South African Renewable Energy Masterplan

An industrialisation plan for the renewable energy value chain to 2030

Draft Masterplan for review by Executive Oversight Committee

March 2022

mineral resources & energy
Department:
Mineral Resources and Energy
REPUBLIC OF SOUTH AFRICA

the dtic
Department:
Trade, Industry and Competition
REPUBLIC OF SOUTH AFRICA

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

Acknowledgements

Social compact partners

With participation in the plan development phase by the Public-Private Growth Initiative (PPGI) and Harambee Youth Employment Accelerator (Harambee). The many contributions from industry, labour, civil society, researchers and advisory in the Industry Working Group and Industry Reference Group are gratefully acknowledged. In addition to members of the task teams (Annex A), expert advisory is appreciated from TIPS, Letsema, Trade Advisory, CSIR, UCT, Meridian, Naim Rassool and Urban Econ.

Sponsors of plan development phase

The drafting of the South African Renewable Energy Masterplan, the gathering of industry, government, labour and civil society insights and the drafting of this document has been made possible with the financial support of:

- The South African Department of Science and Innovation via the Energy Secretariat at The South African National Energy Development Institute.
- The department for Business, Energy and Industrial Strategy (BEIS) in the context of the UK PACT (Partnering for Accelerated Climate Transitions) flagship programme under the International Climate Finance (ICF) portfolio.
- The UNDP via the South African Wind Energy Programme (SAWEP) secretariat.
- The New Zealand High Commission.
- The Aspen Global Change Institute (AGCI) via the Smart Energy for Europe Platform (SEFEP) GbmH in the context of CRUX Policy Centre Power.

The contents of this publication are the sole responsibility of South African Renewable Energy Masterplan and do not necessarily reflect the views of the funders.

Secretariat and project management

GreenCape provides the secretariat of the SAREM development process, managing the project, the research and consultation.

Image credits: GreenCape

Executive Summary

The Draft South African Renewable Energy Masterplan (SAREM) presents the vision and opportunity for a renewable energy manufacturing value chain in South Africa, on the back of a rollout of renewable energy technologies as mandated by the Department of Mineral Resources and Energy (DMRE).

The Integrated Resource Plan (IRP2019) envisages adding 14,400MW of wind and 6,400MW of solar PV, including some additional 4,000MW of embedded generation and 2,000MW of storage by 2030. Alongside potential export opportunities and the growth of the hydrogen market in the longer term, this represents a significant opportunity for economic growth and the creation of decent jobs in South Africa.

The analysis underpinning SAREM indicates that localising 70% of the components and 90% of Balance of Plant and Operations and Maintenance in the wind and solar PV value chains, combined with battery energy storage, could deliver 36,500 new direct jobs by 2030, with a total GDP contribution of R420 billion.

SAREM's core framework (Figure 1) demonstrates how a sustainable market can be built to capture this opportunity. Optimising the industry's economic value add, enabling future energy demand growth, stimulating trade and export, and developing skills and new entrants to the supply chain will be key enablers of the vision. Ensuring short-, medium-, and long-term market certainty – through the combination of demand for renewable energy MW and the local content policy that defines the rules for procurement – will enable the stability needed to unlock investment and drive sustainable growth. Both public procurement and private offtake could provide a line of sight to the pipeline of MW demand and the local content requirements.

Transformation and Just Transition imperatives cut across all areas of the house (see Figure below). These imperatives can be supported by bringing emerging suppliers into the value chain, with a particular emphasis on active participation in ownership and management by Black persons, women, youth and disabled persons. By 2030, 10% of renewable energy manufacturing can be located in areas that are set to see a reduction in coal sector activity – known as Just Transition hotspots. Around 10,000 youth and former coal sector employees can be trained to pivot existing skills towards new job opportunities.

South Africa already has a solid base for manufacturing key components that make up the renewable energy value chain, however, the local renewable energy industry is still in a nascent stage, and there are a number of challenges to address to capture the value at stake.

An opportunity to break the system of challenges around capacity, timing, and exemptions from designations might be to introduce a preferential procurement mechanism that motivates bidders to proactively develop and secure supplier capacity. Learnings from earlier bid rounds and comparator economies indicate that the scoring system can be improved upon too. Shifting from a CAPEX-based scoring to a points-based scoring system incentivises cost efficiency and would take us beyond the achievements in local balance of plant and into key component manufacturing.

A further opportunity is to think beyond public procurement to capture the growth potential of private sector offtake and export. An ecosystem of local market competitiveness will be needed to realise these opportunities and build a sustainable market in the medium to long term.

There are a number of perceived trade-offs to negotiate in this area. As the country builds out its renewable energy capacity, the first ostensible choice is whether to deploy capital to the cheapest electricity or to invest in local manufacturing, even where it comes at a price premium. The current available estimates of local costs for key components and balance of plant indicate they would incur a net positive impact to the economy, if produced locally – making it worth developing a local manufacturing industry. To maximise this net economic benefit, a framework for procurement and industry support would be needed to support competition and provide downward pressure on local production premiums.

An associated challenge is the trade-off between input material costs and beneficiation in manufacturing. While SAREM prioritises beneficiation in manufacturing, this will depend on the International Trade Administration Commission (ITAC) and the dtic rationalising instances where input materials are more expensive to produce locally than to import, or where there is import protection on materials and not on the beneficiated product.

And while protecting the local market enables competition domestically, it does not necessarily enable global competitiveness. Here there are further trade-offs to consider. A phased and combined approach,

The SAREM "house"

A framework for building a sustained industry

Vision

Industrialisation of the renewable energy value chain to enable inclusive participation in the energy transition, serving the needs of society and contributing to economic revival

Objectives By 2030

Grow the economy	R420bn to GDP
Create and sustain decent employment	36,500 new direct jobs
Grow capacity in the value chain	70% key components, 90% of BoP and O&M
Build a transformed industry	51% (R20 bn/year production value)
Contribute to a Just Energy Transition	10% of national production value, 1 major component manufacturer in a hotspot. 10,000 Hotspot youth and former coal sector employees trained and 3,600 employed.

1 Optimise value-add

Maximise jobs & economic value-add per MW through local content policy & competitiveness. Support through enabling input materials.

2 Future demand growth

Future-looking electricity and energy planning. Support through enabling system readiness.

3 Trade & export

Develop an export market for local products and expertise.

4 Skills & new entrant support

Enable skills development in sync with industry needs and support new entrants to supply chain, tech transfer.

5 Build a transformed industry

Ensure initiatives in each pillar are targeted to inclusiveness.

6 Enable co-locating in transition hotspots

Target initiatives to enable locating in economies affected by energy transition.

7 Market certainty

Build a foundation of short- medium- and long-term demand and policy certainty.

with initial limited protection for government offtake combined with support to build competitiveness for private offtake and export over time, could offer the way forward.

Indeed, decision makers are faced with a spectrum of paths to choose from in how to shape the local market – with prescribed control at one end, and industry-enabled competitiveness at the other. In between are a range of options that optimise for the best of both worlds – enabling industry to identify the most competitive niches for localisation strategies, while retaining sufficient control to ensure that a minimum trajectory is guaranteed, with a motivation to overshoot, and **Transformation** and **Just Transition** objectives are met.

From a broad range of possible actions emerging from consultation and research, a number of priority actions emerge for consideration. Chief to consider is creating the bedrock of market certainty the industry is calling out for. Providing a longer-term outlook on government procurement rollout – with consistent rules around local content requirements – will go a long way to developing this certainty. Trade and industrial policy will play a key role in enabling an ecosystem of competitiveness in the short to medium term, while a view to the future Power-to-X opportunity such as in hydrogen production can build the confidence needed to unlock investment today. Industry can play a driving role by establishing supplier development commitments on the private sector offtake pipeline and coordinating through Operation Vulindlela to further enable industrialisation off the back of growing private sector offtake.

Where skills development is concerned, stakeholders may consider developing a multi-stakeholder skills platform that builds on foundational skills and keeps technical training institutions aligned with the evolving needs of industry. This could be leveraged to pivot skills in **Just Transition** hotspots to support coal sector workers into new decent job opportunities in the renewable energy sector. A related **Transformation** action could see industry and government working together to support emerging suppliers into the value chain, for example, by establishing competitive capital mechanisms.

Finally, in all this, it is worth remembering that South Africa's energy sector is embedded in a complex socio-economic context and the potential for industrialising the renewable energy sector means many things to many different stakeholders. Recognising the multiple perspectives and objectives of the social compact partners in government, industry, labour and community requires dialogue to find common ground and collaboration to realise this significant opportunity for South Africa. Champions of the Masterplan will each need to "bring something to the braai" if the renewable energy opportunity is to be harnessed in the name of industrialisation and economic growth and development.

Opportunities, challenges and priority actions by 2030

Top Opportunities

- 36,500 new direct jobs, R420bn contributed to GDP
- Emerging suppliers brought into value chain with inclusive participation in ownership and management by black persons, women, youth and disabled persons
- 10% of national renewable energy manufacturing providing economic diversity to hotspots for the Just Transition
- 10,000 youth and former coal sector employees trained, pivoting skills to new opportunities

Top Challenges

- Build confidence in the market to enable investor to invest now with certainty on future demand and local content requirements
- Find the right approach to procurement that unlocks the capacity-timing-exemptions problem
- Create an ecosystem of competitiveness that enables sustainable supply to export and private sector offtake

Top trade-offs

Deploy capital to cheapest electricity vs to net economic benefit through local manufacture

Input materials vs beneficiation in manufacturing

Prescribed control vs industry-enabled niche strategies

Protect local market vs. enable global competitiveness

Top actions

Short, medium and long term market certainty through:

- Government procurement programme rollout clear for sufficient years, with consistent local content requirements
- Trade and industrial policy that supports an ecosystem of competitiveness
- Initiate Power-to-X path

Skills platform that builds on proactive foundational skills development and keeps technical training institutions aligned with needs of industry. Leverage this for pivoting

Industry and government establish competitive capital for emerging suppliers and industry establish supplier development commitments on private sector offtake pipeline

Enable industrialisation through growing private sector pipeline for offtake, coordinating through Operation Vulindlela

Table of contents

Acronyms and abbreviations

AfCFTA	African Continental Free Trade Agreement
AIS	Auto Investment Scheme
AMCU	Association of Mineworkers and Construction Union
APDP	Auto Production and Development Programme
ASCCI	Automotive Supply Chain Competitiveness Initiative
BASA	Banking Association of South Africa
BBBEE	Broad-based Black Economic Empowerment
BEPA	Black Energy Professionals Association
BESS	Battery Energy Storage Systems
BoP	Balance of Plant
BTM	Behind the meter
CAPEX	Capital expenditure
CEPPWAWU	Chemical, Energy, Paper, Printing, Wood and Allied Workers' Union
CIP	Critical Infrastructure Programme
COSATU	Congress of South African Trade Unions
CPFP	Capital Projects Feasibility Programme
CSIR	Council for Scientific and Industrial Research
DBSA	Development Bank of Southern Africa
DHET	Department of Higher Education and Training
DMRE	Department of Mineral Resources and Energy
DSI	Department of Science and Innovation
dtic	Department of Trade, Industry and Competition
EIB	European Investment Bank
EIP	Eco-industrial park
EWSETA	Energy and Water Sector Education and Training Authority
FEDUSA	Federation of Unions of South Africa
FTM	In front of the meter
IDC	Industrial Development Corporation
IEP	Integrated Energy Plan
IP	Intellectual property
IPP	Independent Power Producer
IPPO	Independent Power Producer Office
IRP	Integrated Resource Plan
ITAC	International Trade Administration Commission
JT	Just Transition
LCR	Local Content Requirements
MENA	Middle East and North Africa
MERSETA	Manufacturing Engineering Related Services Sector Education and Training Authority
NAACAM	National Association of Automotive Component and Allied Manufacturers
NERSA	National Energy Regulator of South Africa
NIPP	National Industrial Participation Programme
NMC	Nickel, Manganese and Cobalt (batteries)
NT	National Treasury
NUM	National Union of Mineworkers
NUMSA	National Union of Metalworkers of South Africa
OEM	Original Equipment Manufacturer
OPEX	Operational expenditure
O&M	Operations and maintenance
P2X	Power-to-X
PPPFA	Preferential Procurement Policy Framework Act
RE	Renewable Energy
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RFP	Request for Proposal
SAESA	South African Energy Storage Association

Acronyms and abbreviations

SANEDI	South African National Energy Development Institute
SAPVIA	South African Photovoltaic Industry Association
SAREC	South African Renewable Energy Council
SAREM	South African Renewable Energy Masterplan
SARETEC	South African Renewable Energy Technology Centre
SAWEA	South African Wind Energy Association
SAWEP	South African Wind Energy Programme
SEZ	Special Economic Zone
SSEG	Small Scale Embedded Generation
TBC	To be confirmed
TIPS	Trade & Industrial Policy Strategies
TVET	Tertiary Vocational Educational and Training

List of figures and tables

Foreword

The South African Renewable Energy Masterplan (SAREM) is one of over 14 industry-specific masterplans in progress since 2019. The masterplan development approach collaborates between industry, labour, government and community to develop an industrialisation implementation plan for the renewable energy sector.

SAREM is an action-oriented plan that focuses on leveraging investment in the renewable energy value chain to deliver decent jobs and support economic growth, while supporting Transformation and Just Transition imperatives.

The national masterplan process falls under the reimagined Industrial Strategy of the Department of Trade, Industry and Competition (the dtic). Oversight of the Renewable Energy Masterplan's development is chaired by the Department of Mineral Resources and Energy (DMRE) Minister Gwede Mantashe.

The basis of this report was informed by a swot analysis, comparator economy analysis and in-depth review of the industry status quo (see swot analysis, Annex B). A broad range of stakeholders have provided input and comment. A full list of all implementation plan actions for consideration, arising from consultations and research, is available in Annex A.


JASP

1 Introduction

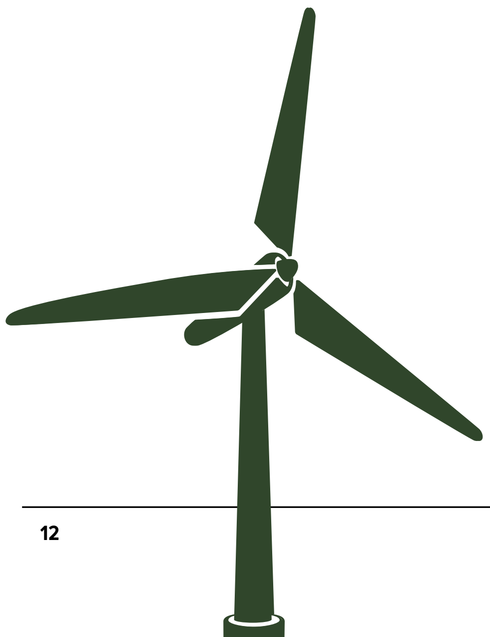
Unlocking the growth and jobs opportunity through the renewable energy value chain.

The Integrated Resource Plan (IRP) is South Africa's official long-term plan for new electricity generation capacity. As a peg in the ground for the potential market for components and services in the renewable energy value chain, the IRP envisages adding 14,400MW of wind and 6,400MW of solar PV, including some additional 4,000MW of embedded generation and 2,000MW of storage by 2030. In the longer term, the evolution of the energy and electricity mix plans according to DMRE's processes may see significant growth in renewable energy capacity demand, given the growth of hydrogen production (captured in the Green Hydrogen Strategy) and electric vehicles.

The IRP represents a significant opportunity for economic growth and the creation of decent jobs by building out the renewable energy manufacturing value chain in South Africa. Establishing a vibrant manufacturing sector is a powerful engine of growth and development – creating decent job opportunities while driving significant capital accumulation and enhancing economic productivity.

Procurement will play a key role in kickstarting the creation of a sustainable renewable energy value chain – and the market is becoming increasingly diversified. Alongside government procurement through the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), and growing procurement by Eskom, private sector procurement will become increasingly important. The recent announcements of significant renewable energy capacity investments by mining companies are strong indicators of increasing private sector offtake. Beyond local procurement, there are also additional export opportunities for manufacturers, particularly into the African market. This is in addition to the scope of the IRP and dependent on having the right support mechanisms in place.

SAREM presents the vision and opportunity for a renewable energy manufacturing value chain in South Africa, exploring industry dynamics, opportunities, challenges, and the key contributions of stakeholders across government, the private sector and labour. SAREM aims to foster South Africa's industrial development on the back of a rollout of renewable energy technologies, as mandated by the DMRE. Within this framework, SAREM seeks to maximise the contribution of the renewable energy value chain to South Africa's Just Transition by locating economic activities in regions negatively impacted by the transition away from coal ('Just Transition hotspots'), wherever possible.



2 Vision Opportunity

Understanding the value chain's economic value add

Localising the renewable energy value chain is an enormous opportunity for job creation and economic stimulus in South Africa, and stakeholder inputs have motivated high-level aspirations and objectives to capture this growth opportunity. SAREM's overarching vision (Figure 1) is for the *'Industrialisation of the renewable energy value chain to enable inclusive participation in the energy transition, serving the needs of society, and contributing to economic revival.'*

Analysis of the renewable energy value chain reveals that localising 70% of the components and 90% of Balance of Plant (BoP) and Operations and Maintenance (O&M), combined with battery energy storage[1], could deliver 36,500 new direct jobs by 2030, with a total GDP contribution of R420 billion (Figure 2).

The "house" diagram – SAREM's core framework (Figure 3) – demonstrates how a sustained market can be built to capture this vision and opportunity, serving five key objectives: grow the economy, create and sustain decent employment, grow capacity in the value chain, build a transformed industry, and contribute to a Just Transition.

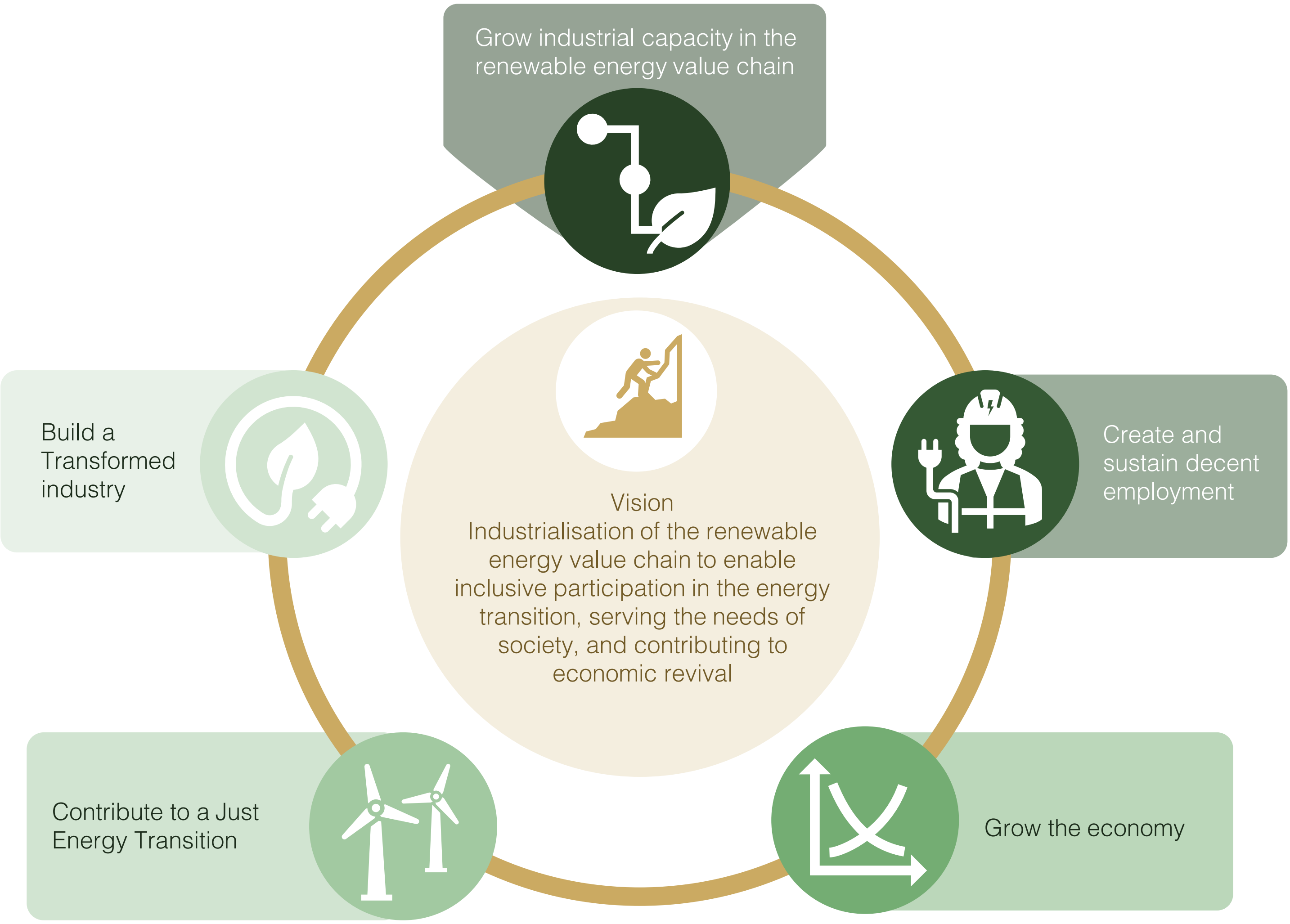
The house framework ensures the four supporting pillars and two cross-cutting objectives come together to create a sustained industry underpinned by policy that drives market certainty and stability, for example, by defining the procurement rules for local content requirements. Key to achieving the vision and objectives will be optimising the industry's economic value add, enabling future energy demand growth, stimulating trade and export, and developing skills and new entrants to the supply chain. Transformation and Just Transition imperatives cut across decision-making in all four pillars and their supporting work areas (see Chapter 5).

2.1 The opportunity articulated in South African policy

With IRP2019, the DMRE has signalled the technologies that will form the total South African energy mix. The IRP envisages adding 14,400MW of wind and 6,400MW of solar PV, including some additional 4,000MW of embedded generation and 2,000MW of storage by 2030. This additional renewable energy capacity will catalyse a local manufacturing market.

Fortunately, South Africa has a solid base for manufacturing key components – a strong steel and cement industry for towers, an extrusion industry for mounting structures, electro-technical expertise

Figure 1: SAREM's high-level vision and five key objectives



1 World Bank, "Whole Nine Yards" scenario, 2021

for key electrical components, an abundance of raw and semi-processed minerals for use in batteries, and an established boatbuilding and composites industry for blades.

Capitalising on the value chain opportunity in IRP2019 could see South Africa ramp up to a potential 2030 scenario of 36,500 new direct jobs and R38 billion turnover in renewable energy manufacturing per year. Figure 4 depicts how the jobs and turnover opportunity increases if the country moves beyond expanding existing capacity and adds new key component manufacturing in wind and solar, in particular. Longer-term ambitions for growth scenarios – such as those linked to the hydrogen economy – could see the annual manufacturing turnover tripled and a 200,000 strong workforce serving the value chain by 2050. The range of possibility from wind and solar alone is evident in Figure 4. (For the full breakdown of opportunity across the value chain, see Tables 2-1 and 2-2, Annex C.)

Figure 2: Objectives and associated targets for 2025 to 2030

	Objectives					
	Grow the economy (GDP contribution)	Create and sustain decent employment (new jobs)	Grow capacity in the value chain (% localised)	Build a transformed industry (ownership and management of local manufacturing capacity by Black persons, women, youth and disabled persons)	Contribute to a Just Energy Transition (integrate into hotspot economies)	
2030 target	R420bn to GDP	36,500	70% of key components, 90% of BoP & O&M	51% (R20 bn/year revenue)	10% of national production value (R42bn/year), 1 major component manufacturer in a hotspot	10,000 hotspot youth & former coal sector employees trained and 3,600 employed
2025 target	R130bn to GDP	26,000	40% of key components, 80% of BoP & O&M	40% (R11 bn/year revenue)	Geographic competitiveness initiatives in place in SEZs, EIPs, repurposing	Skills programme operational

Figure 4: Range of opportunity in new wind and solar jobs and local production in 2030

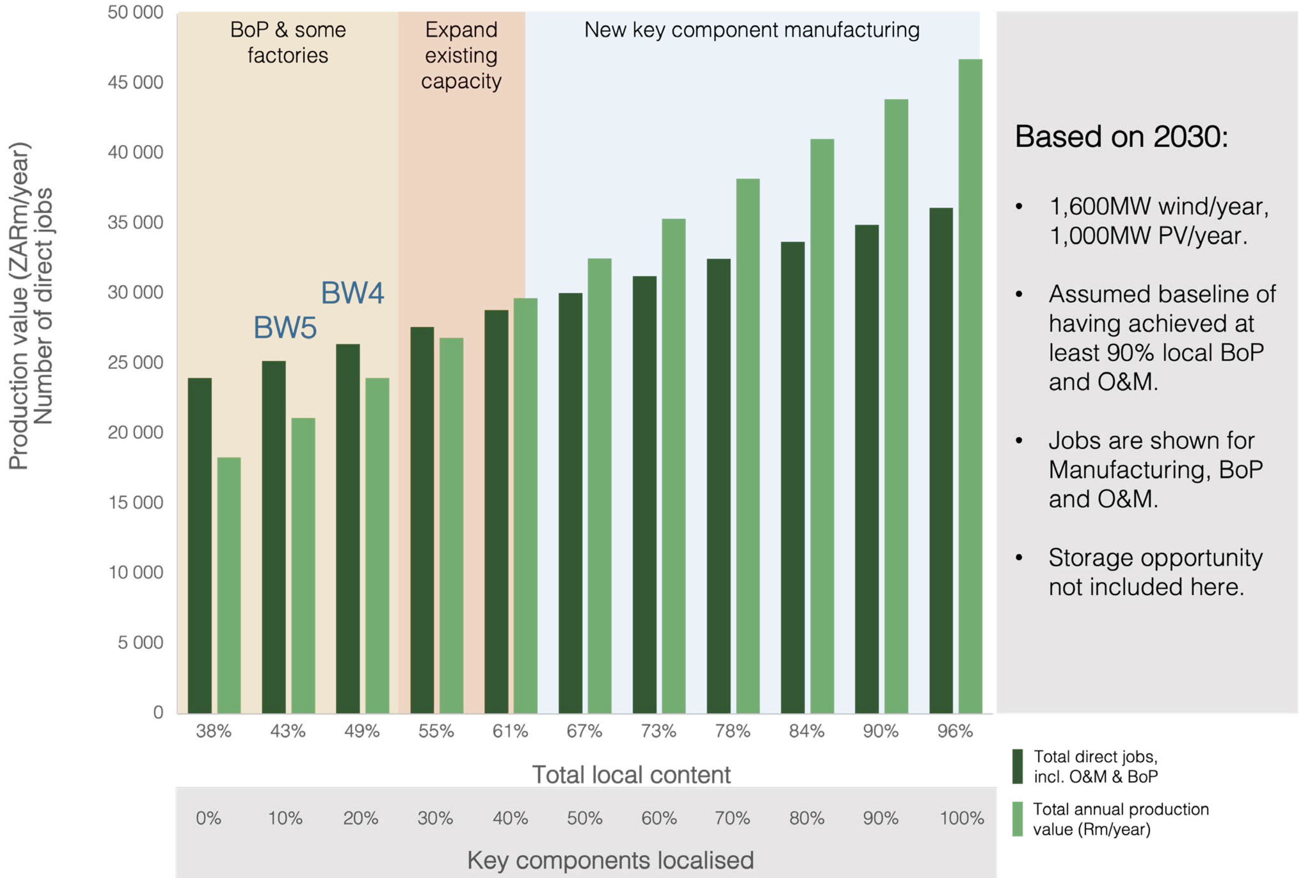


Figure 3: The SAREM "house"

A framework for building a sustained industry

Vision

Industrialisation of the renewable energy value chain to enable inclusive participation in the energy transition, serving the needs of society and contributing to economic revival

Objectives By 2030

Grow the economy	R420bn to GDP
Create and sustain decent employment	36,500 new direct jobs
Grow capacity in the value chain	70% key components, 90% of BoP and O&M
Build a transformed industry	51% (R20 bn/year production value)
Contribute to a Just Energy Transition	10% of national production value, 1 major component manufacturer in a hotspot. 10,000 Hotspot youth and former coal sector employees trained and 3,600 employed.

1 Optimise value-add

Maximise jobs & economic value-add per MW through local content policy & competitiveness. Support through enabling input materials.

2 Future demand growth

Future-looking electricity and energy planning. Support through enabling system readiness.

3 Trade & export

Develop an export market for local products and expertise.

4 Skills & new entrant support

Enable skills development in sync with industry needs and support new entrants to supply chain, tech transfer.

5 Build a transformed industry

Ensure initiatives in each pillar are targeted to inclusiveness.

6 Enable co-locating in transition hotspots

Target initiatives to enable locating in economies affected by energy transition.

7 Market certainty

Build a foundation of short- medium- and long-term demand and policy certainty.

How are jobs calculated and defined in this document?

The fact base presented in this draft masterplan is consistent with IRP2019 and DMRE multipliers. The conservative figure is given, not including indirect, induced, and cumulative job-years. Jobs are defined as direct jobs, with people employed in that year, rather than cumulatively.

Wind and solar PV jobs are calculated as follows:

1. The amount of MW of renewable power capacity as in the IRP2019, e.g. 1,600MW of wind power added in 2030.
2. The amount of MWh of renewable energy assumes load factors for the technologies as follows: Solar PV: 25%, Wind: 33%.
3. The amount of jobs multiplies the above by the job intensity used in IRP2019 modelling from the DoE's 2016 job intensity assumptions:

Jobs per MW and GWh	Wind	Solar PV
Construction (/MW)	6.4	8.72
Operation (/GWh)	0.13	0.12
Manufacturing (/MW)	4.51	4.92

4. This yields total jobs in each year for each technology across construction, operations, and manufacturing. This represents the *maximum* number of jobs (i.e. if 100% were local), e.g. 39,000 total jobs in 2030.
5. To convert to localised jobs, a percentage of localisation is defined and applied, for example, if BoP is 90%, O&M 90% and manufacturing 70%, then these percentages multiplied by the total maximum jobs would yield 32,500 jobs in wind and solar.

Battery energy storage jobs are calculated according to the World Bank 2021 report methodology.[2]

2.2 Market opportunity in the public and private sectors

To capture this opportunity, market certainty is needed. Market certainty can be created through various measures, and one of the key enablers – raising the generation licence cap to 100MW – has already happened, paving the way for diversified offtake. Public sector offtake market certainty enablers that have already been put in place are notably the IRP2019 and Ministerial Determinations for the procurement of 6,800MW of solar PV and wind, and 513MW of storage capacity.

Alongside public sector commitments, private offtake and export are both enablers of a sustainable industry and there is an emerging private market, with major players who can add certainty and have corporate supplier development imperatives. Recent announcements by a number of mining companies, for example, signal growing opportunity in this area.

A set of levers can support industrialisation in response to the private offtake market. These include initial import tariffs to support industrialisation, building competitiveness through input materials, industry support in finance, special economic zones (SEZs), and other ways to reduce overheads and increase ease of doing business. The Re-imagined Industrial Strategy leverages private investment and builds industrialisation on the back of infrastructure, supporting both public procurement and private sector offtake.

Despite the growing importance of private offtake, analysis of comparator countries (see Chapter 3) indicates the importance of kickstarting industrialisation with public procurement to provide certainty, scale and local content imperatives.

2 World Bank, South Africa Battery Value Chain Development Scenarios, 2021.

3 Comparator economy analysis

Building a sustainable market

Key findings from comparator economy analysis reveal a number of common success factors in building out a renewable energy value chain. Countries that have successfully established local renewable energy manufacturing all had:[3]

Longer-term visibility of the size of the local market and certainty to invest: The requisite size of the market for wind is 400MW per facility per year for five years, while for solar PV it is 300MW per facility per year for five years. However, for countries close to large export markets, such as Morocco, Tunisia and Turkey, these amounts were smaller.

Established local content requirements: These were in place across all comparator countries, except Denmark, initially to protect "infant industries" and attract foreign investment.

Industry support mechanisms and government investment: The range of mechanisms included training, diffusion of best practice – for example, through clustering, standards and means of testing and certification – and financial support and public programmes focused on research and development (R&D).

Export support: The interventions adopted to support export included trade promotion, export credits, and binding commitments for export as part of local content requirements. Successful countries export 60-80% of production – for example, Morocco exports 70% of local blade production.

