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Fostering a just energy transition: Lessons from South Africa's Renewable Energy Independent Power Producer Procurement Programme

Krish Chetty[a], Yul Derek Davids[a], Modimowabarwa Kanyane[b], Thanyani Madzivhandila[a], Tahiya Moosa[a] and Lebogang Ndaba[a]

[a]Human Sciences Research Council, Cape Town, South Africa; [b]University of Venda, Limpopo, South Africa

ABSTRACT

South Africa's renewable energy independent power producers (REIPPs) largely depend on foreign manufacturers and resources as they generate the power needed to address the country's energy crisis. This foreign dependence contradicts some principles of a just energy transition, which encourage developing local job creation in the renewable energy sector. Although South Africa has increased its power procurement targets and relaxed some regulatory requirements in response to the current energy crisis, the long-term policy framework is unclear. Sustainably expanding renewable energy generation depends on a clear policy framework which plots the transition from coal and develops local manufacturing and skilling capacities. Through a case study review of two South African wind farms, this article examines how REIPPs can shift their reliance on foreign equipment manufacturers and skilled resources to local providers, fostering a sustainable and inclusive just energy transition.

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Renewable energy; Renewable Energy Independent Power Producer Procurement Programme; international partnerships; socioeconomic development; energy security; just energy transition

Introduction

The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) was established to diversify and expand South Africa's energy generation capacity. In 2022, the programme initiated its sixth bidding window, inviting independent power producers (IPPs) to submit their plans to contribute to the country's renewable energy generation plans.[1] IPPs engaged in the REIPPPP must raise funds for their project and secure equipment for their power plants and skilled resources to construct and maintain these projects. Given the limited competitive local manufacturing capacity and available skilled resources, the IPPs have turned to international providers.[2] However, these projects must also meet local regulations that pertain to South Africa's broad-based black economic empowerment (BBBEE) goals. Thus, the project must balance black empowerment with energy generation demands. Balancing these demands is a challenge, prompting South African President Cyril Ramaphosa to relax these restrictions following a speech he delivered on the energy crisis on 25 July 2022, acknowledging that the regulations constrained the growth of the renewable energy sector, affecting the country's energy security. [3]

CONTACT Krish Chetty kchetty@hsrc.ac.za

Given South Africa's energy crisis, planned renewable energy power procurement wqs increased to 5200MW in 2022, nearly doubling the procurement from bidding window five.[4] Consequently, local manufacturing and skills development programmes must be expanded to respond to these demands, requiring renewable energy policy to be cognisant of its current constraints.[5] Thus, while these power plants are expected to become the engines of future energy sector job creation, in reality, given the local capacity constraints, the IPP has sourced support from their international original equipment manufacturing (OEM) partners. Given that these are long-term projects, these IPPs have entered into operations and maintenance contracts with their international partners for continued maintenance involving skilled resources and component manufacturers.[6]

Ayobami Solomon Oyewo et al suggest that renewable energy generation can provide a pathway for job creation.[7] However, given the capacity constraints, managing the IPPs' international partnership commitments is crucial to allow them to transition from dependence on international service providers to local alternatives. The just energy transition (JET), described by the Presidential Climate Commission[8] and forming the basis of a major South African energy policy programme described elsewhere in the special issue in which this article appears, must recognise these challenges and prescribe appropriate policy changes. These changes must plot the transition from coal to renewables and develop the environmental support to ensure the IPPs can draw from local providers as they continue operations in the South African environment.

Elsewhere, Lesley Wentworth and Catherine Grant Makokera reason that the rules of engagement with the private sector must be redefined to ensure that these public-private partnerships promote affordable access to quality infrastructure.[9] The private sector carries significant risks when raising finance for a project. In addition to these risks, the IPPs, in this instance, must also overcome local constraints to satisfy regulatory requirements.[10] Carrying this burden may be unsustainable. While the president called for pragmatic regulatory requirements in the short term, the projects involve long-term investments requiring long-term policy commitments. Thus, South Africa's JET must be supported with long-term policy commitments.

Against this backdrop, the ensuing discussion hinges on responding to the following research question: How can IPPs shift from reliance on foreign OEMs and skilled resources and transition to local alternatives to foster a JET in the South African context? To answer this question, the article first discusses the methodology employed and examines South Africa's implementation of the JET through a systematic literature. This is followed by a review of South African wind farms, which informs the concluding analysis.

