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Energy and Industrial Policy Failure in the South African Wind Renewable Energy Global Value Chain: The political economy dynamics driving a stuttering localisation process

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ABSTRACT

This paper utilises a combination of a political economy approach and a GVC framework to analyse the dynamics of the wind energy value chain in South Africa. The paper focuses on the complex intertwined interplay between energy and industrial policy and shows how they negatively impacted on efforts to increase localisation of domestic manufacturing and services industries. It discusses the opportunities and constraints, success and failures of a localisation process contained arising from the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). It finds that early modest industrialisation gains, linked to the local content requirements in the REIPPP auctions, notwithstanding the policy shortcomings, did have a notable localisation impact but fell short of the ambition in broader policy documents. Nonetheless, these signs of progress from foreign lead firms, large global 1st tier suppliers, and local firms, were substantially undermined, in some cases reversed, as a consequence of the political choices to suspend the renewable energy programme. It shows how political economy dynamics resulted in a failure to ensure continuity and predictability of the auction bidding process within REIPPPP, and how this cascaded down the wind energy value chain constraining the initial localisation processes. These dynamics also resulted in a failure of the South African government to prioritise, develop, and embed renewable energy within its industrial policy framework. As the economy emerges from the Covid-19 crisis this will pose political economy challenges as coalitions of South African stakeholders struggle over the task of breaking from a carbon intensive path dependency and inaugurating a new green industrialisation path.

Keywords:
Wind renewable energy; global value chains; industrial policy; localisation; REIPPPP; green industrialisation

1. Introduction

Industrialisation continues to be necessary in enabling countries to transition to better development outcomes. The processes associated with a growing manufacturing base, resulting from industrialisation, can create significant employment at higher wages than might generally be earned in the primary sector. Whilst the globalization of production systems, and the rise of industrial output in the faster growing economies of Asia, has made the path towards industrialisation a challenging one for many countries, state led or facilitated industrial policies, related to support of the industrial sector, remain a key ingredient of development policies for many developed and developing countries. For many countries hoping to exploit new economic opportunities, such as those associated with renewable energy, these growth sectors can present localisation opportunities. This involves the securing of a new profile of production and service supplier activities by entering appropriate global value chains (GVCs) and linking to multinational (MNC) lead firms engaged in renewable energy activities. This will deepen existing industrial and service capabilities, in fields often dominated by providers located in more advanced economies. Such efforts are by no means always straightforward to pursue. After all, they face a complex global economic environment where production and service hubs tend to select their territorial operational space based on multiple and varied factors. For countries such as South Africa, with a notable industrial heritage, a relatively developed set of institutional capabilities, and a market of some scale in terms of per capita GDP, population and other resources – especially those related to renewable energy – these prospects should not be less challenging.

Globally, the emergence in the last two decades, of significant scale demand and supply technologies for renewable energy generation, particularly in wind and solar, has provided many countries with the opportunity of securing a lower carbon energy supply footprint. Alongside this, the growth of these technologies has also presented opportunities to bolster domestic economic sectors associated with the design, development and operation of such facilities and their integration into domestic, and in some cases, international energy supply systems. Between 2010 and 2018, global renewable energy output for power in gigawatts has grown from 1,320 GW (312 GW excluding hydro) to 2,378 GW (1,246 GW excluding hydro) (REN21 2011: 15 & REN21 2019: 19). The wind energy sector, both in terms of offshore and onshore wind energy generation, has seen its level of energy supply for power grow from 198 GW in 2010 to 591 GW installed capacity in 2018, or 5.5% of global electricity production (REN21 2011: 15 & REN21 2019: 19, 41). Significantly, this growing share of energy output has also been associated with substantial real declines in the costs associated with renewable energy, as scale and innovations in technology has developed and, critically, as emissions and broader environmental costs associated with fossil fuel energy have been better accounted for. Thus, beyond the so-called 'greening' of domestic energy markets and the associated direct economic opportunities linked to the development of this sector, renewable energy expansions have also provided opportunities for producers not linked to these sectors to take advantage of reduced direct and indirect production costs (Harrison *et al*. 2017). This has further stimulated policy maker interest in the potential of the renewable energy sector and its associated economic activities. Increasingly well-developed global and domestic regulatory and finance associated with renewable energy projects has further supported these developments in a context, where at least historically, many developing countries struggled to make advances even in conventional energy supply.

Thus, it is no surprise that many emerging economies have initiated plans to grow the renewable energy share in their countries and to bolster their presence in economic activities associated with them. South Africa is widely noted as one of the pioneers for developing an internally best practice auction bidding framework (Eberhard 2014; Baker and Wlokas 2015; Hansen et. al 2020), whilst countries such as China, Vietnam, Turkey, Morocco, Brazil, Argentina and others have made very significant expansions in renewable energy projects, a number of these now contributing to emerging economies now starting to drive global demand, and in the case of solar energy, supply of renewable energy technologies (REN21 2019).

South Africa's entry into the world of renewable energy has various origins: The 2009 Copenhagen COP promise to set a voluntary target of reducing carbon emissions by 34 percent by 2020, and 42 percent by 2025; hosting the Durban COP17 in 2011; a government Green Economy Policy paper (2011); and the Treasury's increasing concern about an electricity supply and pricing crisis emanating from the monopoly state owned coal-fired corporation (Eskom). Consequently, there was external and internal pressure for the government to initiate a renewable energy programme. This included foreign multilateral and bilateral donors, the World Bank, and other development finance institutions (DFIs), as well as foreign FDI keen on entering a new renewable energy market. The initial proposal was a feed-in tariff model (REFIT). But this was plagued with institutional struggles, resulting in policy incoherence and continued implementation delay, and hence never got off the ground (Morris and Martin 2015). By 2011 REFIT was totally abandoned. However, it had garnered attention from international solar and wind companies. These set up offices in Cape Town, spending substantial time and money preparing projects for a forthcoming independent power producing procurement process, thereby creating the economic roots of a renewable industrialization path.

Using the momentum created, National Treasury stepped into the policy lacunae. Working through the Department of Energy, it set up an entirely new, highly innovative, competitive bidding procurement process. It also created a small, highly flexible, renewable energy procuring unit, existing in the interstices of departmental formality, to control and regulate the bid windows in the auction process. The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) was launched in July 2011[1]. This caught the imagination of the global renewable energy community, the bids took off, FDI from Independent Power Producers (IPPs) poured in, and within a few years had a substantial impact in creating a locally based supply chain. However, by 2015, government blocking interventions to support the renewable energy program, 'malicious compliance' by the coal based monopoly state owned electricity corporation (Eskom) aimed at obstructing the programme, and the meddling of a predatory elite in government and the private sector aimed at siphoning off state funds, resulted in the total stalling of the dynamic driving the localisation process.

Much of the literature on South Africa's experience with seeking to enhance localisation impacts through its renewable energy programme emerged in the early days of the programme itself. A fair amount was more concerned with the broader renewable energy dynamics of the programme or the technical features of procurement (of which local content formed a part) but did not necessarily explore the localisation dynamics in much detail (Montmasson-Clair and Ryan 2014; Baker and Wlokas 2015; Morris and Martin 2015). However, contributions looking at the early phase of the programme, such as those of Moldvay *et al*. (2013), Rennkamp and Westin (2013) and Baker (2016) discussed the economic development criteria and their likely opportunities and challenges in terms of programme design and the economic or governance features. Somewhat more recently contributions by Baker and Sovacool (2017), Eberhard and Naude (2017) and Ettmayr and Lloyd (2017) have all looked more closely at the emergent localisation features of the first few rounds of the REIPPPP although their research was still somewhat constrained in being undertaken when some of the impact features were still emerging. Recently Larsen and Hansen (2020) discussed the factors influencing impacts on the local content regulations in the 2011-2015 period. They note how the global features of the wind energy value chain both supported and constrained some local industrialisation impacts.

Larsen and Hansen (2020) point out that the South African programme appeared to work against and with different dynamics in the wind energy GVC: on the one hand there were efforts to develop distinct local industries to supplant those already featuring in the GVC, whilst on the other there was facilitation and some industrial policy support for international suppliers to locate in South Africa.

[1] For a fuller discussion of the details of the REIPPPP and the progress made in its first few years of operation see Eberhard and Naude (2017), as well as Morris and Martin (2015) for a detailed political economy analysis of the various stages of the South African renewable energy program.

Moldvay *et al*. (2013) had earlier noted, when the programme was in its infancy, that achieving greater impact would require a more substantial industrial policy support approach then was apparent at the time. A similar point is also made by Baker and Sovacool (2017: 10) who, whilst expressing some reservations about industry interest or compliance with the local content scheme, also point out that their expectations for sustained and deeper industrialisation impacts were low in that elements of a more proactive government "innovation and industrial policy" were not seen. Our findings coincide with these others in raising the inadequacy of the South African industrial policy response. However, our research and analysis goes substantially beyond these contributions.

First, this paper not only picks up where others ended their enquiry, but also extends the discussion by applying a complex analytic framework focused on power relations to understand the stakeholder dynamics within the wind energy value chain, the policy dynamics between these stakeholders and the state, as well as the dynamics of conflicting interests between differing coalitions of support and opposition to extending the scope of the renewable energy programme and its localisation impact. The paper's conceptual foundations therefore lie in a combination of a political economy approach focused on coalitions of interest and power dynamics within the renewable energy space (Morris and Martin 2015; Schmitz 2016) and a GVC mapping framework emphasising the power dynamics of governance between lead firms and suppliers (Gereffi 2005; Kaplinsky 2016; Davis et al 2018; Larsen and Hansen 2017). Second, it deepens the evidentiary base and analysis pertaining to the localisation impacts of the introduction of a wind renewable energy value chain in South Africa. Drawing on an extensive set of interviews it explores the localisation impacts in creating backward production linkages in terms of local manufacturing, logistics and services suppliers. Third, it draws on a GVC analytic approach to examine the role that an incoherent industrial policy framework played, sets out the dynamics driving local production linkages, analyses the policy failures leading to a stalling of the localisation process, and explains the diversionary initiatives that firms in the supply chain were forced into in order to survive. Fourth, whilst setting out the initial progress made in delivering some local content, employment and industrialisation gains, the analysis also looks at the negative impact on localisation processes arising from the political stalling of further renewable energy procurement coupled with government's inadequate prioritising of renewable energy in its industrial policy. Drawing again on the political economy and GVC dynamics at the heart of the process the paper poses the challenges this presents for the future of a green industrialisation path going forward in a post Covid-19 world.

Using a largely qualitative methodology the research process involved both an exhaustive review of relevant materials, as well as interviews with close to 30 respondents. These came largely from the firms (both domestic and international) operating in the renewable energy space, as well as interviews in the public policy space (government policy makers, regulators, or working for other relevant institutions) that have closely observed the wind-energy sector in South Africa in recent years. These semi-structured interviews were carried out in South Africa and in Europe, and respondents were identified on the basis of their exposure to the South African wind-energy environment. The interviews included the following: market-leading technology suppliers dominating the wind turbine market for grid-scale generation plants; companies involved in putting together and/or servicing the bids for the REIPPPP wind energy contracts (feasibilities, legal, finance); companies providing services to the IPP contract parties from planning, environmental approvals, engineering, through to transport, logistics and construction; suppliers to the wind farm projects including suppliers to the Engineering, Procurement and Construction (EPC) contractors and the wind turbine providers; researchers and government regulators and policy makers.

The paper is structured in the following manner. The Introduction is followed by Section 2 setting out the key features underlying the wind energy GVC. Section 3 provides a schematic overview of the South African wind energy value chain. In Section 4 we outline the place of renewable energy in South Africa's industrial policy. Section 5 a wealth of empirical material discussing localisation within REIPPPP. Section 6 draws out pertinent conclusions from the previous analysis and discussion.

2. An overview of features of the wind energy global value chain

In order to appreciate the global context influencing dynamics in South Africa's wind energy value chain development experience it is necessary to understand some of the contemporary features of this chain. Elola *et al*. (2013) report on two main elements of the wind energy global value chain (GVC): "(a) the manufacturing chain, consisting of the production of turbines and their different parts and components; and (b) the deployment chain, which involves the distribution and the utilization of the energy" (Elola *et al*. 2013: 995). In terms of the manufacturing chain they list the following key functions, "(1) turbine research, design and engineering; (2) design and manufacturing of components such as blades, towers, bearings, gearboxes, controls, systems and power converters; and (3) turbine generator assembly". For deployment there are three phases, "(1) predeployment, including project promotion, design and phases such as site assessment, planning and finance; (2) deployment that includes site construction, transport and grid connection; and (3) post-deployment which includes operation, maintenance and sales." (Elola et al. 2013: 995). In GVC analysis chain governance is critical and these authors note that generally the two phases are led by different lead firms with the manufacturing lead by an Own Equipment Manufacturer (OEM) and the deployment or development phase led by a project owner such as a utility or an energy provider contracted to develop a wind energy facility. However, it is also noted that turbine manufacturers (the OEMs) can also be involved in the deployment and operations and maintenance phases (O&M).