Consistency with the industrial strengths of the country: Comparator countries built on existing capabilities by leveraging local strengths in existing or related industries. New capabilities initially leveraged off foreign companies through a range of mechanisms such as local subsidiaries, joint-ventures, and licenced production.

3.1 The importance of consumption and production support and policy choices

Comparator economy analysis reveals that local manufacturing can be promoted without local content requirements stipulated by government when market stability[4] and a combination of consumption support and production support[5] is provided; a vital requirement as firms depend on the combination of consumption and production support to invest.

In this regard, Figure 5 shows the various strategies employed in comparator countries across a spectrum of no assistance in either area, through to assistance in both consumption and production support. Alongside are the types of interventions that have been adopted, or could be considered, by the DMRE, the Department of Trade, Industry and Competition (dtic) and the Department of Science and Innovation (DSI) to build a sustainable market locally.

Figure 5: Strategies employed in countries to support consumption and production

1. Kuntze and Moerenhout, 2013, 2. Haley and Schuler, 2011

3 Agence Nationale port la Maîtrise de l'Energie, *Etude sur le potentiel de création de valeur locale de l'industrie tunisienne dans le secteur de l'énergie eolienne*, 2013.
4 Kuntze and Moerenhout, *Local Content Requirements and the Renewable Energy industry - A Good Match?*, 2013.
5 Haley and Schuler, *Government Policy and Firm Strategy in the Solar Photovoltaic Industry*, 2011.

The comparator economy analysis provides a helpful indication of the impact of certain policy choices. For example, where the market had not yet matured and the government procurement programme halted, local industry collapsed with it, as seen in Argentina and South Africa (during the hiatus on REIPPPP Bid Window 4; see Section 3, Annex B, Factory investments: what happened and why?). In addition, defining local content on cost led to Balance of Plant mostly, as has been the case in both Morocco and South Africa.

Allowing flexibility in the choice of components to localise was more effective at building a market than forced and component-specific prescribed localisation – where requirements were forced and component-specific, the tendency was for unintended consequences, high costs and slow rollout, as was the case in Russia and India.

In general, providing line of sight to demand was an enabler, and defining local market size a driver. However, there are important caveats to consider. For example, Turkey and Morocco permitted large block allocations to single bidders, whereas in South Africa this approach would face challenges in competition requirements. It is also noteworthy that India's scale didn't help it overcome the unintended consequences of its restrictive component-specific approach.

Finally, the examples provided by other countries reveal that setting thresholds that ramp up over time requires complementary tariff incentives, finance or other industry support mechanisms.

For a full view of the comparator economy analysis see Section 2, Annex B.

3.2 Spectrum of possible paths, from market-led to controlled

Comparator countries have followed a range of approaches from market-led to government controlled, each with pros and cons. An in-between approach along this spectrum may offer the best of both worlds (Figure 6).

Market-led: A market-led approach allows a high degree of preferential procurement on local content. In this scenario, the government does not apply minimum thresholds or prescribed components, enabling the market to respond with its own optimal supply of local content. The result, therefore, is a fast response that sees capacity come online quickly in such a way that the transition to supplying private offtakers can happen at speed. There is, however, limited control of the degree and specific components, and limited ability to align with contextual benefits – for example, Transformation and Just Transition imperatives.

Controlled: A controlled approach implements high minimum thresholds and prescribes specific components, with government enforcing component localisation and protection through the likes of designations. This path's result is slow, expensive rollout with high local content, and granular control of every element. There is limited ability to transition to supply private sector offtake, as has been the experience in Russia and during the stasis experienced on the local REIPPPP Bid Window 5.

Spectrum in between: A combination approach can be optimised for speed, a guaranteed minimum path and cost-effectiveness. In this scenario, government implements conservative minimum thresholds, growing over time as the market responds. Here incentive is provided for industry to overshoot in preferential procurement. Government predefines the relative value of local content (not by CAPEX) and permits industry to choose which order of components to prioritise. The result is a medium-speed rollout, where manufacturing capacity ramps up alongside delivery of generation capacity, with a guaranteed minimum path ensured. Ensuring sufficient weighting and supplier commitment at bid stage would incentivise bidders to proactively secure supply.

Trade-off considerations

Of course, there are trade-offs to consider when deciding between prescribed control versus industry-enabled competitiveness. Local content policy and the approach to procurement has a spectrum of options that enable industry to identify the most competitive niches for their localisation strategies: for example, a combination of increasing conservative thresholds, local content scoring and industry choosing their merit order of localisation.

4 Value Chain

Analysing the status quo across the onshore wind, solar PV and battery storage value chains

Renewable energy value chains are highly competitive and dominated by a small number of leading firms. Recent years have seen considerable consolidation in both the wind and solar industry. In wind, the top ten global companies captured 85.5% of the market share in terms of installed capacity in 2019. China continues to dominate solar PV manufacturing, with Chinese firms producing 80% of the modules shipped by the top 10 manufacturers in 2019.[6]

The South African Energy Storage Association (SAESA) reports that South Africa was already the sixth largest market in the world for residential Battery Energy Storage Systems (BESS) in 2020. China is the dominant player in manufacturing Lithium-Ion Batteries (LIBs), with three-quarters of global production capacity. Similarly, the supply of cathodes, anodes, separators, electrolytes and electrolyte salts is concentrated in a few countries (China, Japan, South Korea, and the United States) and a limited number of firms. The patent landscape related to climate change mitigation in transport and LIBs is also heavily dominated by a few countries (US, Japan, Germany, South Korea, France, China and the United Kingdom).[7]

Renewable energy technologies are developing rapidly, requiring the financial ability to quickly adapt or change production lines in manufacturing facilities. Strategic localisation, rather than whole-of-value-chain localisation, may therefore be an effective strategy for capturing the potential value in renewable energy manufacturing in South Africa. Alternatively, a fundamental shift in renewable energy procurement mechanisms could be used to draw extensive local manufacturing to South Africa, leveraging learnings from comparator economies and evolving innovations in establishing the REIPPPP.

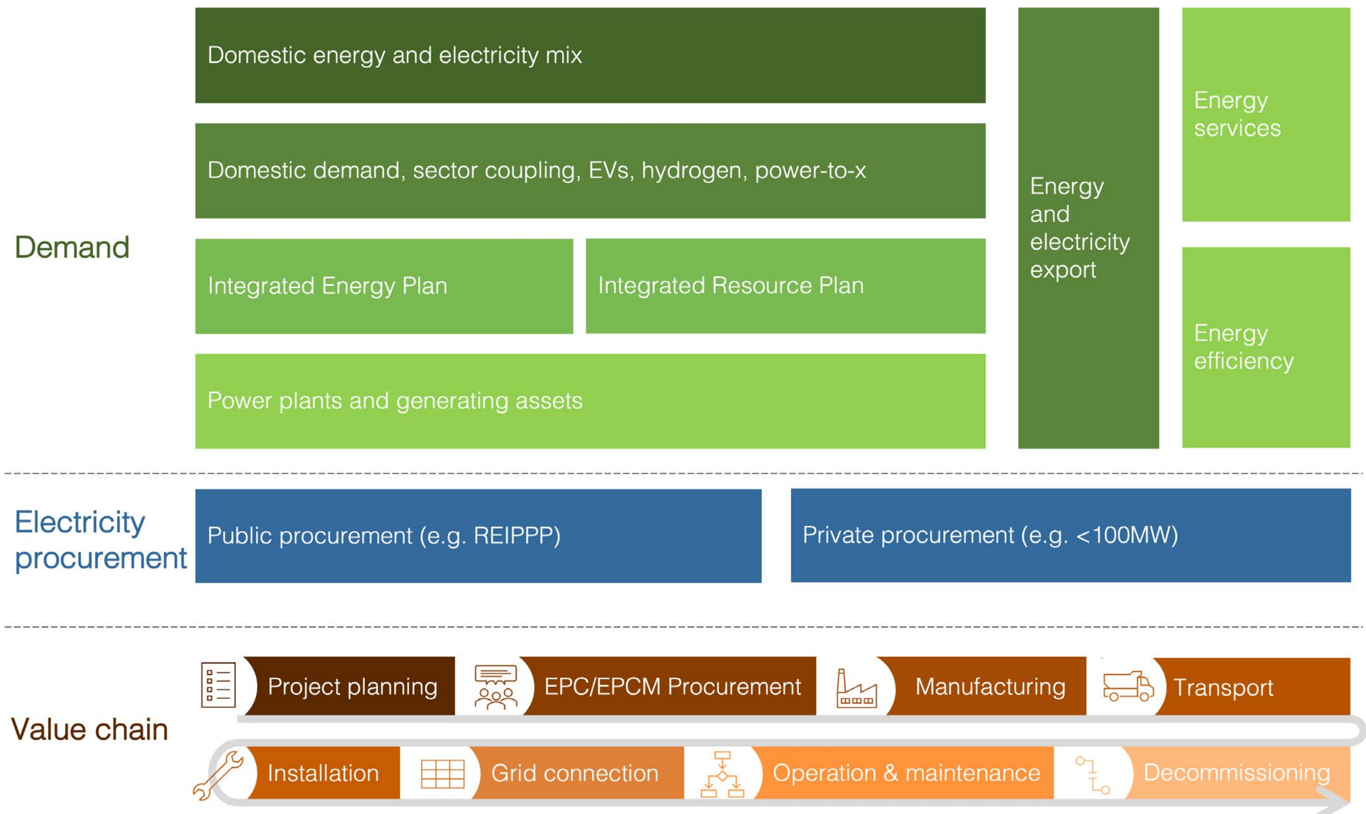
However, expectations regarding export opportunities globally and into Africa need to be realistic. Many countries have already established renewable energy manufacturing capability, the majority with better access to large renewable energy markets (Asia, North America, and Europe). The Africa and Middle East build could be 22GW a year of wind capacity and 27GW a year of solar PV capacity between 2030 and 2050 but, given current trends, the largest portion of this annual build is expected to be contributed by the Middle East and North Africa. The Sub-Saharan African utility scale market is largely at a project – rather than programme – level.

Small scale embedded generation and generation for energy access in the African market offers potential for local developers and manufacturers. South Africa is strong on installation and maintenance of industrial and residential scale solar PV and there is opportunity for export of these services to the African market. This may be a key point of leverage for local manufacturing.

4.1 Unlocking the potential of the renewable energy value chain

From project planning through procurement of engineering, manufacturing, and installation to decommissioning, the industrialisation opportunity for South Africa lies across the end-to-end renewable energy value chain (Figure 6).

Figure 6: The opportunity lies in the value chain, from project planning to decommissioning



6 Ren21, *Renewable Energy Global Reports*, 2019.
7 TIPS, *Opportunities to develop lithium-ion battery value chain in South Africa*, 2021.

The areas where an industrialisation plan have the most impact are those that require intervention to stimulate their localisation, combined with those that have the greatest impact in terms of economic opportunity and job creation.

Manufacturing has the highest GDP and job creation multipliers per unit of capital expenditure, though stimulating industrialisation in the manufacturing part of the value chain will require a range of implementation interventions (see Figure 4-1, Annex C). Construction and Balance of Plant (BoP) combined have already demonstrated themselves to be natural low hanging fruit for local content in REIPPPP implementation to date, localising in excess of 80% on the back of available in-country capacity and pipeline.

The following section explores the status quo in onshore wind, solar PV, and battery energy storage to explore the potential of each value chain for South Africa.

4.2 Onshore wind

Relative value of system elements

The onshore wind CAPEX breakdown shown in Figure 7 is based on the reported values of early REIPPPP bid rounds (see Figure 4-5, Annex C) and combined with other references. Given that there were no direct-drive wind turbines installed at the time, these numbers reflect the relative costs for geared wind turbines.

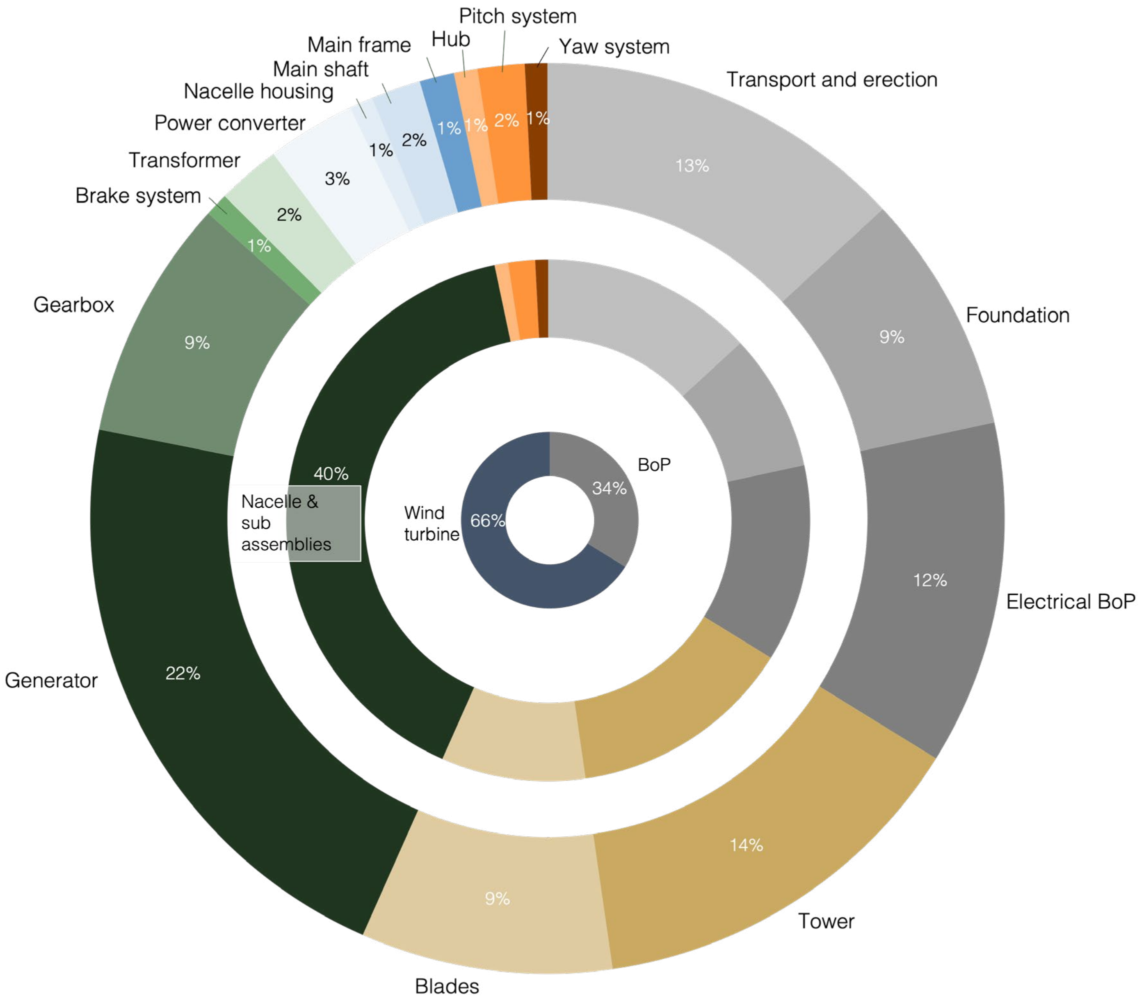
In general, 64-85% of the value of an onshore wind project until operation is in the supply of the wind turbine, including installation. Of the capital cost, towers and blades combined represent about half the cost, and the nacelle and all its sub-components make up the other.

Balance of Plant

Balance of Plant – referring to those parts of the system capital expenditure that do not include the wind turbine components and assembly – is generally broken down into logistics and installation, civil and electrical (Table 1). With an established civil engineering, construction and transmission and distribution capacity in South Africa, these elements have been most readily provided by local companies in the first bid rounds of REIPPPP (see Figure 12).

The hiatus in procurement in REIPPPP around the signing of Bid Window 4 saw some local civil engineering capacity eroded and there will need to be some ramp-up to full capacity again with the restarting of the government procurement programme.

Figure 7: Onshore wind CAPEX breakdown[8]



8 Combined estimate from (IRENA 2017a) and DTIC from IPPO data from Bid Windows 1-3, 2014.

Table 1: Wind farm Balance of Plant and installation breakdown

Component	High-Level Description	Existing related industry in SA?	Supplying to RE in SA?	Potential (Low/Med/High)	Required conditions to localise
Wind turbine installation and construction					
Installation		Yes	Yes	High	Conditions exist in current market
Onshore logistics		Yes	Yes	High	Conditions exist in current market
Craneage		Yes	Yes	High	Conditions exist in current market
BoP: Civil					
Foundations		Yes	Yes	High	Conditions exist in current market
Access roads		Yes	Yes	High	Conditions exist in current market
Laydown/hard stand		Yes	Yes	High	Conditions exist in current market
Temporary site camp		Yes	Yes	High	Conditions exist in current market
O&M buildings		Yes	Yes	High	Conditions exist in current market
BoP: Electrical (MV reticulation and IPP substation)					
MV Cable	Fabrication of MV cable	Yes	No	High	Supply chain integration
LV/MV transformer		Yes	No	High	Supply chain integration
Switchgear	Manufacturing & testing of switchgear	Yes	No	High	Supply chain integration
MV/HV transformer		Yes	Yes	High	Conditions exist in current market
Switchyard, control room		Yes	Yes	High	Conditions exist in current market

Wind turbine generator system

Based on literature and interviews, Table 2 shows the key components of the wind turbine generator system and the existing capability in related industries in South Africa, showing whether they have been sourced locally to date in public procurement programmes, if they have potential for localising, and what conditions would be required to establish local production.[9,10]

Steel, tooling for manufacturing, towers and generators are the inputs and components most readily localised, followed by carbon fibre, fibreglass, blades and nacelle electronics. Local nacelle assembly (even if initially from largely imported components) is an important enabler of higher value local turbine component manufacturing. An additional total local market of 1,000MW per year would enable local nacelle assembly and local manufacturing of generators and converters. OEMs indicate that a demand of 400MW per year per facility for a minimum of five years is required to make the local manufacture of blades a potentially viable investment.

South Africa has well-established manufacturing capability in lower-tech utility scale wind energy components. However, there is not yet enough capacity to serve the full annual build in the IRP2019. With a need for 400MW per year per facility, there is potential for two or three new wind tower manufacturers within the scope of the IRP2019, depending on the size of turbines and the split between steel and concrete towers.

Table 2: Wind turbine assembly and key components breakdown

<table>
<tr><th>Component</th><th>High-Level Description</th><th>Existing related industry in SA?</th><th>Supplying to RE in SA?</th><th>Potential (Low/Med/ High)</th><th colspan="4">Required conditions to localise</th></tr>
<tr><td colspan="9">Wind Turbine Assembly</td></tr>
<tr><td>Wind turbine and rotor assembly</td><td>Assembly and testing of full wind turbine system and rotor</td><td>Yes</td><td>Yes</td><td>High</td><td colspan="4">(Performed on site)</td></tr>
<tr><td>Nacelle Assembly (geared/direct) *</td><td>Nacelle assembly and testing of geared / direct drive WTG</td><td>No</td><td>No</td><td>Med</td><td colspan="4">Demand of 400 MW/year/facility for a minimum of 5 years / 1000MW/year in market for 5 years.</td></tr>
<tr><td>Hub assembly*</td><td>Hub assembly and testing</td><td>No</td><td>No</td><td>Med</td><td colspan="4">Market certainty: pipeline and local content requirements</td></tr>
<tr><td colspan="9">Key components</td></tr>
<tr><td>Tower</td><td>Full fabrication of steel or concrete tower.</td><td>Yes</td><td>Yes</td><td>High</td><td colspan="4">Both steel and concrete towers already produced locally; expansion of capacity required to meet scale of demand</td></tr>
<tr><td>Tower Internals</td><td>Fabrication of tower internals</td><td>Yes</td><td>Yes</td><td>High</td><td colspan="4">Already produced locally; expansion of capacity required to meet scale of demand</td></tr>
<tr><td>Tower Fasteners / Anchor Cage / Bolts</td><td>Fabrication of tower fasteners / anchor cage</td><td>Yes</td><td>Yes</td><td>High</td><td colspan="4">Anchor cages already produced locally. Fasteners, bolts to be integrated into supply chain.</td></tr>
<tr><td>Blades</td><td>Full manufacturing and finishing of WTG blades</td><td>No</td><td>No</td><td>Med</td><td rowspan="13">It takes 3-4 years for local suppliers of critical components to be able to deliver at the required quality.</td><td colspan="3">A demand of 600 MW/year/facility for 5 years. 36-month lead time. Initial period deemed 100% for post-molding.</td></tr>
<tr><td>i. Generator (geared)</td><td>Manufacturing and testing of generator for geared WTG</td><td>No</td><td>No</td><td>Med</td><td rowspan="10">Subject to local nacelle assembly: 400 MW/year/facility for 5 years / 1000MW/year in market for 5 years. A period of 3-5 years is expected from importation of nacelle components to local production of some to all components.</td><td colspan="2">400 –450 MW/year/facility.</td></tr>
<tr><td>ii. Generator (direct drive)*</td><td>Manufacturing and testing of generator for direct drive WTG</td><td>No</td><td>No</td><td>Med</td><td colspan="2">400 –450 MW/year/facility.</td></tr>
<tr><td>Cooling System</td><td>Assembly and testing of cooling system</td><td>No</td><td>No</td><td>Med</td><td colspan="2">TBC</td></tr>
<tr><td>Brakes</td><td>Manufacturing of brakes</td><td>No</td><td>No</td><td>Med</td><td colspan="2">Subject to nacelle assembly</td></tr>
<tr><td>Transformer</td><td>Manufacturing and testing of transformer</td><td>Yes</td><td>No</td><td>Med</td><td rowspan="6">Requires some development of existing local manufacturing capability to adapt to renewable energy industry / OEM requirements and standards.</td><td>Requires some development of local transformer manufacturing capability to adapt to requirements and standards of renewable energy industry.</td></tr>
<tr><td>Converter/inverter</td><td>Manufacturing and testing of converter/inverter</td><td>Yes</td><td>No</td><td>Med</td><td>400 MW/year/facility. Some current capacity, not currently utilised by OEMs – requires development to meet OEM requirements and standards.</td></tr>
<tr><td>Nacelle Cover</td><td>Manufacturing of nacelle cover</td><td>Yes</td><td>No</td><td>Med</td><td>Existing SA composite manufacturing capability</td></tr>
<tr><td>Nacelle main frame (machining)</td><td>Machining of nacelle main frame</td><td>Yes</td><td>No</td><td>Med</td><td>TBC. Existing SA casting and forging capability</td></tr>
<tr><td>Main Shaft*</td><td>Machining of main shaft</td><td>Yes</td><td>No</td><td>Med</td><td>Existing SA casting and forging capability</td></tr>
<tr><td>Hub (machining)*</td><td>Machining of rotor hub</td><td>Yes</td><td>No</td><td>Med</td><td rowspan="2">Subject to hub assembly</td><td>Subject to hub assembly. TBC. Existing SA casting and forging capability</td></tr>
<tr><td>Pitch System</td><td>Assembly and testing of pitch system</td><td>No</td><td>No</td><td>Med</td><td colspan="2">Supply chain integration</td></tr>
<tr><td>Yaw Gear</td><td>Fabrication of yaw gear</td><td>No</td><td>No</td><td>Med</td><td colspan="3">Supply chain integration</td></tr>
<tr><td>Gearbox (geared)</td><td>Manufacturing of gearbox for geared wind turbines</td><td>No</td><td>No</td><td>Low</td><td colspan="4">Highly specialised manufacturing</td></tr>
<tr><td>Bearings</td><td>Manufacturing of main rotor, yaw and pitch bearings</td><td>No</td><td>No</td><td>Low</td><td colspan="4">Highly specialised manufacturing</td></tr>
</table>

*significant differences in specifications and processes between direct drive and geared wind turbines

9 Urban-Econ Development Economists and EScience Associates, *Photovoltaic Electricity. The localisation potential of Photovoltaics and a strategy to support the large scale roll-out in South Africa*, 2013.

10 DTIC, IPPO, GreenCape and suppliers 2020, 2021.

Sequencing localisation with sub-assemblies

There is a natural sequence of potential localisation for the onshore wind system elements. This is most telling in nacelle assembly, where some 30-40% of the system capital cost is housed in a combination of several thousand sub-components. (See Figure 4-6, Annex C for a proposed sequencing of localisation, based on 2013-2015 costs and assumptions.)

Pivoting existing industrial capacity

There are subsets of components for which South Africa is positioned with existing related industrial capacity. However, pivoting to manufacture these components will require some development of existing local manufacturing capability to adapt to renewable energy industry and OEM requirements and standards. For example, the low-voltage, medium-voltage, and high-voltage electrotechnical industry offers potential for transformers and inverters; casting and forging can be adapted for shafts, hubs, and nacelle main frames; while composites could pivot to nacelle housings and blades.

4.3 Solar PV

Relative value of system elements

Figure 8 indicates the cost breakdown of utility-scale solar PV systems, as reported from Bid Window 4.[11] (Figure 4-7, Annex C captures 2013 reference data.)

Balance of Plant

Balance of Plant in onshore logistics, civil and electrical aspects have been largely naturally localised with existing capacity in South Africa (Table 3).

Figure 8: Utility-scale solar PV cost breakdown

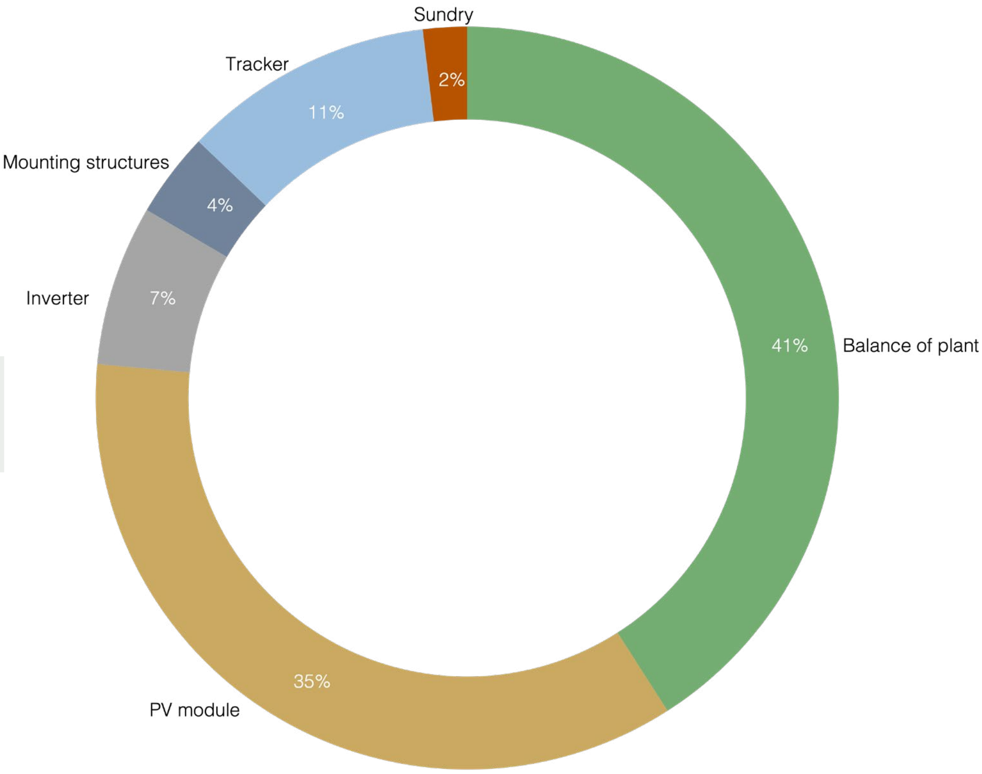


Table 3: Solar PV Balance of Plant and installation breakdown

Component	High-Level Description	Existing related industry in SA?	Supplying to RE in SA?	Potential (Low/Med/High)	Required conditions to localise
Installation and construction					
Installation		Yes	Yes	High	Conditions exist in current market
Onshore logistics		Yes	Yes	High	Conditions exist in current market
BoP: Civil					
Access roads	Roads and gates	Yes	Yes	High	Conditions exist in current market
Drainage, field prep	Miscellaneous site civils	Yes	Yes	High	Conditions exist in current market
O&M buildings		Yes	Yes	High	Conditions exist in current market
BoP: Electrical (Reticulation and IPP substation)					
DC and AC network	Fabrication, installation of cable	(Yes)	Yes	High	Conditions exist in current market
MV/HV Transformer		Yes	Yes	High	Conditions exist in current market
Earthing grid		Yes	Yes	High	Conditions exist in current market
Control room		Yes	Yes	High	Conditions exist in current market

11 Combined estimate from (IRENA 2017a) and DTIC from IPPO data from Bid Windows 1-3, 2014.

Solar PV key components and inputs

Solar PV key components are broken down into sub-assemblies in Tables 4 and 5: module, inverters, mounting structures, trackers, and cabling.

Much of South Africa's local solar PV capacity is in the downstream stages of the value chain, particularly in the large-scale commercial and industrial market (100kW – 1MW) and small-scale commercial, industrial and residential market (<100 kW). This means that to date the capacity has been more suited to Tier 2 supply and there has been limited ability for local manufacturing to serve the utility and large commercial and industrial scale, which require Tier 1 standards for financing.

Crystalline silicon (c-Si) PV module manufacturing is fragmented, offering greater localisation opportunity than concentrator photovoltaics (CPV) and thin film modules, which are produced in a one-step process. Investment into manufacturing of thin film manufacturing capacity is around ten times more expensive than c-Si PV. This masterplan focused on crystalline silicon modules, as they dominate the South African installation market.

To date, the local capacity that has been tapped has been largely in BoP, mounting structures and trackers – over 80% of BoP and over 75% and 85% of mounting structures and trackers respectively in Bid Window 4.[12]

.

Inverters: Inverter supply is a highly competitive international market. Tier 1 companies invest considerably in R&D to improve efficiency and ensure reliability, and rigorous testing and certification is required. There is thus a sizeable entry barrier for local producers. Inverter-unit assembly with core imported products and some local components, as well as manufacturing under licence, have been achieved before, but requires reestablishment and rebuilding of the confidence of international suppliers to re-enter the local market, and support to local producers to meet quality standards and access testing and certification locally. For inverters, magnetics and transformer capability can be expanded through reductions in raw material costs (especially steel), additional milling capacity for magnets and improvement in efficiencies of local transformers to meet the standards expected by international inverter manufacturers.

Modules: Sustained demand of at least 300MW per year is required to justify investment in module manufacturing and backward linkages (cells and other components). Currently, there are two module manufacturing facilities – ArtSolar (a toll manufacturer) and Seraphim. Seraphim is establishing two entities toward both cell and module manufacture, with equipment ordered to expand their module manufacturing capacity from 100MW per annum to 1,000MW by mid-2022. Seraphim announced a R437 million investment to this effect in March 2022.

Mounting structures: Mounting structures are more readily localised due to the high cost of transport but are relatively lower value components of a solar PV system. Addressing input material (i.e. steel and aluminium) costs could open the way for more local mounting structure manufacturing. Support for tooling, additional aluminium extrusion capacity and building capability for adaptable manufacturing could also assist local producers to be more competitive.

Table 4: Solar PV assembly breakdown

Component	Existing related industry in SA?	Supplying to RE in SA?	Potential (Low/Med/ High)	Required conditions to localise
Modules	Yes	Yes	Low-Med	300 MW/year/facility sustained over 5 years. Rapidly evolving technology so requires ability to rapidly adapt / upgrade production technology hence localisation potential M-H depending on requirements of local market. Two factories established locally, but not competitive against imported modules so limited private offtake. Local lamination is well established and 100% local due to use of local labour (13-14% of module cost)
Inverters	Yes	Yes	Med	Highly competitive international market; strong part of competitive advantage; rigorous testing and certification required so high entry barrier for components, but local assembly with core imported products and some local components possible; but requires re-establishment of confidence in consistency of local market and set up of testing capability to enable local assemblers to meet quality standards required by OEMs.
Mounting structures	Yes	Yes	High	May require ramp up period to re-establish and reduction of cost of local steel and aluminium to be competitive
Trackers	Yes	Yes	High	May require ramp up period to re-establish
Cabling	Yes	Yes	High	Need to build confidence in international OEMs of local capability which is well established for other sectors (electricity, mining, telecoms infrastructure). Industry suffers competition from imported cables (subsidised or sub-standard) and "cable dumping" which affects local market.