Methodology

This article recognises the dire situation outlined by President Ramaphosa in his 25 July 2022 speech to the nation on South Africa's energy crisis. In this light, the article reviews the experiences of two South African wind farms. The construction and operations of these wind farms have depended on partnerships with foreign OEM partners. Given the value of these partnerships, the article identifies strategies for the IPPs' transition from foreign dependencies of equipment and skilled resources to local alternatives. The article examines this transition in the context of the JET as described by academia and the South African government.

Prior to the case study analysis, the authors undertook a systematic literature review to gather information about two elements of the wider discussion on renewable energy. These are international partnerships among power producers, and the dimensions and goals of the JET. These form the basis of the study's sub-research questions:

(1) What are the optimal conditions for facilitating international partnerships between power producers and original energy manufacturers?
(2) How is the just energy transition framework aligned with the South African renewable energy policy?

In collecting this information, the authors employed Rob Briner and David Denyer's 'Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA)'.[11] This approach allowed the research team to collect data reproducibly and transparently by following a structured method of searching, screening and selecting an appropriate literature set.

Peer-reviewed literature was sourced from the Elicit.org research database, which applies a unique methodology to identify relevant literature. Its search format is not based on a keyword search but on a mathematical semantic similarity between the inputted research question and the database's stored research articles, using the OpenAI Generative Pre-trained Transformer Three (GPT-3) model.[12]

Three approaches were applied to identify suitable literature using Elicit.org. The first involved a review of the top ten articles that matched the respective sub-research question based on the relevance of the article's title. The second approach involved sourcing literature on the most cited papers aligned with the sub-research question input into Elicit.org. The third approach involved sourcing the top ten most recent papers on each sub-research question. The below table describes how many articles were either sourced, found relevant or excluded per sub-research question. In total, twenty-four papers were reviewed (see Table 1).

Selection of cases

This article follows from a Human Sciences Research Council study of how India and China, as members of BRICS (Brazil, Russia, India, China and South Africa), have initiated partnerships that contribute to South Africa's expansion of the REIPPPP. Given that wind energy is the predominant form of renewable energy supplied to the South

Table 1. Elicit.org search results by sub-research question.

Sub Research Question	Title	Citations (Descending)	Year (Descending)	Total Sourced
What are the optimal conditions for facilitating international partnerships between power producers and original energy manufacturers?	Available: 10 Relevant: 10 Duplicate: 0 Selected: 10	Available: 10 Relevant: 10 Duplicate: 10 Selected: 0	Available: 10 Relevant: 10 Duplicate: 9 Selected: 1	11
How is the just energy transition framework aligned with the South African renewable energy policy?	Available: 10 Relevant: 10 Duplicate: 0 Selected: 10	Available: 10 Relevant: 10 Duplicate: 7 Selected: 3	Available: 10 Relevant: 10 Duplicate: 10 Selected: 0	13
Total				24

Source: Authors.

African grid, local wind energy power producers were reviewed. Local power producers that partnered with an Indian or Chinese counterpart were shortlisted. As described in Table 2, there was only one wind farm that partnered with an Indian OEM (Cookhouse), while there were four wind farms that partnered with a Chinese OEM (if the Longyuan-Mulilo De-Aar 1 and Longyuan-Mulilo De-Aar 2 are counted as one project). From the four Chinese-partnered wind farms, the most information was published about the Longyuan-Mulilo wind farms, hence its selection. The aim of these case studies was to identify the challenges and successes achieved through these international partnerships. In addition, information was sourced from Chinese online resources and was translated into English using the Google Translate platform.

Integration of fieldwork

The publicly available data about these wind farms was sourced to corroborate or refute primary qualitative data collected during semi-structured interviews with nine South African energy experts, including representatives of municipal energy departments, non-governmental organisations and the private sector, in 2021. All data was gathered voluntarily and confidentially. Additionally, this research approach was approved by the Human Sciences Research Council's Research Ethics Committee, which served as an ethics standard compliance and assurance instrument.

These qualitative in-depth interviews were further supported by three online public dialogues held in 2021 and 2022, summarising critical issues related to economic growth development and financing renewable energy. These dialogues were attended by community members affected by the selected wind farms, project developers, policymakers and researchers. Renewable energy researchers from China and India also participated in these two dialogues. The discussion of the findings and conclusion from these dialogues follow.