Whilst we adopt a similar GVC structure as proposed by Elola et al 2013, we also highlight another critical linkage in the chain – that of the role of enterprises engaged in providing services. These occur in the manufacturing aspects of the chain – such as the critical and distinctive types of logistics for transporting towers or project management services involved in setting up the towers, turbines and blades. There are also critical services linkages involved in the deployment elements of the chain (Energy Alternatives India undated; Matsuo & Schmidt 2019). For example, much of the pre-deployment phase depends crucially services on such as financial, legal, site discovery, and environmental. These service activities are knowledge intensive and create rent rich linkages which yield considerable income to those engaged in them. A further reason to appreciate the integration of service type activities in the value chain in this context is that they have been specified as part of local content in South Africa's local content regulations pertaining to the country's renewable energy procurement (Ettmayr & Lloyd 2017: 3). In addition, we also stress that ownership also plays an important role in this GVC. The lead firms driving both manufacturing and deployment in South Africa and most other emerging economies, excluding China, are large foreign based enterprises as has also been highlighted by Baker and Sovacool (2017) and Larsen and Hansen (2020).

The growing appetite for wind energy projects in middle income and the wider developing country field has been a major feature of the global sectors growth in recent years (Elola *et al*. 2013; REN21 2019). Alongside this there has often been an eagerness on the part of policy makers to secure some localisation and industrialisation gains from the investments associated with this growing renewable energy industry. The growth of the wind energy sector has not only been driven by falling costs of the technology and thus the potential to supply more cost-effective energy in markets where energy supplies have often been constrained. It has also been influenced by global compacts such as those associated with the Conference of the Parties (COP) commitments on climate change where countries have been seeking to raise cleaner energy usage for both domestic public and private sectors.

As the industry has increasingly globalised, driven both by the opening up of wind energy project opportunities in many parts of the world, and by the emergence of substantial manufacturing production capacity in countries such as China and India, so the lead firms have tended to exhibit a preference towards encouraging suppliers (such as their preferred tower and blade providers) to set up operations in the host country, which involves a significant form of localisation, albeit of foreign owned firms (Larsen & Hansen 2020). As such this value chain exhibits similar characteristics as the

automotive GVC (Barnes and Morris 2008), insofar as, under stable and growing economic conditions as well as sufficient market demand, it encourages follower sourcing from large MNC first tier suppliers – e.g. tower, blade and nacelle turbine component manufacturers - establishing subsidiary plants in the local economy rather than importing such critical components (Larsen and Hansen 2017). There are also other local suppliers down the chain either feeding into these MNCs or providing services and products directly to the IPP/OEM. Whilst there is still limited evidence from emerging economies (beyond China) of a significant scale from locally owned suppliers of major manufactured inputs, a number of studies do report on some locally owned production and service linkage firms further down the chain. These localisation obligations might result due to lower barriers to entry and due to the impact of local industrial policy enabling factors interacting with lead firm strategies (Elola *et al*. 2013; Matsuo & Schmidt 2020).

In respect of key wind energy turbine, blade, and tower manufacturing, it is the international OEM turbine companies (e.g. General Electric, Nordex Acciona, Vestas, Siemens, and Goldwind) that determine the many performance features and standards for those supplying the sector (Baker 2016; Baker & Sovacool 2017; Matsuo & Schmidt 2019). They also impact elements of the deployment value chain – e.g. the construction of civil elements to support towers and turbines. Recent trends in the global wind energy sector also point to the buyers of energy – often through governments, utilities or regulators setting supply conditions – increasingly having an influence on the wind energy value chain. The pressure to yield falling energy prices has forced the OEMs to consolidate in order to have the institutional capacity to accelerate innovation such as the production of much higher output capacity turbines (REN21 2019). This consolidation process has also enabled them to use their buying power to influence the geographic distribution of production and service activities, for example through localization (Larsen & Hansen 2020) and to increase their power with respect to engagements with stakeholders in new markets (Baker & Sovacool 2017). Thus, these lead firms are also able to exert considerable influence over the factors driving value chain choices from one market to another.

Global production of turbines and related components remains concentrated across a relatively small number of OEMs that have centred the development and assembly functions of their products in a handful of locations around the world, and built very focused supplier relationships in terms of specifications that met their specific design and technology considerations. Whilst European producers have, together with General Electric of the USA, for a number of decades, dominated the field of turbine supply, the global demand for wind energy had an impact on the location of production and related suppliers - not least because of the use of local content requirements by governments. Alongside this, similar to the trends in many manufacturing sectors, increasing numbers of components have been sourced from emerging markets and in particular from China with its vast manufacturing capabilities. As a result, whilst significant portions of wind farm development costs are somewhat 'naturally localised' – because of the need for on-site construction activities – the localisation of wind turbine and tower production in markets of wind farm development was by no means a given. That said the pervasiveness of LC requirements in wind energy markets (Hansen *et al*. 2019) has meant the role-players were certainly aware that South Africa would also probably seek a variety of localisation impacts, and possibly industrialisation impacts, in its REIPPPP. As one respondent put it: *"Each country takes a slightly different approach on these matters and there is always some negotiation"*.

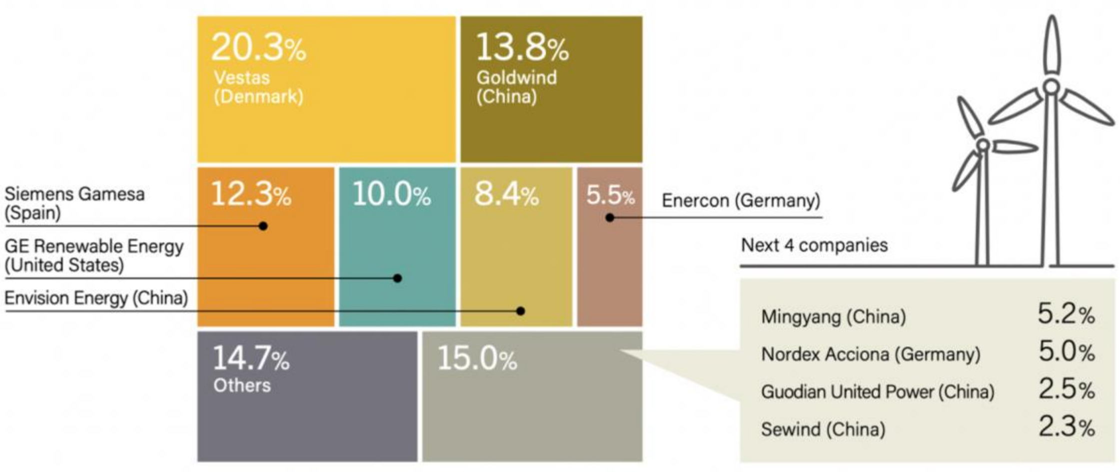
The renewable energy and industrial policy architecture of the OEM's original base countries has influenced their characteristics (Rennkamp & Westin 2013; Matsuo & Schmidt 2019). As these firms have internationalised so has policy in major markets where they feature. Operating in various emerging market contexts with different policy demands has also influenced their approach. Thus, the price of market access for OEMs is that in some cases they have to make some adjustment to local market policy considerations. For example, in Brazil generous finance provision through the public development bank was made conditional on OEMs localising some of their production processes and some suppliers (Rennkamp & Westin 2013). Policy support has also encouraged them to work with

local suppliers for turbine-related components. In Russia it has been agreed that some OEM intellectual property must be transferred to a local turbine firm as part of the conditions of accessing the market, and a company such as Vestas has had to agree to a "mandatory export obligation" to access local wind energy markets (Radowitz, 2020).

However, despite this process of building a much more globalised pattern of production, the context for many countries has not necessarily improved their ability to localise elements of the GVC (Baker & Sovacool 2017; Harrison *et al*. 2017; Lema *et al*. 2018; Matsuo & Schmidt 2019). They might either lack the scale of an energy market (and thus economies of scale for production), or be challenged by the capacity of producers in larger countries or more sophisticated markets to meet price and/or quality demands. Nonetheless, some elements of the GVC do lend themselves to production closer to the wind energy final facility site. The most obvious amongst these are those in the deployment links of the value chain (construction, logistics, transport, and various services). However, the challenge of successfully moving large wind energy turbines and related items over long distances and the high costs of doing so can also create a space for some aspects of localised manufacturing. For example, REN21 annual report states: "While most wind turbine manufacturing takes place in China, the EU, India and the United States, the manufacture of components (such as blades), the assembly of turbines and the locations of company offices are spreading to be close to growing wind energy markets – including Argentina, Australia and the Russian Federation – as companies seek to reduce transport costs and to access new sources of revenue." (REN21 2019: 124)

The REN21 report for 2019 notes that the GVC context is a highly dynamic one and the patterns of activity and influence are subject to change. Similar to GVC concentration processes manifested in other sectors: "Severe competition is causing further consolidation among turbine manufacturers, and it pushed seven small turbine equipment manufacturers out of the market in 2018. And while 37 manufacturers in 2018 delivered wind turbines to the global market, the top 10 companies captured an 85% share (up from 80% in 2017 and 75% in 2016). The top five manufacturers alone accounted for nearly two-thirds of the turbines delivered in 2018." Vestas of Denmark is noted as the top global turbine producer with over 20% of the market and a notable global presence. The next largest turbine OEMs in 2018 were Goldwind (China), Siemens Gamesa (Spain), followed by GE Renewable Energy (USA), and Envision (China) (REN21 2019: 124). In 2018 half the top ten were Chinese producers, although these were mostly supplying their domestic market (Figure 1). It is expected that these top companies will continue to change places as new technology enters the market and as the influence of repowering contracts in mature facilities escalates in Europe.

Figure 1: Market shares of top 10 Wind Turbine Manufacturers (2018)



Note: Based on total sales of approximately 50.6 GW
Source: GWEC, REN 21

The need to ensure greater output has resulted in producing physically larger and technologically more complex turbines impacting on tower design, construction and materials: “The general trend continued towards larger machines – including longer blades, larger rotor size and higher hub heights – as turbine manufacturers aimed to boost output and to gain or maintain market share.” (REN21 2019: 126). Hence wind farms will need less towers, less foundation platforms, and less connective infrastructure to deliver the same output, although the locational dynamics (where wind farms are sited for wind optimisation or other regulatory and political reasons) does not necessary always support the use of the largest or most advanced plant. This suggests that turbine optimisation decisions are likely to require more knowledge intensive services and higher order production capabilities too. These assorted technology change dynamics, affecting many different aspects of the value chain (including design, operation and maintenance), are likely to create pressure to maintain considerable technological adaptive capacity as well as respond to the related pressures of improving efficiencies and lowering costs (REN21 2019: 125). They also create new opportunities, for example in operating drones or sensors to do tower, nacelle and blade analysis, or in the provision of the increasingly specialist transport and construction capabilities to move and install the equipment for wind energy facilities.

3. Schematic overview of the wind energy global value chain in South Africa

In South Africa under REIPPPP the wind energy value chain has the following linkage and governance features dependant on different stages of project development.

At the start of an auction window the IPP Unit (representing the government) puts out a Request for Proposals (RGP) to guide a bidding round for renewable energy with the intention to feed this supply into the regulated grid energy market. Together with various government departments and institutions, expert advisory inputs are sourced from a wide range of specialist service providers (legal, financial, energy grid planning and related fields). This constitutes an injection of public funds into procuring domestic and international advisory expertise.

In response to the RFP, IPP consortiums are formed which are put together by a lead bidder - also called project sponsor or lead developer. The consortium draws on a range of partners and external service provider organisations (both domestic and international). These include various necessary services for the proposal itself as well as down the line once the wind farm is set up and running – financing, legal, wind modelling, environmental, built environment, land assembly, and EPC advisory services. The consortium will also include a preferred OEM, which provides its specific technology and costings, as well as domestic empowerment partners. The consortium, through the lead bidder, will then set up a Special Purpose Vehicle (SPV), which is the legal entity of the project, to secure the necessary project financing – usually 70% debt financing and 30% equity finance provided by the lead bidder and others. The financing is secured at risk on the assumption that a successful bid will generate the necessary repayment revenue flowing in the future. If the bid is not successful then the expenditure incurred in the process is simply lost, although the project can be submitted in a new form in subsequent bid windows. Once the necessary groundwork has been done, which will involve a certain amount of local spend, and the proposal is completed, then the lead bidder (on behalf of the IPP consortium) submits the bid to the IPP office.

Once a consortium has won a bid and is selected from a bidding round the consortium IPP lead bidder signs a power purchase agreement. We can now simply use the nomenclature of ‘the IPP’. It also confirms contractual arrangements with its main consortium partners, especially its chosen financiers as well as the OEM and EPC providers. It also establishes contracts with a land owner and any local community structures. All of this enables finalisation of plans and the commissioning of site-related works. It is in this stage of the project that the bulk of pre-operational expenditure, including localised spending, starts to occur. In this phase a wide range of service providers are utilised and almost all of the manufactured input is sourced.

At this point the balance of value chain governance responsibility usually shifts dramatically from the IPP lead bidder to the OEM[2]. The OEM now effectively plays the lead governance role of the value chain in this stage – it takes responsibility for the process of procuring appropriately designed towers and turbine equipment, and now also plays the key governance role in regard to tower and turbine installations. The OEM not only designs the requisite equipment for the turbine but will also specify any structural design matters for the EPC. It will also source from its own suppliers components for the turbines (such as gears, switches, shafts, rotors, generators, wiring, electronic and digital controls), the turbine casing or nacelle and also the required blades from specialist manufacturers. The OEM handles the assembly of the full turbine and nacelle as the final stage before installation. The EPC is responsible for civils and so-called balance of plant (BOP) related work. This can include a wide range of elements including equipment for grid connections such as transformers, road infrastructure, ancillary buildings, internal roads, drains, utility connections and the foundations for the towers.