12 Combined estimate from (IRENA 2017a) and DTIC from IPPO data from Bid Windows 1-3, 2014.

Table 5: Solar PV key components breakdown

Component	Existing related industry in SA?	Supplying to RE in SA?	Potential (Low/Med/High)	Required conditions to localise
Modules				
Cells	No	No	Med	Highly competitive industry with current oversupply globally. Tier 1 companies forward integrated (only supply to companies making own PV modules). Min of 300MW/year/facility required for 5 years
Lamination	Yes	Yes	High	Already localised
Aluminum Frames	Yes	Yes	High	Already produced locally, but not competitively. Local producers need economies of scale (increased demand) to reduce cost.
Super-substrate (glass)	Yes	No	Med	SA production potential for rolled glass high but considered uncompetitive by manufacturers especially against Asian producers with large economies of scale. High iron content of SA silicon will require large demand/economies of scale to produce low iron solar glass
Backing sheet	Yes	No	Low	Concentrated supply chain limiting opportunity for local manufacturing
Ethylene Vinyl Acetate (EVA)	Yes	No	Low	Concentrated supply chain limiting opportunity for local manufacturing. Some potential if large demand/economies of scale
Copper wiring	Yes	No	Med	Some potential for manufacturing of wiring with imported copper. Local copper uncompetitive (quality and cost due to economies of scale)
Junction box	Yes	Yes	Med	Some smaller scale manufacturing established Requires about 300 MW/year demand to justify investment in local production
Inverters				
Magnetics	Yes	Yes	High	Additional mill equipment is required to enable production of magnetics locally, but economies of scale are required to be competitive. (Magnetics for small scale inverters can be made locally.)
Enclosures	Yes	Yes	High	Scaling of local production likely to be enabled by local assembly of utility scale inverters where reduced shipping cost of local production can give a competitive advantage to locally produced enclosures. (Some small scale inverter manufacturers source enclosures locally.)
Transformers	Yes	No	Med-High	It takes 3-4 years for local suppliers of critical renewable energy components to be able to deliver at the expected quality. Requires some development of local transformer manufacturing capability to adapt to requirements and standards of renewable energy industry.
Power Stage and Power Electronics	Yes	Yes	Low	Limited manufacturing using imported components (70% of value). Requires some development of local power electronics manufacturing capability to adapt to requirements and standards of renewable energy industry.
Circuit boards	Yes	Yes	Low-Med	Some locally assembled printed circuit boards (PCB) are made from imported materials (30% of value), but not produced competitively. It may be difficult to produce competitively locally due to economies of scale of international manufacturers.
Mounting structures				
Steel profiles	Yes	Yes	High	Local producers need economies of scale (increased demand) to reduce cost. Existing capability for production of flat, rolled, and stainless steel. Where required to be local, these are currently sourced locally at some premium.
Aluminium profiles	Yes	Yes	High	Requires dedicated extrusion capacity to respond to needs of renewable energy industry in terms of scale and timing of demand (currently primarily using imported aluminium billets, see materials section; in facilities that produce for multiple sectors).
Nuts & bolts	Yes	Yes	High	Well established local producers that produce for multiple sectors.
Clamps and rails	Yes	No	High	Fixed axis use clamps, single axis trackers use bent steel rail. Capability exists in South Africa, not predominantly utilised at present. Design needs to be approved by PV module supplier.
Cables				
Conductors (copper rods, aluminium rods)	Yes	Yes	High	Relatively good backward integration (i.e. sourcing components locally). Aluminium imported; establishing local aluminium rod production would boost localisation potential of cables. Copper imported when local supply inadequate
Insulation (polymers)	Yes	Yes	High	Challenging to remain globally competitive due to technology development (requires investment in manufacturing).
Armour (steel)	Yes	Yes	High	Some local production (primarily using imported steel, see materials section). Local producers also need economies of scale (increased demand) to reduce cost / be competitive with imported armour
DC cable connectors	Yes	No	Med	Highly specialised component. Innovation required to enable competitive advantage. -Design and quality for minimum losses, design for tool-free assembly

Cables: There is established local production of cables due to use of cables in other sectors, but local suppliers face competition from imported cables and need to build confidence of international OEMs and finance providers. Conductors constitute the largest portion of cable cost, followed by insulation and armour. Production of all these components is established locally. There is much potential for further localisation of conductors, insulation, and armour, but input material prices (steel, aluminium and polymers) need to be addressed. Local aluminium rod production could boost local cable production.

South Africa has manufacturing capability in aluminium frames and junction boxes. Availability, cost, and quality of input materials, in particular steel and aluminium, are consistently flagged as swing factors in the ability to provide components of this value chain at competitive rates.

The local production of solar PV components is also an enabler for the growth of local raw material supply chains. Glass, steel, concrete, and aluminium are some of the largest, but not the only, raw material inputs to solar modules. There may be additional local manufacturing opportunities through the expansion of aluminium module frame and junction box manufacturing facilities. The localisation of glass would need substantial investment and may come with a considerable price premium due to the high iron content of South African silicon.

There is also potential for expansion of enclosure and packaging production.

4.4 Battery energy storage

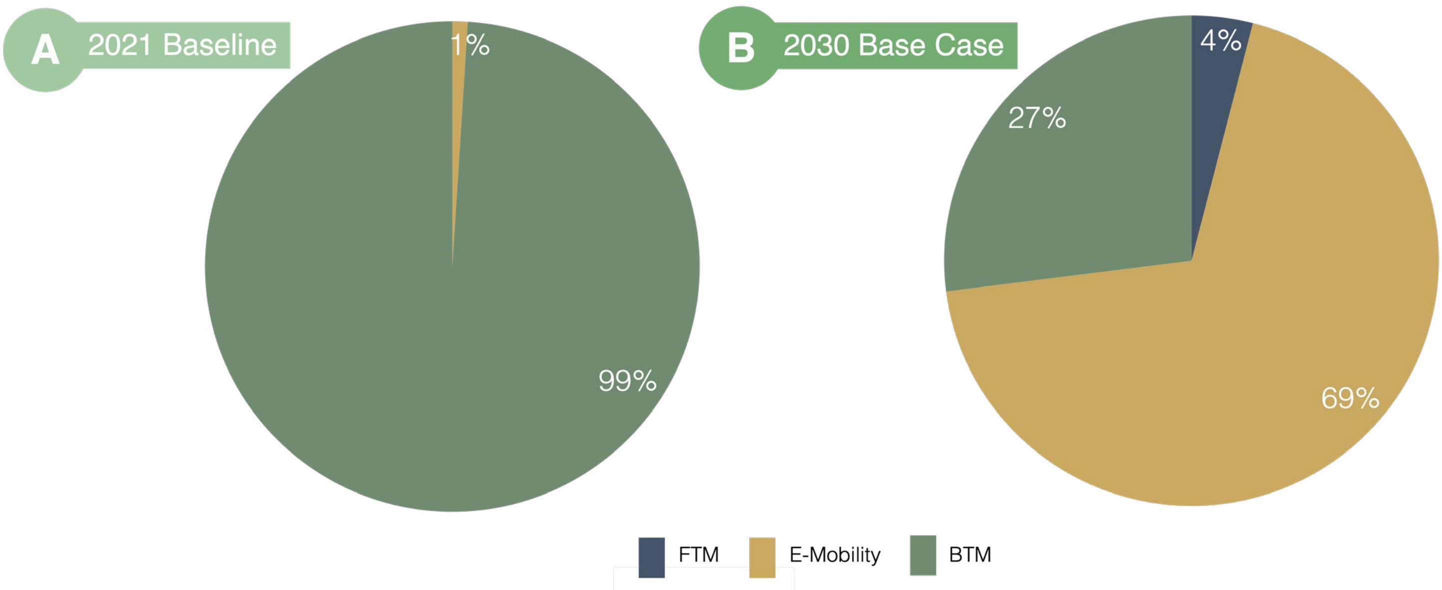
As an enabler of higher proportions of variable generation, battery energy contributes to the renewable energy capacity growth path and therefore supports the market for renewable energy products and services into the future. The data referenced here is drawn from two sets of research performed in 2021, by the Trade and Industrial Policy Strategies (TIPS)[13] and World Bank.[14]

Battery energy storage market potential

The relative size of the battery energy storage market segments in South Africa is shown in Figure 9, differentiating between behind-the-meter (BTM) or in-front-of-the-meter (FTM) and the electrical vehicle sector (e-mobility). At present, the bulk of the market is in BTM applications (99%), a proportion of which would be integrated in hybrid energy systems with solar power, such as in small scale embedded generation (SSEG). By 2030, BTM drops to 27% and the 2000MW FTM allocation in IRP2019 is indicated as only 4% of the full sector opportunity.[15]

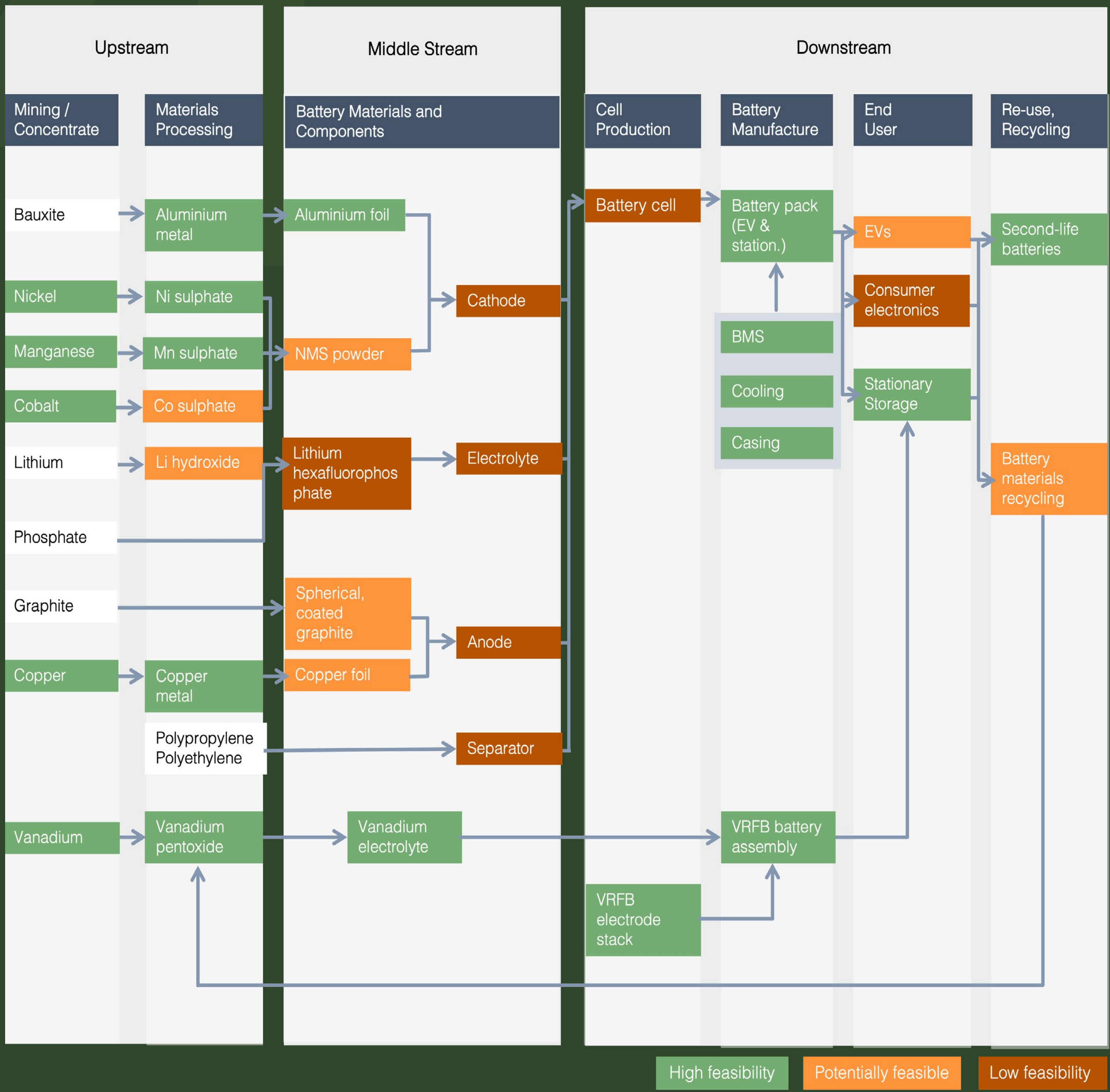
In the World Bank study, Customised Energy Solutions (CES) identifies ranked opportunities in the battery value chain as being concentrated mostly in the upstream and downstream sectors (Figure 10). (Figure 4-8, Annex C shows the relative cost breakdown of battery energy storage, while Figure 4-9, Annex C shows potential job creation and GDP contribution for each part of the value chain.)

Figure 9: Battery market potential by application in South Africa



13 TIPS, *Opportunities to develop lithium-ion battery value chain in South Africa*, 2021.
14 World Bank, *South Africa Battery Value Chain Development Scenarios.* Drafted by Customised Energy Solutions (CES), 2021.
15 *Ibid.*

Figure 10: Opportunities in the battery energy storage value chain



CES maps out a three-phase process for unlocking the battery energy storage opportunity:

- **Today ("easy pickings"):** Local battery mineral beneficiation and BESS integration.
- **5 years ("bridging the divide"):** Regional battery mineral beneficiation hub, larger-scale BESS integration for FTM and BTM. This step adds localisation of NMC-powered production and manufacturing of spherical graphite and lithium hydroxide.
- **10 years ("whole nine yards"):** Battery cell manufacturing and EV production features in an integrated battery value chain, building on the prior step of establishing lithium-ion cell manufacturing and production of EV batteries for the local automotive industry.

These phases ratchet up to a cumulative R11.3 billion potential GDP contribution by 2030, with 4,000 direct FTE jobs. (Figure 4-9, Annex C shows the scenario-based opportunity breakdown for the battery value chain.)

Implementation opportunities for developing the battery energy storage value chain

When considering the overlap between the implementation plan elements that would enable industrialisation of the renewable energy value chain and the battery energy storage value chain, three considerations are relevant.

First, the proportion of the market for battery energy storage relevant to enabling renewable energy and to the IRP is a relatively small proportion of the total market potential. Second, key opportunities in the demand creation for battery energy storage are not related to renewable energy, notably electric vehicle uptake and manufacturing. Third, the battery energy storage value chain is itself distinct from that of the value chain for renewable energy.

However, given the overlap between procurement mechanisms and the objectives and workstreams that would be generic to the renewable energy and battery energy storage value chain, there is potential for SAREM implementation plan elements to be enabling for both. There will also remain opportunity in battery energy storage value chain industrialisation that requires exploration beyond those levers relevant to renewable energy. This motivates the consideration of battery energy storage as a distinct workstream or sector plan, as with the hydrogen market.

Further work is needed on battery storage as it is a more nascent industry, both in South Africa and globally, than solar PV and wind. More information is needed to work through the different risks and opportunities with greater granularity. Implementation in this sector should work iteratively with ongoing data gathering.

In summary, Figure 11 provides an overview of the combined manufacturing components and materials in the onshore wind, solar PV, and battery energy storage value chains.

4.5 Value chain status quo in South Africa and its untapped potential

Looking at data from the REIPPPP Bid Window 4 projects – which totalled 1,121MW – provides some sense of the renewable energy value chain opportunity.[16] The total capital value of the infrastructure in Bid Window 4 was R40 billion (Figure 12); R19 billion of that was local and R21 billion imported. The bulk of localisation in solar PV was in BoP, mounting structures and trackers. In wind, it was BoP and towers. The bulk of the imports in solar PV was in the photovoltaic module with its associated inputs such as frames, glass and cells. In wind, the collection of components that constitute the rotor, nacelle and drivetrain remained largely untapped.

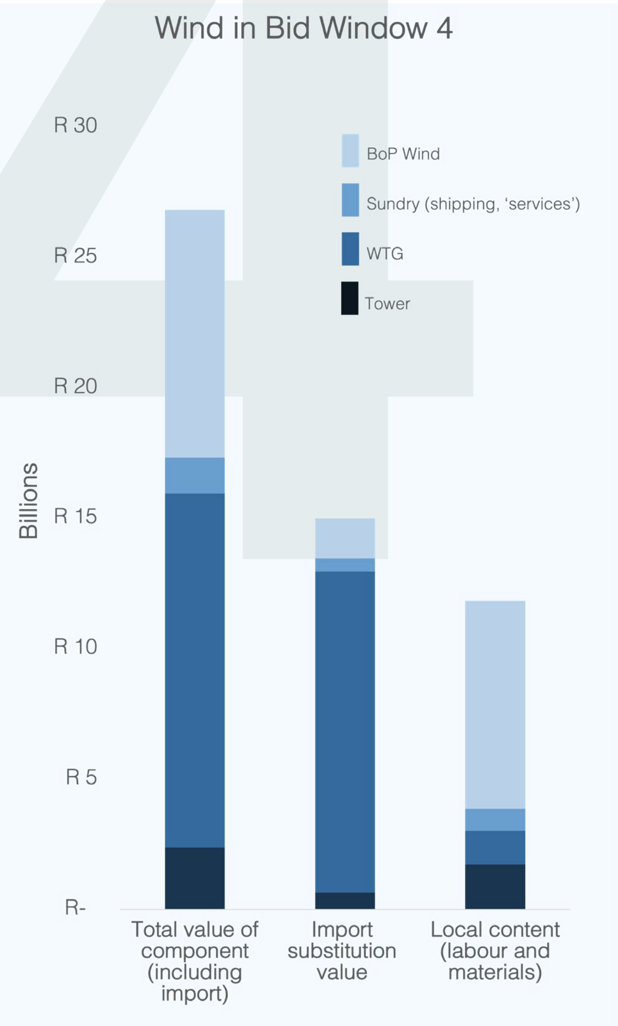
Bid Window 4's local content commitments averaged 49% of total project value and Bid Window 5's averaged 44%.[17] The percentage drop is attributed to the removal of preferential procurement in the bid scoring. As a measure of status quo, the numbers from Bid Window 4 and Bid Window 5 indicate the relative scale of opportunity in particular parts of the value chain. In absolute terms, if REIPPPP rules remain consistent in future bid windows, the total value of local production is likely to scale linearly up to the point where additional market dynamics begin to play a part, such as through ramp-up of local capacity on the back of growing market certainty.

16 IPP Office, 2021.
17 IPP Office presentation, "Power Futures Lab Webinar: Analysing South Africa's Renewable Energy IPP Procurement Programme Bid Window 5 Results Confirmation, 2021/11/03.

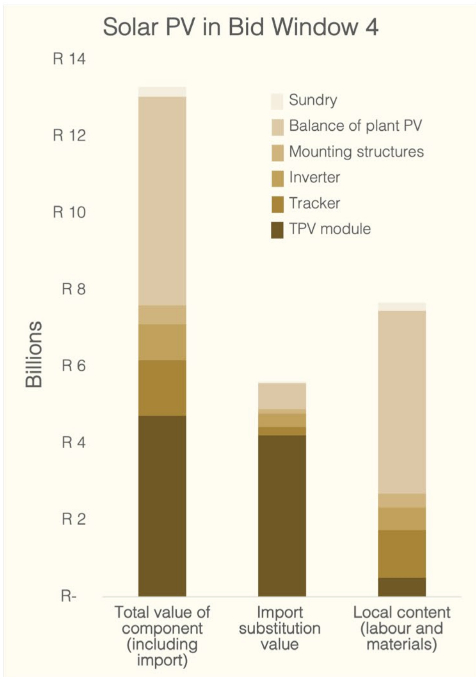
Figure 11: Combined manufacturing components and materials for wind, solar PV and battery storage

	Wind	Solar PV	Battery storage
Materials	• Cement & concrete • Iron & steel • Polymers & plastics • Fibreglass • Aluminium & alloys • Copper and Alloys • Oil • Coolant	• Silicon & glass • Cement & concrete • Iron & steel • Polymers & plastics • Aluminium & alloys • Copper and Alloys • Other metals & minerals (e.g. cadmium)	• Cobalt • Graphite • Lithium • Manganese • Nickel • Titanium • Phosphate • Aluminium • Copper • Iron • Polymers • Vanadium
Component production	• Generator • Gearbox • Bearings • Brakes • Housing • Frames & shafts • Inverter (assembly) • Transformers • Rotor hub • Tower • Tower internals • Blades	• Cells • Aluminium Frames • Super-substrate (glass) • Backing sheet • Ethylene Vinyl Acetate (EVA) • Copper wiring • Junction box • Magnetics • Transformers • Circuit boards • Electronics • Enclosures • Steel profiles • Aluminium profiles • Clamps • Nuts & bolts • Conductors • Insulation • Armour	• Cathode • Anode • Electrolyte • Separator • Current collectors • Cell casings • Electronics
Component assembly	• Nacelle (assembly) • Rotor (hub + blades) • Tower	• Modules • Inverters (assembly) • Mounting structures & trackers • Cabling	• Battery pack (assembly) • Battery management system • Site controller, energy management system • Cooling system • Inverter
System assembly	• Turbine	• Solar PV system	• Energy storage system

Figure 12: Total capital value of infrastructure as bid in Bid Window 4



BW4 local value	Solar PV	Wind
BoP	88%	84%
Key Components	37%	23%
Combined	58%	44%



- Bid Window 5 commitments averaged 44% of total project value
- The bulk of localisation in solar PV was in balance of plant, mounting structures and trackers. In wind it was balance of plant and towers. The bulk of the imports in solar PV was in the photovoltaic module with its associated inputs such as frames, glass and cells.
- In wind the collection of components that constitute the rotor, nacelle and drivetrain are largely untapped.

Aggregated from IPP Office, 2021

The first step in building a local manufacturing ecosystem is to introduce a system of measures that enables the development of local value chain elements. To then drill down into a merit order of prioritising at the component level requires working in balance to provide a competitive framework that moves local manufacturing naturally toward those components for which there are competitive benefits to produce locally (see 'Public procurement levers: REIPPPP' in Chapter 5) and strategic focus on those parts of the value chain that stimulate relatively high job creation and GDP value-add compared to their relative cost versus import (see 'Exploration of value add to the economy from localising components', Chapter 5).

From one OEM or global value chain player to another, the merit order of prioritisation will differ. Notwithstanding this variance, initial indications group primary components into three categories, from those that localise naturally to those that require stronger measures to localise.

1. Naturally localise with sufficient market certainty and scale

- Balance of Plant cables and ancillaries
- Towers and internals (concrete and steel) – both strong job creators
- Some solar PV mounting hardware

2. "Low hanging fruit" with some competitive measures to tip the scales, for example, scoring

- Nacelle assembly
- Wind turbine hubs
- Inverters and transformers
- PV module with imported cell PV trackers and mounting hardware
- Blade post-moulding (high labour intensity)

3. Higher premium with stronger measures to localise

- Solar cells and hence PV module with local cells
- Full blade manufacture

5 Industry Dynamics

Assessing what it would take to build the market

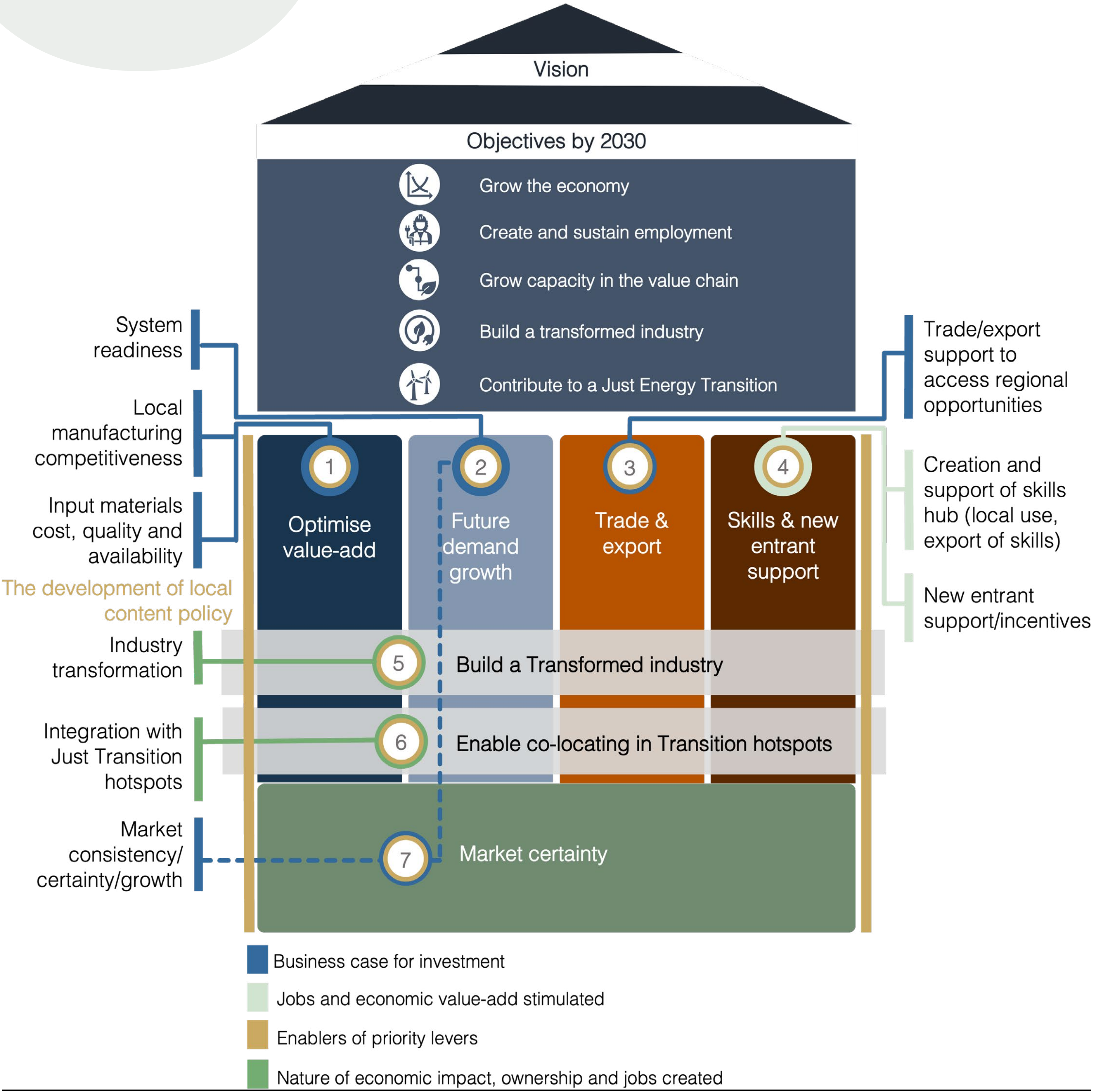
Renewable energy manufacturing is embedded into an energy system and the energy sector in South Africa is embedded in a complex socio-economic context. The potential for industrialising the renewable energy sector therefore means many things to many different stakeholders. Recognising the multiple participants, multiple perspectives and objectives requires dialogue to find common ground and collaboration to realise this significant opportunity for South Africa. The interconnectedness of the parts needs to be analysed thoroughly to understand relationships – only then will the possible positive benefits be realised and unintended negative consequences avoided (for a view on the system dynamics see Figure 5-1, Annex C).

5.1 Reinforcing work areas to build a sustainable renewable energy value chain

During focus groups and research for the development of SAREM, ten programmatic work areas were identified, which together would support the creation of an enabling environment for the renewable energy value chain. These work areas would help to realise the four pillars of the SAREM house framework, while also ensuring Transformation and integration with Just Transition hotspots, and local content policy to create market certainty and stability (Figure 13).

The ten work areas are reinforcing. For example, input cost, quality and availability; trade and export support; and the development of local content policy are all enablers of market certainty and market competitiveness.

Figure 13: The 10 work areas in relationship to the SAREM house framework



Local manufacturing competitiveness

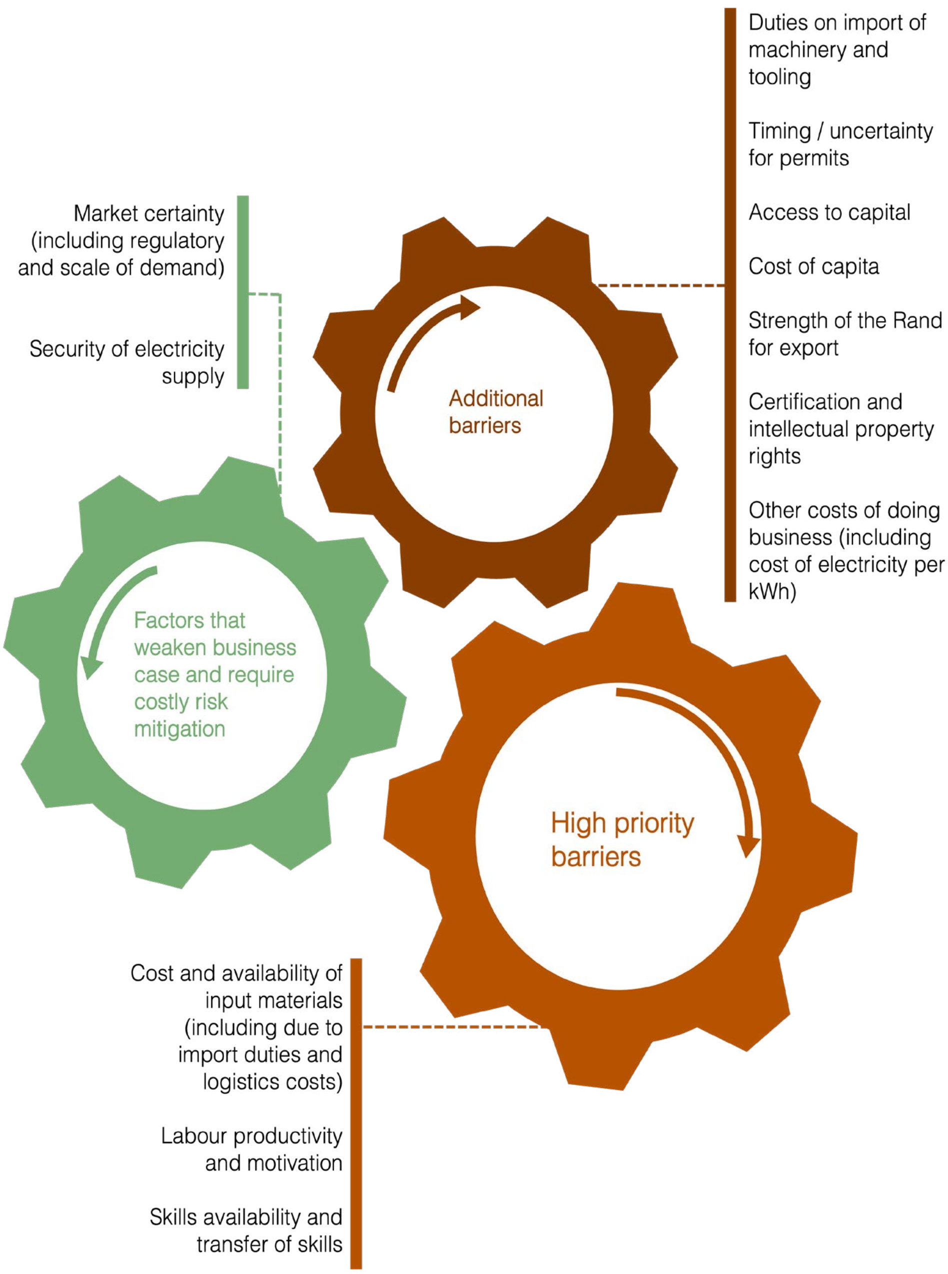
The South African manufacturing sector is currently facing challenges from multiple angles, including the small size of the domestic market, the threat of cheap imports, policy uncertainty, high input costs and a limited skills base (Figure 14).

Deloitte has identified the most important aspects influencing manufacturing competitiveness in South Africa: cost and availability of labour and materials, local market attractiveness, energy cost and policies, economic, trade, financial and tax systems, physical infrastructure, supplier network and government investments in manufacturing. Discussions on competitiveness with industry often return to the baseline theme of the inability to make an investment decision and secure capital that is not priced commensurate to market risk because of uncertainty in the market.

Competitiveness of local manufacturing[18] is a pathway to industrialisation rather than a workstream on its own. The two paths to growth of local content are, on the one hand, a policy framework that may mandate import substitution, and on the other, being able to compete with imports so the market naturally moves towards procurement of local products and services.

