains is necessary to decisively bolster investment in the sector (see Montmasson-Clair and Chigumira, 2020 for a review of policy instruments). This could be achieved by reactivating the existing (but currently inactive) 12i tax allowance incentive for (both greenfield and brownfield) manufacturing investment, with a focus on renewable energy and battery value chains (and possibly other green technologies).

A (regional) value chain approach, unlocking synergies between developments in the renewable energy and storage industry and mining and mineral beneficiation, steel and aluminium production, automotive manufacturing, and end-of-life management, would critically enhance South Africa's competitiveness. It is also a prime opportunity for regional and South-South collaboration, notably around developing the battery value chain.

Dedicated support for industrial parks to procure reliable, low-carbon (and affordable) power, along with the promulgation of existing tax incentives (namely the Sections 12R and 12S of the Income Tax Act) to all Special Economic Zones (SEZs) in the country, is paramount to maintain the competitiveness of industries. In addition, to support exports, the implementation of a Customs Control Area and associated zero-rated VAT/duty-free benefits by SEZs that have not yet managed to do so (such as the Atlantis SEZ) should be fast-tracked.

The strategic application of import duties, along with mandatory quality standards, is furthermore fundamental to ease the import of critical inputs and components while protecting local manufacturing against cheap, often sub-standard and subsidised, imported products. It is also counter-productive if the import of a final product is duty free while one or more of the inputs needed to manufacture this final product domestically attract high tariffs. It is, for instance, the case for local manufacturers of combiner boxes, which pay import duty on some electrical sub-components. In turn, duties could play a role in protecting the domestic manufacturers of solar panels, mounting structures made with locally-sourced steel as well as LIB packs (by imposing tariffs on imported fully-assembled products).

In addition, the enforcement of custom duties (i.e. ensuring that products are imported under the correct tariff codes) and mandatory quality standards on imported goods would play a significant role in preventing the entry of sub-standard products in the country as well as the circumvention of existing tariff protection. This would directly support the local manufacturing of several products, such as batteries, cables, mounting structures, fasteners, transformers, steel towers and tower internals.

This should be completed by enhanced testing and certification capabilities to prevent local manufacturers from having to obtain certifications overseas (generally in the EU and the US). Testing capabilities exist in some parts of the value chain, such as solar modules, LIBs, transformers, cables or fasteners. Additional capabilities are deemed necessary for batteries, solar panels, inverters, transformers, cables and fasteners. The possibility of developing other testing capabilities, such as anemometer calibration, should also be explored in the future.

Cross-cutting ecosystem measures

Beyond these demand- and supply-side considerations, the broader value chain ecosystem must be geared towards the development of local capacity and capabilities.

A heightened focus on supplier development would unlock substantial support for new entrants and emerging suppliers, particularly from previously-disadvantaged groups. An OEM-led cluster platform linking the different parts of the value chain (OEMs, Tier 1 and Tier 2 companies) would enhance and institutionalise transparent communication on OEM specifications/expectations as well as support the upgrading of local manufacturers' technical capabilities and quality standards through firm-firm collaboration (Barnes et al., 2023). Establishing a Transformation Fund, targeting new entrants and emerging suppliers, and an extension of the dtic's Strategic Partnership Programme, a cost-sharing scheme (up to 50:50 basis) aimed at incentivising large private-sector enterprises to develop the capacity of SMMEs within their supply chain, would further support the deepening of the local value chain. This should go together with implementing clear, bespoke Broad-Based Black Economic Empowerment (B-BBEE) requirements for the sector.

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The development of skills must follow a demand-led approach anchored in collaboration between education and training institutions and industry, to ensure skills supply and demand match in quantity and quality. Companies in the value chain require a range of skills. White-collar skills (e.g. project and business development managers) are mostly in demand during the early stages of projects, while highly skilled roles, like engineers and designers, are required across various parts of the value chain. Blue-collar skills are predominantly located in the later part of the value chain from the Engineering, Procurement, and Construction (EPC) stage onwards and in the manufacturing stage. Skilled technicians, such as high voltage electricians, welders, solar PV installers, and wind turbine service technicians, are the most sought-after blue-collar skills (GreenCape, 2022). New skills will also be required in the future for end-of-life management. In addition to these "technical" skills, the growth of the renewable energy and battery storage industries requires a vast range of skills in governance, policy and planning, legislation and pricing, as well as customer engagement, education and awareness (African Energy Leadership Centre and Centre for Researching Education and Labour, 2023).

While a significant number of people are enrolled in related qualifications and trainings, completion rates remain low, generally between 20%-30%, calling for targeted, collaborative efforts to map, build and activate skills in the value chain (DHET, 2023). The enhancement of the existing Power Up match-making platform would enhance the emergence of demand-led, fit-for-purpose qualifications. In addition to dedicated programmes to build the skills in the value chain, increased opportunities for people to shift from "learning to earning", through initiatives like the Youth Employment Service (Yes4Youth) and a clear pathway for Artisan Recognition of Prior Learning, would support the development of an employment pipeline in the sector.

Besides skills development and retention, a dynamic value chain depends on being technologically ready. The renewable energy and storage sector, like other greentech developments, is rapidly evolving. South Africa does not have, on the whole, the capacity to compete with market leaders (namely China, the US, Japan, South Korea and the EU) in research, development and innovation. Nevertheless, South Africa displays some pockets of excellence (e.g. in the battery value chains, inverters or transformers) which can be leveraged to facilitate local innovation, technology adoption (of both local and foreign origins), as well as skills development.

Technology commercialisation, i.e. the transition from R&D to market readiness (and scale-up), remains the primary barrier in South Africa. Despite some existing support mechanisms, such as the Technology Innovation Agency's pre-commercialisation and commercialisation programmes, the dtic's Support Programme for Industrial Innovation and the Khoebo Innovation Promotion Programme managed by the Industrial Development Corporation, multiple incubation programmes and a number of private sector funders, a "valley of death", fuelled notably by a lack of venture capital, hinders the innovation journey of local entrepreneurs.

Dedicated programmes to support technology readiness are required, from increased technology commercialisation funding and de-risking programmes for new technology trials, to technology piloting through public procurement and heightened incubation spaces, notably access to machinery and expertise.

CONCLUSION

In a nutshell, South Africa has a unique opportunity to harness "more than the electrons" from the growth of the renewable energy and battery storage industry and spur industrial development. Opportunities are plentiful provided an ambitious mix of measures – cutting across demand-side, supply-side and ecosystem building initiatives – is rapidly implemented. Indeed, the window is closing as leading countries cement their positions through extensive green industrial policy and demand support packages.

Importantly, in the South African context, the value chain can, with the right incentives, make a meaningful contribution to the country's just transition to a more inclusive, green economy, creating much-needed decent jobs and economic opportunities, empowering previously-disadvantaged populations, and promoting the inclusion of women, youth and persons with disabilities. It is the vision of the South African Renewable Energy Masterplan (SAREM). Let it not be a wasted opportunity.

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