In the South African context the bulk of local content has been delivered during this phase - civil construction and related services and inputs and, beyond the first few bid rounds, also towers making up local content. Local project managers are appointed to oversee the work of these various role-players in delivering projects on cost and on schedule. Specialist contractors, provided by the OEM, or endorsed by them, are also utilised for the work of installing towers and the installation of the turbines and blades.

At the wind project commissioning stage a further stage arises related to project operations and maintenance (O&M). In most cases the OEMs have at least a five-year renewable contract to operate the wind energy technology (turbines) on behalf of the IPP. However, from the date of a completed project hand-over, it is the IPP that ultimately takes control of decisions related to the project, including ongoing operations and maintenance (O&M), whether it be with the OEM or through other providers. The O&M phase involves mostly services commissioned from local providers (such as crane operators, wind tower maintenance technicians) or through the OEM structures (locally or internationally), as well as IPP interactions with the range of project stakeholders (including grid operators, local communities, land owners, regulators). Some supply of manufactured inputs does take place for items such as replacement parts (blades, gears etc), paint and lubrication. In other contexts the O&M spend has ultimately also turned into project recapitalisation work as outdated equipment reaches the end of its design life and gets replaced with updated equipment. Some of the older wind farms in South Africa are entering the second decade of their 20 year contract terms and this is a matter being explored by IPPs and policy makers alike, especially since these earlier projects won bids at higher energy prices than later projects.

These various stages of the South African wind energy procurement value chain are schematically represented in Table 1. The schema of stages also shows the lead firm role under “corporate response” as well as the various suppliers involved in each stage. It breaks these suppliers down in terms of services provided or manufactured components supplied. Furthermore, in conditions where REIPPPP was fully operational, it provides a breakdown of these categories of these supplier services and providers according to whether they were imported, partially local, or fully localised. This disaggregation of suppliers demonstrates two important aspects of localisation under REIPPPP:

a) the current state of localisation opportunities for localisation of suppliers under current REIPPPP conditions – i.e. assuming a limited role for industrial policy; and
b) the opportunities for expanded localisation if renewable energy and industrial policy were integrated and aligned, which is discussed in the latter parts of this paper.

[2] One global IPP lead developer, rather than handing over effective power to the OEM, prefers a more hands-on role and operates in a joint governance relationship with its preferred OEM.

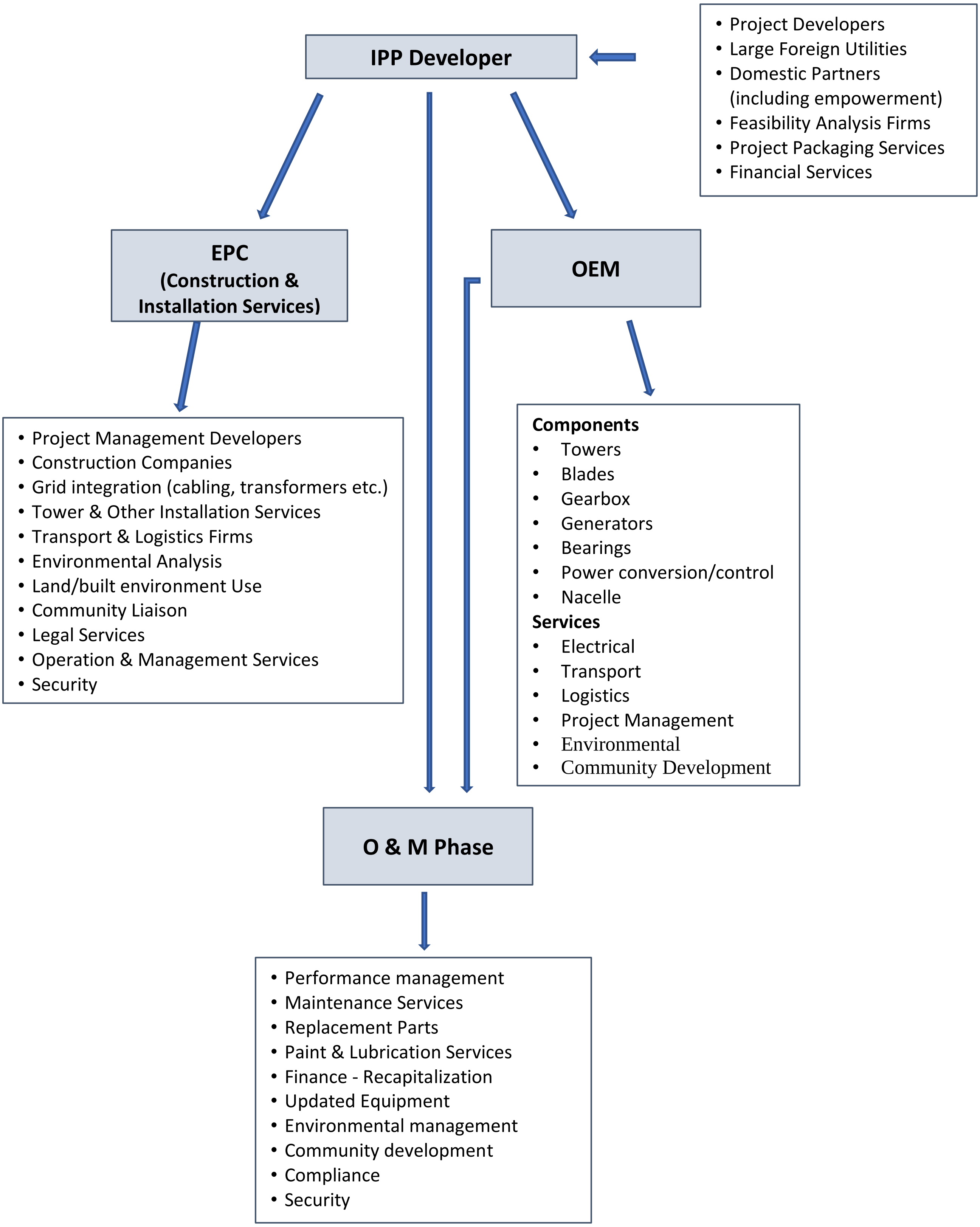
Table 1: Wind energy project development features for South Africa REIPPPP (circa 2013/14/15)
(**Key**: standard text = rarely localised; **bold** = substantially localised; *italics* = partially localized)

Procurement Stage	Corporate Response	Services utilized	Manufacturing
1. State sets out broad energy policy framework including RE elements.	Parties explore possible project feasibilities & partnerships (often prominent role by companies with existing profile of RE projects or utility companies).	**Public policy development (legal, financial, tariffs, grid planning, demand assessments/modelling, energy systems research).** Technical feasibility assessments (wind resources mapping, equipment testing). *Exploring of institutional arrangements (due diligence assessments; legal).* **Advanced training (energy-related)**	OEMs begin location adapted project modelling & design.
2. IPP Unit announces RFP intention to procure RE & confirms mechanisms	Parties establish bidding entities & secure MOUs with project partners, including OEMs, land-owners, prospective communities).	**Public procurement design & confirmation (legal, financial, grid planning, policy - environment, community, economic development)** *Detailed project feasibility, design & costing in consortium with confirmed OEM partner (legal, EPC, financial, environment, community, economic development, land use, logistics) leading to partner contracting.* **Advanced training (energy-related)**	OEMs & other possible suppliers interact over supply specifications. Confirmation of supply design range, prototyping, costings & production capacity verified.
3. IPP Unit opens RE bidding round	Lead bidders create financing SPVs and develop & submit bids for wind energy projects	*Final bid development including bid testing for feasibility in relation to confirmed bid requirements.*	
4. IPP Unit awards bids	Project developers confirm IPP contracts - verified award conditions, partner contracts - OEM, Project Managers, EPC firms, requisite local actors.	*Finance & legal compliance/closure; Technical compliance confirmed (equipment specifications, delivery terms, grid connection features, economic development, environmental/other specifications converted to project agreements).* **Project site agreement with land owners, communities, regulators (e.g. land use) – community development experts, land use specialists, lawyers, surveyors, marketing.**	
5. Energy contract signed	IPP & Eskom sign Power Purchase Agreement.	*Legal advisors.*	

6. Project development phase with bid & contract specifications monitored for compliance during project delivery	IPP issues contracts to initiate project delivery.	*Windfarm project engineering design* *Wind specialists; Project finance; Legal; Project Management* **Engineering, Procurement/Contracting for civil works & balance of plant by a single entity. Services procured include:** **Civils contractors; Building contractors; Town planning; Architecture; Environmental specialists; Community development practitioners; Enterprise development specialists; Site clearance contractors; Landscapers; Plumbers; Electricians; OHS services; Security; Staff accommodation/transport; Tower erection; Tower internals fitting; Grid tie in; Marketing & promotion** *Transport & logistics (incl. specialized cranes); Tools & equipment sales/supply; Turbine & blade installation contractors (working with OEMs); Operational testing; Training/certification of workers with specialist contractors*	OEMs lead production of turbines, handling design, procurement, some component production & assembly. Key turbine components produced by/for OEMs - gears, shafts, transformers, generator, brakes, controls, rotors, motors, wiring, instrumentation, nacelle, blades & **towers (concrete or steel**). **EPC companies procure balance of plant elements such as: access roads, tower foundations, substations and on-site temporary construction buildings, including reinforcing bars, cement, aggregate, bricks, on-site temporary construction buildings, electrical (cabling, lighting, switches, pylons, transformers etc), plumbing, communications equipment, *tools & equipment*, windows, doors, fencing, security equipment, plans for landscaping, roofing timbers, structural steel, roofing materials, pre-formed concrete/cement items (e.g. paving, drains).**
7. Project operational supply to grid enabled	IPP – wind farm starts when Eskom agrees energy supply to grid	*Performance monitoring* **Site compliance certified (environmental, building inspectors)**	
8. Operational phase with features of project monitored for ongoing compliance/performance		*Performance monitoring* **Site compliance monitoring (structural, environmental, etc.); Project contractual compliance (supply quality/availability/delivery, economic development, community obligations)** *OEMs or service providers contracted: monitoring tower, turbine, blade, physical checks, maintenance work;* *Specialist equipment hire; General site maintenance incl. environmental services management, grass cutting, maintenance/ repairs - built structures, civils structures (roads, paving, drains & electrical equipment; landscape services, building contractors, painters fire protection, plumbers, electricians); Ongoing security for site & facilities (security guards, armed response); Equipment supply/maintenance* **Advanced/technical training (energy-related fields; Marketing/promotion.**	OEMs or approved suppliers provide replacement parts (blades, gears, generators, l*ubricants*, instrumentation & sensors, *paints* etc). **EPC contractors or direct suppliers to supply *equipment* & materials for structures & facilities maintenance.**

Bearing in mind the above stages under REIPPPP, the various linkages and key actors players in the wind energy global value chain as it is manifested in South Africa are schematically represented in a value chain map form in Figure 2.

Figure 2: Schematic Overview of South Africa's Wind Energy GVC



4. Emergence of renewable energy commitments within South Africa's industrial policy

South Africa has a long history of active industrial policies to support the development of domestic manufacturing (Hirsch 2005, Bhorat *et al.* 2017). However, despite some notable successes in sustaining a competitive industrial base in a handful of manufacturing sectors, the country has experienced a considerable decline in the share of manufacturing output in GDP and also in the share of manufacturing employment (Bhorat & Rooney 2017). Whilst manufacturing registered very modest growth, other sectors, particularly those related to consumption activities, witnessed much higher rates of growth, and thus increased their share of national economic activity. South Africa's manufacturing prospects, initially geared towards growth through export orientation, were also challenged by the parallel rise of China as a dominant producer and exporter of manufactured items. The pressures of competing with this economic behemoth overwhelmed many manufacturing sub-sectors with many firms reducing their operations or even closing down. In response the government embarked, in the early 2000s, on a renewed effort to build a more effective industrial policy environment.[3]

The various Industrial Policy Action Plans (IPAPs), driven by the Department of Trade and Industry, were intended to set out the specific interventions that government would undertake, often with other stakeholders, to help achieve broad industrial objectives. The intention was to present some level of public policy support across a number of priority sectors. These included heavier industries that were seen to be aligned with efforts to add value to South Africa's substantial mineral resources, technologically complex manufacturing activities with extensive value chains (e.g. automotives) that could also help raise South Africa's export earnings and attract FDI, and labour-intensive sectors (e.g. clothing) to absorb large numbers of lower-skill unemployed. Although the first IPAP (2007) noted energy as an important sector, renewable energy did not feature high on any policy priorities.

However, the discourse started to change by the beginning of the new decade. In 2010, influenced by upcoming commitments linked to the planned 2012 Rio World Summit on Sustainable Development, South Africa hosted a Green Economy Summit. This marked the first key point where environmental sustainability challenges and clean energies were identified as significant for the intended economic development path. The summit report argued for setting aggressive long-term targets to stimulate industrialisation and local manufacturing, and use the energy transition to help develop green supply chains, skills and employment. Summit resolutions included: "Greater localisation of job-intensive green industries and those in which South Africa has a comparative advantage, in manufacturing of products and materials in key sectors, including in the low carbon energy, consumer products, building and transport sector" (Department of Economic Development 2010: 62). Although only one mention of the wind energy sector was made, the key ideas appeared in subsequent industrial policy documents.