In this context, policy support has a clear role to play in the protection of local industry and direct support to decrease the cost of doing business. There are a number of potential levers the DTIC could pull on to support these imperatives, for example, targeting incentives to renewable energy manufacturing and analysing the trade-offs on protected key materials to resolve mitigations where supply constraints reduce the competitiveness of priority components (see Table 6, for further enabling actions by the DTIC and other stakeholders).

Figure 14: Barriers to building local market competitiveness



18 Deloitte, *Enhancing Manufacturing competitiveness in South Africa*, 2013.

Input material cost, quality and availability

Input materials have been raised as a critical consideration for producing competitively-priced products that meet offtaker quality standards and can be supplied in time to reach commercial operation deadlines.

In some cases, raw materials have been earmarked for local beneficiation and are protected by duties on the same-material imports. Where this has introduced a price differential or a constraint in quality or availability of such materials, a trade-off is identified between enabling competitive local manufacturing versus protecting a local raw-material market. In photovoltaics, for example, South Africa is at a steep disadvantage against China, where the leading global cell and module manufacturers are strategically supported by government. China encourages beneficiation by constraining export of raw material and heavily incentivising export of completed products.

However, looking at sector-specific policies in isolation can lead to unintended consequences in other sectors. Protectionism and industry concentration in the local iron and steel and plastics sectors has meant that imports were often cheaper and of better quality than local suppliers, limiting the options for localisation. This drives home the need to consider the combination of policies with a more holistic lens, including through their respective sector-specific masterplans. An example of the need for such rationalisation is that there are constraints and tariffs on the imports of the materials to make PV modules presently; the fully assembled modules don't have such constraints.

Trade-off considerations:
SAREM prioritises beneficiation in manufacturing. To resolve the inevitable trade-offs, ITAC and dtic could seek to rationalise where input materials are more expensive to produce locally than imported, or where there is import protection on the materials and not on the beneficiated product.

Figure 11 (page 32) maps the beneficiation phases for each of the major technologies in IRP2019. Steel, aluminium, glass and battery minerals have been flagged, meriting a deeper dive with manufacturers, suppliers, DTIC, ITAC, and other masterplans relevant to those materials. The Manufacturing Circle's February 2022 study "South African Renewable Energy Material Demand Study" aims to interface their work on the Steel Masterplan and inputs to SAREM on several other material flows. Their analysis indicates certain bottlenecks in availability, with more detail in the reference (see Figure 4-7 and Table 4-1, Annex B). A notable concern to the sustainable supply capacity is in the gaps in procurement that implementation according to the timing in IRP2019 would see. PV procurement gaps introduce the "lumpiness" of the offtake pipeline that would challenge investment decisions into capacity in the upstream and downstream value chains.

System readiness

The shift in the exemption limit from 1MW to 100MW has substantially changed how the South African government approaches the implementation of the IRP in meeting the country's electricity demand. As a result, future demand for renewable energy will include a growing proportion that is customer-driven rather than predominantly centrally procured.

However, the rapid and distributed growth of the South African renewable energy market will put added pressure on technical systems and government systems, and the ability of these systems to address growth in demand will be key to future market growth and consistency. This is particularly relevant in National Energy Regulator of South Africa (NERSA) processes, municipal system reform (such as, wheeling) and grid readiness (transmission and distribution).

Trade and export support to access regional opportunities

As local renewable energy offtake markets may become more diverse and less dependent on public procurement levers in the medium term, trade and industrial policy comes to the fore. The medium-to-long-term objective could therefore focus on making local producers more competitive globally.

Continental Africa is an obvious target, leveraging the African Continental Free Trade Agreement (AfCFTA), but international markets can also be considered. However, at present, some OEMs indicate that – despite all available incentives – they are still challenged to make the case for shifting production capacity from other countries to South Africa to serve their international distribution.

The local and export market are closely intertwined, and the case for setting up to serve the domestic market requires the ability to serve some export market – this signals the need to ensure the competitiveness of local manufacturers against production outside South Africa.

Three themes emerge to enable export:

- **Competitiveness:** through such programmes as SEZs with their Customs Controlled Areas (CCA) and the suite of existing dtic programmes;
- **Input materials:** to identify what inputs would be required for inclusion under Schedule 3 and 4 to make export competitive, and whether dtic and the International Trade Administration Commission (ITAC) would consider their exemption; and
- **Export promotion:** leveraging learnings from the Auto sector's export promotion to establish an equivalent to the Auto Investment Scheme (AIS) and the Auto Production and Development Programme (APDP).

Market certainty

In the long term, market certainty rests on two elements: trust built on the momentum established in the roll-out of the IRP, and the scale of demand that will come with the evolution of the macro-energy market such as the amount of capacity growth required by the trend to electrification of transport and thermal loads, the scheduled retirements in Eskom's coal fleet, combined with Power-to-X and green hydrogen production.

In the short term, the market relies on public procurement rolling out reliably with consistent requirements or incentivisation of local content in the bid rules, alongside some measures of import substitution.

In the medium term, the levers for incentivising procurement of local components cannot rest on public procurement alone. A conducive environment is required. The dtic has the means to encourage export and promote local competitiveness, and this is where the market will look to build a sustainable business case.

Across the short-, medium- and long-term timeframes shown in Figure 16, the following steps could be considered toward establishing market certainty.

Short term: build confidence through REIPPPP implementation: Implementing several years' worth of government procurement (for example, through REIPPPP) would help to build market confidence, as would a consistent set of local content policy criteria over the quantum of MW to be procured. This would enable investors to take a longer view beyond individual bid success or failure.

Medium term: create a competitive environment through trade and industrial policy: Developing consistent trade and industrial policy could foster a competitive environment beyond public procurement mechanisms. This suite of policies could include promoting export, resolving trade-offs on local protection of input materials (versus importing materials that make local beneficiation competitive), and leveraging existing instruments to support local competition such as SEZs and investment incentives.

Long term: build momentum and grow demand: Updating the IRP and ERP at consistent intervals and enabling the diversified generation of power at scale through system-readiness interventions could help to build momentum and grow demand over the longer term. This could also be achieved by enabling the Power-to-X market through programmes to drive hydrogen, electric vehicle adoption and the conversion of thermal to electrical loads. While these are not SAREM interventions, they indicate the requirement to interface with the Industrial Development Corporation (IDC) and DSI on the implementation of the Hydrogen Society Roadmap and the Green Hydrogen Commercialisation Strategy. Increased private sector offtake is another important contributor to market certainty across all time horizons. This certainty can be provided by the major offtakers providing pipeline information to the market.

Providing line-of-sight to future demand is a key enabler for market certainty, and therefore investment. A five-year-plus view of MW demand, for example, could unlock investment for major components facilities now, whereas a short-term outlook encourages limited investment that simply builds on existing manufacturing capacity (see section 5.3, page 47).

For a full explanation on market certainty, see Section 4, Annex B.

Skills

An available and competitive skilled workforce is a critical component of the masterplan, as the availability of appropriate (foundation) skills and mechanisms for rapid and affordable training could increase South Africa's attractiveness as a renewable-energy-manufacturing destination.

Skills development involves a wide-ranging set of stakeholders, policymakers, and practitioners. One recommendation is to host this function on a platform that connects stakeholders and is guided by ongoing feedback through an interface with industry. This type of demand-led training would ensure a match between the growth of manufacturing capacity and available skills.

The Department of Higher Education and Training (DHET), the Manufacturing Engineering Related Services Education Sector and Training Authority (MerSETA), the Energy and Water Sector Education and Training Authority (EWSETA) and Tertiary Vocational Education and Training (TVET) colleges are key players from the government policy and implementation side. Furthermore, existing institutions such as the South African Renewable Energy Technology Centre (SARETEC) and the programmes run by Harambee and Yes4Youth are notable resources to consider in implementation. NUMSA's insights have also been instructive in shaping the suggested approach to this platform, having been active participants in the equivalent structures in the automotive sector.

Figure 15: Steps to build market certainty over three time horizons

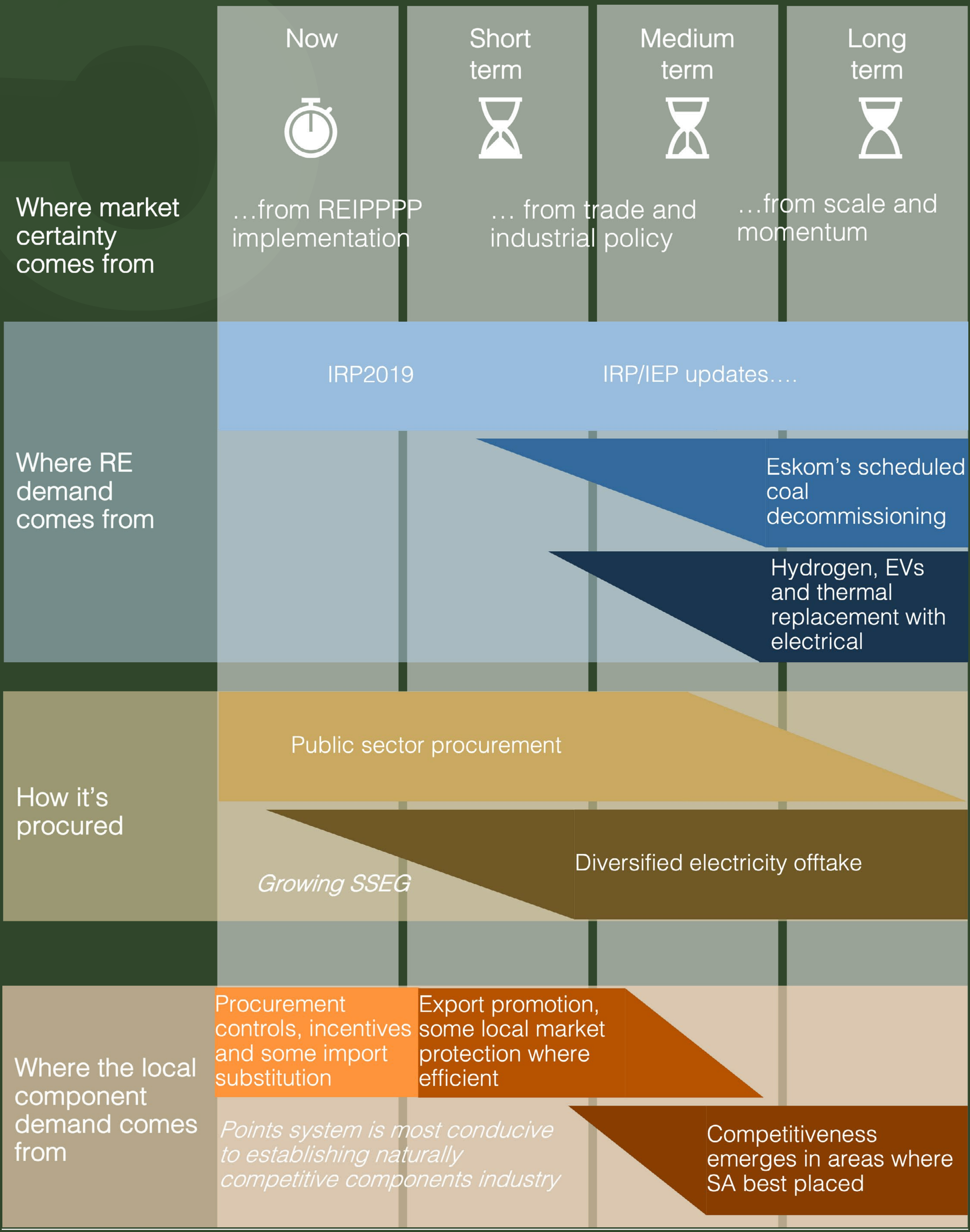
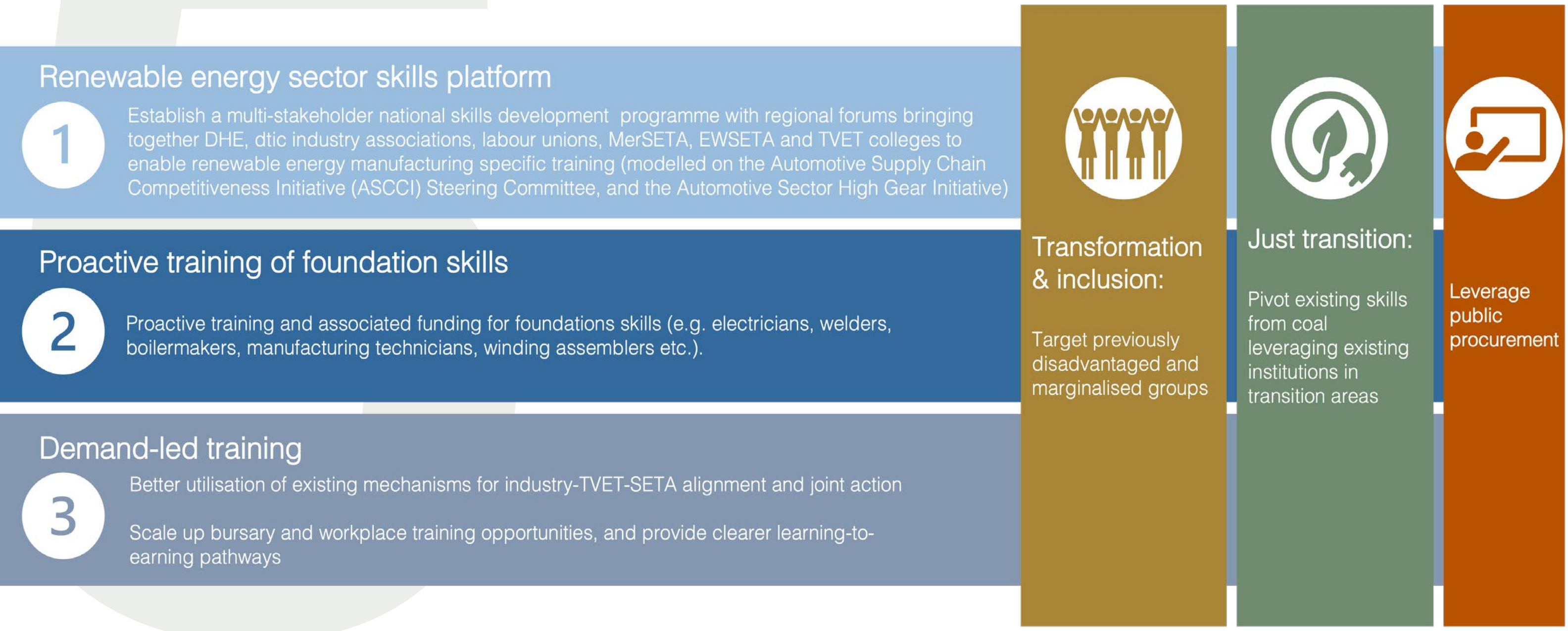


Figure 16: Schematic overview of skills levers



demand in the manufacturing component of renewable energy value chains, from highly skilled to semi-skilled roles (Figure 17).[19]

Overlaid onto this is the imperative to target interventions toward the objectives of Transformation and integrating with Just Transition hotspots. Beneficiary selection can be focused on historically-disadvantaged persons, women, youth, rural communities, and those with disabilities. The levers could also target businesses located in transition hotspots such as Mpumalanga. In addition, reskilling could leverage the existing coal sector and power generation institutional capacity for training.

Technology transfer: In order to empower local industry to participate actively in the global value chain, measures to enable technology transfer are needed to enhance the technical capabilities of the existing manufacturing base. Such measures would need to be cross-cutting in nature and, in order to be implemented coherently, would require DSI, dtic, DHET, Labour, OEMs, and local industry associations to coordinate efforts to establish a Technology Transfer System (TTS).

Given the relatively mature status of the renewable energy value chain, in particular in wind and solar PV – as reflected in the highly competitive status of the global status quo – early coordination between the state and OEMs is likely to focus on improvements on the manufacturing process and cost reduction as opposed to product innovation. The opportunity for deeper local involvement in intellectual property development may be greater in the battery energy storage sector, given its relative nascency.

Figure 17: Occupations in high demand across the renewable energy value chain

Value Chain Stage	Highly Skilled	Skilled	Semi-Skilled
Manufacturing Wind		Welders, electricians, boilermakers, production/ manufacturing technicians.	Spray painters.
Manufacturing Solar	Electrical/ mechanical transformer designers.	Electricians, mechatronic technicians	Winding assemblers, soldering specialists.

19 The study, titled Assessment of local skills for the South African renewable energy value chain, considered the skills demand across the entire value chain: solar PV, wind and battery storage. It was commissioned by the Hydrogen and Energy Sub-Programme of the Technology Innovation Programme of the DSI, in collaboration with the dtic, via the Energy Secretariat at SANEDI.

New entrant support and incentives

Entering the supply chain of global value chain players and OEMs is an opportunity both for startups and for established manufacturers currently serving other sectors. However, harnessing this opportunity comes with the business-development and capacity-building challenges facing all new ventures, as well as barriers to entry specific to this sector and its contracting framework.

For example, on-boarding a new supplier into a major OEM's supply chain is time-consuming and non-trivial, even when the component may be readily available in South Africa. New suppliers need to be identified, vetted and audited, and their products must meet all standards and certification requirements. Major changes to the supply chain affect conditions of financing, such as IEC certification, and require updates to such certification. In all, this can take 12 months before actual production commences. This timeframe is beyond what is workable between Notice to Proceed and Commercial Operation Date (COD).

In addition, emerging suppliers are not in the position to put up warranties and guarantees to the extent that global value chain players can. Several contracts' worth can quickly exceed their balance sheets. Innovation with a blended finance instrument may assist, for example, warranty arrangements in which a third party is introduced to assist with derisking.

Furthermore, investing in factory expansions or new facilities, without a sufficiently-sized committed order book, is challenging against the backdrop of short- to medium-term market uncertainty. Even if investment decisions are made on a critical mass from a single successful bid, investors struggle to secure binding conditional orders at the time of bid. They are similarly unable to make binding commitments to supply as they are unable to raise capital based on conditional orders in bids.

While the ultimate solution lies in market certainty built on securing momentum in public procurement and track record in the private offtake market, there may be an interim means to backstop such commitments in the uncertain period between bid and notice to proceed with an innovation leveraging blended finance.

Integration with Just Transition Hotspots

Contributing to a Just Transition is one of the key objectives of the industrialisation plan. Where job creation and economic value-add can be co-located with Just Transition hotspots such as Mpumalanga, it would aid in diversifying these economies. Improving competitiveness in Just Transition hotspots, directing investment in the renewable energy industry in hotspot economies, and stimulating demand through renewable energy MW development in these areas are all levers that can be explored to direct job creation to these local economies.

Furthermore, Just Transition is a critical concern for labour, as it involves a fundamental re-organising of the workforce as some sectors wane and others emerge. In the growth of new economic sectors, opportunity arises for labour unions to secure a trajectory of sustainable employment. Elements of various other initiatives have captured some of this intent, including the Framework Agreement for a Social Compact on Supporting Eskom for Inclusive Economic Growth, 2020.

Most unions recognise that the transition is already underway, and the focus of concern is to ensure that it happens in a just manner. Within the scope of SAREM, it is of primary importance to ensure that workers have the opportunity to continue to secure sustainable livelihoods – this means creating new economic opportunities and making these readily accessible to all who seek such opportunities, including unions' constituencies.

Potential jobs in emerging renewable energy manufacturing constitute one such opportunity. Key enablers in this regard would be to create the means to identify potential placements, prepare the workforce for them, and connect potential candidates. This would entail skills development, including identifying transferable skills and leveraging existing institutional capacity to reskill workers employed in the coal sector, and developing a platform to connect opportunities for placements to workers with existing and transferable skills (see Skills work area, page 38).

For a full explanation of integration with Just Transition hotspots, see Section 6, Annex B.

Industry Transformation

Transformation is one of the primary objectives of SAREM – defined on the principle of inclusiveness – and is one that cross-cuts all work areas. In this light it looks to enable the active participation of Black workers and investors and focuses on gender-inclusiveness, youth, people with disabilities and rural communities. As such, each implementation plan element should have a lens on its activity to ensure Transformation and inclusiveness.

Consultation indicates a widely-held view (also reflected in the imperative to REIPPPP bidders to integrate "boots-on-the-ground" shareholding in IPPs), that inclusive participation in the sector must go beyond passive equity in assets. Active ownership in manufacturing and services is encouraged. This is where the scope of SAREM, in the industrial capacity serving customers such as these IPPs, comes into play, as it focuses on industrialisation of the value chain.

A set of typologies for structuring a local manufacturing business is shown in Figure 5-3, Annex C, reflecting various modes for local and Black participation. It provides a set of options to explore when considering the most suitable model for meaningful and inclusive empowerment. In addition, the relationships between owners could influence the relative distribution of benefits. Employee share ownership schemes have been touted in other masterplans and have been put forward by labour participants as one of the paths to inclusive participation in ownership. Industry and labour unions would need to scope these, drawing on learnings to ensure they result in financial empowerment of workers. Employee ownership would map to the local and/or black ownership in the typologies in Figure 5-3, Annex C.

Despite the absolute imperative to act in service of Transformation, Figure 18 captures some of the complexity of this work area, discovered through consultation, and offers five key opportunities for intervention: effective implementation of transformation strategies, ensuring access to opportunities (for example, through public procurement and policy), increasing ownership in the value chain, increasing the competitiveness of inclusive business, and increasing the competitiveness of an inclusive workforce.

The development of local content policy

Dynamics in public procurement: Local content policy plays a key role in the creation of a sustainable value chain. In particular, the dynamics that play out around designations, preferential procurement rules, and the CAPEX scoring system have high influence over value chain stakeholders' strategies for localisation.

Designations are at present a primary tool for import substitution, where a component's local value-add in the long term is well understood and there is a strong ability to define and forecast capacity. In private-to-private contracting, the premise is that with sufficiently binding conditions on an offer to supply – throughout the back-to-back contract chain from supplier through OEM and Engineering Procurement and Construction (EPC) – a bidder should be able to hold a local manufacturer to a commitment to produce the required capacity. The local supplier needs to have either the capacity available at risk – based on longer-term market certainty – or be confident in its ability to scale in the required timeframe – an investment difficult to commit to without the certainty of a notice to proceed after financial close.

While well intentioned as a mechanism to support local content, designations can have unintended consequences. When the contract chain breaks down, for example, players may resort to applying for an exemption. Where bidders have some confidence that exemptions would be granted, the case for bidding with local content falls over as there is no longer a level playing field, and legal challenges would likely follow.

In addition, in a rapidly innovating technology sector, designations are most times unable to track the evolution of the technology. Thus, in this protected context, there is little incentive for local suppliers to innovate and, as variations on the solution are offered for import, the argument could be made that such products are not available in the country and hence exemption should be granted. As a result, designation is constantly playing catch-up rather than enabling a responsive market.

Whether there is sufficient capacity to meet the scale of demand is a chicken-and-egg situation that sees potential suppliers waiting for firm orders to raise capital to expand, investors holding off such capital until firm orders are in place, and bidders holding off on firm orders while capacity is not confirmed. The current system pits players in an irreconcilable game around timing and exemptions. The structure incentivises players to race to the bottom on local content and find ways in which to prove that insufficient capacity exists, such that exemptions can be secured. With these limitations in mind, stakeholders are seeking alternatives.

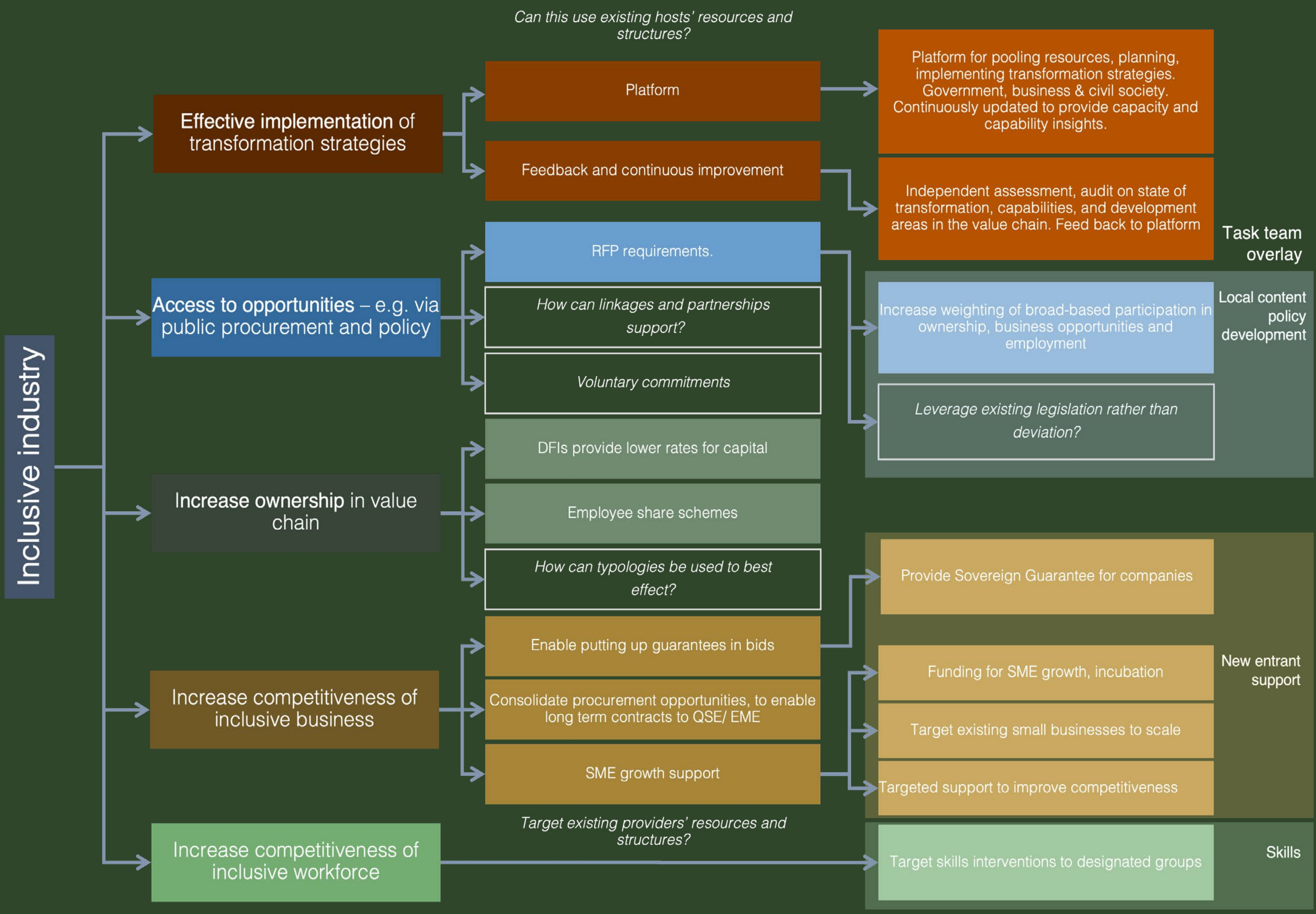
Such an alternative may be to establish a system that encourages a race to the top on local content, where having greater local-content scoring puts the bidder in a more competitive position in procurement. If there were sufficient scoring incentive in bids, industry would mostly likely drive localisation to win. A weighted mechanism such as a local points system would favour establishing capacity that leverages local strengths to best effect and tracks international evolution and innovation.

Public procurement levers:
REIPPPP: Up to Bid Window 4 of the REIPPPP, a deviation from the PFMA was leveraged to incentivise a set of economic development objectives. A 70/30 adjudication weighting permitted 30% to be evaluated on the basis of a combination of parameters in addition to price, including socio-economic development, enterprise development, local content, and Black- and women-owned participation. This delivered the outcomes shown in Table 5-2, Annex C.

In Bid Window 5, the adjudication framework was changed to the 90/10 weighting as required by National Treasury. Potential manufacturers' feedback has been that this weighting decreased the ability to invest in local content, indicating that the 90/10 system can only ensure the use of existing manufacturing capability but not appropriately incentivise new investment. The possible evolution of public procurement rules to respond to these challenges, subject first to exploring a deviation from 90/10 with National Treasury and the IPPO, is to shift the part of the bid scoring allocated for local content from a percent-of-CAPEX system to a points-based system.

Points systems have been used effectively in such markets as Morocco and Turkey, for example. A points-based system would entail tabulating the list of components with points allocated to each one. In designing the table, the number of points allocated to each component could be weighted toward those

Figure 18: The complexity of developing an inclusive industry



with highest value-add. The OEMs could select from the list to meet the targets and set the level of bid competitiveness.
A points-based system does not contain an embedded incentive towards less efficiency and therefore is less vulnerable to influencing the ranking of scores by bidders versus the percentage-of-CAPEX value system. It also encourages building competitiveness on the international stage, requiring less protection. It further enables OEMs to focus on the strategic development of local capacity where it is most competitive, leveraging areas where the domestic context provides most advantage and will be able to establish itself most sustainably. Furthermore, a points-based system adapts to the market, encourages innovation and tracks evolution of technology internationally, enabling progressive ratcheting up as the market grows, with the ability to provide some steer toward the most efficient domestic value-add.

Beyond the points-based system, the "low-hanging fruit" scenario for industrialisation in renewable energy value chains can be achieved without preferential procurement mechanisms. This includes identifying existing industries that could supply components as an expansion to their existing customer base or with a small pivot, such as cable tie suppliers. The goal of this would be to characterise and document the best path to capitalise on this opportunity.

Exploration of value-add to the economy from localising components: (Trade-off considerations): There is a broad trade-off to consider between deploying capital to the cheapest electricity versus harnessing the net benefit to the economy through local manufacture. The current available estimates of local costs for key component and Balance of Plant are within the range that would incur a net positive impact to the economy if produced locally.

Research and modelling inputs to SAREM have explored the relative potential price premiums for the local production of key components in South Africa, alongside their gross value add to the economy. These were viewed in combination with a macro-economic model that considered the impact on the economy of capital injected into such a premium. [20]

The indication of these models showed that it is worth exploring localising certain components, notwithstanding that it may incur a level of premium. There is a spectrum within this, from components that are on the cusp of competitive to manufacture locally under some conditions of input costs, to those that incur some premium. However, where such premiums can be kept manageable by ensuring the market clears efficiently, the gross value-add results in a net-positive impact.

In order to maximise the economic net benefit, a framework for procurement and industry support should promote competition and provide downward pressure on local production premiums (see Section 5 work areas: Market Certainty and Development of Local Content Policy).

For a full explanation of value-add to the economy from localising components, see Section 5, Annex B.

Policy and investment support across other workstreams: The suite of DTIC directorates' existing tools and mechanisms could help boost competitiveness for private offtake and export and promote investment by creating medium-term market certainty. These could be targeted to renewable energy manufacturing and arranged to maximise their accessibility to potential investors, for example, through a one-stop shop kind of packaging.

There are a few instances where these can be explicitly leveraged within this plan, including:

- The Black Industrialists Programme
- SEZs and eco-industrial parks:

  - Just Transition hotspots can be established to boost their competitiveness for a company to locate there – for example, in the EMalahleni REDZ in Mpumalanga. Eco-industrial parks are also a possible model for repurposing initiatives.

  - Strategic infrastructure build and flexible lease terms can be implemented to reduce lead time and mitigate market certainty risk, proactively establishing top structures suited to major component manufacture.

- Export promotion and incentives as structured for the Auto sector, for instance, the Auto Investment Scheme (AIS) and the Auto Production and Development Programme (APDP).
- Critical Infrastructure Programme
- Capital Projects Feasibility Programme

20 UCT, Estimating impact of local manufacturing on GDP, 2021. This was a research input to GreenCape.

5.2 A focus on the diversified offtake market

There is growing recognition of the opportunity in the private offtake market for driving value chain industrialisation in South Africa, estimated to be in excess of 5000MW (R92billion of investment) in the medium term. To leverage this requires a particular set of implementation levers, some of these in common with those for public procurement.

The demand for renewable energy components and services is procured through two mechanisms: public procurement and private procurement. The market may be domestic and for export. The renewable energy power capacity growth that defines the domestic case market for components and services is quantified in the IRP.

The private sector offtake pipeline presents a private-to-private opportunity to the local value chain market that helps build market certainty. Combined with a level of certainty on the government procurement programme and some scope for export, this establishes a business case for investing in manufacturing capacity now. There are levers in SAREM that can enable diversified renewable energy offtake (through system readiness) and there are levers that can enable private sector buyers to procure local (see Table 5-2, Annex B).