Background for a study of South Africa's wind farms

Wind energy is the predominant form of renewable energy supplied to South Africa's grid. South Africa is fortunate, with 80% of its land mass having a suitable wind supply for energy generation. Wind turbines produce significantly higher energy at a higher elevation and are generally mounted on 100-metre-high towers. Typically, REIPPPP wind farms have installed large wind turbines, which, in 2014, produced energy 40% cheaper than coal-fired power purchased from Eskom, the state-owned enterprise providing the majority of power in South Africa.[13]

The strength of the wind turbine varies by vendor and requires specialised installation and maintenance skills unique to the model of the turbine. The turbine is coupled with large blades approximately 48 metres long, having a rotor diameter of 101 metres. Thus, for the wind farm's construction, the project owner must plan for assembly of the nacelle (the turbine), construction and installation of the wind tower, blade installation, and cabling to connect the wind farm to the grid.[14] Given these requirements and the lack of local supply, South African wind farms have predominantly sourced their equipment, components, materials, resources and skills from outside the country. As

Table 2. South African Farms listed by the source of their turbines.

Name	Installed Capacity [MW]	Turbine Count	Original Equipment Manufacturer	STATUS	Foreign Head Quarters
Amakhala Wind Farm	134.4	56	Nordex	Fully Operational	Germany
Chaba Wind Farm	21	7	Vestas	Fully Operational	Denmark
Cookhouse Wind Farm	*138.6*	*66*	*Suzlon*	*Fully Operational*	*India*
Copperton	102	34	Acciona	In Construction	Spain
Dassiesklip Wind Farm	*27*	*9*	*Sinovel*	*Fully Operational*	*China*
Dorper Wind Farm	100	40	Nordex	Fully Operational	Germany
Excelsior	*32*	*13*	*Goldwind*	*In Construction*	*China*
Garob	136	46	Acciona	In Construction	Spain
Gibson Bay Wind Farm	111	37	Nordex	Fully Operational	Germany
Golden Valley	*117*	*48*	*Goldwind*	*In Construction*	*China*
Gouda Wind Farm	138	46	Acciona	Fully Operational	Spain
Grassridge Wind Farm	60	20	Vestas	Fully Operational	Denmark
Hopefield Wind Farm	66.6	37	Vestas	Fully Operational	Denmark
Jeffreys Bay Wind Farm	138	60	Siemens	Fully Operational	Germany
Kangnas	137	61	Siemens	In Construction	Germany
Karusa	140	35	Vestas	In Construction	Denmark
Khobab Wind Farm	140.3	61	Siemens	Fully Operational	Germany
Kouga Wind Farm	80	32	Nordex	Fully Operational	Germany
Loeriesfontein 2 Wind Farm	140.3	61	Siemens	Fully Operational	Germany
Longyuan-Mulilo De Aar 1 Wind Farm	*100.5*	*67*	*United Power*	*Fully Operational*	*China*
Longyuan-Mulilo De Aar 2 Wind Farm	*144*	*96*	*United Power*	*Fully Operational*	*China*
MetroWind Wind Farm	27	9	Sinovel	Fully Operational	China
Noblesfontein Wind Farm	73.8	41	Vestas	Fully Operational	Denmark
Nojoli Wind Farm	88	44	Vestas	Fully Operational	Denmark
Noupoort Wind Farm	80.5	35	Siemens	Fully Operational	Germany
Nxuba	139	47	Acciona	In Construction	Spain
Oyster Bay	140	41	Vestas	In Construction	Denmark
Perdekraal East	108	48	Siemens	In Construction	Germany
Roggeveld	140	47	Acciona	In Construction	Spain
Soetwater	139	35	Vestas	In Construction	Denmark
Tsitsikamma Community Wind Farm	93	31	Vestas	Fully Operational	Denmark
Waainek Wind Farm	24	8	Vestas	Fully Operational	Denmark
West Coast 1 Wind Farm	94	47	Vestas	Fully Operational	Denmark

Source: SAWEA 'South African Wind Farms.' Accessed February 24, 2022. https://sawea.org.za/wind-map/wind-ipp-table/.
Note: The italicised wind farms have partnerships with India or China.

noted in Table 2, every South African wind farm involved in the REIPPPP partners with a foreign turbine manufacturer.[15]

The turbines are sourced through three possible business models. Firstly, the wind farm may opt for a 'Supply Only' model where the turbine is purchased from a factory. The customer must take responsibility for transporting the turbine and finding the equipment needed for installation. Secondly, the wind farm project owner could opt for the 'Supply and Installation' model, whereby the turbine is purchased, and the manufacturer transports, erects and installs the turbine and wind tower. The third model, the 'Engineering, Procurement and Construction (EPC)/ Turnkey', involves the complete installation, testing and maintenance of the turbine, blades and towers.[16] These business models differ based on the project owner's dependence on the manufacturer for the construction and maintenance of the wind farm.