The New Growth Path, driven by the small and less powerful Department of Economic Development, set out "critical markers for employment creation and growth and identifies where viable changes in the structure and character of production can generate a more inclusive and ***greener*** economy over the medium to long run." (Department of Economic Development 2011: 6). It identified "green economy" as one of key potential employment drivers and set a target of, "300 000 additional direct jobs by 2020 to green the economy, with 80 000 in manufacturing, and the rest in construction, operations and maintenance of new environmentally friendly infrastructure". It also noted that, "renewable energy opens up major new opportunities for investment and employment in manufacturing new energy technologies as well as in construction." (p.31). The NGP placed a "state-led" industrialisation path at the centre of government policy and elevated the role of public procurement as a core tool in achieving developmental objectives. Alongside this, the Department of Trade and Industry (where the

3 There have been numerous industrial policy iterations: Micro-Economic Reform Strategy, Integrated Manufacturing Strategy, Regional Industrial Support Programme, Support Programme for Industrial Innovation, National Industrial Policy Framework, Industrial Policy Action Plan, Regional Industrial Development Strategy, Customised Sector Plans.

real economic power lay) in its IPAPs of the early 2010s started to make some very limited mentions of the need to develop ‘green industries’ (Department of Trade and Industry 2011).

This did not mean that the government was positioned for a state driven green economy/renewable energy industrialisation path. For the State itself was fissured in terms of economic policy, adopting and circulating as official government policy three economic/industrial policies representing different departments and ideological positions – the overarching National Development Path (NDP) driven by the Minister in the Presidency for national planning and held greatest social sway, the IPAPs, from the Department of Trade and Industry which represented the consensus of many parts of industry, and the NGP which was marginalised as a left alternative position arguing for a more central role for the state in resolving South Africa’s economic challenges (Kaplan 2013).

The launch of REIPPPP in 2011, designed to procure the 3,725MW of new renewable energy generation allocated in the IRP 2010, and the creation of the IPP Unit with the backing of the National Treasury but housed in the Department of Energy, heralded a major step forward for the nascent “green” energy industrial policy intentions (Eberhard & Naude 2017). The IPP Unit proceeded to build a coalition of support amongst critical government departments (Morris and Martin 2015). Allocating smaller amounts through five bid windows allowed potential project developers time to prepare their bids, create a broader scope for participation, and increased competition between developers to drive the bid prices down. Most significantly, the segmented allocation also gave ample opportunities for ‘learning by doing’, and ensured that the process would remain dynamic and open to improvements.

To inform localisation discussions, the IPP Unit worked with the DED and the DTI to incorporate local content provisions in its auction requirements. The latter was in line with the second IPAP which had noted the potential of “green” industries, but the thrust of this “green” agenda was clearly prospects of concentrated solar thermal plants and biofuels, although in passing it made mention of the need to unpack the potential of wind, biomass and waste management (Department of Trade and Industry 2011). Job creation and new industrial development were viewed as key aspect of the bidding programme in order to gain widespread support within government, unions, and the various social partners. Hence the new renewable energy programme needed to have some local content requirement and development projects for the communities that the construction of these wind and solar farms would be directly affecting (Interviews with DTI and IPP unit officials).

The REIPPPP design process involved the DoE working closely with the DTI and the DED to build in programme features that might support the securing of significant local development impacts. The design of this programme was also informed by technical work done on behalf of the DTI supported by bi-lateral aid. In a report authored by Szewczuk et al. (2010), ‘Investigation into the Development of a Wind-Energy Industrial Strategy for South Africa’, the large potential of renewable energy generation was confirmed and the imperative for both supporting and leveraging this with industrial policy was articulated. The report noted that it was essential that a supportive and appropriate policy environment was created for renewable energy investors, especially considering the emergent characteristics of some of the technology and the lack of experience with both the technology and the institutional environment in the country. It thus emphasised that efforts at industrial policy would need the following to underpin the renewable energy programme:

- A favourable investment climate, stable macroeconomic policies, good repayment records in a legal system allowing for contracts to be enforced and laws to be upheld.
- A clear policy framework specifying roles and terms for private and public sector investments.
- Comprehensive regulatory performance
- Supervision of private and public sector assets.
- Coherent power sector planning with energy security standards and planning roles and functions, as well as built-in contingencies to avoid emergency power plants or blackouts.

- Competitive bidding and transparent procurement to drive down prices. (Szewczuk et al 2010).

With specific reference to industrial policy to support renewable energy and to support industrialization gains from renewable energy it was suggested that the DTI consider the following: Local content requirements, fiscal and tax incentives, export credit, quality certification, research. It was noted that similar industrial policy efforts had been used across a variety of sectors internationally in support of strategic sectors (Table 2 below).

Table 2: Policy measures to support wind power, country comparison

Direct Policies	**Primary countries where implemented**
Local content requirements	Spain, China, Brazil, Canadian Provinces
Financial and tax incentives	Canada, Australia, China, USA, Spain, China, Germany, Denmark
Favourable customs duties	Denmark, Germany, Australia, India, China
Export credit assistance	Denmark., Germany
Quality certification	Denmark, Germany, USA, Japan, India, China
Research and development	All countries; notable programs in Denmark, Germany, USA, Netherlands

Source: Lewis and Wiser (2007) as reported in Szewczuk et al 2010: 104

Szewczuk et al (2010) also noted that a range of factors would impact on the feasibility of attaining local content and employment gains. These included the technology deployed (the type of towers and the characteristics of the turbines), the expected performance requirements of facilities, the contract periods, the scale of projected demand over a horizon of projects, pricing for energy sold on the grid, related and supporting policies linked to potential suppliers, and other regulatory factors, including for instance financing, taxes and incentives.

The DoE and the DTI agreed on the procurement approach to adopt for using REIPPPP to achieve economic and developmental agendas. The South African Preferential Procurement Policy Framework Act (PPPFA) dictates that tenders will be selected on a 90/10 preference point system - 90 points by price and 10 points allocated for a specific set of development-based criteria. The IPP Unit requested an exception and were granted a 70/30 preference point system (See Table 3). There was a fear that 30 developmental points would deter foreign interest in the REIPPPP. However, the IPP Unit deemed this risk necessary to ease the tension between the DoE and National Treasury's energy security aims and DTI's developmental objectives, as well as to assuage the concerns of industry and labour.

As a result, the consortiums bidding for the first round of auctions were required to meet some minimum requirements (amended in later rounds) in terms of specified fields of 'Economic Development'. These included job creation, local content, ownership, management control, preferential procurement, enterprise development and socio-economic development. According to a senior DTI official involved in this process, all these fields were understood to contribute in some way to enhancing the prospects of industrialization. However, the local content requirements were understood as being the most targeted instrument in support of domestic industrialization objectives.

Table 3: REIPPP Economic Development criteria scoring component in South Africa's auctions

Economic Development Element	**Weighting**	**Points**
Job Creation	25%	7.5
Local Content	25%	7.5
Ownership	15%	4.5
Management Control	5%	1.5
Preferential Procurement	10%	3.0
Enterprise Development	5%	1.5
Socio Economic Development	15%	4.5
Total	**100%**	**30.0**
ED Total Points	30 points	
Price Total Points	70 points	

Source: Morris and Martin 2015

This approach sought to use these criteria as the primary and sole instrument in helping to achieve a somewhat narrowly framed industrial policy outcome. As officials involved in the process noted, the country was entering a new field of energy investment, and government did not want to add significantly to already mounting issues of wider investment risk for potential investors. It was also very cognisant of trying to avoid onerous requirements that might translate into higher energy prices in a context where South Africa's energy costs had already been reflecting major increases. Hence the IPP unit response to support industrialization was somewhat muted as part of an effort to ensure that the overall policy environment for renewable energy investment was attractive for investors. Critically, there remained major uncertainty where departmental leadership of a 'greening' of industrialisation would lie. The DED was identified as the lead national department for the 'green economy', but it was a junior government Ministry, whilst the DTI, which had the substantial clout, had the mandate for industrial policy efforts and the dominant view within it paid lip service, rather than championing, a green industrialisation path as a central policy plank (Interview with senior DTI official).

This division between government ministries was also reflected within departments. For example, in 2102 an official within the DTI developed a powerpoint presentation - A Solar and Wind Sector Development Strategy Solar Energy Technology Roadmap – arguing that "a large renewable energy programme can put electricity on the grid, support industrialisation and jobs and address South Africa's climate commitments." (Ntuli 2012: 4). The aim was to shift thinking within the DTI to support the broader renewable energy development, referred to as "market creation", through a variety of measures - encourage suppliers to take advantage of incentives, renewable energy finance via DFIs, R&D support, trade and investment facilitation, and developing technical and physical infrastructure.

DTI officials responsible for carrying these programmes forward indicated that some progress was made on these fronts, but mainly through the scope of the DED. For example, winning some support from DFIs for financing of renewable energy black empowerment stakes in REIPPP projects, boosting research and development at the Council for Scientific and Industrial Research (CSIR), as well as facilitating purchase agreements linked to start-up tower, turbine and blade manufacturing (Interviews with former and present DTI officials). However, there is no evidence that it developed sufficient traction within the DTI to significantly impact on the direction of its flagship IPAP.

Simultaneously there were ongoing discussions between the IPP office, other sympathetic government officials, and the local content working group of the South Africa Wind Energy Association (SAWEA) Manufacturers focused on the economic development intentions of the REIPPP. This resulted in the IPP office initially raising the bidders expenditure targets on local content (in the second round of bids) and then looking to raise both the qualifying threshold and the target in the third round of REIPPP bidding criteria. For example, wind and solar photovoltaic started the first round with local content thresholds of 25% and 35% with targets of 45% and 50% respectively. For the second bid the threshold remained the same but the target jumped to 60% for both, whilst in the third bid the threshold rose to 40% and 45% respectively and the target increased to 65% for both (IPP Office, 2016).

The rationale was to increase the spread of local spend without specifically focussing on what that spend should incorporate. The initial phase of REIPPPP had made allowance for project planning work, done by South African-based teams/subsidiaries of international companies and the Engineering, Procurement and Contracting entities (EPC) associated with establishing solar or wind farms and their grid connection infrastructure. However, it did not specify any local content items, that should make up the bulk of 'local content' spend. By shifting the thresholds and targets for local content in the REIPPPP bids it was intended to require bid winners to raise the level of local procurement spend beyond initial project services and construction-related consumables/inputs to include key items related to the solar and wind energy technology. In the case of wind energy this might include transformers, towers, blades, turbines and their nacelles and associated componentry.

Crucially though this approach to local content contained a major industrial policy flaw. By only focussing on the blunt policy instrument of local spend it was geared to various departments being able to meet social targets of general employment and black economic empowerment, rather than a strategic industrial policy intent to build local services and manufacturing capacity. In the process it skewed local content away from focusing on increasing particular value-added activities (post project planning services, or critical manufactured items, or technology acquisition) in the supply chain to make the greatest domestic industrial impact.

There was some intent from some DTI officials for a more substantial and coherent institutional policy approach but it did not move much beyond these blunt localization elements in REIPPPP bidding programme.[4] For instance, IPAP of 2012/13 – 2014/15 was clear and ambitious in stating: "The localisation of elements of the global value chain for wind and solar power could establish South Africa as a regional renewables manufacturer and service hub…. An integrated and coherent strategy is required to combine a renewable energy generation plan with an appropriate financial and industrial development localisation strategy." (Department of Trade and Industry 2012: 67). It is however far from clear whether the these IPAP sections were much more than words since there was very little of an implementation strategy attached to them.

The DTI commissioned a study intended to review the experience of the first phases of the renewable energy programme and its industrialisation impacts, as well as to inform government industrial strategy choices and policy making on possible future reforms of the renewable energy procurement efforts. The study set out a series of approaches for a more substantial industrialization path around wind energy renewable energy procurement than had been in the general statements of intent issued previously. However, as a senior DTI official noted, the study was commissioned simply as a guide to the setting of targets for future strategy. It noted the progress at the time in the establishment of two steel wind tower producers - DCD at Coega, the Gestamp Renewable Industries (GRI) project in the Western Cape - and also the commissioning of concrete towers by Acciona (via Concrete Units). These were highlighted as important indicators of what could be achieved in domestic manufacturing terms, with a relatively modest local content policy, and without much in the way of additional policy support. It also noted that ongoing wind energy investment in the country was projected to generate further opportunities in blade production and nacelle/casing production as well as assembly of the nacelles. This is something that industry respondents confirmed was being actively considered in light of possible REIPPPP auctions related to the then planned round five and future expected rounds.

However this report also noted that the substantial deepening of manufacturing elements of the value chain would require a greater market allocation to wind energy in that, "allocations suggested in Promulgated IRP (2010) will offer limited opportunities and in the case of the draft updated IRP (2013) no opportunities for establishment of new manufacturing facilities in the future, if considered without other market segments" (Urban-Econ Development Economists & Escience Associates 2014: xx)[5]. These market segments related to either expansion of installation levels in South Africa and/or growth of a sub-Saharan market for wind energy renewable energy which might be able to be partially serviced from South African component producers. Present and former DTI officials noted that this expansion was being pushed for as a key part of the green industries programme.