There are common levers for maximising the opportunity in public, private and export markets: building market certainty and competitiveness. "Relative competitiveness" can be achieved in protecting a local market through either import tariffs or thresholds and tariff incentives in procurement. The latter are effective in government procurement and to a limited extent in private offtake, depending on corporate supplier development objectives. Protection controls such as designations serve only the public procurement sector. And while measures such as import tariffs, preferential procurement and designations may help incubate a local market, the learning from comparator economies is that they should be done alongside measures to build a competitive market so as to encourage sustainable offtake to the private sector and export in the long term, at which point they can be relaxed.

Trade-off considerations: There is a trade-off between protecting the local market versus enabling global competitiveness. Protecting the local market enables relative competition for the domestic market, however, it does not build global competitiveness. A phased and combined approach that introduces initial limited protection for government offtake, combined with support to build competitiveness for private offtake and export over time, would help to build a sustainable industry.

Table 6 shows the way the various markets for renewable energy demand and local value chain demand are enabled in turn. Table 7 presents enabling actions for consideration by the social compact partners and mandate holders.

Table 6: Mechanisms for value chain market in public, private and export sectors

	Public	Private	Export
	IRP		
Size of renewable energy capacity demand	Defined by Ministerial determinations for procurement. Evolves according to DMRE's processes. E.g. 6800MW PV and wind, 513MW storage.	Not yet well defined, growing with enablers such as 100MW cap, wheeling, trading. EIUG and Minerals Council ~5000MW+ by 2030.	Undefined, opportunity in SAPP
Procurement mechanisms	IPPO (e.g. REIPPP, RMIPPP, BESS), Eskom, Municipal	EPC/EPCM or Private PPA in SSEG (e.g. domestic rooftops) and utility-scale large corporate.	Bespoke, private to private for direct export of components and services.
Size of opportunity for value chain industry	Up to amount localised through public procurement	Up to amount localised through private procurement (up to R92bn investment)	Direct export additional to that through MW demand. Some companies exporting already, e.g. GRI, Seraphim
	Enablers of local content to meet the demand		
Investment risk assessment	Line-of-sight to pipeline and local content policy		
Global competitiveness	Price competitiveness, e.g. as driven by costs of doing business, overheads, and input materials		
Relative competitiveness	Import tariffs		n/a
Local content requirements	Thresholds and preferential procurement	Voluntary corporate objectives, supplier development	n/a
Protection, controls	Designations	n/a	n/a

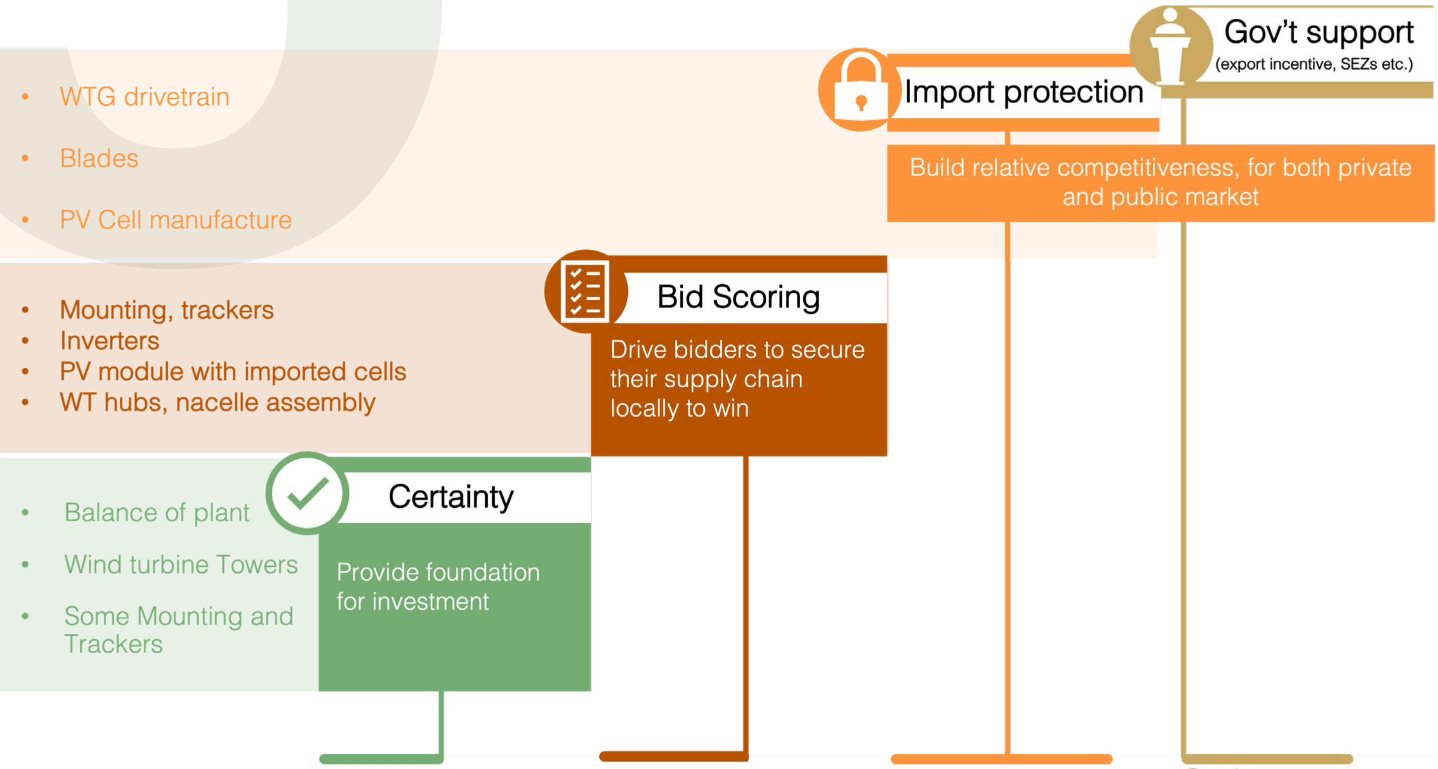
Table 7: Enabling actions for diversified offtake market

Workstream	Action	Mandate holders/ implementors
System readiness	Build capacity of distribution licensees (e.g., Municipal distribution entities) to accommodate smaller-scale distributed generation projects).	DMRE, NERSA, Municipalities
	National wheeling and trading frameworks, including for local municipalities	Presidency: coordinate through Operation Vulindlela
	Invest in transmission and distribution infrastructure to enable best wind and solar resource deployment, leveraging concessional finance.	Eskom
Market certainty	Provide information on timing and flow of procurement pipeline. Maximise scale in combined procurement	Industry: corporate offtakers
Local content requirements	Implement voluntary thresholds, preferential procurement, and supplier development programmes	Industry: corporate offtakers
Competitiveness		
Direct support to decrease cost of doing business	dtic Target existing suite of investment support to renewable energy competitiveness and make accessible. Build accessibility and knowledge of suite of incentives – e.g. through 1 stop shop. Target suite of incentives to renewable energy manufacturing (12i, CPFP, CIP, SEZs, CCA, export promotion) (see action 2.3)	dtic
	Subsidised electricity tariffs for manufacturers (see Labour Policy Brief, IEJ 2021).	National Treasury
Input materials: measures to improve cost, quality, and availability	Analyse trade-offs on key materials that are protected and resolve mitigations where supply constraints reduce competitiveness of priority components. Apply import duty exemptions to strategic input materials. (see action 3.1)	dtic, ITAC
	Improve competitiveness of local materials. Relevant implementation actions of the applicable materials masterplans (see action 3.2)	Steel Masterplan project teams
Cost of capital (see action 6.6)	Develop finance offering at competitive rates for factory investment / expansion by transformed industrialists	IDC, DBSA
	Establish Transformation fund to provide capital for emerging new entrants: Develop mechanism to finance the fund, Appoint fund manager	Industry, dtic, DMRE

5.3 What it takes to build up the market

Developing a sustainable local market that can meet public procurement requirements, serve the private sector, and leverage international trade opportunities is a gradual process that builds up over time. The experiences of comparator economies alongside local analysis reveal the types of foundational steps that can build certainty to invest through to measures that contribute to competitiveness such as export incentives (Figure 19).

Figure 19: Interventions to build up for local content in South Africa



	Certainty	Bid Scoring	Import protection	Gov't support (export incentive, SEZs etc.)
Public procurement	REIPPPP rounds, ministerial determination, RFP	Enabled through bid weighting.	Import tariffs and designations	Supports across the board
Private procurement ("100MW" and SSEG)	Major corporate pipelines, system readiness: 100MW cap and wheeling	Only up to some threshold corporate imperatives (competitiveness is key)	Import tariffs	Drives relative competitiveness
Tariff premium	No premium on tariff expected	Max 20% using proposed 70/20/10 scoring	Depends on several factors	No tariff premium, Economy wide opportunity cost
Reference/Data	Comparator countries & BOP costs that are unsuitable for import	BW4 49% BW5 44%	US anti-dumping protection of 10% led to Seraphim and ArtSolar investing in SA	Ease of doing business & timeframes will impact success

Importantly, investment depends on the line-of-sight to future demand. For example, providing a view beyond five years of 1,000MW per year in the market or 400MW per year per facility could unlock investment in a major components facility, leading to greater job creation and economic growth opportunities (Figure 20).

Figure 20: Line-of-sight to future demand enables increasing levels of investment now

a. Industry interviews 2020-2021 and New Entrants Task Team, 2021.
b-d. Industry interviews with GreenCape, dtic, IPPO, OEMs, 2020-2021 and Urban-Econ Development Economists and EScience Associates, 2015)
d. Agence Nationale port la Maîtrise de l'Energie, 2013
Note: In Brazil, different bid timeframes were required to bring different tech capacity manufacturing online. Kruger et al., 2018

6 Implementation Plan

Prioritising actions across key stakeholders

Research and consultations have given rise to a number of potential implementation actions that respond to the diagnosis and together help pave the way for a sustainable renewable energy value chain industry in South Africa.

The following section presents the key actions that could be considered and championed by various mandate holders.

6.1 Priority actions

For short-term market certainty and to encourage components to be localised based on their competitiveness and value-add, the procurement criteria in the implementation of the IRP through the REIPPPP would be adjusted to a 70/20/10 adjudication weighting, with a local content points scoring system implemented. This would be the mandate area of the DMRE, implemented through IPPO, and would need to provide sufficient years' consistency to kick-start industrialisation.

For medium-term market certainty and support for establishing a manufacturing base that can compete internationally, the suite of dtic levers in trade and industrial policy would be brought to bear to support competitiveness, with an incentive framework for export and rationalising of import duty exemptions on certain input materials. A system of export credits and a decision path to a similar set of incentives as support the automotive manufacturing industry could be explored.

A demand-led skills development programme, building on proactive foundational skills development would require the coordination of multiple stakeholders and initiatives. The effectiveness of this intervention lies in its ability to ensure that technical training institutions' offering is kept up to date with industry's needs. The initial step would be to set up and resource such a platform with voluntary participation from industry, labour and government institutions. This would also enable connecting the available workforce with placements. Through this, organised labour could come to the fore on championing a workforce with growing skills competitiveness.

Transformation via private sector procurement through capital and corporate objectives would ensure commitments to supply chain transformation requirements embedded in ESG and finance terms from capital providers. With the scale of renewable energy procurements announced by major players in the economy, amounting to several thousand MW in the medium term, this would present a suite of opportunities outside public procurement programmes. Together these include supply chain requirements in procurement of energy by corporates, voluntary supplier commitment, employee shareholder schemes and requirements by funds and lenders with ESG and impact imperatives. They could provide competitive capital for new entrants into manufacturing, including via a Transformation fund to be financed through a mechanism such as REIPPPP and/or voluntary contributions.

Industrialisation through growing the private sector pipeline for offtake could be enabled through system readiness measures in transmission reinforcement, wheeling and trading mechanisms. The current 5,000MW+, R92 billion pipeline through major corporates presents an opportunity with reinforced private-to-private market certainty potential. Providing support to increase manufacturing competitiveness through trade and industrial policy tied to increased local content could help develop this procurement pipeline. There is opportunity to align and coordinate with Operation Vulindlela.

For all actions under consideration, including possible implementation plan elements arising from consultation and research, see Annex B.

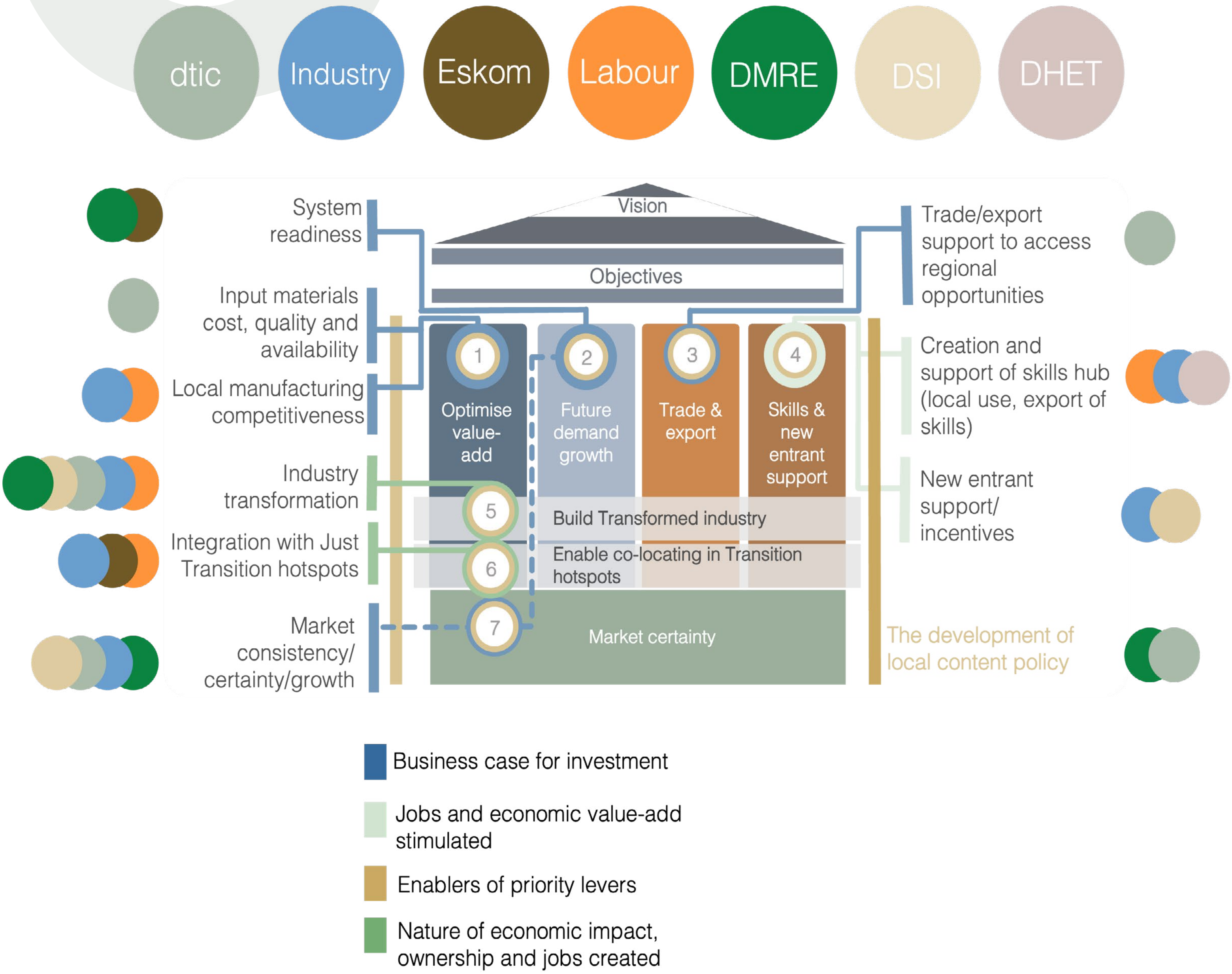
Table 8: High priority implementation plan elements

	Implementation plan element	Actions	Time-frame	Mandate/ decision maker	Implementer
1.	Provide confidence in the implementation of sufficient years' worth of government procurement (e.g. REIPPP) with consistent competitive adjudication framework	Announce dates of procurement rounds for sufficient future rounds of government procurement (e.g. REIPPP)	6 mo	DMRE	IPPO
		Application to National Treasury for REIPPPP adjudication weighting of 70/20/10. Aligned with legislation 10 points toward transformation, 20 points to local content, 70 on price.	3 mo	National Treasury	DMRE, IPPO
		Add points-based scoring table for components in the RFP.	3 mo	dtic	IPPO
2.	Export promotion and private offtake incentive framework managing trade-offs on import protection on input materials	Support local manufacturing competitiveness through incentive structure and export promotion embedded in trade and industrial policy. Institute system of export credits for renewable energy components. dtic Explore parameters for decision-making for emulating auto's AIS & APDP.	6 mo	National Treasury, dtic	dtic
		Analyse trade-offs on key materials that are protected locally and resolve on exemption or other mitigations where supply constraints reduce competitiveness of components. Apply import duty exemptions to strategic materials.	3 mo	dtic	ITAC
3.	RE sector skills platform that iteratively links demand-led skills development with industry needs.	1) Set up steering committee, identify a host, 2) secure funding. Appoint implementer and 3) roll out programme as described in scope: connect industry and relevant institutions (e.g. TVETs), maintain platform for placements, ongoing audit and assessment.	1) 3 mo 2) 6 mo 3) 4 y	Labour, Industry, DHET	To be appointed by host.
4.	Transformation via private sector procurement through capital and corporate objectives	Supply chain requirements of local content and transformation.	6 mo	Major corporates, EIUG, Minerals Council	Corporates, OEMs / suppliers
		Requirements embedded in ESG / finance terms from capital providers: DFIs, banks and funds inter alia IDC, DBSA, BASA, Labour.	6 mo	Individual capital providers	Individual capital providers
		Establish Transformation fund to provide capital for emerging new entrants. Develop mechanism to finance it (voluntary industry contributions and/or IPPO, NT to consider a % of REIPPPP), appoint fund manager	6 mo	National Treasury, Industry	IPPO, fund manager to be appointed
5.	Enable industrialisation through growing private sector pipeline for offtake, coordinating through Operation Vulindlela	Provide market certainty through information on timing and flow of combined procurement pipeline.	6 mo	Industry offtakers	Industry offtakers
		Implement voluntary thresholds, preferential procurement, supplier development programmes	6 mo	Industry offtakers	Industry offtakers
		Enable diversified offtake through System Readiness actions	1-15y	DMRE, NERSA, Eskom	DMRE, NERSA, Eskom
		Build ecosystem of competitiveness through suite of levers as in priority 2, above	3 mo	dtic	ITAC

6.2 Contributions from stakeholders across government, business and labour

There are unique and critical contributions that each key stakeholder can "bring to the braai" to build a sustainable renewable energy manufacturing value chain in South Africa. Figure 21 maps the spheres of influence of government, labour and industry across the ten programmatic work areas discussed in Chapter 5. Below, a suite of potential interventions is given for consideration by each stakeholder.

Figure 21: How government, industry and labour can influence the growth of a sustainable renewable energy value chain



Industry

1. Grow capacity in the value chain by
    a. Direct investment in manufacturing facilities.
2. Build long term market certainty by
    a. Enabling the Power-to-X market, such as green hydrogen, with direct investment.
3. Improve competitiveness by
    a. Building competitiveness of input materials and engaging in materials Masterplans.
4. Enable new entrants to the supply chain by
    a. Developing solutions to warrantees and guarantees challenge.
    b. Participating in blended finance instruments for guarantees and factory investment.
    c. Mentor emerging suppliers.
5. Enable Transformation and inclusivity by
    a. Participating in platform for oversight of effective implementation of Transformation strategies.
    b. Working with Labour to scope and adopt employee share scheme models.
    c. Embedding ESG requirements regarding Transformation in investment funds.
    d. Developing requirements in procurement and supplier development based on corporate transformation objectives.
    e. Establishing and populating a Transformation fund to provide capital for emerging new entrants.
6. Encourage industrialisation in Just Transition hotspots by
    a. Directing investment to Just Transition hotspots: in generation assets and manufacturing.
    b. Developing voluntary procurement requirements to incentivise local manufacturing in hotspots. e.g. mines with local procurement imperative.
    c. Working with labour in initiatives to pivot skills, leveraging existing training assets and capacity to enable new employment opportunities for former coal sector employees.
7. Support skills development by
    a. Participating in a renewable energy sector skills platform that iteratively links demand-led skills development with industry needs.
    b. Introducing or scaling up internal training programmes for demand-led training, partnering with government training providers and including bursaries, internships, apprenticeships and mapping clear skills development and employment pathways for trainees.
8. Drive private-to-private market development by
    a. Contributing to market certainty by private corporate offtakers sharing pipeline information, aggregated where competition permits, and developing supplier development and procurement principles for local industrialisation aligned with corporate objectives.

Labour

1. Enable Transformation and inclusivity by
    a. Participating in a platform for oversight of effective implementation of Transformation strategies.
    b. Working with industry players to scope and adopt employee share scheme models.
    c. Embedding ESG requirements regarding Transformation in Labour's investment funds.
2. Support a Just Transition by
    a. Embedding ESG requirements regarding Just Transition in Labour's investment funds.
    b. Working with industry players in initiatives to pivot skills among workers in the coal sector.
3. Help build competitiveness and workforce opportunities through skills by
    a. Participating in a renewable energy sector skills platform that iteratively links demand-led skills development with industry needs.

The Department of Science and Innovation

1. Build long term market certainty by
    a. Enabling the Power-to-X market through Hydrogen Society Roadmap.
2. Enable Transformation and inclusivity by
    a. Applying an inclusivity (GESI) lens to all DSI-championed initiatives.
3. Enable new entrants to the supply chain by
    a. Targeting existing business incubation and capacity-building support to emerging suppliers in renewable energy.
    b. Supporting technology transfer to new entrants, as described in Labour policy brief.
4. Encourage industrialisation in Just Transition hotspots by
    a. Directing investment to hotspots, for example, in R&D, testing and certification facilities
    b. Supporting initiatives to pivot skills, leveraging existing training assets and capacity.
    c. Supporting the pivoting of industrial capacity to meet new value chain opportunities.
5. Support skills development by
    a. Driving skills for the future by participating in a renewable energy sector skills platform that iteratively links demand-led skills development with industry needs.
    b. Working with industry on demand-led skills: internal training programmes partnering with government training providers, including bursaries, internships, apprenticeships.
    c. Playing a key role in a task team to develop a Technology Transfer System.

The Department of Trade, Industry and Competition

1. Build market certainty by
    a. In the short term: Establishing a consistent set of local content policy criteria, setting RFP requirements for sufficient period of learning and building up capacity.
    b. In the medium term: Developing consistent trade and industrial policy that builds a competitive environment beyond public procurement mechanisms.
    c. In the long term: Enabling the Power-to-X market through Hydrogen Society Roadmap and Green Hydrogen Strategy.
2. Set local content policy by
    a. Working alongside DMRE and IPPO, instituting a weighting in REIPPPP that encourages bidders to proactively establish the local supply chain to win: for example, a 70/20/10 adjudication weighting with points-based scoring in government procurement.
3. Build an ecosystem of competitiveness in the medium- to long-term by
    a. Targeting a suite of investment support to renewable energy competitiveness, making it accessible through a one-stop shop and targeting suite of incentives to renewable energy manufacturing (for example, Section 12i for Greenfield Investments, the Capital Projects Feasibility Programme (CPFP), the Critical Infrastructure Programme (CIP), SEZs, CCA, and export promotion).
    b. Managing trade-offs on input materials by analysing key materials that are protected locally and resolving on exemption or other mitigations where supply constraints reduce competitiveness of priority components. Applying import duty exemptions to strategic input materials.
    c. Building competitiveness of input materials through initiatives cross-referenced in the materials Masterplans.
4. Support new entrants by
    a. Targeting existing business incubation and capacity-building support to emerging suppliers.
5. Establish trade/export access to regional opportunities by
    a. Supporting local manufacturing competitiveness through incentive structure and export promotion embedded in trade and industrial policy. Instituting a system of export credits for renewable energy components.
    b. Exploring bilateral arrangements with other countries in Sub-Saharan Africa.
6. Enable Transformation and inclusivity by
    a. Participating in platform for oversight of effective implementation of transformation strategies.
    b. Leveraging dtic's existing Black Industrialists Scheme (BIS), which is well positioned to target the renewable energy value chain. Consider the BIS as a host to establish a multi-stakeholder steering committee and resource and implementing agent to support the scope as described.
7. Encourage industrialisation in Just Transition hotspots by
    a. Improving geographical competitiveness of hotspots through:
        - Establishing SEZs and eco-industrial parks in hotspot areas, and
        - Targeting a suite of incentive programmes to hotspots.

Department of Mineral Resources, National Energy Regulator of South Africa and Independent Power Producer Office

1. Build market certainty by
    a. Providing confidence in the implementation of sufficient years' worth of REIPPPP to galvanise industry.
    b. Establishing a consistent set of local content policy criteria, setting RFP requirements for sufficient period of learning and building up capacity.
    c. Enabling the Power-to-X market through Hydrogen Society Roadmap and Green Hydrogen Strategy.
    d. Enabling diversification of offtake (already progressed with 100MW generation licence cap).
2. Set local content policy by
    a. Instituting a weighting in REIPPPP that encourages bidders to proactively establish local supply chain to win: for example, a 70/20/10 adjudication weighting with points-based scoring table.
3. Support trade/export access to regional opportunities by
    a. Exploring bilateral arrangements with other countries in Sub-Saharan Africa.
4. Enable Transformation and inclusivity through
    a. Participating in platform for oversight of effective implementation of transformation strategies.
    b. Including Transformation criteria in public procurement (for example, in the 70/20/10 weighting).
    c. Establishing and populating Transformation fund to provide capital for emerging new entrants, overseeing the appointment of a fund manager and the mechanism to populate the fund, considering, for example, the equivalent of the IPPO "development fee" for this purpose.
5. Encourage industrialisation in Just Transition hotspots by
    a. Encouraging locating renewable energy generation and supply chain in hotspots through public procurement.
6. Ensure system readiness to support the demand rollout, both for public and private offtake by
    a. Building capacity in distribution licensees (DMRE working with NERSA).
    b. Creating national wheeling and trading frameworks, including for local municipalities

Eskom

1. Encourage industrialisation in Just Transition hotspots by
    a. Directing investment to hotspots: in generation assets and manufacturing, such as the Komati microgrid manufacturing facility.
    b. Developing procurement requirements to incentivise local manufacturing in hotspots, for example, mines with local procurement imperative.
2. Support Just Transition through skills by
    a. Working with labour and industry in initiatives to pivot skills among coal sector employees, leveraging existing training assets and capacity.
3. Ensure system readiness to support the demand rollout, both for public and private offtake by
    a. Investing in transmission and distribution infrastructure to enable best wind and solar resource deployment. Building out new transmission and distribution infrastructure.
    b. Leveraging concessional finance as a key system readiness intervention.

Support for South African National Renewable Energy Plan

The following parties express support for the Masterplan and commit to work with all social partners towards the outcomes:

Executive Oversight Commitee members and witnesses

Name	On behalf of	Signature
Gwede Mantashe Minister, DMRE	South African Government	
Thabo Mokoena Director General, DMRE	South African Government	
Jacob Mbele, Deputy Director General, DMRE	South African Government	
dtic	South African Government	
DSI	South African Government	
Lucky Moni CEPPWAWU	Labour	
Tony Ehrenreich COSATU	Labour	
Aretha Charles NEDLAC	Community	
Nhlanhla Ndlovu NEDLAC	Community	
Gerald Borcherds CEO, Seraphim	Manufacturers in South Africa	
Pius Gumbi BEPA	Emerging suppliers to the renewable energy value chain	
Louise Paulsen Managing Director, Vestas	Original equipment manufacturers (OEMs) and global value chain leaders	

Industry associations and representatives

Name	On behalf of	Signature
Valentino Adams Director, CS Renewables	Manufacturers in South Africa in wind power	
Gerald Borcherds CEO, Seraphim	Manufacturers in South Africa in solar PV	
Niveshen Govender COO, SAPVIA	South African Photovoltaic Industry Association (SAPVIA)	
Terence Govender Chair, SAREC	South African Renewable Energy Council (SAREC)	
Mercia Grimbeek Chair, SAWEA	South African Wind Energy Association (SAWEA)	
Pius Gumbi Executive Director, Smartinnovation Energy	Emerging suppliers to the renewable energy value chain	
Hope Mashele Managing Director, Vikinduku Engineering Projects BEPA	Emerging suppliers to the renewable energy value chain	
Mikhail Nikomarov CEO, Bushveld Energy	Manufacturers in South Africa in battery storage	
… SAESA	South African Energy Storage Association (SAESA)	
Hiten Parmar Director, uYilo Electric Mobility Programme	Original equipment manufacturers (OEMs) and global value chain leaders in battery storage	
Louise Paulsen Managing Director, Vestas	Original equipment manufacturers (OEMs) and global value chain leaders in wind power	
Frans-Willem Vermaak Business Development Manager, Lumax	Manufacturers in South Africa in solar PV	
Lourens Vermaak Sales Manager – Africa, Trina Solar	Original equipment manufacturers (OEMs) and global value chain leaders in solar PV	

Industry associations and representatives I voluntary endorsements from individual companies, organisations, and associations

Name	Designation	Signature

Investments and catalytic projects aligned with the implementation of this plan

Name	Company / organisation	Investment or catalytic project	Investment value (ZAR)	Jobs created	Implementation date	Signature
Komati	Eskom	Komati microgrid manufacturing facility			2021	
Seraphim	Seraphim	Solar PV module and cell	R437m			
Polarium	Polarium	Lithium ion module manufacture	R20m			
Bushveld	Bushveld					
ArtSolar	ArtSolar					
SBIDZ: African Quartz	SBIDZ: African Quartz	Solar cell manufacture				

References

Agence Nationale port la Maîtrise de l'Energie (2013). Etude sur le potentiel de création de valeur locale de l'industrie tunisienne dans le secteur de l'énergie éolienne. Provided by GIZ.

Altgen (2019). Green Economy Skills Audit. Prepared for GreenCape by Altgen Employment Services

Apricum (2019). Towards a subsidy-free era for China's solar PV market. Available from: https://www.apricum-group.com/towards-a-subsidy-free-era-for-chinas-solar-pv-market/

Deloitte (2013). Enhancing Manufacturing competitiveness in South Africa, Available from https://www2.deloitte.com/content/dam/Deloitte/dk/Documents/manufacturing/manufacturing-competitiveness-South-africa.pdf

Engineering News (2020). South African Steel Industry in Distress, 6 March 2020: Available from: https://www.engineeringnews.co.za/article/opinion-south-african-steel-industry-is-an-industry-in-distress-2020-03-06 (Accessed November 2020).

EScience Associates, Urban-Econ Development Economists Chris Ahlfeldt (2013). Photovoltaic Electricity. The localisation potential of Photovoltaics and a strategy to support the large scale roll-out in South Africa. Available from: http://www.sapvia.co.za/wp-content/uploads/2013/03/PV-Localisation-Final-Report-v4-lowres.pdf

Ettmayr, C. and Lloyd, H. (2017) Local content requirements and the impact on the South African renewable energy sector: A survey-based analysis, South African Journal of Economic and Management Sciences 20(1), a1538. Available from: http://dx.doi.org/10.4102/sajems.v20i1.1538

GreenCape (2021) Assessment of local skills for the South African renewable energy value chain, Commissioned by Hydrogen and Energy Sub-Programme of the Technology Innovation Programme of the DSI, in collaboration with the DTIC, via the Energy Secretariat at SANEDI.

GreenCape et al (2020-2021), Interviews with suppliers, OEMs with DTIC, IPPO, confidential data aggregated into insights, not published.

GreenCape (2020), SAREM Interim Research Summary. Circulated to SAREM stakeholder groups, Dec 2020.

GreenCape (2021a), SAREM Workstreams and Levers Discussion Document. Circulated to SAREM stakeholder groups, August 2021.

GreenCape (2021b), SAREM Emerging Actions Discussion Document. Circulated to SAREM stakeholder groups, September 2021.