Mandisa Mkize and Jack Radmore, on behalf of GreenCape, estimate South Africa must install 3600 wind turbines by 2030 to meet the Department of Mineral Resources and Energy's 2019 Integrated Resource Plan target, highlighting the increasing demand for these components.[17] Notably, GreenCape indicates that South Africa is well-resourced in its supply of steel and cement, which are crucial resources needed for the manufacture of turbines and wind blades. In addition, the country has a well-developed industry capable of mounting structures, installing electrical components and processing raw materials, including recycling materials used in batteries or previously used by the textile industry.[18] According to Thomas Larsen and Ulrich Hansen, by 2022 in South Africa there were only two manufacturers of wind towers, one producing wind blades and none manufacturing or assembling the turbine; this highlights the country's current weak manufacturing capacity.[19] In addition, while South Africa has construction capabilities, it lacks maintenance capabilities, a sector in which jobs have longer-term career prospects.

South Africa is attempting to entice international manufacturers into localising the production of their equipment, thereby creating jobs and reducing manufacturing costs. Special economic zones (SEZs) have been established to incentivise businesses to localise manufacturing. Through the SEZ initiative, most progress has been made in tower manufacturing and less in blade and nacelle production.[20] Boosting investment into local manufacturing is expected to streamline the construction of the wind farms, potentially reducing construction costs and providing wind farm project owners with a local alternative to source quality products in the long term. However, despite the demand for renewable energy in the short term, it is unlikely the country will be able to improve its nacelle-assembly capacities to compete with its international counterparts, without investments in skills development and building partnerships with equipment manufacturers.[21]

Despite the country's limited manufacturing capacities, the REIPPPP's bidding window five required the power producer to secure 40% of its components from the local market.[22] Energy experts expected this dependence on the local market to slow IPP development as the local manufacturing market is not capacitated to respond to the local demand.[23] However, the regulation could also boost local manufacturing in the long term by spurring the demand for new local components. This restriction has been relaxed in bidding window six, with the president urging a pragmatic approach to assess these conditions.[24] Expanding local capabilities in the short term will be crucial to advancing the country's transition to renewable energy sources, on many levels.

South Africa's just energy transition

The just transition discourse emerged in the 1980s in the United States, to mobilise trade unions against the undermining of jobs reliant upon fossil fuel. The term has since been recently adapted in the energy sector to promote 'green' jobs, in line with the global drive to transition from fossil fuels to renewable energy sources. The emergence of new industries and economic relationships characterises this transition. Often the transition requires governments to balance jobs and economic promotion at the expense of environmental or climate protection.[25] Many countries, like South Africa, are coal-dependent and require a framework that recognises the power dynamics in the energy sector and the role played by the state to ensure a just transition.[26]

While there is no universally agreed definition of the just energy transition, there are several attempts to conceptualise principles that underscore the JET.[27] These principles attempt to balance the climate and social justice agendas. To achieve this balance, dialogue and participation are needed to ensure marginalised communities have a strong voice as new energy plans are devised.[28] In addition, policies must foster economic diversification and innovation that spur new opportunities for job creation and skills development while promoting community-based solutions.[29] The JET must also protect and compensate workers adversely affected by fossil fuel reduction.[30] The transition must also promote access to affordable and sustainable energy, ensuring marginalised communities are supported during the transition.[31] Lastly, the transition must advance regeneration and restoration, promote the needs of the environment, and uphold the rights of future generations.[32]

South Africa's revised Integrated Resource Plan of 2019 describes an energy transition away from coal. It plans for a diversified energy mix with coal comprising a 49% share of total installed capacity by 2030.[33] The rapid transition away from coal is expected to shock the economy, however, affecting the structure and growth. Given these shocks, the Presidential Climate Commission (PCC) was established to recommend a path for the country to ensure a just energy transition. The commission recognises that this transition has the potential for the country to address several social concerns besides energy security.[34] In this light, the PCC has adapted the principles noted above and defined a JET framework focusing on distributive, restorative and procedural justice.[35] The following section examines the PCC's conceptualisation of the framework, highlighting convergences and divergences related to the wider discourse on the just energy transition.

Distributive justice

The PCC has called for the principle of distributive justice to be embodied in transformative economic policies that recognise the uneven burdens and benefits for the public of the energy transition. This relates, among other things, to job opportunities, skills development and corporate responsibility.[36] Jesse Hoffman et al support this view, emphasising the impacts experienced by workers dependent on the coal sector.[37] They note that these workers will find themselves in a state of transition and may not benefit from the shift towards renewable energy.