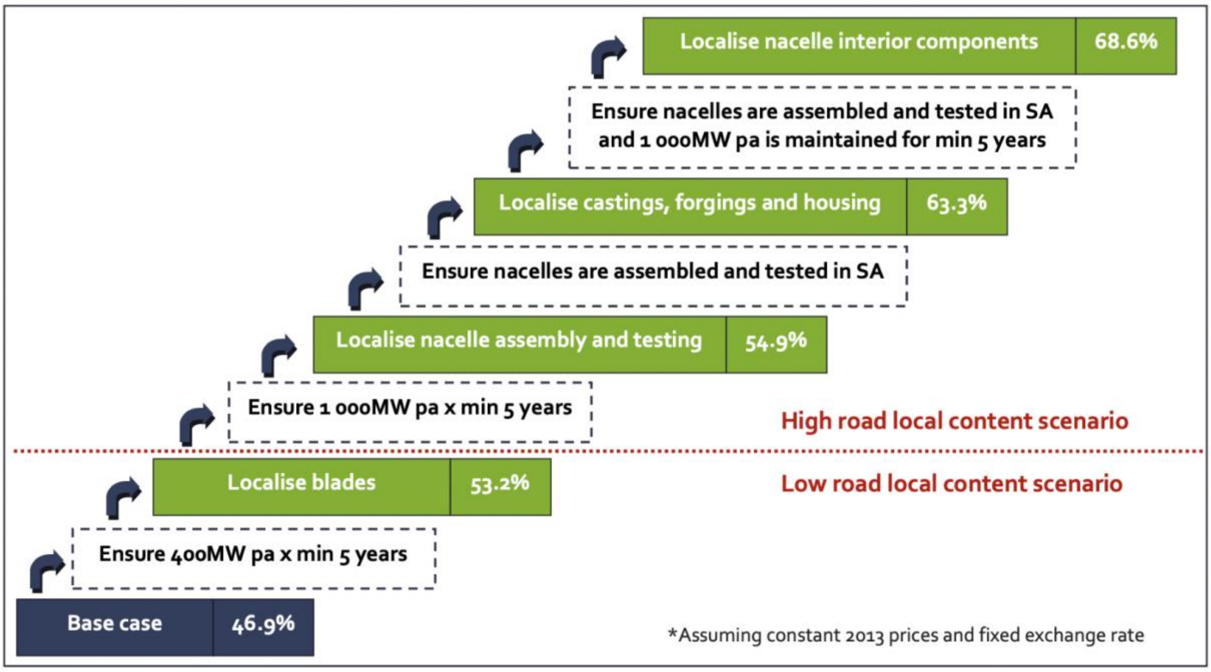
Figure 3 provides a summary of the "low road scenario" (based on the 2010 IRP commitments) and a progressively enhanced "high road scenario" (increases in IRP wind energy commitments and

4 Interviews with present and former DTI officials

5 The draft 2013 IRP, which was published for comment but never adopted by Government, outlined an intention to cut the 2010 IRP wind energy procurement from 9 200MW by 2030 down to 4 360MW for the same period. This would have substantially increased the risk and curtailed the scope for securing the large-scale manufacturing capital investments – e.g. the DCD wind towers project which struggled to meet delivery standards and closed in 2016, with the loss of 125 jobs.

expansion of the SSA market) if it was possible to secure a progressive increase in the value of local content manufactured in South Africa.

Figure 3: Various local content scenarios for wind energy in South Africa



Source: Urban-Econ Development Economists & Escience Associates 2014: 141

The development of local capacity for blades and other components (beyond towers and some ancillary items) was clearly stated, in this advisory report to the DTI, to require both "market-pull" mechanisms and "demand-push" mechanisms: ".. it is clear that setting new thresholds and targets needs to be accompanied by a support programme to catalyse local manufacturing, and at the same time revise the manner in which local content thresholds are stipulated" (Urban-Econ Development Economists & Escience Associates 2014: 149). Examples provided of "market-pull" interventions were mainly identified as those which increase the scale of wind energy commitments in South Africa and a clear policy path to realise these. "Demand-push" interventions related largely to policy efforts aimed at supporting existing and prospective manufacturers such as incentives, trade policies and finance support. The imperative of policies to support both these dimensions has also been noted by Montmasson-Clair & Ryan who stated, in their review of the procurement features of the South African renewable energy programme, that "industrialisation envisioned as part of the programme remains constrained owing to the limited megawatt capacity allocated per technology (to create sufficient aggregate demand for international companies to set up manufacturing sites in the country) and the small existing manufacturing base." (2014: 522)

The handful of key officials trying to press for a more substantial commitment to renewable energy in the review of the IRP all suggested that they understood this as key to shifting the industrialisation gains from a few initial projects into a more viable industry growth path. They assumed that the forthcoming IRP would be even more renewable energy friendly, and planned a more ambitious strategy to yield local industrialisation gains. According to DTI officials (present and past) interviewed, the assumption made was that the time was ripe for a more aggressive set of renewable energy commitments. To some extent this was incorporated within industrial policy material produced subsequently by the DTI. The IPAP (2014/15 – 2016/17) emphasized the importance of using public procurement to support industrialization gains and committed to, develop and design further sector-specific incentives for strategic sectors such as "Green Industries". It added that the "sheer size and long term nature of the REIPPPP provides an ideal vehicle to support the development of a competitive

renewable energy manufacturing sector and related support industries that will also lead to the creation of decent jobs.” (Department of Trade and Industry 2014: 112)

However, this came to nought as the fissures in government resulted in dramatic shift against a renewable energy based green industrialisation drive. The coal lobby and carbon emission coalition backing Eskom, undeniably supported by then President Zuma, who was already “captured” (Chipkin & Swilling 2018) by a predatory group inside and outside the state intent on looting state coffers (in this case Eskom), used the draft IRP of 2013 to push for a drastic reduction in renewable energy allocations. This predatory elite was actively engaged in securing massively corrupt coal and other tenders from Eskom at inflated prices, with no due diligence exerted, and no control over their contractual delivery performance. Since their economic success depended solely on diverting state funds into their own bank accounts, they viewed the private sector driven renewable energy programme as a competitor to be undermined and stopped. Rather than publish a new IRP the Cabinet instead effectively suspended the REIPPPP auction bidding process. Eskom refused to sign purchase power agreements for awarded projects. Ministers and the regulatory bodies under their supervision halted signing off on any of the planned future renewable energy auction steps (Morris and Martin 2015; SAREC 2017). The balance of forces within government had dramatically shifted.

Despite this premature stalling of the programme, the DTI still reported positively on local content gains. The DTI’s IPAP 2018/2019 – 2020/2021 (10th edition) states that as of early 2018 the “total committed investment is R201.8 billion, of which REIPPPP has attracted R48.8 billion in foreign investment and financing. This created 32,532 new job years for South African citizens and has secured carbon emission reductions of 17.25 Mtonnes of CO_2. It has also contributed to localisation objectives, with local content commitments by IPPs amounted to R67.1 billion, or 45% of the total project value of R147.6 billion for all the bid windows. Actual local content spend – where construction has already started - amounts to R38.1 billion.” (Department of Trade and Industry 2018: 41).

However, despite this enthusiastic reporting of selected impacts from past rounds, it appeared that in the face of dithering on energy policy at the highest level in government, the DTI could do little more than note that the absence of policy clarity and actual renewable energy procurement. Officials suggested that this policy impasse made the further development of a somewhat more sophisticated industrial policy response rather moot. In echoing the prior advice it had received the DTI’s IPAP 2018/2019 – 2020/2021 noted that previous policy had recognised that “a critical mass of renewable energy-generation projects can achieve a range of objectives including localisation of components, job creation and competitiveness improvement”. In an unusually candid comment, the document also acknowledged that the failure to create an appropriate investment environment for renewable energy was, “starkly illustrated in the stalled REIPPPP and the negative investment market signals which arose from this”. In a similar vein, the DTI went on to point out that the “inescapable imperative of securing a dramatically less energy, carbon and waste intensive, environmentally sustainable growth path - across all sectors of the economy - requires much greater collaboration and calibration of policy and programmes across all of government and the SOCs. This will need to embrace the challenge of transitioning out of carbon-intensive, mostly coal-based production to renewable energy in a manner that has minimal socio-economic impact and grasps the significant industrial opportunities that will arise from this critical transition” (Department of Trade and Industry 2018: 41, 6). Although the remainder of the stalled Round 4 IPPs had been approved, after years of delay, to progress in 2018, there still remains little in the way of policy clarity on how the energy landscape will develop, despite the government endorsing a new Integrated Resource Plan 2030 in late 2019 (Department of Energy 2019) confirming an intention to proceed with procurement of a further 14,400 MW of wind energy through to 2030 (on top of existing installed capacity of around 2 000 MW).

5. REIPPPP and Localisation

Despite the damaging *de facto* suspension of the South African REIPPPP programme in 2015-16, four rounds of REIPPPP auctions were initiated. Three of these, Round 1 (advertised in 2011), Round 2 (also advertised in 2011) and Round 3 (advertised in 2013) led to a number of renewable energy projects being actually delivered after the conclusion of all the necessary regulatory procedures. As of April 2018, 43 REIPPPP facilitated projects were operational adding 2 062 MW to the grid. By March 2019 there were 22 operational Wind IPP's with an "installed capacity of 2 078 MW connected to the national grid with more than 900 Wind Turbines spread out over three provinces" (SAWEA 2019a). The much delayed signing off of 27 additional REIPPPP bids in April 2018 (including projects from round 3.5 and 4) saw the total sum procured for all renewable energy (although not yet all operational) stand at 6,328 MW (IPP Office 2018: 26). As of 2019 wind energy was supplying 52% of South Africa's renewable energy power (SAWEA 2019a).

In terms of the localisation impacts, as required in terms of the REIPPPP local content obligations, the reporting generated by the IPP office indicates that the contracted projects met both the bid and implementation requirements (Independent Power Producer Office 2016). Drawing on the same administratively reported data, Lovins and Eberhard (2018) report that in terms of job creation in the first three rounds targets were generally exceeded. As Table 4 demonstrates, in terms of local content, where the first three rounds initially had a threshold of 40% (later increased to 45%) and a target of 65% of the project value, achievement was reported at 50% or a total of R37bn.

Table 4: REIPPPP BW1-3 - Economic Development Criteria Thresholds, Targets and Achievements

Element	Description	Threshold	Target	Achieved
Job Creation	RSA based citizens	50%	80%	90% (Construction) 95% (Operators)
Local Content	Value of local content spending	40% - 45%*	65%	50% (R37 billion)

* 45% for solar PV, 40% for all other technologies
Adapted from Lovins and Eberhard (2018)

Eberhard & Naude (2017) provide an overview of the average local content outcomes for wind energy across the bid windows 1- 4. Here it is worth recalling that across the bid windows the local content requirement was escalated (in terms of thresholds and targets) and the obligations associated with this were made more stringent as policy makers sought to secure greater manufactured input. Across the primary renewable energy technologies (solar and wind) the average bid levels for BW1 and BW2 did not change much, "suggesting that there were constraints to achieving higher local content expenditure" (Eberhard & Naude 2017: 4). This issue of constraints was confirmed by interviews with officials of the IPP Office and with a wide range of industry participants[6]. For example, an expert in energy project financing with experience of a number of the bidding consortiums, pointed out that the absence of local manufacturing of key turbine components made it difficult for local content to go much beyond the minimum specified bid levels. The Director of another company servicing EPC projects pointed out that establishment costs of wind farms generally saw around 70% of costs bound up with the towers and more particularly the turbines and blades.

Therefore, in order to raise the local content by value, some elements of these higher cost items had to be sourced locally. This was initially achieved with the local production of concrete and steel towers. Towers and Balance of Plant[7] together (excluding turbines and blades) were estimated to contribute to around 46.9% of costs in an average wind farm project (Urban-Econ Development Economists & Escience Associates 2014: xxiv). The towers and tower foundations made up the bulk of these costs -

[6] *"National Treasury and Energy were very cautious about loading the programme with too many factors that might push up energy prices, but we understood the programme could evolve..."* (Interview with senior DTI official).

[7] Other items not core to the turbine and its related components and casing such as transformers to connect to the grid, foundations, roads, buildings, fencing, tower internals such as ladders and wiring.

on a per tower-turbine unit basis steel tower costs are generally estimated to be 25% of the total, excluding other ancillary costs for infrastructure at a wind farm such as general buildings[8].

The development of local tower capacity thus enabled the IPP Office to be confident that by BW 3 the minimum local content required could be confidently raised by the IPP Office from 25% to 40% (Table 5). Bids in BW 2 had already started to substantially exceed the lower minimum level and this momentum was sustained into BW 3 and BW 4 as projects found ways to increase local spending in a range of specialised fields - sourcing more certified locally manufactured elements such as tower interiors (ladders, wiring, lighting), components to tie wind farms into the grid, and specialised services such as transportation and the erecting of towers and the associated installation of turbines and blades[9]. The local head of a European OEM turbine company noted that there was an industry-wide push to find ways over and above local tower sourcing to raise local content in order to win bids. He emphasised the complexity of situation in that any one IPP was unlikely to be in a position to provide enough work for some categories of suppliers on its projects alone. As a result of the relatively modest market size generated by the REIPPPP, the impact was often one of deepening the capabilities of a narrower set of firms rather that a wide array of suppliers being able to be supported. This was also noted by a specialised transport provider who indicated that in order to get sufficient loans to buy specialised equipment he had to demonstrate to the local banks that he had contracts to supply services to a number of projects that would provide some sustained revenue.