Haley. U.C.V and Schuler. D.A. (2011). Government Policy and Firm Strategy in the Solar Photovoltaic Industry. California Management Review VOL. 54, NO. 1 FALL 2011. Available from: https://journals.sagepub.com/doi/10.1525/cmr.2011.54.1.17

Hansen, U. E., Nygaard, I., Morris, M., & Robbins, G. (2019). Local content requirements in auction schemes for renewable energy: Enabler of local industrial development in developing countries? UNEP DTU Partnership Working Paper Series 2017, Vol. 2. Available from: https://unepdtu.org/publications/local-content-requirements-in-auction-schemes-for-renewable-energy-enabler-of-local-industrial-development-in-developing-countries/

Hartley, F., Burton, J., Cunliffe, G. McCall, B., Caetano, T. , Ntuli, N., Fourie R. and Chiloane, L. Future skills and job creation through renewable energy in South Africa: Assessing the co-benefits of decarbonizing the power sector. Executive report. Available from: https://www.cobenefits.info/wp-content/uploads/2019/03/COBENEFITS-Study-South-Africa-Employment.pdf

Heidemann, T (2018) Renewable energy: localisation requirements and special investment contracts. Russia. Available from: https://www.cms-lawnow.com/ealerts/2018/05/renewable-energy-localisation-requirements-and-special-investment-contracts?cc_lang=en

Hochberg, M (2016). Renewable Energy Growth in Morocco an Example for the Region, Middle East Institute (MEI) Policy Focus 2016-26. Available from: https://www.mei.edu/sites/default/files/publications/PF26_Hochberg_Moroccorenewables_web.pdf

IEA (International Energy Agency)(2015) Decree No. 449 on the Mechanism for the Promotion of Renewable Energy on the Wholesale Electricity and Market. IEA/IRENA Renewables Policies Database. https://www.iea.org/policies/5510-decree-no-449-on-the-mechanism-for-the-promotion-of-renewable-energy-on-the-wholesale-electricity-and-market

IEA (International Energy Agency) (2020). Data IEA Solar PV module manufacturing and demand, 2014-2020. https://www.iea.org/data-and-statistics/charts/solar-pv-module-manufacturing-and-demand-2014-2020

IFC (2011). Renewable Energy Policy in Russia: Waking the Green Giant. Available from: https://www.ifc.org/wps/wcm/connect/d34e061b-2130-4ec0-8970-7ff66247daac/PublicationRussiaRREP-CreenGiant-2011-11.pdf?MOD=AJPERES&CVID=jh75x5k

IFC (2013) Russia's New Capacity-based Renewable Energy Support Scheme. An analysis of Decree No. 449. Available from: https://openknowledge.worldbank.org/handle/10986/25795

IRENA (2013). Renewable Energy Auctions in Developing Countries. Available from: https://www.irena.org/publications/2013/Jun/Renewable-Energy-Auctions-in-Developing-Countries

IRENA (2015). Renewable Energy Auctions: A Guide to Design. Available from: https://www.irena.org/publications/2015/Jun/Renewable-Energy-Auctions-A-Guide-to-Design#:~:text=Renewable%20Energy%20Auctions%3A%20A%20Guide%20to%20Design%20aims%20to%20advise,decision%2Dmaking%20in%20different%20contexts.

IRENA (2017a). Renewable Energy Benefits: Leveraging Local Capacity for Onshore Wind. Available from: https://www.irena.org/publications/2017/Jun/Renewable-Energy-Benefits-Leveraging-Local-Capacity-for-Onshore-Wind

IRENA (2017b). Renewable Energy Benefits: Leveraging Local Capacity for Solar PV. Available from: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Jun/IRENA_Leveraging_for_Solar_PV_2017.pdf

References

IRENA (2017c). Rethinking Energy 2017: Accelerating the global energy transformation. https://www.irena.org/publications/2017/Jan/Rethinking-Energy-2017-Accelerating-the-global-energy-transformation#:~:text=Increasingly%2C%20renewables%20have%20become%20the,for%20a%20sustainable%20energy%20future

IRENA (2019a). Future of Wind: Deployment, investment, technology, grid integration and socio-economic aspects. Available from: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Jun/IRENA_Leveraging_for_Solar_PV_2017.pdf

IRENA (2019b). Future of Solar Photovoltaic: Deployment, investment, technology, grid integration and socio-economic aspects. Available from: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Nov/IRENA_Future_of_Solar_PV_2019.pdf

IRENA (2019c). Renewable Energy Auctions. Status and Trends Beyond Price. https://irena.org/publications/2019/Dec/Renewable-energy-auctions-Status-and-trends-beyond-price

IRENA (2020). Renewable Energy Statistics 2020. Available from: https://www.irena.org/publications/2020/Jul/Renewable-energy-statistics-2020

KALİ Energy Solutions (2017). REZ Guide: For Solar Energy Investors. Available from: http://www.kalienerji.com/uploads/dokuman/REZ-Guide-For-solar-energy-investors.pdf

Kaziboni, L. and Stern, M. (2020). The impact of local content policies on EU exports and investment, and economic transformation in South Africa. DNA Economics. Available at: http://www.euchamber.co.za/wp-content/uploads/2020/10/Local-Content-Report-Final-October-2020.pdf

Kost,C.,Thomsen, J., Schlegl, T., Fluri, T., Philipps, S., Lude, S., Hädrich, I., Weber, D., Platzer, W. and Wirth, H. (2012). Solar Technologies in Morocco – Industry and Value Chain Assessment, Fraunhofer Institute for Solar Energy Systems ISE. Available from: https://www.ise.fraunhofer.de/en/research-projects/local-manufacturing-of-solar-technologies-in-morocco.html

Kruger, W., Eberhard. A. and Swartz. K. (2018) Renewable Energy Auctions: A Global Overview, Graduate School of Business, University of Cape Town Available from: http://www.gsb.uct.ac.za/files/EEG_GlobalAuctionsReport.pdf

Kuntze, J.-C and Moerenhout, T. (2013); Local Content Requirements and the Renewable Energy industry - A Good Match?; International Centre for Trade and Sustainable Development, Geneva, Switzerland, www.ictsd.org. Available from https://unctad.org/system/files/non-official-document/DITC_TED_13062013_Study_ICTSD.pdf

Livingston, D. (2018). Renewable Energy Investment in Turkey: Between Aspiration and Endurance. Turkish Policy Quarterly. Vol 17. No. 3. Available from: http://turkishpolicy.com/article/933/renewable-energy-investment-in-turkey-between-aspiration-and-endurance

Morris, M. and Staritz, M (2019). Industrialization paths and industrial policy for developing countries in global value chains. Chapter, in: Stefano Ponte & Gary Gereffi & Gale Raj-Reichert (ed.), Handbook on Global Value Chains, chapter 31, pages 506-520, Edward Elgar Publishing.

Manufacturing Circle (2022). South African Renewable Energy Material Demand Study

Morris, M., Robbins, G., Hansen, U., and Nygaard, I. 2020. "Energy and Industrial Policy Failure in the South African Wind Renewable Energy Global Value Chain: The political economy dynamics driving a stuttering localisation process". PRISM Working Paper 2020-3. Cape Town: Policy Research on International Services and Manufacturing, University of Cape Town. Available from: http://www.prism.uct.ac.za/prism/Working-Paper-Series

REN21, (2019), Renewable Energy Global Reports. Available from https://www.ren21.net/reports/ren21-reports/

REN21, (2020), Renewable Energy Global Reports. Available from https://www.ren21.net/reports/ren21-reports/

TIPS (2021); Opportunities to develop lithium-ion battery value chain in South Africa. Available from https://www.tips.org.za/images/Battery_Manufacturing_value_chain_study_policy_brief_March_2021.pdf

World Bank (2021). South Africa Battery Value Chain Development Scenarios. Drafted by Customised Energy Solutions

Annex A

1. All actions under consideration: Possible implementation plan elements arising from consultations and research

	Implementation plan element	Actions	Time-frame	Mandate/ decision maker	Implementer
1. Market certainty					
1.1	Provide confidence in the implementation of sufficient years' worth of REIPPPP	Announce dates of procurement rounds for sufficient future rounds of government procurement (e.g. REIPPP)	6 mo	DMRE	IPPO
1.2	Establish a consistent set of local content policy criteria	Set bid RFP criteria for the same period	6 mo	dtic	IPPO
1.3	Develop consistent trade and industrial policy that builds a competitive environment beyond public procurement mechanisms.	This suite of policy actions is cross-referenced in the 1. Local content policy levers; and 2. Trade and export promotion levers	3 y	dtic	dtic
1.4	Enable power-to-x market	Establish interface with the Hydrogen Society Roadmap and Green Hydrogen Strategy, to enable implementation and ensure manufacturing sector capacity trajectory to suit demand trajectory	3-10 y	DSI,IDC,dtic, DMRE	DSI,IDC,dtic, DMRE
1.5	Enable industrialisation through growing private sector pipeline for offtake, coordinating through Operation Vulindlela	Provide market certainty through information on timing and flow of combined procurement pipeline.	6 mo	Industry offtakers	Industry offtakers
1.6	Cross-reference system readiness for enabling offtake diversity in the medium term				
2. Local content policy					
2.1	Institute 70/20/10 adjudication weighting with points-based scoring table for components in REIPPPP.	Application to National Treasury for REIPPPP adjudication weighting of 70/20/10. Aligned with legislation 10 points toward transformation, 20 points to local content and 70 on price.	3 mo	National Treasury	DMRE, IPPO
2.2		Add points-based scoring table for components in the RFP.	3 mo	dtic	IPPO
2.3	Target existing suite of investment support to renewable energy competitiveness and make accessible	Build accessibility and knowledge of suite of incentives – e.g. through 1 stop shop. Target suite of incentives to renewable energy manufacturing (12i, CPFP, CIP, SEZs, CCA, export promotion)	1 y	dtic	dtic
2.4	Private-to-private procurement requirements based on corporate objectives	Implement voluntary thresholds, preferential procurement, supplier development programmes	6 mo	Industry offtakers	Industry offtakers
3. Input materials					
3.1	Import duty exemption on strategic inputs	Analyse trade-offs on key materials that are protected locally and resolve on exemption or other mitigations where supply constraints reduce competitiveness of priority components. Apply import duty exemptions to strategic input materials.	3 mo	dtic	ITAC
3.2	Improve competitiveness of local materials	Relevant implementation actions of the applicable materials masterplans	As per masterplan	As per masterplan	As per masterplan
4. New entrant support					
4.1	Develop solution to warrantees and guarantees	Innovate and develop 3rd party warranty / instruments for offering to emerging suppliers	6mo	Industry / IDC	Industry / IDC
4.2	Blended finance instrument for guarantees and factory investment	Craft blended finance instruments that a) assists smaller suppliers to put up guarantees in bids and b) provides capital for factory investment to enable commitment pre-financial close	6mo	IDC, DBSA	IDC, DBSA

4.3	Mentoring of emerging suppliers by OEMs	Identify and on-board emerging suppliers	3 y	Industry	Industry
4.4	Target existing business incubation and capacity building support to emerging suppliers	1) Identify host for generic business development support in existing programmes. 2) Develop and implement targeted application of existing business incubation and capacity building support to emerging suppliers	1) 3mo 2) 5y	dtic, DSI	Host to be appointed
4.5	Target the above to Transformation				
4.6	Target the above to Just Transition hotspots				
5. Trade/export support to access regional opportunities					
5.1	Export promotion, incentive framework	Support local manufacturing competitiveness through incentive structure and export promotion embedded in trade and industrial policy. Institute system of export credits for renewable energy components	6mo	National Treasury, dtic	dtic
5.2	Bilateral arrangements with other countries	Diplomatic missions, in particular in Africa. ITAC determine strategic designation of components under AfCFTA	3y	DTIC, DMRE	DTIC, DMRE, ITAC
6. Transformation					
6.1	Establish a platform for oversight of effective implementation of transformation strategies	Host to establish multi-stakeholder steering committee and resource an implementing agent to support the scope as described.	6 mo	Lead dept proposed: DTIC. Social compact partners in committee	Secretariat appointed by host
6.2	Scope and adopt employee share scheme model	Industry players, in consultation with relevant labour unions to scope and adopt ESOPs	1 y	Industry, Labour	Industry, Labour
6.3	Include transformation criteria in public procurement	10 points of REIPPPP adjudication weighting to transformation.	3mo	DMRE, National Treasury	IPPO
6.4	Transformation via private sector procurement through capital and corporate objectives	Supply chain requirements of local content and transformation	6 mo	Major corporates, EIUG, Minerals Council members, Sasol	Corporates (procurement manager), OEMs / suppliers
6.5		Requirements embedded in ESG / finance terms from capital providers: DFIs, banks and funds inter alia IDC, DBSA, BASA, Labour.	6 mo	Individual capital providers	Individual capital providers
6.6	Competitive rates for factory investment capital	IDC, DBSA, BASA, others develop finance offering at competitive rates for factory investment / expansion by transformed industrialists.	6 mo	Individual capital providers	Individual capital providers
		Establish Transformation fund to provide capital for emerging new entrants. 1. Develop mechanism to finance the fund 2. Appoint fund manager	1. 6 mo	Lead dept proposed: DMRE / DTIC. Industry re voluntary commitments	Fund manager to be appointed
6.7	Cross reference other workstreams' focus (new entrant support, skills, local content policy)				
7. Integration with Just Transition hotspots					
7.1	Improve competitiveness in Just Transition hotspots	Establish SEZs and eco-industrial parks in hotspot areas	3 y	DTIC	DTIC
7.2		Target suite of incentive programmes to JT hotspots. Direct investment in certification facilities.	3 y	DTIC, DSI	DTIC, DSI
7.3	Direct investment	Voluntary situation of manufacturing capacity investments in Just Transition hotspots by Eskom, GVCs, emerging suppliers and pivoting local industries.	8 y	Industry, Eskom	Industry, Eskom
7.4	Incentivise through public procurement / Eskom	DMRE, IPPO, NT evaluate merit to geographically focussed procurement round and/or procurement criteria to support JT objectives.	3mo – 3y	DMRE	IPPO, Eskom

7.5	Incentivise through non-REIPPPP procurement	Voluntary procurement requirements to incentivise local manufacturing	8 y	Corporate offtakers, Eskom, munics	Corporate offtakers, Eskom, munics
7.6	Stimulate regional demand	Voluntary and incentivised development of RE generation capacity in hotspots. Explore concessional finance to enable.	8 y	DMRE	IPPO
7.7	Incentivise private sector procurement through capital and corporate objectives: Cross-reference same action for Transformation, hotspots				
7.8	Competitive rates for factory investment capital: Cross-reference same action for Transformation, targeted to hotspots				
7.9	Cross reference other workstreams' focus (new entrant support, skills, local content policy)				
8. Skills and technology transfer					
8.1	RE sector skills platform that iteratively links demand-led skills development with industry needs.	1. Set up steering committee 2. Identify a host, secure funding, 3. Appoint implementer and roll out programme as described in scope: connect industry and relevant institutions (e.g. TVETs), maintain platform for placements, ongoing audit and assessment.	1. 3 mo 2. 6 mo 3. 4 y	Labour, Industry, DHET	Implementer to be appointed (e.g. as with High Gear)
8.2	Proactive training of foundational skills	1. Identify relevant foundation skills as communicated through DHET Masterplan support process (action completed in DHET forms) and further engagement with industry if required. 2. DHET to further define actions required for implementation	2 y	DHET	DHET
8.3	Demand-led training	1) Industry to introduce/scale up internal training programs partnering with government training providers and including bursaries, internships, apprenticeships and mapping clear skills development and employment pathways for trainees. Clarify whether there are any tax benefits or incentives for industry to set up / scale these programmes. (National Treasury). 2) Roll out the determined programmes	1) 1 y 2) 8 y	Industry, National Treasury	Industry
8.4	Pivot existing skills in transition areas	1. Identify priority skills to pivot, design and implement programme. Minerals Council, Eskom and incumbent industries in collaboration with existing initiatives inter alia CSIR, Res4Africa, TIPS, GIZ. 2. Existing industries and institutions (including TVETs) assess their current offerings, adapt as needed and actively contribute to the reskilling.	1. 1 yr 2. 1 yr	TVET, Eskom, Minerals Council, Labour unions.	TVET, Eskom, Minerals Council, Labour unions.
8.5	Build a system to enable technology transfer	1) Project team of Labour, DTIC (a representative to look across the various initiatives in DTIC), DSI, DHET, DMRE for policy position to establish the cross-cutting initiatives and coordination to enable technology transfer. 2) Roll-out TTS, with possible state-funding. Early coordination between the state and OEMs to focus on improvements on the manufacturing process and cost reduction as opposed to product innovation.	1) 6mo 2) 5y	Cross-departmental, OEMs, labour	Cross-departmental, OEMs, labour
8.6	Target the above to for inclusivity				
9. System readiness					
9.1	Enable diversified offtake in small scale embedded generation	Build capacity of distribution licensees (e.g., Municipal distribution entities) to accommodate smaller-scale distributed generation projects).	1 y	DMRE,	NERSA , Municipalities
9.2	Enable diversified offtake in municipalities and private sector through wheeling and trading frameworks	Enable establishment of- and red tape-reduction toward national wheeling and trading frameworks, including for local municipalities	1 y	DMRE	NERSA, Municipalities, Eskom
9.3	Invest in transmission and distribution infrastructure to enable best wind and solar resource deployment	Build-out new transmission and distribution infrastructure, leveraging access to concessional finance to enable.	15 y	Eskom	Eskom

2. SAREM task team members

These are the current members of task teams as of the date of this document working to articulate each work area in implementable form during plan formulation. Some of these teams' membership evolves with the specific matters being worked upon. Task teams during implementation phase would be decision-makers, implementers and champions from social compact partners.

		Name	Organisation
1.1 Current Market Certainty	Industry	Hemkant Limaye	LM Wind
	Industry	Lourens Vermaak	Trina Solar
	Industry	Etienne Gerber	POLARIUM
	Industry	Pierre Venter	BASA
	Industry	Fanele Mondi	EIUG CEO
	Labour	Ntshebele Mankge	AMCU
	Labour	Lucky Moni	CEPPWAWU
	Labour	Tony Ehrenreich	COSATU
	Government	Thabang Audat	DMRE
	Government	Bernard Magoro	IPPO
	Government	Vikesh Rajpaul	Eskom - Renewables
	Government	Thami Klassen	dtic Spatial Ind Devt, Economic Transformation
	Government	TBC	DTIC Trade & Industrial policy
	Other expert	Jarrad Wright	CSIR
1.2 Future Market Growth	Industry	Mike Levington	NAVITAS
	Industry	Alex Vogel	SASOL
	Industry	Steve Nicholls	NBI
	Industry	Suren Rajaruthnam	Anglo Platinum
	Government	Somila Xosa	DSI
	Government	Mahandra Rooplall	IDC
	Other expert	Thomas Roos	CSIR
2. Industry Transformation	Industry	Hope Mashele	BEPA
	Industry	Marubini Raphulu	Kona Energy
	Industry	Viren Gosai	Art Solar
	Industry	Martin Aldworth	Hulamin
	Industry	Sabine Dall'omo	Siemens
	Labour	Maja Mpahlehle	NUM
	Government	Takalani Tambani	dtic (BI Programme)
	Government	Jacob Maphuta	dtic (BBBEE)
	Government	Elizabeth Marabwa	DMRE
	Government	Winnie Mamatsharaga	DMRE
	Government	Maduna Ngobeni	IPPO
	Other expert	Tafadzwa Mudyiwa	Letsema

		Name	Organisation
3. Local Content Policy	Industry	Hammaren Govender	Vestas
	Industry	Mikhail Nikomarov	Bushveld
	Industry	Gerald Borcherds	Seraphim
	Industry	Janek Winand	Siemens Gamesa
	Industry	Pierre Venter	BASA
	Industry	Hein Reyneke	Mainstream
	Industry	Mark Dixon	Actom (Steel)
	Industry	Colin Little	(Steel MP)
	Industry	Maloba Tshehla	ED Platform
	Labour	Lucky Moni	CEPPWAWU
	Government	Manqoba Simelane	NT
	Government	Gerhard Fourie	dtic
	Government	Thuli Dlamini	IPPO
	Government	Busi Mkhize	Eskom
	Government	Sumaya Nassiep	Eskom
	Other expert	Lucy Chege	DBSA
4. Input Materials	Industry	Frans-Willem Vermaak	Lumax
	Industry	Viren Gosai	Art Solar
	Industry	Daniel Erasun Mora	(GRI)
	Industry	Hammaren Govender	Vestas
	Industry	Martin Aldworth	Hulamin
	Industry	Das Lingum	Hulamin
	Industry	Henk Langenhoven	Minerals Council
	Industry	Jan Kotze	Arcelormittal
	Industry	Franck Wandji	Arcelormittal
	Industry	Luigi Guerra	Elettronica Santerno
	Labour	Melanie Roy	Numsa
	Government	Nyakallo Dlambulo	dtic
	Government	Thandi Phele	dtic
	Other expert	Philippa Rodseth	Manufacturing Circle (for aluminium also)
5. Export	Industry	Daniel Erasun Mora	GRI
	Industry	Kaloyan Dimov	SolarMD
	Industry	Louise Paulsen	Vestas
	Industry	Gerald Borcherds	Seraphim
	Industry	Stephen Liasides	Alvern Cables
	Labour	Ashley Benjamin	Fedusa
	Government	Gerhard Fourie	dtic
	Government	Annelize v.d. Merwe	dtic
	Government	Joseph Senona	dtic
	Government	Luke Govender	dtic
	Government	Mkhululi Mlota	dtic
	Government	John Rocha	dtic
	Government	Marius Collins	ITAC
	Government	Lerato Mataboge	dtic (delegations?)

		Name	Organisation
6. System readiness	Industry	Simon Pickett	Eldo
	Industry	Marc-Henri Veyrassat	EnPower
	Industry	Nikolai Germann	EnPower
	Industry	Simon Haw	Sola Group (wheeling)
	Industry	Sue Rohrs	Rohrslaw
	Industry	Ethel Teljeur	ex NERSA - trading
	Industry	Nhlanhla Ngidi	AMEU
	Industry	Silas Mulaudzi	AMEU
	Government	Moefi Moroeng	NERSA
	Government	Andrew Etzinger	Eskom Tx
	Government	Azwimbavhi Mamanyuha	Eskom Dx
	Government	Mthokozisi Mpofu	DMRE
	Government	Pervelan Govender	IPPO
	Government	Paul Vermeulen	CityPower, SAESA
7. New Entrant Support	Industry	Hope Mashele	BEPA
	Industry	Viren Gosai	Art Solar
	Industry	Pierre Venter	BASA
	Industry	Lucy Chege	DBSA
	Industry	Itumeleng Mphahlele	I-G3N
	Industry	Valentino Adams	CS Renewables
	Industry	Luigi Guerra	Elettronica Santerno
	Industry	Angelina Mohanpersadh	Goldwind
	Government	Mahandra Rooplall	IDC
	Government	Bernard Magoro	IPPO
	Government	Pervelan Govender	IPPO
	Government	Thulisile Dlamini	IPPO
	Government	Shareen Osman	DTIC (Industrial Finance branch)
	Government	Nomvuyo Guma	NT (Economic Policy division)
8. Local Manufacturing Competitiveness	Industry	Tembela Caza	ACTOM
	Industry	Leon Viljoen	RESEF
	Industry	Gerald Borcherds	Seraphim
	Industry	Wido Schnabel	Canadian Solar
	Industry	Daniel Erasun Mora	GRI
	Industry	Mikhail Nikomarov	Bushveld
	Industry	Stephen Liasides	Alvern Cables
	Industry	Luigi Guerra	Elettronica Santerno
	Labour	Riefdah Ajam	Fedusa
	Government	Nyakallo Dlambulo	dtic
	Government	Thandi Phele	dtic
	Government	Kgashane Mohale	IDC

		Name	Organisation
9. Skills Development	Industry	Hlengiwe Radebe	SAWEA ED workgroup, Globleleq ED
	Industry	Stephen Liasides	Alvern Cables
	Industry	Rifquah Hendricks	juwi Renewable Energies
	Industry	Hemkant Limaye	LM
	Labour	Gideon du Plessis	Solidarity
	Labour	Melanie Roy	NUMSA
	Government	Helen Brown	MerSeta
	Government	Sebolelo Chabane	MerSeta
	Government	Ms Tsholofelo Mokotedi	EWSETA
	Edu	Arnold Rix	University of Stellenbosch
	Edu	Ben Groenewald	CPUT
	Edu	Robin Naidoo	Northlink College
	Edu - transition	Jannie Pretorius	Gert Sibande TVET College, Mpumalanga
	Other expert	Naim Rassool	Independent
	Other expert	Beth Dealtry/ Shivani Singh	NAACAM
10. Just Transition hotspots Integration	Industry	Tommy Garner	RE developer
	Industry	Henk Langenhoven	Minerals Council
	Industry	Christian Teffo	Minerals Council
	Labour	Lebogang Mulaisi	COSATU
	Government	Thami Klassen	dtic Spatial Ind Devt, Economic Transformation
	Government	Gerhard Fourie	dtic
	Government	Ilze Baron	dtic
	Government	Ntokozo Ngcwabe	DMRE
	Government	Garrith Bezuidenhoud	DMRE
	Government	Mandy Rambharos	Eskom
	Other expert	Gaylor Montmasson-Claire	TIPS

Annex B
FULL EXPLANATORIES

1. SWOT analysis

A SWOT analysis, drafted out of the research phase and complemented with emerging insights, can be divided into the elements particular to localisation in general and industrialisation in particular. The initial indicators of areas of opportunity are then identified in primary sectors. These tables draw largely on Morris *et. al* 2020.[1]

1. 1 SWOT analysis of localisation and elements shared with industrialisation

Strengths	**Weaknesses**

• Strong specialised services (e.g. environmental studies, legal services, structuring financials deals, engineering design, location assessment)
• Local experience in balance-of-plant (BOP) (i.e. civils, transport & erection, grid integration) and in manufacturing of BOP components (esp. electrical components for grid integration)
• Reasonably diverse representation of OEMs in country – renewable energy market beyond “emerging” stage[1]
• Proximity to- and established trade with- Sub-Saharan African (SSA)
• Relatively strong industrial sector and manufacturing capacity amongst Sub-Saharan African countries and SADC in particular.
• Strong finance sector with extensive experience in structuring of project finance both in SA and SSA
	• Policy context
	  • Lack of energy policy certainty / long term reliability / continuity and predictability in growth of market
	  • Lack of policy (implementation) certainty with regard to renewable energy allocations and procurement (bid windows in auctions) and market structure limiting bulk of market demand to REIPPPP
	  • Slow planning cycles that do not correspond to the dynamics of demand and supply
	  • Government and industry interactions focused primarily on compliance (rather than a strategic agenda)
	  • Complex business environment / low ease of doing business
	• Manufacturing enablers
	  • Policy instability leading to economic instability and exchange rate volatility
	  • Lack of energy security / load shedding
	  • Financial viability of primary buyer / off-taker (Eskom)
	  • Relatively expensive local finance compared to international finance

Opportunities	**Threats**
• Export revenue through strong specialised services (e.g. environmental studies, legal services, structuring financials deals, engineering design, location assessment)	• Localisation and industrialisation • Reduced economic growth expectations (in part due to COVID-19) leading to lower local energy demand than considered in energy planning

There is diverse representation of OEMs in South Africa, and the renewable energy market is no longer “emerging”; however, renewable energy manufacturing can still be considered as nascent or emerging.

1 Morris, M., Robbins, G., Hansen, U., and Nygaard, I. 2020. Energy and Industrial Policy Failure in the South African Wind Renewable Energy Global Value Chain: The political economy dynamics driving a stuttering localisation process. PRISM Working Paper 2020-3. Cape Town: Policy Research on International Services and Manufacturing, University of Cape Town. Available from: http://www.prism.uct.ac.za/prism/Working-Paper-Series

1. 2 SWOT analysis of industrialisation

Strengths

- Nascent renewable energy local component manufacturing industry (steel and concrete towers, solar module assembly)
- Access to local raw materials (e.g. steel, aluminium)[1]
- Manufacturing base in selected allied industries (e.g. structural steel, electrical equipment, fibreglass)[2]
- Special economic zones (SEZs) (including one Green Tech SEZ) and associated incentives

Weaknesses

- Policy context
  - Limited alignment between energy and industrialisation policy
  - Local content rules that focus on total spend rather than specifically tailored to industrialisation (i.e. focussing on content)
  - Local content rules that focus on quantum of employment rather capacity being built
  - Limited integrated industrial policy and support mechanisms (incl. lack of renewable energy specific support mechanisms)
  - Limited government support for localising technology suppliers and increasing technology capacity
- Market context
  - Relatively small local renewable energy market at great distance from other high growth markets
  - Due to delays in establishing local manufacturing, potentially missing the global renewable energy industrialisation window of opportunity
- Manufacturing enablers
  - Relatively weak industrial base and weak supply fields (e.g. steel, metal casting, electronics assembly)[3]
  - Cost of material inputs to renewable energy manufacturing and particularly steel and aluminium.
  - Low level of technology intensity in the market
  - Relatively limited R&D capability (technologies and manufacturing processes)
  - Shortage of required technical skills
    Applies to localisation as well.
  - Relatively unpredictable and expensive labour (compared in particular to Asian economies)
  - Skills base skewed to unskilled labour
    Majority of labour in renewable energy value chains is skilled labour and there is currently a shift to knowledge intensive services and higher order production capabilities in renewable energy value chains.
  - Other factors that reduce global competitiveness (compared in particular to Asian economics):
    relative expensive of electricity, relative expense of property rental, relative expensive of capital and relative cost of overheads

Opportunities

- Expansion of local steel and aluminium manufacture, provided cost can be reduced to be cost competitive with imports.
  For example, for the IRP2019 build, it is estimated that there is a potential for 5% (Wind: 4%, Solar PV 1%) increase in annual local steel production, which would contribute about 2.2 billion to GDP and create over 700 jobs.[4]
- Toll manufacturing facilities that allow production for more than one project/OEM so as to enable local manufacturing in response to the current nature of procurement of utility scale renewable energy in South Africa (i.e., local content requirements for concurrent projects with short lead times and considerable upfront uncertainty with regard to whether local manufacturing capacity will be utilised).
- Expanded manufacturing and export of small scale/embedded generation renewable energy technologies (particularly, small scale wind turbines, biogas digesters)

Threats

- Lower margins in industry leading to reluctance of OEMs to share technologically advanced and knowledge elements of value chain
- Competitions from other emerging economies: many other developing / emerging economy countries have increase own renewable market and put in place mechanisms to promote localisation
- Possible oversupply of renewable energy manufacturing capacity globally which could make it difficult to achieve local manufacturing profits or justify development of manufacturing capacity in a new region.

Notes:

1. There are some concerns regarding the relative cost of local raw materials
2. There has been a decline in manufacturing in the last decade, and there are contradictory views on the ability of the local industries to produce at the quantity and quality required by the renewable energy industry
3. There are contradictory views on the ability of the local industries to produce at the quantity and quality required by the renewable energy industry
4. Estimate based on IRENA (2017a, 2017b) and South African Iron and Steel Institute factors per 1000 tonne steel (Engineering News, 2020)

1. 3 Opportunities in solar PV

1. Additional module manufacturing. The business case for new entrants may not be strong based on local demand only, given currently established (dedicated OEM and toll) module manufacturing capacity.
2. Expansion of aluminium module frame and junction box manufacturing facilities, provided cost of aluminium can be reduced to be cost competitive with imports.
3. Inverters
   3.1. System assembly with core imported products and some local components, as well as manufacturing under license. This would require support to local producers to meet quality standards and access to testing and certification locally.
   3.2. Expanding magnetics production and support through additional milling capacity
   3.3. Expanding transformer production through reductions in input material costs (especially steel), and support for improvement in efficiencies to meet the standards expected by international inverter manufacturers.
   3.4. Expanding of enclosure and packaging production.
4. Mounting structures are more readily localised due to the high cost of transport but are relatively lower value components of a solar PV system.
5. Expansion of production of steel and aluminium mounting structures, provided steel-production and aluminum extrusion production capacity can be expanded, support provided for tooling and cost of these inputs reduced to be cost competitive with imports.
6. Small scale embedded generation renewable energy technologies
7. Expansion of cable production by expanding local production of conductors, insulation, and armour, provided input material costs (steel, aluminium, and polymers) are addressed. Local aluminium rod production could boost to local cable production.