Christina Hoicka et al argue that, given that the benefits are likely to accrue to large corporates rather than to workers, investments in renewable energy infrastructure should be located in areas where marginalised communities reside.[38] Implementation of this recommendation would improve access for these communities to clean, reliable and affordable energy opportunities. The analysis by Katharina Löhr et al of West African states notes that such an approach can bridge the energy divide experienced in rural communities.[39] In addition, to overcome benefits wholly accruing to corporate interests, Hoicka et al recommend that small and medium-sized enterprises, cooperatives, and community-owned initiatives be incentivised to participate in the power-procurement programme.[40] Such an effort could contribute to a more inclusive and diverse set of power providers.

Restorative justice

According to the PCC, the need for restorative justice emerges from acknowledging past injustices inflicted on disenfranchised communities. The PCC, therefore, indicates that

those workers employed in the fossil fuel sector, and all people affected by a harmful coal-based environment, must be supported. In addition, the PCC calls for community ownership, eliminating energy poverty and rehabilitating degraded land, air and water systems. The PCC also recommends BBBEE strategies to remedy past harms.[41] In evaluating the PCC's recommendations, Löhr et al point out that this principle effectively covers most of the population of South Africa, not just those affected by a shrinking coal sector.[42]

Furthermore, the inclusion in this context of the BBBEE policy framework has been criticised, with some arguing that this is only symbolic in the energy sector, and does not result in tangible improvements for the marginalised.[43] Thus, the approach needs to be revised to ensure true community participation, ensuring that marginalised communities benefit from future investments. In addition, there is a need to ensure that gender equity is centralised in the JET framework, as there is evidence that women are disproportionately affected by energy poverty.[44]

Procedural justice

The PCC also emphasises procedural justice in its framework. The procedural justice principle follows from the need to promote mechanisms for effective community engagement. In this respect, the principle focuses on the modalities of community participation.[45] Taliep recommends creating opportunities and platforms for accessible and inclusive community engagement.[46] Such platforms must be a conduit for marginalised voices, allowing the community to influence and shape environmental and energy policies and project implementation plans. Thus, the PCC must investigate appropriate feedback loops between the community, policymakers and industry representatives during the transition.

These feedback mechanisms must be facilitated by robust legal frameworks and monitoring and evaluation systems that follow community-agreed processes.[47] Such mechanisms require robust systems and dedicated resources to ensure an effective, transparent and accountable system of governance. For its successful implementation, there is need of an independent oversight body that monitors the implementation of policy and offers clear guidelines for community engagement and participation.[48] Hoicka et al also advocate for participatory budgeting, community-led planning, and public-private partnerships as mechanisms that could advance community involvement and decision-making.[49] By providing for such procedures, the PCC can ensure that the JET framework is truly responsive to the needs and concerns of all stakeholders, particularly those historically marginalised and excluded from the benefits of the energy sector.

International partnerships in renewable energy

Hitherto, all REIPPs in South Africa's wind energy sector have partnered with an international OEM to secure equipment and resources. These arrangements are necessary given local shortages in skilled workers and manufacturing capacity. The design of these partnerships is crucial for promoting a JET that prioritises local development while advancing the country's reliance on renewable energy. Defining an appropriate partnership model is complex, given that the country wishes to incentivise foreign investment while enabling foreign developers to promote local skills transfer and development at an appropriate scale to enable sustainable change.[50] As local entrepreneurs engage

foreign OEMs, the partnership is influenced by power dynamics. Often, the competing interests of the larger organisation dominate partnership agreements.[51]

Unbalanced partnership negotiations have allowed the international OEM to gain a stronger position in the resulting partnership agreements; these agreements are thus more favourable to the OEM resulting in less attention directed to South Africa's local economic development.[52] During such negotiations, the local developer's limited financial resources tend to result in agreements promoting short-term financial gains, with minimal local investment in skills development and local manufacturing.[53] In addition, given the REIPPs' dependency on the OEM's equipment, the plant might find it difficult to change equipment suppliers in the long term, becoming tied to international manufacturers.[54] It is also stated that cultural dynamics can influence and downplay communication and knowledge sharing, thus leading to misunderstandings and limited skills transfer.[55]

In addition, South Africa's energy crisis has made finding the appropriate policies which balance energy generation with local social development is a complex endeavour. The literature notes several recommendations. Firstly, policies should avoid blanket local content regulations which may impede short-term energy generation, choosing instead a phased implementation of policies that advance local content generation.[56] To that end, South African energy policy must incentivise the domestic manufacture of OEM equipment and introduce targeted skills development programmes focusing on the needs of REIPPs.[57] Separately, research from the South African Institute of International Affairs (SAIIA) has reached similar conclusions related to the development of the green hydrogen ecosystem.[58] To further encourage knowledge transfer, research institutions should be encouraged to partner with international OEMs to accelerate the adoption of new technologies and skills transfer.[59] Thus, the country's REIPPPP must develop and implement a supportive policy framework that integrates these concerns, balancing short-term energy demands with longer-term social development needs.