Table 5: Average Local Content as a percentage of Total Project Cost versus Thresholds* and Targets

	BW 1			BW 2			BW 3			BW 4		
	Min	Target	Average Bid	Min	Target	Average Bid	Min	Target	Average Bid	Min	Target	Average Bid
Wind	25%	45%	27.4%	25%	60%	48.1%	40%	65%	46.9%	40%	65%	44.4%
Solar PV	35%	50%	38.4%	35%	60%	53.4%	45%	65%	53.8%	45%	65%	62.3%

*Threshold = Minimum obligation

Adapted from Eberhard & Naude (2017)

Also key to enabling the higher level of local content, beyond the towers and mostly localised EPC, was what a senior local official of a European OEM reported as, *"a surprisingly capable and innovative group of technical services companies"*. The respondent noted that although the risks of working with new suppliers was very high in the first bid round, as the OEMs became increasingly familiar with the capabilities of domestic firms and they found there were many individuals and specialist companies that could adjust to working in the renewable energy space despite often high barriers to entry. This enabled consortiums to be confident in trying to reach higher targets and in actually attaining them. A major advantage for some of these non-manufacturing suppliers was that they could also access global opportunities and thus were not limited to the emerging South African market (Interview with a the South African-based renewable energy division of an international engineering and built environment services company).

It is worth appreciating that across these bid processes, the DTI, and DED did not only expect the local content requirements to do all the work of their renewable energy-linked industrial policy. They also sought to facilitate the entry of a local tower producer and put similar efforts into the IWEC consortium[10] that was expected to produce both a local turbine and a local blade fabrication plant. As

[8] https://www.windpowerengineering.com/understanding-costs-for-large-wind-turbine-drivetrains/.

[9] The significance of the different categories of minimum, target and average (Table 4) requires elaboration in order to analyse the local content movement during these four bid windows. The weighting of local content (25%) in the total bid tender score meant that IPPs needed to go beyond the minimum threshold in order to up their score. Hence local content proposals within bids tended to collect around the target rather than the minimum. This is evident in the jump in average bids - from 27.4% in window 1 to 48% (window 2, 46.9% (window 3), and 44.4% (window 4) when the target was raised after window 1 – as the IPP office and DTI tried to use policy regulations to encourage an increase in local content.

[10] https://www.ee.co.za/wp-content/uploads/legacy/energize_2012/09_ST_02_Massive.pdf.

an official of the DTI noted, *"it was clear to us that we could not just sit back and wait for international suppliers to come, we wanted to encourage domestic firms to enter this business"*. Considerable institutional backing was provided to these local flagship projects - the Dorbyl/DCD tower plant and the IWEC turbine and blades initiative.

However, these industrial policy efforts did not take cognisance of the dynamics driving the wind tower global value chain which tended to support a follower sourcing model (Larsen and Hansen 2017). The OEMs driving the installation of a particular IPP winning bid can, and in many cases where demand justifies do, encourage their foreign first tier suppliers (e.g. towers, blades, and nacelles) with whom they have longstanding trusted relationships to establish a subsidiary plant in the country. They typically start this follower sourcing process through localising production of *towers*, then *blades* (which is often the most expensive component to localise other than production of key elements of the turbine itself), and then *nacelles,* including assembly of imported components (in some cases also locally sourced inputs). Follower sourcing ensures that critical technical standards are maintained, logistic import costs are cut, and delivery reliability is maintained. But OEMs only encourage follower sourcing if a combination of factors is in place - market demand has to be large enough to justify local production, continuity and predictability of window bids over time to ensure sustained market demand is guaranteed by the country's renewable energy IPP allocation framework. Moreover, if the host country has an industrial policy specifying clear and key local content requirements that need to be met, coupled with appropriate incentives, then follower sourcing will be tailored to country context.

Follower sourcing as a key GVC strategy was confirmed in interviews with company representatives from the European headquarters and South African offices of some major wind OEMs (e.g. Vestas, Siemens) as well as foreign multinational first tier suppliers (e.g. GRI, LM Wind, Resolux). As one leading OEM representatives put it, the company *"tries to encourage first tier suppliers of critical components to go together into a new market either by using sticks or carrots tactics".* First tier suppliers depend greatly on established trust relationships with the OEMs, and they therefore follow direct requests and established commitments within an OEM's follower sourcing strategy. As a blade manufacturer put it, "*We have no plans to localise. The OEMs have the plan and we simply react*".

Given that these OEMs were dependent on already established, high trust relationships with their own 1st tier suppliers, they were not willing to take the risk of procuring such a critical high-risk item from an unknown new local first tier producer. As one local OEM representative put it, *"we did share our specifications and certification requirements with the DCD team but they were trying to do in a year or two what other global suppliers had developed in almost two decades"*. Ultimately, despite the acquiring of equipment by IWEC and the production of a prototype and the official opening of the DCD plant, neither managed to secure any business in the four rounds and any prospect of doing that was undermined by the suspension of the REIPPPP. As a former senior DTI official reflected, *"there remains a very strong view amongst the political leaders that localisation must be about indigenous firms being grown into this supply chain, but this obsession might well have cost us opportunities to bring more follower suppliers in at an earlier stage"*.

The emphasis that a key measure of localisation should be about black ownership – in line with the government's intent to accelerate Broad-Based Black Economic Empowerment – as well as the focus on the quantum of employment generated, rather than the specific technological capabilities associated with firms and their related employment profiles, revealed the somewhat blunt character of the local content policy scoring system utilised by the IPP office. This was summarised by an OEM representative that, compared to South Africa's successful local content programme in the automotive industry, local content within the overall REIPPPP framework was less important compared to black empowerment. In his eyes it was apparent that the DTI had either not been involved in using its experience in other sectors to design similar local content regulations for REIPPPP, or had not seen it as integral to its industrial policy priorities. By ignoring the crucial strategic task of building

capabilities and skill levels in the renewable energy value chain and instead using very blunt policy instruments, the government diverted state industrial policy away from a targeted process of enabling a new strategic industrialisation path. It sacrificed long term industrial possibilities for short term political gains for vested interests. As one of the foreign first tier MNC representatives put it: *"In South Africa, it appears that the objective has been mainly to employ as many people as possible, preferably woman and black employees, rather than promoting a technology industrialisation strategy per se. This is the opposite in Russia, where local component production is key".*

This blunt approach is apparent in an unofficial presentation of the DTI's (Green Industries Directorate) where measures of "development success" under bid windows 1, 2, and 3 focused primarily on "development criteria" defined as: job creation, local content defined as local spend[11], advancing ownership by black people and local communities, involving black people in management positions, and preferential procurement by sub-contracting to black and women owned enterprises. In terms of this presentation the programme was deemed to be contributing to broader development objectives by using three very blunt policy measures: 30% percent "shareholding by black South Africans across the complete supply chain, with 11% by local communities"; 49% local content achieved in construction, with local content measured by percentage of total value spent; 111% total amount of employment achieved during construction, being 11% higher than the set target (Department of Trade and Industry 2016: 7). Reference to the desired broader industrialisation gains, as noted in various DTI policy documents already cited, seemed to get no mention in the way the DTI reported on the impacts. This was despite the DTI staff interviewed acknowledging that both wind and solar energy procurement had the potential to provide important lessons for deepening green industrialisation gains beyond these narrow measures in order to enhance local productive capacity to participate in growing global value chains. According to an industry observer, this situation might have emanated from the rise in populist policies at the core of the Zuma government. It was argued that the intended finesse in many public programmes and projects was lost in favour of accelerating highly visible, yet often unsustainable policy choices.

Government under this administration promoted state-owned enterprises (e.g. Eskom) into a central role in its agenda for changing the structure of the South African economy. This elevated decisions around energy (also transport etc) above other policy concerns, and ensured that the real policy focus centred around matters relating to Eskom and its supplier mines. Despite some lofty goals stated in policy documents, the real effect of this was to drop the development of a new "green" industrialisation path way down the economic agenda. Energy and economic policy largely orbited Eskom and its restructuring problems/concerns, rather than a wider set of industrialisation objectives centred around using renewable energy pathways to secure a new industrialisation trajectory. In political economy terms, the net effect was that the balance had shifted dramatically, and the voice of those in the DTI (and elsewhere) that were pushing an agenda more aligned with global trends were substantially marginalised.

Nonetheless, despite this somewhat narrower reporting focus, after bid window 1, some evidence of steps towards deepening local industrial capacity were observed. Since securing bids still required more local content, the OEMs began engaging with their 1st tier suppliers to consider establishing local production plants in order to help them meet expected increases in local content requirements. After bid window 2 the multinational wind tower company GRI established a large plant in Atlantis to ensure local wind tower supply, based in part on a promise of exclusivity of supply from one OEM player in the South African market. A number of industry respondents and government officials also confirmed that there were advanced discussions for a large international blade manufacturing companies to set up an operation in South Africa. Two international OEM's operating in the country also outlined that

[11] Paying local agents for imported components is local spending in the South African economy but that does not mean localisation of such componentry has occurred.

feasibility work was being done on nacelle assembly and some additional component sourcing. This was based on projections of a possible longer-term horizon of wind energy projects in the country – something that the DTI report had also envisaged.

However, when these localisation processes were stalled in 2015 and the South African government *de facto* put subsequent rounds of the REIPPPP bidding process on hold, it became clear that the balance of power within the state had decisively shifted against the REIPPPP program. The coalitions of interest in the public and private sector backing coal fired energy, as well as those clustered around the Zuma state capture project dependant on siphoning off state funds through various corrupt tender practices, had consolidated their hold on the state and was backtracking on its published and projected renewable energy commitments. Ironically just as the world was decisively shifting away from carbon-based energy generation, and the South African renewable energy framework was being internationally hailed as pathbreaking, the whole REIPPPP programme came to a shuddering halt.

The reliability of South Africa's renewable energy policy bidding process was fundamentally undermined by this process of starting and then capriciously stopping. Global IPPs interested in South Africa as a viable renewable energy environment could not, indeed would not, make investment decisions and balance financial risks without a perspective of long term policy reliability. They could not look to consolidate consortium partners, not prepare the necessary, but arduous and financially risky, bidding documentation if there was no certainty as to when the next bid window would become available. As one IPP developer representative put it: *"We need an IRP with clear yearly allocations to provide policy certainty for renewable energy investment…. At the moment we are caught between REIPPPP commitments and policy uncertainty".*

This refrain was repeated through a number of interviews with various private sector players. Respondents repeatedly emphasized the need for consistency in the REIPPPP determining investment and localisation responses within the value chain. In short, without the policy guarantee of long term **continuity** of the renewable energy programme, coupled with a scheduled and repetitive **predictability** of the window bidding process, the REIPPPP auction system could not continue to attract IPP developers and consortia.

The breakdown in continuity and predictability of the REIPPPP auction framework did not only put a halt to the IPP bidding process. It also cascaded down the value chain, putting the brakes on foreign enterprises trying to implement local content policy, as well as local suppliers taking advantage of new opportunities provide by the policy, and thereby fundamentally undermined the localisation process. The connection to the REIPPPP framework was pithily reiterated by another OEM senior staff member, *"predictability is key to localise production"*. As an OEM executive said *"The stop and go policy made sure that all industry localisation gains were killed"*. A public sector official working with the industry in the Western Cape noted that the breakdown in the continuity of the REIPPPP process, "*caused all the hard work in developing both local supplier and follower sourcing FDI projects to be put on the back burner*".

This breakdown of continuity and predictability manifested itself all the down the value chain starting with the large foreign first tier suppliers.

- A first tier tower supplier, having established a plant in Atlantis in 2014, was forced to put workers on short time and then use its global base to try and export. Finally, it was forced to stop production waiting/hoping for the REIPPPP bidding process to recommence. It was only because of the fact that it was a global MNC that the company was able *"to weather the storm and stay open"*, through shifting equipment around and moving into other markets.
- A first tier blade manufacturer which regards following sourcing as a logical continuation of its strategy of responding to its OEM customer needs, halted advanced negotiations to set up a plant in South Africa. As was explained in the interview, the main problem in SA has been the

“*size and lack of predictability in the market demand”*. It typically takes 3-4 years to upgrade a local supplier of critical components to become able to deliver the expected quality. Without a guarantee of an expanding larger market the company was not willing to invest in building up the entire local supply chain and developing the efficiencies to meet international standards.

The intermittency of auctions also cascaded down to second and third tier local suppliers. We set out two examples which captures different types of such locally owned supplier firms.