1. 4 Opportunities in wind

1. Additional wind tower and tower internal manufacturing
2. Local nacelle assembly (even if initially largely from imported components) is an important enabler of higher value local turbine component manufacturing. Local nacelle assembly could also enable expansion in existing casting, forging and transformer production if capacitated for renewable energy component production. However, it should be recognised that the localisation potential of all these components is currently considered medium rather than high.
3. Expansion of cable production by expanding local production of conductors, insulation, and armour, provided input material costs (steel, aluminium and polymers) are addressed. Local aluminium rod production could boost to local cable production.

2 Comparator economy analysis

Comparator economies considered to have relevance to South Africa's case are driving, or have driven, renewable energy industrialisation, not only renewable energy uptake. These could be considered comparable to South Africa based on level of development and level of industrialisation (using indicators such as manufacturing contribution to GDP).[2] China is included as a member of the BRICS group of countries and due to its success in renewable energy industrialisation.

2.1 Common success factors for renewable energy industrialisation

The following summarises the five common factors in countries that have successfully established local renewable energy manufacturing:

1. Size of local market and longer-term visibility of / certainty in local market
   - Wind: 400 MW/facility/year for 5 years; solar PV: 300 MW/facility/year for 5 years
   - Can be smaller for countries close to large export markets (e.g., Morocco, Tunisia, Turkey)
2. The establishment of "local content requirements" (with the exception of Denmark)
   - To (initially) protect "infant industries" and attract foreign investment
3. Industry support mechanisms and government investment
   - Includes (a) training; (b) diffusion of best practice (e.g., through clustering); (c) standards and means of testing and certification; (d) R&D (financial support & public programmes)
4. Export aid
   - Includes trade promotion, export credits, and binding commitments for export as part of local content requirements
   - Successful countries export 60-80% of production (e.g., Morocco local market = 30% of production of blades)

5. Consistency with the industrial strengths of the country
   - Existing capabilities: leveraging local strengths in existing or related industries
   - New capabilities: initially leveraging off foreign companies through a range of mechanisms (local subsidiaries, joint-venture, licenced production)

2.2 Mechanisms to support localisation

There are several mechanisms to support the development of local renewable energy markets globally. The most common for utility/large scale systems are: feed-in tariffs (FITs)/ premium payments and tendering/competitive auctions. The most common for smaller scale systems are: feed-in tariffs and net metering. There has been an increase in the number of countries that use tenders/competitive auctions, but, in 2019 there were still more countries with feed-in tariffs than countries with auctions (REN21, 2020). Some countries use only one, both simultaneously, or have changed over time from one to the other. Within both mechanisms, local content requirements (LCRs) can be used to enable renewable energy localisation and industrialisation. The degree to which the FIT or auction design, specific LCRs and other supporting mechanisms are aligned has a strong influence on the nature, extent, and success of the establishment of local manufacturing capacity.

Other factors that play a role in the success of LCRs to drive localisation and industrialisation include market size and stability, policy design and coherence, restrictiveness of LCRs and the industrial base (Hansen et. al. 2019). In the case of auctions, it was found that cost of capital, resource and expected commercial operating date (COD) may have a stronger influence on electricity price than factors such as local content, concessional finance, guarantees and site selection (Kruger et al. 2018). Innovative project de-risking and financing strategies could be used to address cost of capital (Kruger et al. 2018), while COD is a variable over which the procurer has some control, among others, through good planning. There may thus be means within the auction design process that could help to reduce potential cost premiums for locally manufactured goods.

LCRs protect local manufacturing industries to assist in their development but can also be a hindrance to global competitiveness. The appropriately timed ending of LCRs is thus important to incentivise the local manufacturing industry to achieve the level of efficiency and quality required for global competitiveness. Local renewable energy manufacturing can be established without local content requirements. Market certainty is the key determinant of success under these circumstances (Kuntze and Moerenhout, 2013). When the US introduced stability into its wind energy support schemes, the domestic content of wind projects grew from 25% in 2006 to more than 60% in 2011, without LCRs (Kuntze and Moerenhout, 2013). It is worth noting that LCRs were also introduced in some US states, so not all US renewable energy industrialisation was done in the absence of LCRs. However, local manufacturing was promoted without LCRs when market stability and a combination of consumption support and production support was provided.

Such market certainty can be enabled by stability in renewable energy consumption support (e.g. feed-in tariffs, tax credits, loan guarantees, cash grants) (Haley and Schuler, 2011). All of these renewable energy consumption support mechanisms were used in the US. Tax credits proved to be a key enabler in the US context. In the case of solar PV, protection mechanisms were also used. These included tariffs on imported solar cells and countervailing duties on Chinese solar companies to prevent product dumping. Although protection mechanisms (e.g. tariffs on imports) have been used to "support" local manufacturing, a wide range of more pro-active production support mechanisms can be used (e.g. low interest loans to invest in plants and equipment, export credits, R&D assistance) (Haley and Schuler, 2011).

Firms' strategies in terms of local manufacturing will depend on the combination of renewable energy consumption and production support mechanisms. For example, where there is consumption support and no production support, there is a tendency to import, rather than manufacture locally and/or build a local industry that exports (Haley and Schuler, 2011). To effectively enable a sustainable local renewable energy manufacturing industry to develop, it is important to understand the effect of different combinations of consumption support and production support (Haley and Schuler, 2011).

Table 2-1: Comparator economies[3]

Indicator	South Africa	Brazil	Russian Fed'n	India	China	Argentina	Morocco	Turkey
Population Size	58.6 million	211.1 million	144.4 million	1 366 million	1 398 million	44.9 million	36.5 million	83.4 million
GDP per capita US$ Nov 2020	$6 001	$8 717	$11 585	$2 104	$10 262	$10 006	$3 204	$9 042
Installed RE Capacity in 2019 (MW)	6 167 Wind: 2 094 Solar: 3 061[4]	141 933 Wind: 15 365 Solar: 2 485	52 728 Wind: 102 Solar: 1 064	128 233 Wind: 37 505 Solar: 35 060	758 626 Wind: 366 452 Solar: 205 493	12 689 Wind: 1 609 Solar: 441	3 267 Wind: 1 225 Solar: 734	44 587 Wind: 19 949 Solar: 5 996
Manufacturing (% of GDP in 2019)	12	9	13	14	27	13	16 (2018)	19
Renewable electricity targets	40% of capacity (MW), 33% energy (% of MWh) by 2030	20% of electricity mix from non-hydro RE. Currently expect 28% by 2027	4.5% by 2024	100 GW Solar (60% utility/40% rooftop) 60 GW wind by 2020	35 % by 2030	20% by 2025	42% by 2020 and 52% by 2030	50% by 2023 (revised in 2018 from 30%)

Table 2-2: Suite of policy attempts and their impacts in comparator countries

The country comparisons reveal the suite of policy attempts and their result/impact in countries with similar attributes to South Africa

	South Africa	Brazil	Turkey	Morocco	Russia	India
How local content defined	cost	weight	predefined items	cost	predefined items	predefined items
Import protection designations/tariffs	●		●			●
Thresholds to be eligible to bid	●	●	●	●	●	●
Finance, tax, investment incentive		●	●	●	●	
Tariff price incentive	●		●			●
Flexibility on choice of components	●	●	●	●		
Size of market (based on installed capacity 2019) and form of certainty	◔	●	●	●	●	●
Achievements (what they got)	~45% local content. BoP, towers, PV mounting structures, inverters and a few manufacturers, experiencing difficulty aligning supply and domestic demand and sustaining without export.	Mostly low tech heavy industries such as towers, blades, some nacelle components. Several wind turbine assembly and manufacture plants (13 tower manufacture). High local steel cost drove interest in concrete towers. 34 PV assembly, manufacture	Large localisation of solar (cell, module, invertor, tracking) and wind components (blades, tower, generators)	Mostly BoP and one a blade factory (70% for export). PV mounting structures and cables.	Slow build at high cost (have to build a manufacturing facility for one-off projects). Some joint ventures for localisation.	Low local content, Thin-film imports rose with prescriptive C-Si requirements. C-Si market did not sustain itself and there were WTO challenges.

3 For detailed references on data see GreenCape, *SAREM Interim Research Summary*, 2020.
4 This amount includes PV and CSP. It differs from the IRP and CSIR REIPPPP statistics, but is presented here to be part of a consistent data set from the same source.

2.3 Insights from comparative analysis

Countries with a similar scale and rate of procurement to South Africa are Brazil and Turkey. Argentina, the Russian Federation and Morocco show early signs of success in industrialisation, but the scalability and sustainability of this success still needs to be demonstrated. Key factors contributing to successful localisation in Brazil were lead times for project construction which allowed ramp up of manufacturing (three, four and six years for renewables compared to a typical two years in SA[5]) and LCRs that were not obligatory but allowed access to very favourable concessional finance.

It took about 12 years (1997–2009) for China to establish extensive value chain manufacturing and the ultimate dominance of its local turbine developers in its local market. Thereafter LCRs were discontinued. Apart from LCRs, key enablers were the very large local market and strong manufacturing base.

Countries with very stringent requirements for ownership/local partnership, setting up local manufacturing facilities and transfer of intellectual property are the Russian Federation and Turkey. Both support this with complementary mechanisms/incentives (financial and non-financial).

Countries that have "winner-takes all" bidding/award multiple projects to single or limited bidders (e.g. Morocco, Turkey YEKA/REZ system) provide economies of scale to developers/OEMs to enable the setting up of local manufacturing facilities. The attendant combination of enabling lead times, stipulations for setting up local manufacturing facilities and accompanying support lead to notable investment in local manufacturing of several components (Morocco) and more extensive value chain development (Turkey). Site selection, permitting and development by government (Morocco, Turkey YEKA/REZ system), including renewable energy parks (Morocco) have been an enabler particularly in "winner-takes-all"/limited award contexts.

Flexibility in how LCRs are met has been a key enabler in countries which have established local renewable energy manufacturing (Brazil, Argentina, the Russian Federation, Morocco, Turkey). The mechanisms for this flexibility differ from LCRs being a condition of access to concessional finance (Brazil, Argentina) or special tariffs (Turkey YEKDEM system), ability to make local content "offers" (the Russian Federation, Turkey YEKA/REZ system, Morocco) and innovative contracting arrangements (the Russian Federation, Turkey YEKA/REZ system).

Since export of 60-80% of production contributes to the business case for investment in production facilities, those countries with access to large markets (e.g. Morocco, Turkey) have an advantage in attracting investment in local manufacturing.

By 2018, SA had the largest auction programme in Sub-Saharan Africa (SSA): 6300MW multiple renewable energy technology programme vs 20-100MW individual solar PV projects in other SSA countries[6] and most stringent LCRs (min 40% vs 5-20% in other SSA countries) consistent with market scale, expected ability to provide products and services, and relative emphasis on cost-effective pricing (Kruger et al. 2018)

2.3 Renewable energy industrialisation contributions to a Just Transition

Creating localised green decent jobs, including through decentralised energy and energy efficiency are key Just Transition implementing measures internationally. Understanding the country context is important when looking to learn from other countries. Just Transition experiences to date are primarily from wealthier countries, so adaptation to the developing country context, and specifically to the local context, is critical. Successful transitions can take considerable time (e.g. the Ruhr region of Germany took 60 years to go from a coal and steel industry dominated region to being a renewable energy and clean technology leader in Germany and internationally).

Renewable energy infrastructure and supply chains can contribute to diversification of regional economies in transition areas, particularly where these can build on related existing industries and businesses. Public procurement and sustainable infrastructure projects are key measures for job creation in transition areas.

Multi-stakeholder contribution to strategic considerations that inform planning ensures relevance and validity and supports implementation. Organised Labour have been key champions of transition planning and implementation, e.g. in Canada.

Public and private sector skills development is important for the redeployment of workers and the creation of income opportunities for workers, their families and communities. Investment in educational institutions and technology development increases a region's ability to become a significant player in the global renewable energy value chain.

5 Such longer lead times may have been enabled by the concessional finance provided in Brazil. There is thus merit in gaining better insight in the relationship between cost of capital, COD and the other variables that affect auction electricity prices (see earlier point drawing on Kruger et al. 2018). However, with sufficient size and continuity of market, and attendant establishment of local manufacturing capacity over time, lead time to set up new local manufacturing capacity to meet the procured capacity for new auction is likely to become of lesser significance.

6 Note: other technologies have been enabled via feed-in tariffs schemes (e.g. hydro and biomass in Uganda) and there are a number of large scale non-auction/non-FIT wind investments in SSA (e.g. Kenya, Ethiopia) where procurement has been done through mechanisms such as direct negotiations.

Utility scale and small scale renewable energy infrastructure and renewable energy manufacturing can be key enablers of socio-economic development in coal-mining and coal-based power generation regions in South Africa. Drawing on international case studies, this could be through, for example:

- Adaptation of existing industries and infrastructure: coal mining companies and coal-based power generators can become renewable energy generators (e.g. mining companies / mines sites becoming renewable energy generators; coal-based generators converting to biomass)
- Adaptation of existing supply chains to become renewable energy component suppliers: for example, gearboxes for mining equipment expertise adapted to gearboxes for turbines, steel industry pivoting to wind power manufacturing.
- Creation of renewable energy markets through stimulating local demand for green technologies: for example energy efficiency projects in industry, building retrofits for energy efficiency, community-based renewable energy generation.
- Conversion of existing industrial sites to renewable energy technology and manufacturing hubs

3. Factory investments: what happened and why?

The business case for establishing a manufacturing facility could be premised on two assessments of the offtake market: invest when securing an offtake contract versus investing in long-term market certainty (Table 3 2). In either case, the long-term market certainty is a baseline requirement, at least to the extent that is securing an initial offtake contract tips the scales on the investment decision. In GRI's R450 million investment in a tower manufacturing plant in a joint venture with 25% Black ownership, the business case was possible by mitigating risks around an "invest-when-win" approach. Timing of construction approvals was brought to a minimum by coordinating municipal departments with the result that production began within 11 months of the investment decision. With momentum building from round to round, market certainty grew, and other investments were made on the longer-term expectations around the rollout of the procurement envisaged under the IRP.

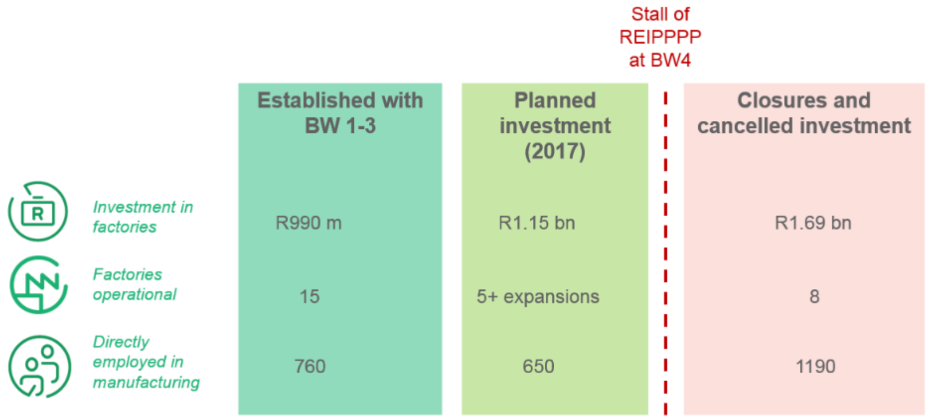
Table 3-2: Business case drivers: winning bid versus long term market

Invest-when-win	Invest based on market certainty
▪ Manufacturers wait until given either Preferred Bidder, Financial Close or Notice to Proceed ▪ Requires very tight timing on ramp-up to production capacity ▪ Very little line of sight to future capacity ▪ Timing is fully based on bid commitments ▪ Risk carried by the chain of contracting: supplier -> OEM -> EPC -> bidder ▪ Factors outside the control of the manufacturer require mitigating risk, e.g., delays in building plan approvals	▪ Manufacturers invest based on confidence in the potential market size and market share ▪ Has been effective in some markets, demonstrated pre-Bid Window 4 in South Africa ▪ The feedback loop is delayed – such certainty only grows after several cycles of procurement demonstrated, and the market is more risk-averse since BW4 stalled ▪ Requires mitigation of risk of uncertain cycles of procurement

Data from interviews with key component manufacturers showed a promising growth trajectory[7]. This was interrupted by market uncertainty at the stalling of Bid Window 4. The business case for investment in the long-term market opportunity was eroded when it was demonstrated that the procurement programme was exposed to interruptions that would compromise a sustainable pipeline of factory offtake.

7 TIPS Policy Brief, April 2021: 12. As of December 2019, the REIPPPP had, for instance, generated R53.7 billion local content expenditure, achieving 50% local content (IPP Office, DBSA and NT, 2020).

Figure 3-1: Effect of market certainty on industrialisation investments



Data compiled from interviews with active investors and manufacturers in the market[8] showed a market base of R990 million invested in manufacturing facilities on the back of bid windows 1 to 3, 15 operational factories and 760 employees. The stalling of the procurement programme saw some R1.69 billion in closures and cancelled investments, with a lost opportunity of over 1,000 jobs. These numbers do not include the business rescue proceedings of several major construction and balance plant companies that ensued. It serves to illustrate the power of market certainty in driving the business case for investment.

4. Market certainty

4.1 Context in the evolution of the market for renewable energy in South Africa

Market certainty was identified as the most important work area. Developers need to understand the framework for competition, Manufacturers need to build the case to invest and develop the necessary skills and teams to execute. Government aims for predictability and a long-term relationship with the industry. Banks, finance houses and unions need certainty to position their actions and interventions to optimise their contributions.

Systematic certainty entails the conditions for predictability such as in the roll-out of bid rounds and the processes to financial close of projects. Certainty requires a consistent approach. For the system to settle into a working state, a consistent approach is required. As efforts to work outside the system fail, this builds the kind of feedback that enforces such certainty and, provided it converges toward success and failures don't propagate, it settles into a working state than only requires refinement over time. To date, with around one hundred REIPPPP projects completed successfully, the lack of failures creates the context or impression that there is always space for a negotiated settlement, a best-and-final-offer post preferred bidder. This introduces a source of idiosyncratic uncertainty.

The source of market certainty in South Africa has a short term, medium term and long-term context to it. It can be viewed against the backdrop of how the market for renewable energy capacity may evolve and how the mechanisms by which it is procured evolves in these timeframes.

In the medium- to long-term, the IRP would be expected to evolve, following re-evaluation of the national demand and the inputs to the modelling that informs it at intervals. Market certainty as it pertains to the MW to be commissioned hence rests on the IRP, in its current timescale, plus certainty on factors that may see it evolve in the long term. Such long-term evolution may be affected by major shifts in the energy mix such as in the phased retirement of some 22GW of Eskom's existing coal fleet by 2035 and growth of potential adoption of electric vehicles, replacement of thermal loads with electrical and a future market for export of green hydrogen. Certainty on the implementation of the IRP rests in the mechanisms for capacity to roll out and in turn this informs the certainty on the demand for local components and services to commission such capacity.

Implementation of the IRP is defined by the oversight of the DMRE, which pronounces on procurement through such public procurement mechanisms as the REIPPPP. Such public procurement may contain requirements and incentives for supporting policy objectives, such as localisation. In the shortest time horizon, potential investors in manufacturing capacity may be focussed on the opportunity embedded in the most immediate and certain form: the present REIPPPP bid window, its RFP requirements and whether they are a winning bidder. In the medium term it would be on a view to how consistently such bid windows are implemented and with what consistency on local content requirements.

8 DTIC/GreenCape 2017, RE Closures_Retrenchments 2017 data.

Outside of the REIPPPP, municipalities have growing ability to procure their own capacity and further, outside of all forms of public procurement, customer-driven capacity choices are beginning to play a growing role with the private sector procuring their own power. SSEG is seeing MW-scale growth year on year and the lifting of the threshold on generation licence requirements to 100MW signals a possible tipping point, with major corporate players opting for their own generation capacity. What private sector procures is expected to be roughly aligned with what market forces are driving: lower carbon intensity requirements of financiers and offtakers, especially for export of products to foreign markets, combined with lower cost per kWh mean a growing preference for renewable energy. Eskom's own decisions around what to procure as an offtaker and what to develop itself will be informed by reading this market and understanding where its strategic offering to major consumers lies. What these trends point to is that primary determinants of market certainty around renewable energy procurement are clearly dominated still by DMRE's implementation through such mechanisms as REIPPPP in the short term horizon, with a shift thereafter to a more diversified market. In the long term, certainty may come from a market setup where capacity is privately procured, and the system operator goes out to ask for players to come in.

4.2 Building a framework for market certainty

In the long term, market certainty rests securely on two elements: trust built on the momentum established in the roll-out of the IRP and the scale of demand that will come with the amount of capacity growth required to fill the gap left by Eskom's scheduled ~22GW coal fleet retirement by 2035 and a trend to electrification of transport and thermal loads combined with power-to-x and production of green hydrogen. The sheer scale of this demand (estimated more than 150GW renewable energy by 2050) would be sufficient to offer a case for producing locally with efficiencies of scale. Coming out of a period of building local capacity and establishing local core competencies, there would be an offering that has established its competitiveness. For this trajectory to be clear, stakeholders need to know the policy position of South Africa, with respect to climate change. As communicated by one labour union representative, government's position on climate change will inform the energy mix going forward and this will help the market understand where it stands with regard to the growth of demand for components and services.

In the short term, the market relies on public procurement rolling out reliably with consistent requirements or incentivisation of local content in the bid rules. At this time, without the momentum in place yet, some measures of import substitution are required. The market will respond to this framework where it is consistently applied, with sufficient timeframes between bid rules and commercial operation. This can also be achieved by setting the bid rules for several rounds at once. Consistency is key in respect of having a level playing field. With a level playing field, developers and manufacturers alike have a business case for local investment. Where exemptions are applied on designated components, the business case for local suppliers being able to compete is disrupted.

What happens in the medium term, between the certainty of rounds of public procurement such as the upcoming bids round of REIPPPP and the long-term momentum? During this period, the levers for incentivising procurement of local components cannot sit alone in public procurement and a conducive environment is required, regardless of the specific procurement mechanism. Trade and industrial policy come to the fore here to encourage export and promote local competitiveness and are where the market will look for building a sustainable business case.

Within the three timeframes, the steps toward establishing market certainty motivate actions in time frames:

1. Short term: build confidence through REIPPP implementation
2. Medium term: create competitive environment through trade and industrial policy
3. Long term: build momentum and grow demand

4.3 Mitigating against market uncertainty risk

Investment always carries an inherent risk, and a business case will weigh these up against the opportunity and consider ways to mitigate such risk. A well-crafted commercial contract will allocate risk where the ability to control it lies. Providers of capital will price in risk into their valuation models' discount rate and into their return expectations on debt or equity.

It has been discussed above how the timeframe is a key factor in the nature of the risk. Investors considering a factory establishment or expansion must consider whether they are making a play on the background market certainty or on a concrete order book, such as may be secured from a successful bid into REIPPPP. In practice it is typically a combination of both, wherein an anchor order of sufficient size tips the scales toward a longer-term play. The challenges of securing such binding orders prior to having the capacity in place are discussed in the task team new entrant support. Amongst the ways of mitigating around a stalling of the public procurement pipeline, where control over such implementation certainty sits with government, are the government-sponsored investment support programmes such as SEZs. Where SEZs could make strategic proactive investment into top structures that would be suitable for renewable energy manufacturers, this would significantly reduce risk around timeframes for ramp-up to production for new production capacity. SEZ operators could ensure these structures are not so bespoke as to rule out allocating to other types of manufacturing. Further consideration of soft terms on leases, where concessions are made in the case of public procurement- or policy-related interruptions to the IRP implementation.

9 UCT, *Estimating impact of local manufacturing on GDP*, 2021. This was a research input to GreenCape.

Certainty also lies in the ability of the offtaker to take on new power purchase agreements. Relying on Eskom as sole offtaker, through the REIPPPP, has been raised as a risk. This is mitigable through introducing offtaker diversity. This may involve enabling of municipal and private generation and procurement of power. The growth of the number of municipal SSEG-enabling tariff structures, wheeling frameworks and the lifting of the threshold on generation licence applications are examples of ways in which this is enabled. These are inherent to the evolution of the market discussed in the section above. Herein, viewed in the light that they help mitigate single offtaker risk, they can be seen as a positive feedback loop to building market certainty. Initiatives to assist with these are discussed in *system readiness.*

5. Exploration of value add to the economy from localising components

The trade-off of domestic economic value add is raised in consultations. Research and modelling inputs to SAREM have explored the relative potential price premiums for local production of key components in South Africa, alongside their gross value add to the economy. These were viewed in combination with a macro-economic model that considers the impact on the economy of capital injected into such a premium. Considering the economic value-add from the manufacturing of key components, the indication of these models is that it is worth exploring localising certain components, notwithstanding that it may incur a level of premium.

There is a spectrum: from components that are on the cusp of competitive to manufacture locally under some conditions of input costs to those that incur some premium; however, where such premiums can be kept manageable by ensuring the market clears efficiently, the gross value-add results in a net positive impact. With future and ongoing data gathering to refine model inputs, it may inform the prioritising of components to support and indicate those that may be inefficient to localise most competitively.

To determine the maximum premium on components that would still provide a net positive impact on the economy, two models are combined:

- Model 1[10] : Toward identifying efficient local production opportunities
  - Indicates direct GDP value add from local production of key components of value chain, applying the SAMs multipliers for that sector.

- Model 2[11] : SATIM-GE model on impact allocation of capital in the economy
  - This model will, by design, show a loss to the economy based on capital spent. It indicates that for every MW built a 1% increase in cost would give a R0.04bn loss to GDP.

- Combined:
  - Using the multiplier compared to the direct GDP creation found in the Model 1 data enables the calculation of the point at which the premium hits a "tipping point" i.e. the maximum premium for a net positive economic impact.

This gives an indication of the results that will be generated when combining the modelling work. It presents the maximum premium for a net positive economic impact. That premium is the inflection point beyond which there is no economic benefit. The economic benefit increases as you move from that premium toward a zero premium.

For example:

- If a wind turbine blade was made in South Africa, it would generate a value-add to the economy through being locally produced. If it costed more to produce locally than imported, that extra cost of capital would mean a loss to the economy. There is a point at which the loss due to that premium is the same as the value-add due to being locally produced. At that point there is no value to the economy to having localised it.

- If the blade was produced locally at no premium it would have maximum local economic value-add. E.g. for an estimated rational subsidy limit of 87%: if the blade costed 87% more to produce locally it would have no net value to the economy. Given the percentage of wind farm cost attributed to the blade, if the wind farm costed 18% more because of local blades there would be no net value to the economy. In between no premium and 87% premium, e.g. if the blade costed 20% more to produce locally, causing the project to cost 4% more, there would still be net positive value-add to the economy.

- The relationship to tariff can then be applied through a project financial model. With a typical sensitivity of 80% between CAPEX and tariff, such a 20% premium on a blade would mean a 3% impact in tariff: so a R0.45/kWh wind farm tariff would become a R0.46/kWh tariff with local blades at 20% premium. At the rational subsidy limit that would be 14% tariff premium, making it R0.51/kWh.

10 Urban Econ, *Toward identifying efficient local production opportunities*, 2021. Sponsored by SAWEP.
11 UCT, *Estimating impact of local manufacturing on GDP*, 2021. This was a research input to GreenCape.

The currently available data gives the conclusion:

1. Current available estimates of local costs for key component and balance of plant are within the range that would incur a net positive impact to the economy if produced locally.

2. In order to maximise net benefit to the economy there should be a framework for procurement and industry support that supports competition and provides downward pressure on local production premiums.

6. Integration with Just Transition hotspots

Contributing to a Just Transition is one of the key objectives of the industrialisation plan. Among the opportunities for job creation and economic value-add, where these can be co-located with hotspots such as Mpumalanga, it will add to diversifying these economies.

Just Transition is a critical concern for labour. It involves a fundamental re-organising of the workforce as some sectors wane and others emerge. In the growth of a new economic sectors and opportunities for employment there is an opportunity for labour unions to secure a trajectory of sustainable employment.

Elements of various other initiatives have captured some of this intent, including the Framework Agreement for a Social Compact on Supporting Eskom for Inclusive Economic Growth, 2020. For most unions, there is a recognition that the transition is underway, and the focus of concern is to ensure that it happens in a just manner. There are many facets to this, and these are expressed in aspects outside the scope of SAREM's influence, including on the structure of ownership and procurement of generation assets in a future evolving energy mix. Within the scope of SAREM, it is of primary importance to ensure that workers have the opportunity to continue to secure sustainable livelihoods and this means creating new economic opportunities and making these readily accessible to all who seek such opportunities, including unions' constituencies. Potential jobs in emerging renewable energy manufacturing constitute one such opportunity. To secure such opportunities, the means to identify such potential placements, prepare the workforce for them, and connect potential candidates will be a key enabler. This opportunity for potential placement in a different sector, in an industry that largely does not yet exist, is an intangible that presents considerable frustration to the incumbent union constituencies facing the transition. This is explored in the skills work area, through two initiatives:

1. Skills development, identifying transferrable skills and leveraging existing institutional capacity to reskill workers employed in the coal sector; and
2. A platform to connect opportunities for placements to those with existing and transferable skills.

The model for implementing this is demonstrated effectively in NAACAM's High Gear, in which NUMSA is an active participant. Solidarity is another union with a proactive skills development approach, including a technical training centre.

In the implementation framework of SAREM, contributing to a Just Transition can be taken to be a cross-cutting objective, in a similar vein to building a transformed and inclusive industry. It should be taken as a lens on the spectrum of possible industrialisation levers, whereby opportunities should be sought to target such levers to encourage integrating with the economies of hotspots. Examples of this can be considered in such elements as skills development, where opportunities are sought to equip the existing and potential workforce in areas such as Mpumalanga with transferrable skills. New entrant support work area initiatives could be targeted to emerging suppliers in hotspots.

Several groupings of levers are explored here: improve competitiveness, direct investment, incentives through procurement and demand stimulation.

6.1 Improve competitiveness in Just Transition hotspots

Where programmes to assist with increasing the competitiveness of local industry by reducing relative cost of infrastructure and cost of doing business, these can be targeted to increase the relative competitiveness in specific areas. These include the likes of SEZs, the 12i tax allowance, Capital Project Feasibility Program (CPFP) and Critical Infrastructure Program (CIP).

SEZs with a renewable energy, or broader Just Transition-related scope, in hotspot areas could encourage locating in these regions. This could be by establishing them in close proximity to areas earmarked for renewable energy development such as the Emalahleni REDZ. Similarly, the eco-industrial park model, also supported by DTIC could be leveraged in repurposing of coal power station sites.

6.2 Direct investment in RE industry in hotspot economies

Where industry has either already made the business case or undertakes to do so, such investments in hotspot regions build the case for transition support and the task team will look to identify such catalytic projects. Eskom has plans underway, for example, to establish a micro-grid manufacturing park at Komati, having elected to move to that location from the original site proposed in order to further the repurposing objective.

Mpumalanga already has a spectrum of existing industries that may be pivoted to supply the renewable energy value chain. To assist such industries to identify the opportunity, these types of manufacturers need to be identified and then linked to potential offtakers through the kinds of new entrant support and on-boarding discussed in new entrant support work area. The Minerals Council's supplier database may be a starting point that the task team could work with.

6.3 Demand stimulation through renewable energy MW development in hotspots

Indications from developers are that more than approximately 3000MW of renewable energy capacity is at various stages of development in Mpumalanga. Such development, where it is not for own consumption or by Eskom, is typically done at risk, pending securement of an offtaker such as via private or municipal PPAs or the REIPPPP. Eskom's estimated grid capacity for connecting such generators stands at 5000MW in Mpumalanga. Solar resources are competitive, and, in some areas, wind resources are sufficient for commercially viable wind farms, albeit less competitive than a large amount of other readily available wind under development in other parts of the country.

It has become empirically evident in areas such as Cookhouse and Bedford in the Eastern Cape that clustered wind and solar project development, construction and operation has led to demonstrable socio-economic upliftment in these areas over the course of a decade. This is due to the increased economic activity generated and induced, in some cases combined by deployment of SED/ED spend by such facilities.

While such spin-offs of renewable energy generation capacity growth are outside the scope of SAREM to influence, it is posited that the growth of such capacity may lead naturally to industrialisation through manufacturing in closer proximity to this construction demand. If this were the case then incentivising capacity in these regions could be explored through geographic-specific public procurement, Eskom procurement or a voluntary targeting by such procurers as Sasol and mines seeking private generation capacity and/or best use of land under rehabilitation.