Case studies: Two South African wind farms

The Cookhouse wind farm

The Cookhouse wind farm is located near the town of Cookhouse in the Eastern Cape Province of South Africa. In 2011, the Cookhouse wind farm was the first and largest bid in the first bidding window of the REIPPPP. The wind farm entered into a 20-year power purchase agreement with Eskom, as it was selected as a preferred bidder in the first round of the REIPPPP. As an output of that bidding window cycle, the Cookhouse wind farm was launched and produced more than 21% of the total national wind energy capacity procured (amounting to 634 MW).[60] Plant construction began in January 2013, and by March 2014, the construction phase was completed, and the wind farm supplied its first electricity to the grid.[61] Despite plans to construct 200 windmills, Cookhouse erected only 66 in total. The wind energy infrastructure of this farm has a capacity to generate 138.6 MW, which reportedly powers an equivalent of 94,000 low-income homes or 43 000 medium-income homes, assuming the medium-income household consumes 7800 kWh annually.[62] Replacing these homes' coal-based power with renewable energy also prevents the emission of 384 000 tonnes of carbon into the atmosphere.[63]

The Cookhouse wind farm was developed through an equity partnership with African Clean Energy Developments (ACED), African Infrastructure Investment Managers (AIIM) and AFPOC Ltd, who needed to source a joint investment amounting to $132 million (R2.4-billion).[64] This was achieved through a partnership with Suzlon Energy, one of India's largest wind turbine manufacturers. The ACED–Suzlon partnership was one of 28 IPPs that signed government contracts in December 2012.[65] The project was financed through AIIM's African Infrastructure Investment Fund 2 (AIIF2), Apollo and IDEAS funds. These funds offered risk-adjusted returns through a contractually robust investment structure with experienced international partners.[66]

The local consortium of investors procured 66 Turbines from Suzlon Energy Ltd. Suzlon Energy was also selected to render EPC services for the wind power project.[67] Suzlon offers multi-make services (servicing of components produced by different manufacturers) when managing wind assets. Suzlon's expertise was expected to help Cookhouse ensure business continuity and secure its revenue, enhancing its return on investment while safeguarding customer assets. Given the EPC contract with Suzlon, Suzlon was responsible for sourcing skilled personnel on behalf of Cookhouse. To initially operate the wind farm, Suzlon set up a team of experienced technicians, sourced from India, who would be on-site for most of 2015 to carry out ongoing operation and maintenance.[68] It appears this is a typical practice under Suzlon contracts; the EPC turnkey contract results in Suzlon's role transitioning from constructor to operator and maintainer of the wind farm.

The Cookhouse wind farm's wind turbine technician training programme is crucial for addressing the area's skills shortages. The programme is developed with the support of Suzlon Energy. This programme involves developing the technical skills needed to work on the wind farm. Cookhouse also paid the tuition fees, working-at-heights training, and trade-tests for three local mechatronics students, providing the on-site training at the wind farm.[69] Suzlon trained an additional 15 technical staff, locally recruited from the Eastern Cape, who formed the long-term operations and management team for the turbines on site.[70] This unique skills-based capacity-building programme addresses localised youth unemployment and demonstrates sector leadership and the value of collaboration.[71] The first group of eight technicians graduated during the first quarter of 2022, and plans are underway for another cohort to attend the programme.[72] Currently, the number of wind turbine service technician graduates produced annually is insufficient to meet demand; there is clearly room for an increased impact of this programme on unemployment in the future.[73]

In addition, the Cookhouse Wind Farm Community Trust holds 25% equity in the project.[74] At Cookhouse, community ownership exceeds the norm prescribed in REIPPPP policy. The Cookhouse wind farm structured an innovative ownership arrangement, providing the local community with a 25% stake in the project company. The Community Trust's share is five times larger than the policy target for local community ownership. This trust ensures that the local development projects will continue to benefit from the dividends over the 20-year project life. The focus of the trust is sustainable socioeconomic development and economic empowerment.[75] The South African government has publicly recognised Cookhouse's community liaison platform and activities and has referred to them as a benchmark for similar programmes, demonstrating progressive approaches and initiatives.[76]