- A wholly South African owned project services company engaged across different aspects of onsite plant installation (electrical, mechanical, rigging, project management and planning) using highly skilled, nimble, flexible, and knowledge intensive staff had managed to substantially upgrade its offerings through substantial investment in skilled staff technical training was badly hit by these continuity constraints. It was saved from having to shrink the firm and retrench staff by moving offshore and adopting an export business strategy. However, it was only able to export its services to new IPP projects in France, Denmark, and Sweden because it had built up strong trust relations with its OEM partner (Vestas) in South Africa. This OEM’s headquarters then requested the local firm to utilise the learned knowledge it had accumulated, following it into these new locations where it was building wind energy plants.
- A small transport company saw the opportunity after the round 1 bid in providing specialised rigs to transport towers. It invested heavily in the necessary specialised trucks and trailers over the various bids, and soon became the major specialised logistics and transport provider for various IPP projects. By round 4 the firm had won the transport contracts for nearly all of the successful projects. The continuity of the IPP bidding process allowed it to build up capacity and flexibility for different types of loads over time. It started in 2013 with 60 staff members, 15 trucks, and 10 trailers. In 2016, on the back of the successful bidding program, it invested heavily in expanding capacity and equipment to 150 staff, 40 trucks, and 35 trailers. The halting of the REIPPPP bidding process hit the firm badly in 2017 when work dried up. It survived by shifting labour not on fixed contract off its books, and moving into finding other markets, using its specialised heavy duty equipment to transport machinery for the mining industry. In 2019 with the hesitant restart of the IPP program the firm once again has expanded - with 180 staff, and now owning 50 trucks, 50 support vehicles, 50 trailers, and 6 mobile cranes which were previously hired in. However, the REIPPPP bidding process still not guaranteed and the possibility of further breakdowns in continuity and predictability the future still looks frighteningly uncertain. As the owner said: *“No industry can operate on a stop/start basis …. the banks tighten financing conditions, and shorten the repayment terms because of risk .... In order for business to be stable we need continuity …”.*

In summary the breakdown of continuity and predictability in the auction bidding process had a disastrous effect down the value chain. It disrupted plans of investors across different tiers, forced major adjustment costs on suppliers, resulted in company closures and blocked new supplier initiatives, caused a shedding of carefully developed skills capabilities, resulted in major job losses, and paused important local content policy reform efforts

Establishing continuity and predictability of the REIPPPP programme and embedding these within a regulatory framework committing government to designated and clear stepping stones would have created an environment in which viable investment projects and supplier relationships could be built. It would have avoided the unravelling of industrialisation that had been taking place since the REIPPP programme had been suspended. It would have also made it more difficult for extended policy disputes within government and with other stakeholders to block or delay the necessary revised IRPs confirming annual renewable energy uptake to meet the country’s energy demand and its climate change obligations. Both OEMs and existing local suppliers placed these issues of continuity and

predictability at the heart of necessary requirements for any ambitious plan to stimulate "green economy" sectors, including building capabilities related to supplying wind energy technologies.

The critical issues of continuity and predictability have been reiterated recently by the wind energy industry association in South Africa which has invested considerable effort in seeking to develop its own set of proposals to support deeper localisation impacts. A recent industry paper points out that, "in order to actively support local manufacturing … government needs to ensure that the energy policy is aligned to the industrial policy in order to create a supportive environment for localisation. Most critical is the continuity, certainty and transparency with regards to future plans for the REIPPPP. This will help maintain the country's existing manufacturing facilities while building confidence to attract more manufacturing investments" (SAWEA 2019b: 5). In arguing for policy certainty and bolder industrial policy, the paper notes that the co-called 'low hanging fruit' of localisation were being met (Table 6). Any additional manufacturing of higher-value items such as blades and manufacturing and assembly processes related to turbines or their components would necessitate sufficient scale and frequency of demand commitments and some additional industry support measures – because of challenges in securing meaningful global supply integration in any South African plant.

Table 6: Local manufacturing in South Africa for wind energy projects

Type of activity/product	Tech Level	Status
Civils inputs (aggregate, cement, steel, pre-cast elements, some yellow goods (plant and equipment)	Low/medium tech	Established
Ancillary structures – fencing, building materials for temporary/permanent buildings	Low tech	Established
Grid integration – cables, distribution and power transformers, medium voltage primary and secondary switchgear, mineral oil and bio-electra oil pole mount switchgear, pylons, indoor and outdoor ring main units	Low/medium tech	Established
Towers – steel towers	Low tech	Established
Towers – pre-cast concrete tower units	Low tech	Mostly disestablished
Tower internals – ladders, cabling, lighting	Low Tech	Established
Blades	Medium tech	None
Turbines – for the commercial grid wind energy sector	Medium tech	None
Nacelles panels	Low Tech	None
Assembly of nacelles & turbine elements	Medium tech	None

Authors adapted from SAWEA and Urban Econ data.

This cascading effect down the value chain demonstrates the intertwining of the REIPPPP framework with that of industrial policy within a green economy growth path. Continuity and predictability was not only critical for IPP bidders to sustain the renewable energy program, it was also necessary for driving local content down the supply chain, as well as creating the potential for building horizontal linkages to firms operating in other supply chains (e.g. metal fabrication). Without state policy ensuring the necessary conditions of guaranteed continuity and repetitive predictability the stable conditions for both IPP developer investment in the bid windows and localised industrial expansion was severely disrupted. Hence the renewable energy program was integrally tied up with the industrial policy aspects of a new green economy path. The success of the former guaranteed the potential for the other.

The overwhelming majority of respondents from the private sector indicated that it was no surprise to them that some form of local content regulations featured in South Africa's procurement model for wind energy. After all, a range of different renewable energy procurement models, including renewable energy auction schemes, around the world had reflected an intent to generate some domestic economic gains from the procurement spend of investing energy companies (Hansen *et al*. 2020). One of the OEM firm representatives noted that even in their original home market there was eagerness on the part of policy-makers to encouraging local sourcing and even some government schemes to support this in the earlier phases of the industry. A number of respondents also pointed out that in markets such as Brazil, Argentina and Turkey they had already experienced a variety of government approaches to

ensure that local industrial gains featured in renewable energy impacts. However, whilst the industry representatives of larger international firms, such as those from the OEMs and the leaders of project consortiums, noted the inevitability of some local content requirements, most also expressed the view that the industrial policy intent behind the South Africa REIPPPP was less substantial than expected. A number noted the finance support that the Brazilian Development Bank had offered to project developers to ensure local manufacturing of supplies into the wind energy sector. Reference was also made to more ambitious renewable energy commitments in a number of countries such as Turkey where the scale of procurement enhanced the viability of manufacturing production for wind energy equipment in the country[12].

One of the heads of the local operations of a turbine OEM claimed that it was a widely held view in the industry that South African policy makers had something of an overly inflated view of the attractiveness of the country as a market for investment and that this might have led to a rather modest industrial policy offering. This respondent noted that South Africa was not a particularly competitive location for manufacturing based on the following aspects: a small market at a great distance from other high growth markets; a somewhat unpredictable labour and skills context; policy instability that also seemed to affect economic stability and exchange rate volatility; a lack of an existing wind energy value chain presence in a range of supply fields such as steel, metal casting and electronics assembly. For this respondent, these market features should have encouraged a more substantial industrial policy offering alongside the local content regulations in order to optimise the impacts. A number of other respondents concurred with this view. A few highlighted South Africa's much vaunted sector programmes such as those pertaining to the automotive industry as an example of what might have been considered for the window of opportunity the REIPPPP provided. As an example of the absence of a more substantial supportive framework for industrialisation in the wind energy sector, two respondents noted that they had been told much about the possible benefits of locating in one of South Africa's new Special Economic Zones, but that when they were actually making decisions the precise status of these zones were far from clear and the zone specifically targeted to host 'green' industries, Atlantis in the Western Cape, was only officially designated in 2018[13].

Apart from the suggestion that this might have arisen out of a sense of hubris amongst the South African policy-makers, some respondents also noted a concern about the apparent preference of DTI and others for supporting local start-ups such as DCD towers[14]. Their concern related to what they felt was a naivety about the GVC dynamics driving the sector, and a failure to fully appreciate how difficult it would be for new suppliers to break into the renewable energy global value chain. These dynamics encompassed issues such as increasing downward pressure on prices (linked to falling global renewable energy generation costs as well as production shifts to Asia) and growing upward pressure on technology development and the related specifications for processes and products. As one industry advisor to the sector noted: *"We see the IDC getting involved in these high-risk domestic projects and ask what might have this effort and these resources done if they had been directed to a stronger drive to secure more follower sourcing".*

As has already been highlighted as a general lament, one senior executive referred to the South African government's tendency to be *"caught in the headlights of indigenous production schemes"* in an industry with a GVC favouring follower sourcing rather than procuring from unknown start-up producers in new markets. Whilst it was emphasised that South Africa did have the capabilities to produce a range of components, the OEMs had built key supplier relationships over time and this had allowed for enhanced trust and sharing of knowledge which was challenging to replicate frequently

12 https://www.lmwindpower.com/en/stories-and-press/stories/news-from-lm-places/production-begins-at-new-wind-turbine-blade-plant-in-turkey.

13 https://www.greencape.co.za/content/atlantis-special-economic-zone-for-green-technologies-celebrates-another-momentum-milestone/

14 DCD Towers received 80% of its start-up capital from the state Industrial Development Corporation (IDC).

with new suppliers over quite short-term cycles. On top of that the upfront capital costs and the costs of learning by any suppliers was often high and would be difficult to handle for firms in a small market with uncertain delivery schedules and without existing supply networks and relationships in other markets. Another respondent concluded in relation to these ventures, *"all that public money went into a project with stakeholders with no exposure to the industry and in the end the project failed – not just because of the policy mess in government's energy approach, but also because the plant really struggled to meet quality and delivery standards associated with the engineering specifications of the turbine OEMs."*

This perspective was reinforced by the comments of two of the follower sourcing suppliers to the wind energy industry. Both pointed out that an industrial policy better attuned to the dynamics of the global value chain might have given serious consideration to how plants investing in the country might well be positioned to use South Africa as a base for exporting into other markets and ultimately serving the future demand of renewable energy projects in Africa. This perspective was informed by the fact that both companies felt that domestic demand – even when the scheme was running smoothly – remained modest. As one said, *"We do hope that the future policy space will substantially increase the allowance for wind energy in South Africa but as it stands we are not yet convinced that we can make a sustainable business of this operation. The context is challenging from so many perspectives, including somewhat ironically in terms of the reliability of energy supply."*.

Another matter that was given a lot of attention from industry players, and somewhat less by government policy makers, was that of the services dynamics within this value chain. Whilst the local content programme allowed for many services provided in the establishment of wind farms to be counted in the contribution to local content, this was seen amongst the policy makers interviewed to be less desirable than manufacturing. There were two features that respondents emphasised that they felt should make policy makers take the high level of local services input more seriously – beyond the construction activities that generated considerable project-based employment. The first of these was that in a relatively short period of time the wind farm developer consortiums found that they could in fact rely not only on South African personnel in many of their own operations in the country, but also on specialised service inputs from suppliers ranging from environmental studies, legal services, structuring financial deals, engineering design, location assessments and many other specialisations. In fact, a number of these were becoming involved in projects in both new markets and in exporting their services to mature wind energy markets too. A number of respondents emphasised that this process could earn much needed export income for the country and that policy should better acknowledge and seek to further develop these impacts. Whilst public entities such as the Council for Scientific and Industrial Research (CSIR) had received funding to do renewable energy research and development, this support and other mechanisms to support the supply of these higher-level skills had been limited. Indeed, an OEM executive interviewed was quite clear about the neglect of the services industry in the state's industrial policy thinking. In his view whilst REIPPPP had not been successful in creating a domestic wind energy *manufacturing* industry, it had been relatively effective in creating a *service* industry feeding into the renewable energy sector.

The second feature linked to services noted by some industry respondents was that the local content scheme focused almost exclusively on the establishment phase. Whilst one government official felt *"once opened these wind farms basically run themselves"*, this was not supported by the industry respondents. Other reviews of wind energy value chains such as that by Elola *et al*. also highlight the imperative to look beyond the establishment/deployment phase of wind projects with these authors noting that, "the operation and maintenance (O&M) phase, … accounts for 20–30% of a project's life-time value (Ayee et al., 2009; Lema et al., 2011)." (2013: 995). With a number of South African wind farms having already been operating beyond five years, it was noted that bidding consortiums planning had to encompass a fairly consistent level of maintenance over the twenty-year contract life.

The technical skills development body for the sector, the South African Renewable Energy Technology Centre (SARETEC) explained that, although the suspension of REIPPPP had resulted in a slowing down of training services demand, both the delayed BW 4b projects that were starting to go to site and the growing maintenance needs of wind farms had seen a surge in demand for technicians to do tower-based maintenance work. They also explained that a number of the international and South African companies that employed these technicians were deploying them to sites around the world with countries such as Denmark, Australia, Vietnam and Kenya mentioned. Various industry stakeholders emphasised that ongoing plant maintenance was an important element of local spending and this was also a manifestation of local content. One respondent noted that whilst it was not necessarily essential for the local content calculation to allocate points for local spending in ongoing maintenance, it should be picked up and supported in a broader renewable energy industrial policy mechanism in that the development of world class exportable skills was core to helping build the country's status as a viable base for future renewable energy industry developments. In support of this perspective one of the local representatives of a large European turbine OEM pointed out that as South Africa's economy matured so its policy frameworks needed to give more attention to tradable services and their associated skills profile[15].

Industry respondents were concerned that the design of the local content programme sent problematic signals as to what was most important to the South African government. Local content regulations could play an important role in driving localisation if properly implement was the consensus of the OEMs pointing to newly established production facilities in Morocco, Russia, Turkey which are driven first and foremost by targeted local content regulations. However, a number of respondents observed that in South Africa the local content elements were but one of a number of economic development deliverables that IPPs were required to meet. Local content was not a central plank of a green industrial policy to weave into an industrialisation path through South Africa's renewable energy program. This was not surprising since its original motivation from National Treasury had been triggered by an electricity crisis focused on insufficient supply and escalating prices rather than a direct response to climate change pressure (Morris and Martin 2015). Reducing carbon emissions through a renewable energy path was an indirect result, not a direct motivation. Consequently, introducing economic and social development issues into the scoring system had more to do with creating a broad coalition of support backing alternatives to the Eskom carbon based energy generation than a substantial attempt to use local content regulations to drive an alternative renewable energy industrialisation path. Local content regulations therefore appeared as one of many socio-economic addons to the REIPPPP framework, rather than a symbiotic way of integrating the renewable energy framework and industrial policy into an industrial drive for localisation.