Annex C
FIGURES AND TABLES

Table 2-1: Combined market opportunity from IRP2019 wind and solar, with battery storage[12]

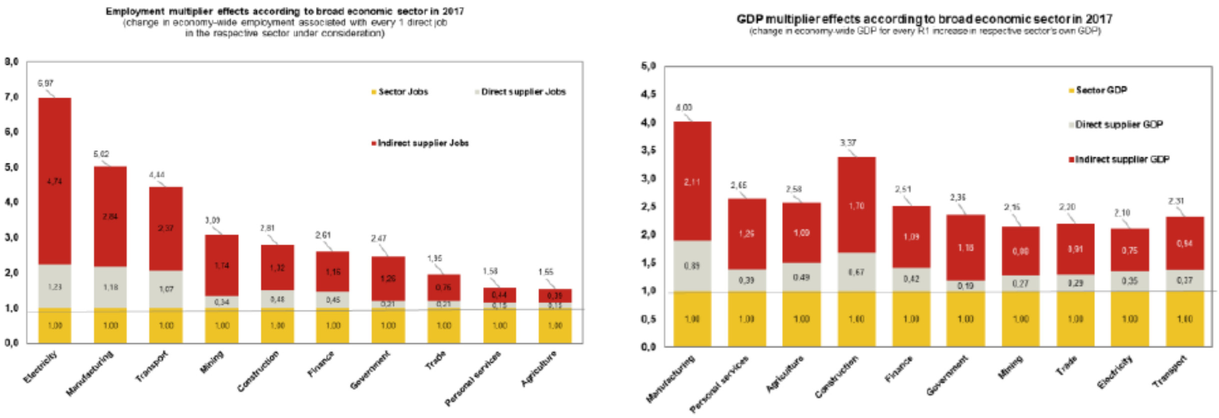
	units	2030 target
Direct jobs created	People employed in 2030	36 571
Wind		19 586
PV		12 900
Battery storage		4 085
Production value	ZAR m up to 2030	313 156
Wind		202 857
PV		67 094
Battery storage		43 205
Total GDP contribution	ZAR m up to 2030	422 462
Wind		274 186
PV		90 814
Battery storage		57 463

Table 2-2: Baseline annual market opportunity from IRP2019 wind and solar[13]

	In the target year				Cumulative target		
	units	2025 target	2030 target	2030 max (100%)	Units	by 2025	by 2030
Demand (MW/year)	MW	2 600	2 600	2 600	MW	10 313	22 888
Wind		1 600	1 600	1 600		6 400	14 400
PV		1 000	1 000	1 000		3 400	6 400
Manufacturing							
% localised		40%	70%	100%		40%	70%
Direct jobs created	People employed	4 854	8 495	12 136	Job-years	14 547	44 920
Wind		2 886	5 051	7 216		9 381	30 307
PV		1 968	3 444	4 920		5 166	14 612
Production value	ZAR m/year	11 377	19 909	28 441		34 693	133 350
Wind		7 728	13 524	19 320		25 116	106 259
PV		3 649	6 385	9 122		9 578	27 091
Total GDP	ZAR m/year	15 290	26 758	38 225	ZAR m	46 628	179 222
Wind		10 386	18 176	25 965		33 755	142 811
PV		4 903	8 581	12 259		12 872	36 410
Balance of Plant & Construction							
% localised		80%	90%	100%		80%	90%
Direct jobs created	People employed	15 168	17 064	18 960	Job-years	56 486	123 539
Wind		8 192	9 216	10 240		32 768	76 800
PV		6 976	7 848	8 720		23 718	46 739
Production value	ZAR m/year	16 274	18 309	20 343		61 515	136 601
Wind		10 304	11 592	12 880		41 215	96 599
PV		5 971	6 717	7 463		20 300	40 002
Total GDP	ZAR m/year	22 133	24 900	27 666		83 661	185 777
Wind		14 013	15 765	17 517		56 053	131 374
PV		8 120	9 135	10 150		27 608	54 403
O&M							
% localised		80%	90%	100%		80%	90%
Direct jobs created	People employed	3 128	6 927	7 697	Job-years	8 795	34 864
Wind		2 328	5 319	5 910		6 433	26 807
PV		800	1 608	1 787		2 361	8 057
Combined value chain							
Direct jobs created	People employed	23 151	32 486	38 793	Job-years	79 828	203 323
Wind		13 407	19 586	23 366		48 582	133 914
PV		9 744	12 900	15 427		31 246	69 409
Production value	ZAR m/year	27 651	38 218	48 784		96 208	269 951
Wind		18 032	25 116	32 200		66 331	202 857
PV		9 619	13 102	16 585		29 877	67 094
Total GDP	ZAR m/year	37 423	51 657	65 892		130 288	364 999
Wind		24 400	33 941	43 482		89 808	274 186
PV		13 024	17 716	22 409		40 480	90 814

12 Assumed localisation levels in wind and solar: 90% BoP and O&M, 70% manufacturing, battery storage “Whole Nine Yards” (World Bank, 2021)
13 Job Intensity from DoE, 2016, GDP multipliers from Social Accounting Matrix

Figure 4-1: Employment and GDP production multipliers



Figures 4-2, 4-3 and 4-4 indicate the cost trajectories for the wind, solar and battery storage energy sectors.

Figure 4-2: Worldwide energy price trajectory

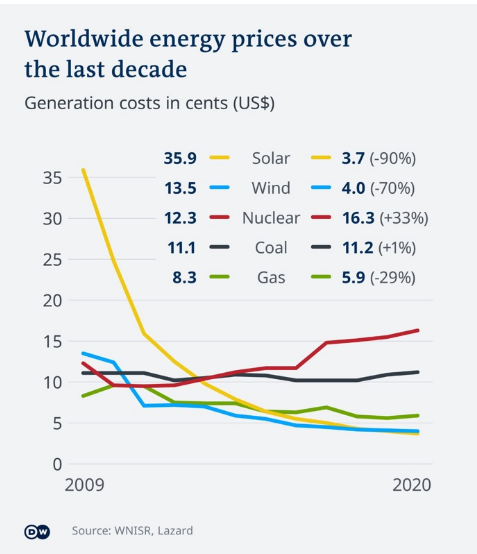
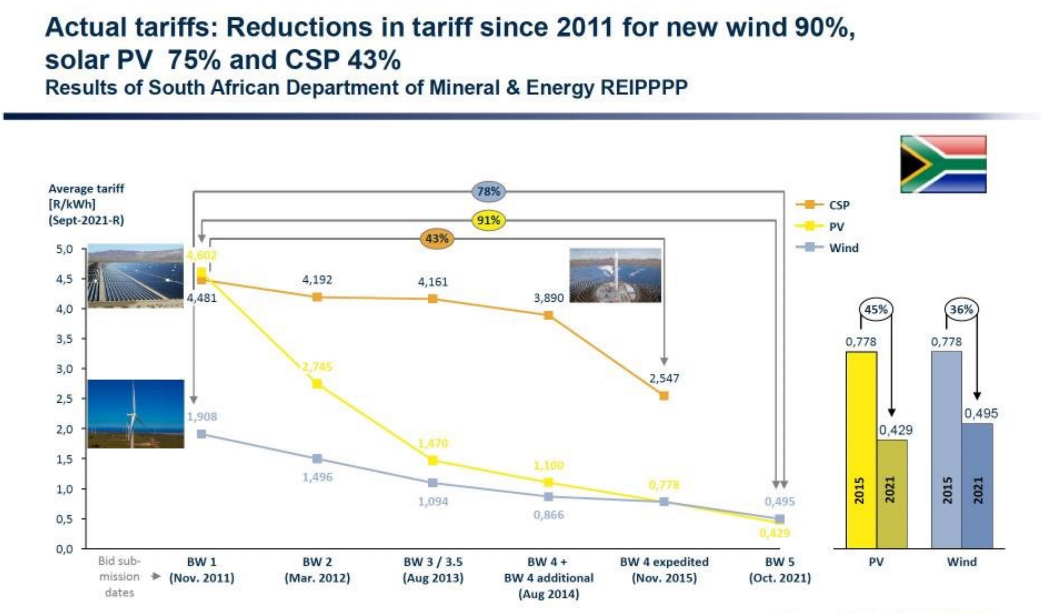


Figure 4-3: Energy cost trajectory in South Africa



Notes: For CSP Bid Window 3 and 3.5, the weighted average of base and peak tariff is indicated, assuming 50% annual capacity factor and 64%/36% base/peak tariff utilisation ratio; BW = Bid Window;
Sources: Department of Mineral & Energy's publications on results of first four bidding windows http://www.energy.gov.za/IPP/List-of-IPP-Preferred-Bidders-Window-three-04Nov2013.pdf; http://www.energy.gov.za/IPP/Renewables_IPP_ProcurementProgram_WindowTwoAnnouncement_21May2012.pptx; http://www.ipprenewables.co.za/gong/widget/file/download/id/279; StatsSA on CPI (http://www.statssa.gov.za/publications/P0141/CPIHistory.pdf); CSIR analysis

Figure 4-4: Cost trajectory of batter energy storage (TIPS, 2021)

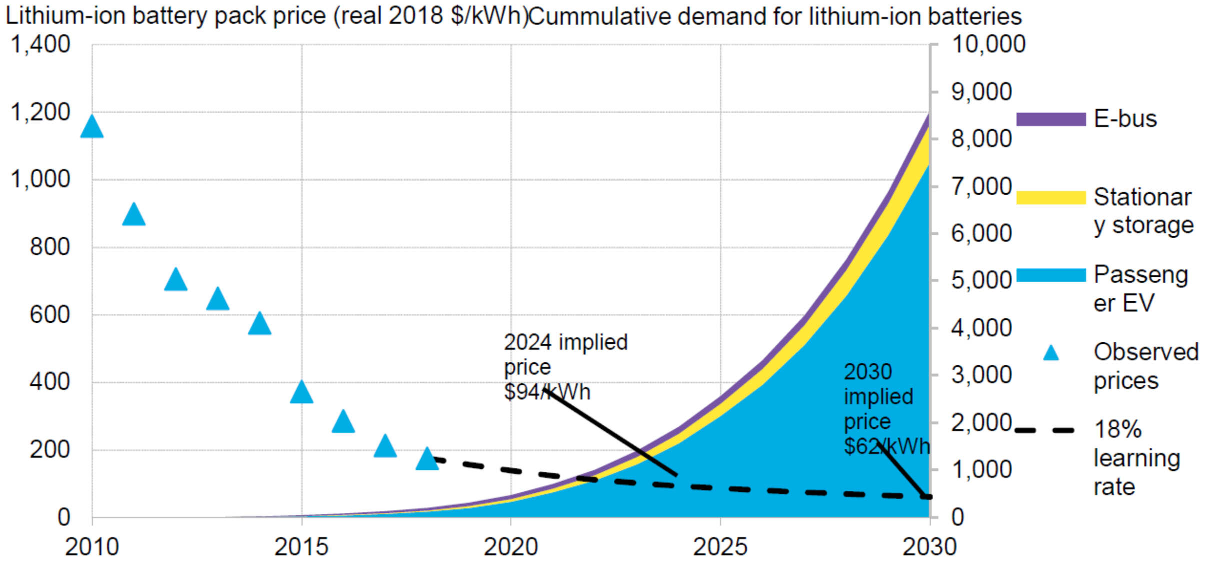
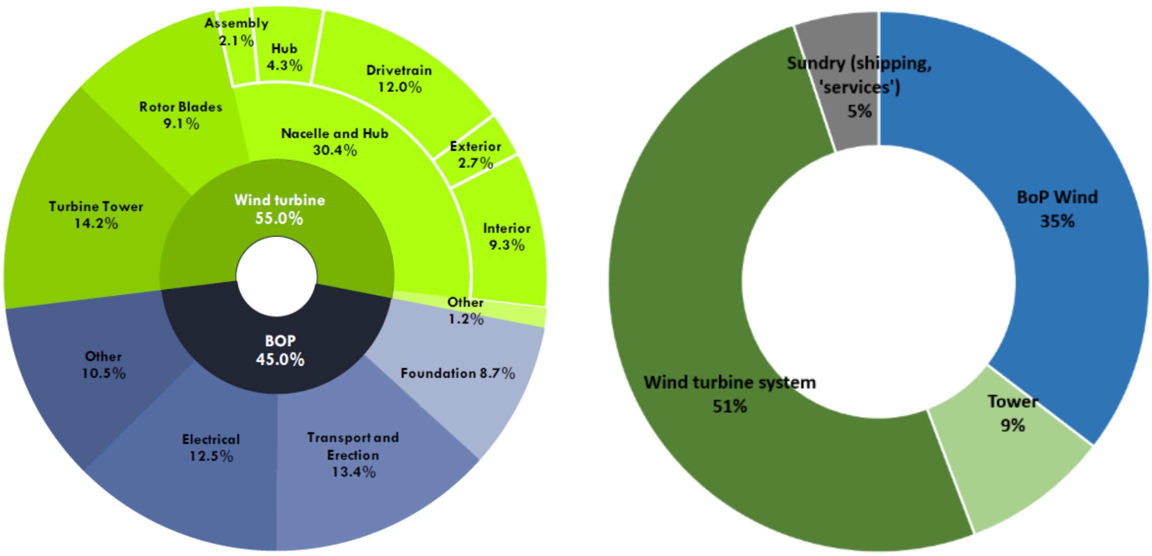
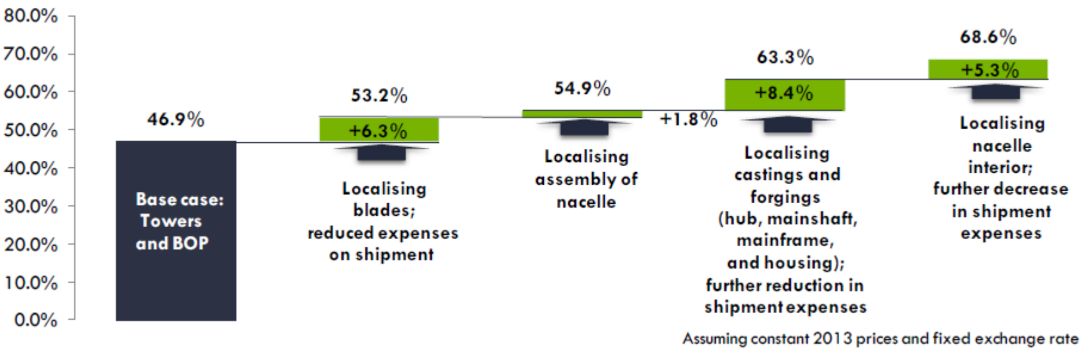


Figure 4-5: Onshore wind CAPEX breakdown from REIPPPP BW1-2[14] (left) and BW4[15] (right)



4-6: A proposed sequencing of localisation, based on 2013-2015 costs and assumptions[16]



14 DTIC from IPPO data from Bid Windows 1-3, 2014. Note: here generator is considered part of "nacelle interior"
15 From IPPO Bid Window 4, 2021
16 Urban-Econ Development Economists and EScience Associates (2015)

Figure 4-7: Utility scale solar PV cost breakdown reference data[17]

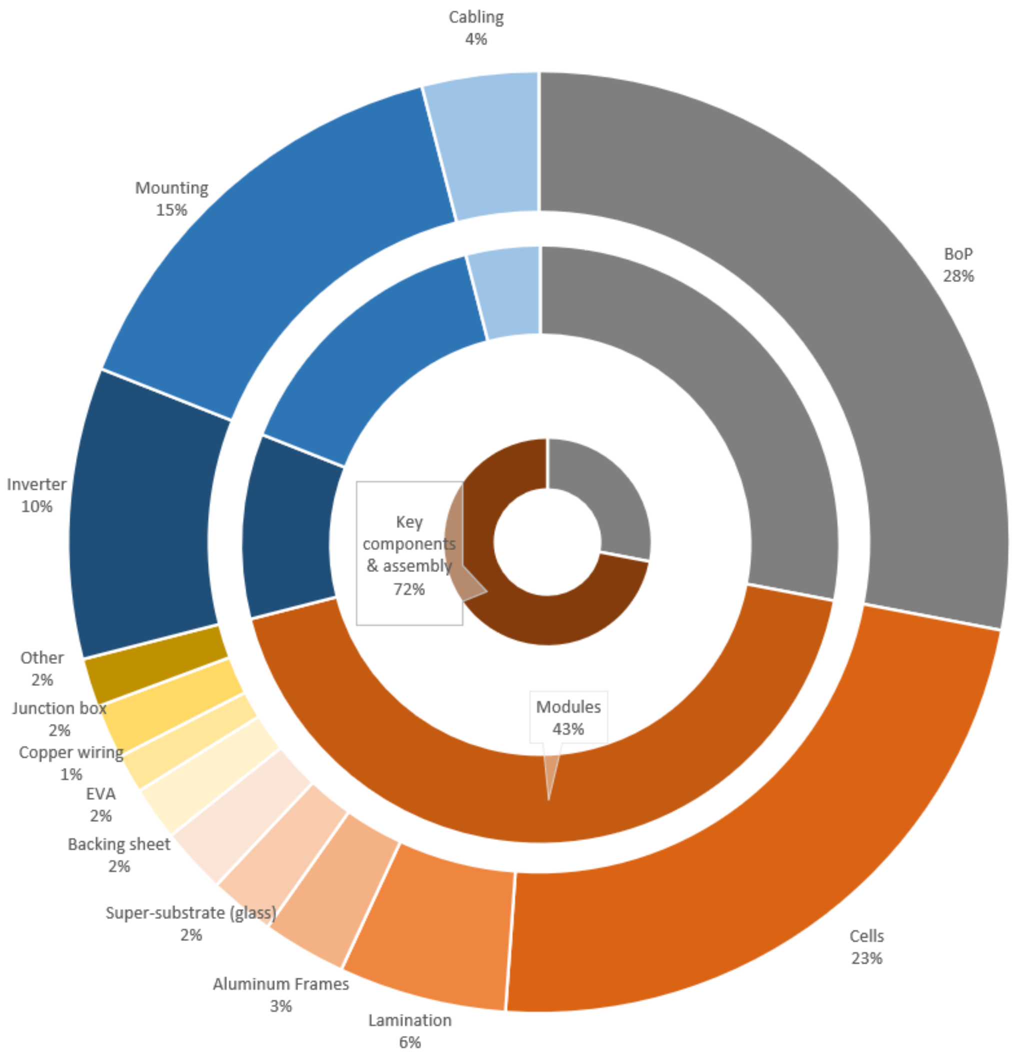
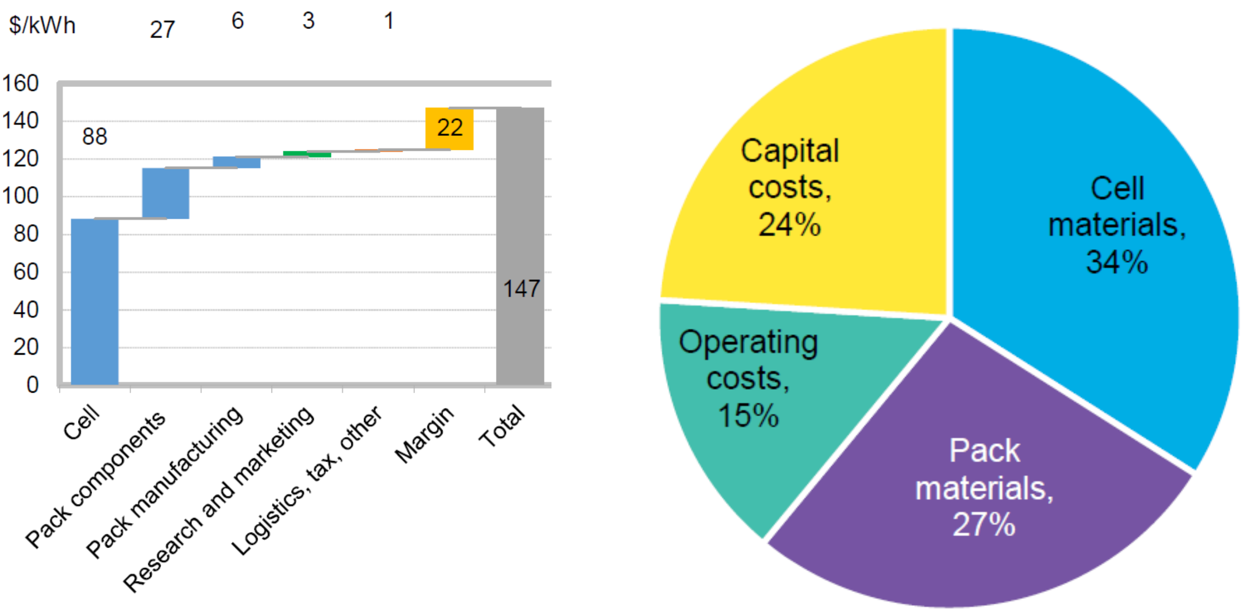


Figure 4-8: Relative cost (left: 100kWh NMC LIB, right: breakdown of Lithium Ion pack) (TIPS, 2021)



17 Based on EScience Associates, Urban-Econ Development Economists Chris Ahlfeldt, 2013.

Figure 4-9: Scenario-based opportunity breakdown for battery value chain (job units FTE)

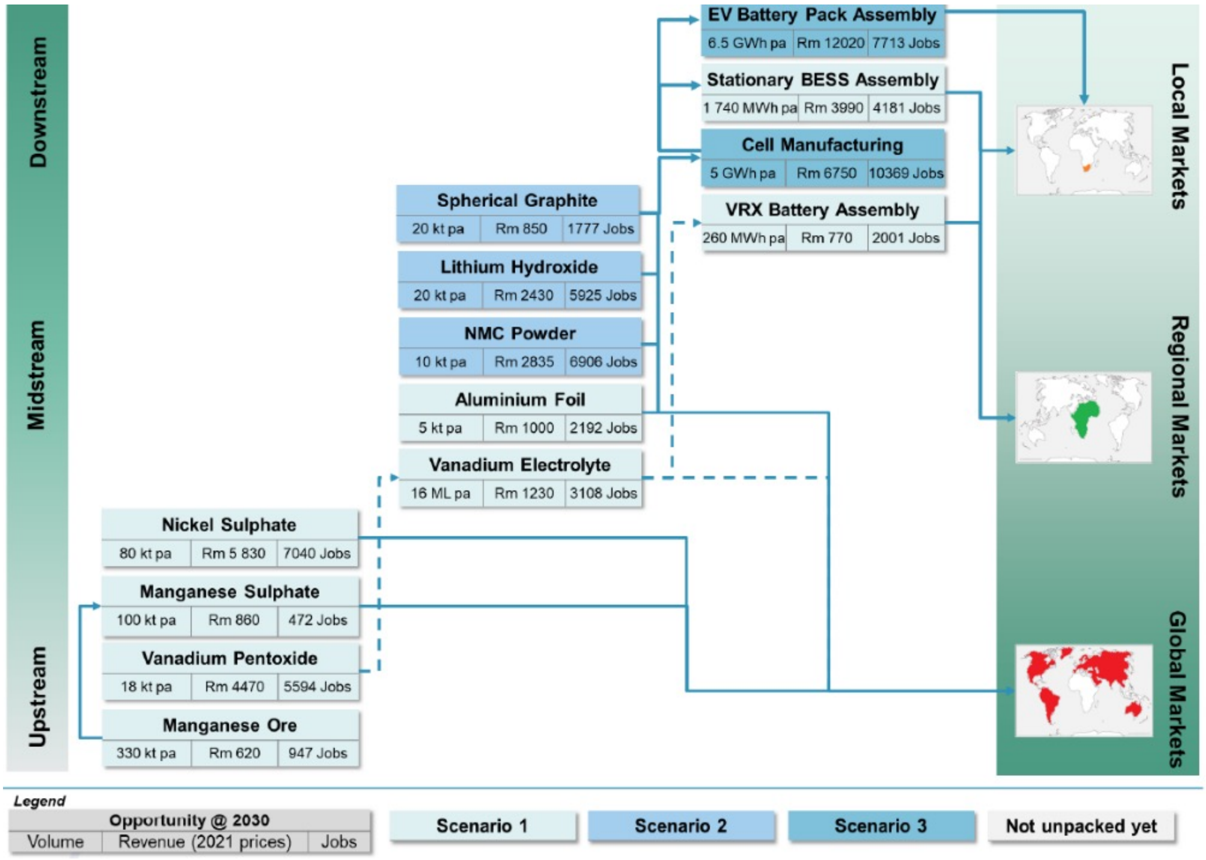


Figure 5-1: System dynamics for a conceptual framework for SAREM

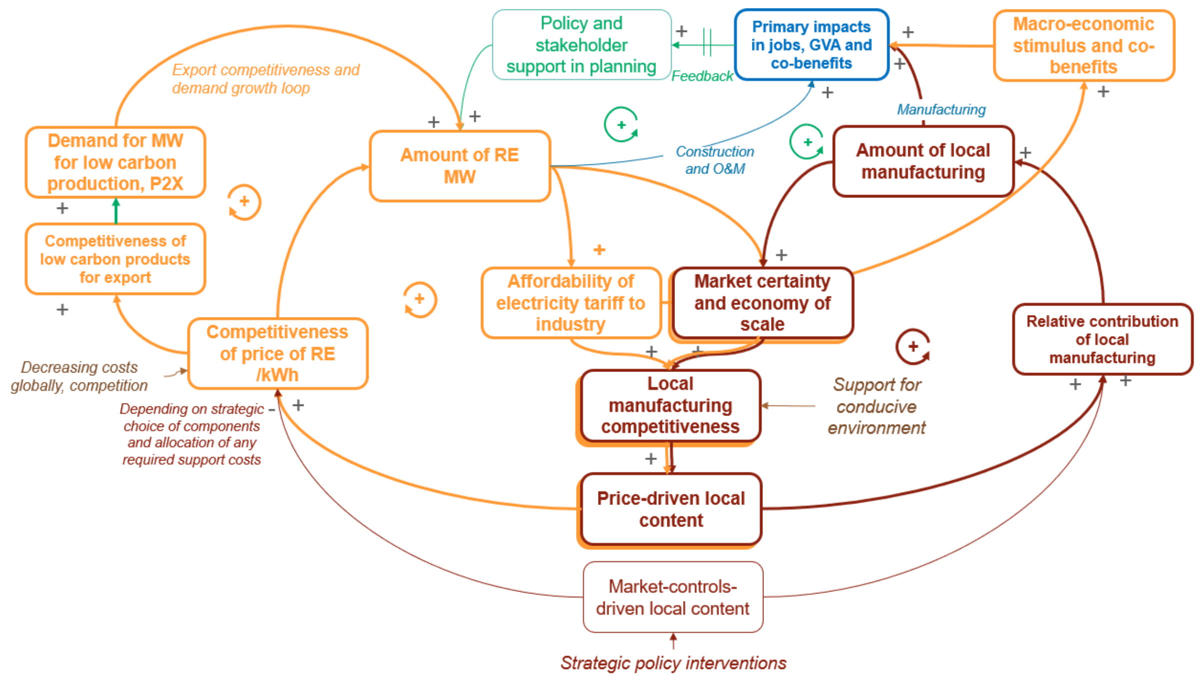


Figure 5-2: Material demand for IRP2019 (Manufacturing Circle, 2022)

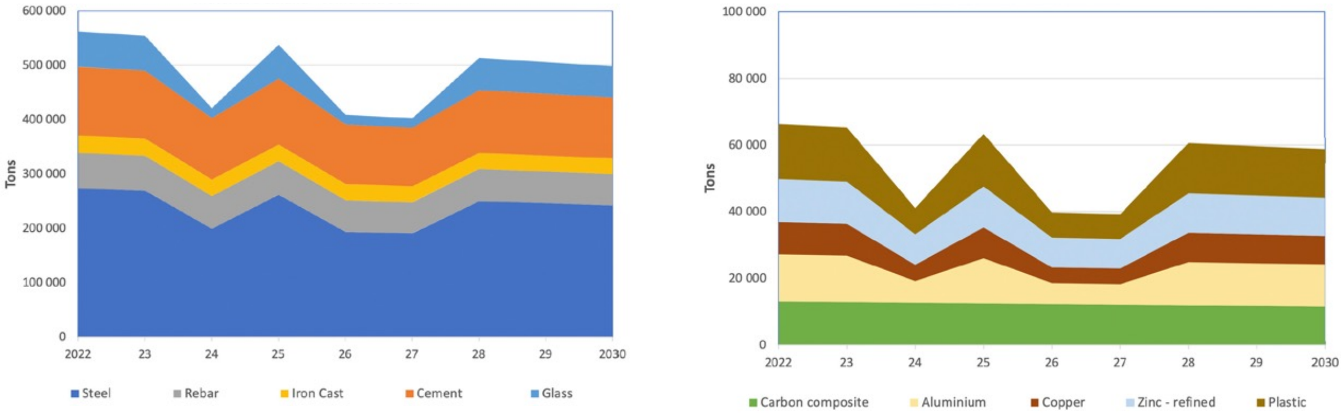


Table 5-1: Peak demand compared to 2021 supply capacity (Manufacturing Circle, 2022)

Material	Peak demand (tons)	Capacity in 2021 (tons)	% Demand from renewables
Steel	273 600	7 700 000	4%
Galvanising	81 600	600 000	14%
Reinforcing bar (Steel)	62 500	600 000	11%
Iron Cast	32 000	500 000	6%
Cement	126 500	17 000 000	1%
Glass	65 000	260 000	25%
Aluminium	14 100	60 000	24%
Copper	9 600	160 000	6%
Zinc- refined	12 900	0	-
Plastic	16 600	1 500 000	1%

Figure 5-3: Typologies for structuring local manufacturing business ownership

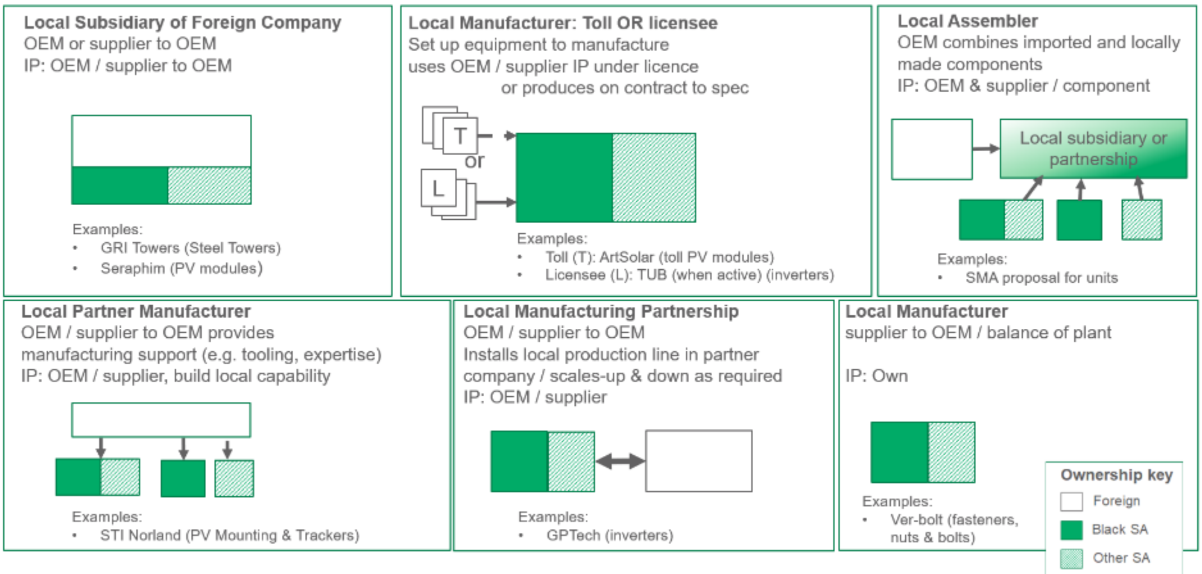


Table 5-2: Economic Development achievements of REIPPP up to Bid Window 4

	Min threshold	Target	Achieved	Value achieved
Job creation for Black South Africans as a share of the total workforce	25%	50%	84%	
Black Ownership (shareholding by Black People)	10%	30%	33%	
Shareholding by Local Communities	2.5%	5%	9%	
Black Top Management	40%	40%	67%	
Local Content	25%	60%	50%	
Preferential procurement				
Share of spend on BBBEE suppliers	50%	50%	83%	R106 bn
Share of spend on Qualifying Small Entities	8%	8%	26%	R4.1 bn
Enterprise Development (Revenue spend on business in local communities)	0.6%	0.6%	0.63%	R7.2 bn
Socio-economic Development (share of spend)	1%	1.5%	2.2%	R23.1 bn