Cookhouse also supports various education-related programmes and local charity organisations, including soup kitchens, special day care centres for children with disabilities, nursing homes, foster care homes and sports facilities.[77] The Cookhouse wind farm has reportedly exceeded its budget when spending on socioeconomic development. To date, 72% of the budget was directed to education-related pursuits, while 28% was spent on healthcare. The funding for healthcare enabled the treatment of 2235 patients. The education funding has supported 2200 children, trained 126 practitioners and principals, and mentored 700 parents in the four beneficiary towns. In addition, the funds have been used to maintain at least 28 Early Childhood Development centres in these four beneficiary towns.[78]

The Longyuan-Mulilo De-Aar wind farm: Maanhaarberg and De Aar North

The Longyuan-Mulilo wind farm, located near De Aar in the Northern Cape Province of South Africa, comprises two wind farms. The first wind farm was approved in 2013 following bid window 3.[79] The second farm is located near the first and was established in REIPPPP bid window 4,[80] with operations commencing in 2017. Longyuan, a Chinese company, and Mulilo entered into partnership negotiations in 2009,[81] and agreed that the first Longyuan-Mulilo wind farm (Maanhaarberg) and the subsequent second (De Aar North) would be structured with 60% Longyuan ownership, followed by 20% owned by Mulilo and the final 20% share owned by a consortium of South African black-owned companies.[82] After these intensive partnership negotiations that had to overcome cultural and language differences, the wind farm was hailed as a 'model of BRICS energy cooperation', and as a model for future Chinese partnerships on the African continent.[83]

Longyuan partnered with Mulilo due to the latter's access to resources and local knowledge. Mulilo first completed a site selection for six possible locations, with two spots prepared with wind-measuring towers. Collecting accurate data about the identified locations was crucial for Longyuan to determine the project's feasibility. By adding to the technical team, Longyuan bolstered the local technical expertise and implemented a suitable wind measurement plan. By 2011, the team had completed the wind measurement exercise and developed a suitable business plan.[84]

In financing the two wind farms, Longyuan South Africa's preferred financing model involved sourcing all loans from South African banks – Nedbank Commercial and the Industrial Development Corporation's Policy Bank – which was believed to reduce the risks of the parent company in China. To secure such a loan, the South African Bank needed to rigorously evaluate the project, assessing its legal, technical, insurance and financial models to determine its profitability. This loan was also contingent on signing the Power Purchase Agreement (PPA), project financing agreements and EPC general contracts for operations and maintenance. Construction could only continue once the loan was secured.[85]

Before securing the loan from Nedbank and the IDC, Longyuan initially attempted to secure a US dollar-backed loan from the China Development Bank, leveraging a relationship with the China–Africa Fund. However, South African policy regulations require a South African business to have 40% local ownership, negating the opportunity for Longyuan China to secure the loan, as the China–Africa Fund initially intended to partner with

Longyuan, resulting in a smaller share of local ownership. In addition, the dollar-to-rand exchange rate fluctuated too greatly, resulting in high hedging costs for the project duration. These complications required Longyuan to source local financing in the name of the merged entity Longyuan-Mulilo (later renamed Longyuan South Africa).[86] These concerns over exchange rate fluctuations confirm concerns raised by renewable energy association representatives regarding difficulties in sourcing international financing.

The two sites, comprising 163 turbines, produce 760 million kWh annually, which reportedly can support 300 000 households. Thus, the two wind farms effectively reduce the production of 619 000 tonnes of carbon dioxide annually.[87] The Longyuan-Mulilo De-Aar wind farms are also recognised for creating 700 construction-related jobs and 100 jobs for managing wind-farm operations.[88] Like Cookhouse, Longyuan-Mulilo has established a community trust that supports social development projects within a 50 km radius of its wind farms. The trust has received a 12.5% equity share in both wind farms.[89] The trust pools community requests related to social development projects and invests in the projects approved by the trustees.[90] Furthermore, post-2020, the wind farm has followed the Longyuan Power Group's 'Blue Book of Overseas Social Responsibility of Central Enterprises' and contributed to COVID-19 prevention initiatives in the De Aar community. These principles follow China's Belt and Road Initiative, which espouses building relationships with mutual benefits and common prosperity.[91]

The Cookhouse and Longyuan-Mulilo wind farms: A comparative analysis and synthesis

Given the aforementioned experiences at the Cookhouse and Longyuan-Mulilo wind farms, the following sections analyse the contributions made by these wind farms in advancing the principles of the just energy transition as set out above.