More than one business leader remarked that having a broad mix of elements in the economic development scoring lessened the imperative to localise manufactured inputs around turbines and associated components. After all, these same respondents noted that in other markets local content might have been a more significant feature of scoring, or the only additional scoring item other than price and this ensuring that firm investments were able to be directed to delivering on two focus areas rather than a handful. The argument being made here was that matters such as black ownership or community economic development in the economic development scoring diluted the commitment to local manufactured content delivery. As one respondent pointed out, *"the signals we took from the way the REIPPPP scoring was set up was that the industrialising impacts were not necessarily the most important feature of economic development. In fact, one could say there was often more scrutiny*

[15] Industry respondents wanted policy clarity on how the 20-year project contract to extend the life of wind farms or re-fit them with new technology could also be planned for to maximise local inputs. Industry requests for policy feedback on this matter had, at the time of writing, not yet yielded any feedback from the relevant authorities.

around community impact features and ownership in terms of the questions we were asked by government officials or political leaders."

An OEM interviewee pointedly argued that the essential problem lay in the inability of government to build a strategic relationship with the GVC lead firms. He pointed to the experience in other markets being based on industry and government building a common strategy which allowed lead firms to buy into an operationally feasible localisation agenda. Best practice in other countries has involved a joint planning process focused on developing industrialisation gains rather than, as in South Africa, a compliance box ticking exercise driven by other agendas. He called the South Africa development approach an unproductive "back-and-forth" model where government proposes something and industry tries to find a way to perform against this, often in an unsatisfactory manner from the perspective of a localisation strategic agenda. As was repeatedly said by industry interviewees as well as some members of the DTI Green industries team, interactions between government and industry were wholly focused on compliance matters rather than on strategic issues. Furthermore any tentative attempts to shift the focus towards a strategic agenda on the part of some DTI officials were stymied by the derailing of the REIPPPP auction process.

Clearly this resulted in SAWEA's publication of its assessment of the reasons for stalled localisation and its own proposals in 2019. As is stated: "Companies which were planning to invest in the transportation and construction sector addressing specific needs of the renewable energy industry had to postpone or cancel planned investments. OEMs and contractors targeting the sub-Saharan or even entire African market were starting to consider where the right hub for addressing this market might be. Engineering services companies which invested in generating smart solutions in South Africa for South Africa, such as smart concrete tower solutions to generate jobs also in remote locations and to increase local content as much as possible, had to rearrange their focus." (SAWEA 2019b: 13)

The comparison with other countries is important, since if local content is a central plank of a renewable energy industrialisation drive then this focuses the policy attention onto a) the way the scoring system is structured, as well as b) the importance of targeting specifically critical links in the value chain. An OEM representative commented that the reason South Africa's local content regulations were highly ineffective was because they simply measured the value of the project and set a minimum percentage which OEMs have to be above to supply turbines. In such case they do not have an incentive to go beyond the minimum spend threshold level. Further, if the spend on the civils and balance of plants amount to X% of the total project value, then sourcing this locally is enough to meet the local content regulations. In some countries where the OEM operated local content regulations were designed as a *scoring system*, they could be used as a competitive parameter in the project bids. Hence, a relative higher price of electricity would not necessarily make the bid uncompetitive if the local content part of the bid is relatively high. This however required an industrial policy approach focusing on targeting critical value chain links for local content. For example, in Morocco, an OEM formed a consortium, which included a proposal to develop a local blade factory and tower factory as a 'package' to score high on the local content regulations. These parameters of a more nuanced local content regulations built into a renewable energy industrial policy are summed up in this comment from a senior OEM staff member: *"It is not only a question about the levels of local content, ... equally important are the rules and regulations of local content - most local content systems are based on a point rating system (e.g. a locally produced generator is given a certain score, and firms can then add up the point scores to comply with the local content regulations)"*.

Finally, most private sector interviewees were outspoken about the fact that that, when it came to industrial policy, the levels of support that were promised in broad policy statements were not forthcoming. As one remarked: *"it seems that energy policy was dictating to industrial policy and as a result the industrial policy input tended to be much less robust"*. Respondents highlighted the failure to come up with a more substantial suite of sector-specific industrial policy instruments that would

help stakeholders work with the state actors to build up South Africa's capabilities as a global supplier of some manufactured components for the wind energy sector. For example, they pointed to a scheme to support exports, more widely available and competitively priced finance, and a clear and coherent industry-government partnership plan similar to that pertaining in some other sectors. The latter could provide clarity on key industry development parameters, including around the demand environment, as well as relating to issues such as skills supply, R&D facilities and tackling cost competitiveness matters – for example those related to steel products. The overwhelming sense was that although government wanted to ensure significant portions of local content were attained, there was an insufficient focus to help build a more sustainable industry able to engage with GVCs. This would also require industrial policy to be more influential with respect to energy policies. This was summed up early on in the programme, but unfortunately never strategically internalised within the South African government: "Opportunity to penetrate the market outside RE IPPPP and tap into sub-Saharan Africa are the game changers, which both simply imply a significant increase in the potential annual installed capacities" (Urban-Econ Development Economists & Escience Associates 2014: xx)

6. Conclusion

The South African experience reveals that the cobbling together of a somewhat eclectic set of initiatives to support green industrial policy around wind energy foundered on the changeable winds of a conflicted set of energy policy-making interests: the localisation impacts that could have been yielded have been curtailed through policy missteps from a lack of a thorough framing of a green industry specific strategy. Despite some more ambitious policy signals, the industrial policy interests were constrained by the government's limited ambitions, framed as a significant share of local spend and more South African owned and operated suppliers emerging as start-ups. The consequences of this included, at least from the industry's perspective, a failure to maximise opportunities such as those related to follower sourcing and the deepening of technical tradeable services. Even taking a somewhat generous approach to the public policy makers schemes to set up a local tower supplier and a turbine and blade producer, it is hard to be convinced that the medium to longer term "unintended impacts" of these efforts justified the diversions away from more attainable, and perhaps less costly, initiatives.

Clearly the policy choice to disrupt South Africa's renewable energy procurement process in 2015 comprehensively interrupted tentative early steps around industrialisation gains that were used to motivate for the programme in the first place. This was confirmed through the numerous interviews conducted with those both in the public and private sectors. Whilst at the time of conducting the interviews there was some muted optimism over government statements related to the intended publication of the 2019 IRP and the possible announcement of the completion of round four contracts, this optimism has been challenging to sustain in a context where decisive policy implementation in favour of renewables has not taken place. Furthermore, during the years of policy uncertainty in South Africa, the wind energy GVC has been adjusting to deploying capacity to other emerging growth markets, thus making the task of securing deeper industrialisation gains even more challenging. As one industry leader put it, South Africa may well have to make a very substantial wind-related renewable energy commitment, perhaps even above that suggested in the still-disputed IRP 2019, to make sure it has a reasonable international negotiating position.

We have argued that within energy policy establishing *continuity and predictability* of the bidding processes within REIPPPP is essential for the sustained success of South Africa's the renewable energy auction programme framework. As we have seen through the lens of a political economy framework, political struggles between divergent interest groups, the failure to establish *sustained continuity* and *repetitive predictability*, disrupted the entire bidding framework and laid waste to IPP developer foreign investment in renewable energy projects. The policy implication is that this process of continuity and predictability in regard to the auction scheme has to have some form of institutionalised policy guarantee. Continuity and predictability of renewable energy opportunities cannot be left to the

whim of a single government minister responding to his favoured interest group. It has to be built into a legislative structure and enshrined within a state guaranteed energy policy framework to ensure that investment risk is minimised and competitive decision making is maximised.

We have also shown how the inability to ensure continuity and predictability cascaded down the value chain and has had a debilitating impact on the state taking advantage of green industrialisation opportunities arising from an expanding renewable energy programme. A failure to maintain a sustained renewable energy bidding process has disrupted attempts to drive local content down the supply chain. Localisation therefore cannot be viewed as pertaining solely to energy policy and left under the sole control of the energy ministry. This is exacerbated in South Africa by the fact that the primary motivation and driver of South Africa's renewable energy program was to overcome an energy crisis and ensure stable electricity supply at reduced prices rather than shifting the economy onto a green industrialisation path. Hence green based industrial policy was at the outset not given pre-eminence in the emergence of a renewable energy policy. Some localisation of manufacturing and services occurred, more as a result of spontaneous economic processes rather than the pace and scope being altered by purposive industrial policy. The policy implications are clear: First, if developing production linkages is to go beyond a slow natural economic process of 'one thing leading to another' then this requires giving pre-eminence to a state sponsored industrial policy process (Hirschman 1981; Morris et al 2012). Second, local industrial objectives (e.g. local content regulations) cannot be ad hoc and simply tacked onto renewable energy bidding processes to satisfy a broad range of development objectives. They have to be clearly defined as industrial policy goals aimed at furthering a focused green industrialisation path so as to increase the rate of local manufacturing and services initiatives following in the train of an expanding IPP programme.

From a green economy perspective, a renewable energy policy to expand the scale and scope of IPP investment (i.e. REIPPPP) has therefore to be integrally intertwined with industrial policy aimed at facilitating the increasing localisation of renewable energy manufacturing and services supply chains. If the increased localisation of these green industrialisation activities, alongside an expansion of the renewable energy bid program, is to have any serious traction in a new growth path then the policy implication is that it has to become a central plank, a prioritised sector of the state's industrial policy framework. It cannot, as has been the case in South Africa, be regarded as a secondary concern palmed off onto those driving the state's energy policy, with some genuflection made through fairly random statements included in the DTI's industrial policy plans.

Finally, a critical lesson we have emphasised is that trying to achieve green industrialisation by focusing local content on project spend as a percentage of gross value is an extremely blunt instrument that is unlikely to achieve substantial localisation of manufacturing and service suppliers. Instead industrial policy has to start from a GVC analytic understanding of the dynamics driving this wind energy value chain, break out of silo mentalities, encourage new forward looking institutional arrangements between different stakeholders, and develop an appropriate GVC informed industrial policy to actualise the benefits of a green industrialisation path that beckons (Morris and Staritz 2019).

The policy implication is twofold: First, industrial policy cannot be undertaken without adopting a collaborative approach with the lead firms, working with the IPP developers and the OEMs, as well as other sections of the local industry, to place localisation at the forefront of a strategic green industrialisation agenda. Second, if this is to expand localisation it has to be targeted, and much more precisely aimed at fostering specific manufacturing and service linkages. The localisation policy framework has to be changed to a more nuanced system where meeting local content requirements should require the lead IPP developers/OEMs to either specify clear sub-sectoral (e.g. towers, blades, nacelle components, generators etc) goals in some sequenced process or packaged together in a refined scoring system.

In conclusion, what is required is a focused approach which recognises the intertwining of energy and industrial policy in a green industrialisation agenda. This would start with an appreciation of the contribution of technical and specialist services to tradeables, the need to better weigh the localisation benefits of follower sourcing to create a domestic supplier base, and the packaging of a more coherent and substantial set of industry support measures. All this requires, as Rodrik argues with specific reference to energy issues, a concerted effort to avoid the pitfall where an energy policy 'tail' wags the industrial policy 'dog, and instead ensuring that industrial policy is saved "from being carried out surreptitiously, as an appendage to other governmental functions and hostage to related, but distinct objectives ..." (Rodrik 2014: p.483).

The implication of the above conclusions is that the South African government has to face the need for restructuring ministerial responsibility and breaking out of the silo mentality of renewable energy and green industrialisation being held hostage by the coal-based interests that used to dominate economic activity. It may have made sense in a historically carbon energy based economic growth path to lump the departments of minerals and energy under one ministerial responsibility. However, in the current global context of a dramatic shift away from coal-based energy and the opportunity for the South African economy to be recalibrated onto a green industrialisation path, this institutional ministerial arrangement is highly problematic. It is internally inconsistent and hopelessly conflictual, and can only result in the continued dominance of coal interests over renewable energy, as is apparent with every day that passes (Eberhard 2020). In this current global world finding ways to transition to a non-carbon pathway, a department of energy needs to be independent and forward looking; to be coupled with ministerial responsibilities tied to countering climate change and fostering green industrialisation, rather than shackled by the political economy coal-based interests of the past.

However, it appears that the political economy dynamics that bolstered a coalition of interests stalling a renewable energy path remain strong within the South African state. Entrenching continuity and predictability within the REIPPPP bidding process is still far from being realised, and the auction bidding process still stutters along rather than roaring forward. Furthermore, despite the warning that 'business as usual' post Covid-19 is a non-starter, and calls from an increasing number of private and public sector quarters for a radical shift away from a carbon intensive industrialisation path, the ministries comprising the 'economic cluster' within government have not placed 'green industrialisation' at the forefront of any economic recovery plan. This still remains a serious challenge which the society and state will have to face in the immediate future, and unfortunately it is not clear which way the balance between the various coalitions struggling around this issue will be played out.

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