Advancing distributive justice?

The Cookhouse and Longyuan-Mulilo wind farms demonstrate the ability of wind-energy projects to generate new jobs. However, most of these jobs are temporary and performed during the farm's construction phase. In the long-term operations phase, jobs are shared between international and local workers. Maintenance work depends on knowledge about the OEM's product, resulting in the wind farm securing international resources to manage most maintenance and operations-related jobs. In addition, Cookhouse and Longyuan-Mulilo entered into EPC turnkey contracts with their respective OEM partners. These contracts were requirements to secure their loans and stipulated that the OEM partner takes responsibility for construction and certain aspects of maintenance. The turbine technician training programmes developed by these farms were intended to generate a supply of skilled workers sourced from the wind farm's surrounding communities. However, the outputs of these programmes are limited, resulting in the wind farms' continued reliance on the OEM for maintenance workers. During Longyuan-Mulilo's construction, the wind farms did exhibit knowledge and skills transfer, with reports of Longyuan overcoming language barriers to work closely with South African civil and electrical engineers.[92] Notably, with the construction contract awarded to Murray and Roberts

Infrastructure, skilled workers were sourced from their Western Cape and Gauteng divisions, not from the Northern Cape directly.[93]

Advancing restorative justice?

The Longyuan-Mulilo and Cookhouse wind farms are not constructed in areas known for coal mining. The closest coal mines near the Longyuan-Mulilo wind farms (near De Aar) would be found nearly 200 km away, near the Black Rock Colliery or other towns such as Kimberley, Postmasburg, and Hotazel.[94] Notably, no coal mines are near the Cookhouse wind farm in the Eastern Cape Province. Consequently, these wind farms are unable to address the shrinking coal-based work opportunities across their respective provinces directly. However, the communities in which the wind farms are located face their own challenges, including high unemployment rates; these were 51% in the Eastern Cape and 46% in the Northern Cape in 2022, using the expanded definitions of unemployment.[95] Given these challenges, the job creation and social development programmes initiated in the surrounding communities of the wind farms are immensely valuable.

Beyond the social impact of these wind farms, they are making substantial contributions to the country's energy security. After successful bids during their respective bidding windows, the farms supplied power to the national grid within two years. These timelines far surpass the delays experienced in constructing coal-power plans. In addition, their clean power generation offsets a substantial quantity of carbon emissions, contributing to the improved health of surrounding communities and general ecological sustainability.

The Longyuan-Mulilo and Cookhouse wind farms also had to satisfy BBBEE requirements. In the Longyuan-Mulilo case, the black ownership requirements contributed to the withdrawal of a potential investor (ie, the China-Africa Fund), and the requirements for sourcing components from local black-owned equipment suppliers were seen to be a challenge threatening the roll out of the farms. As a result, Ramaphosa called for a 'pragmatic' loosening of these requirements.[96] However, for long-term investment in the market, policy clarity is crucial. These projects are long-term investments, so the investors need a consistent regulatory outlook, requiring the state to clarify long-term BBBEE regulations. These points were stressed during interviews with renewable energy sector representatives.[97]

Advancing procedural justice?

Regarding procedural justice, both wind farms have established innovative ownership structures involving local communities. The Cookhouse wind farm's community ownership arrangement gives the local community a 25% stake in the project, five times larger than the policy target.[98] Longyuan, too, has established the De Aar Mulilo Community Trust, representing communities within a 50 km radius of the wind farm, which holds a 12.5% equity share in both wind farms.[99]

While the skills development programmes are not responsive to the scale of work demands, both wind farms have surpassed requirements for community ownership. Their community trusts, it would appear based on the research, have played a vital role in extending social services to the surrounding communities. Thus, the projects initiated

by the community trusts do satisfy some demands for social services in the surrounding communities. By providing community representatives with a share in the wind farm, the community trusts also give a voice to the surrounding communities. While their share of returns will only be received after the respective loans are paid off, in the interim, the community trusts offer a mechanism to direct the efforts of the wind farm in addressing social concerns.

International partnerships, it is here argued, contribute significantly to procedural justice; the research shows that Suzlon's collaboration with Cookhouse and China Longyuan's engagement with Longyuan-Mulilo facilitate the implementation of community ownership and involvement. By creating the right conditions and fostering a collaborative approach, international partnerships can significantly advance just energy transitions, bringing about a greater measure of sustainable development, social equity, and environmental protection. A long-term commitment, adaptability, and a focus on capacity building and knowledge sharing are crucial, however, for realising the full potential of these partnerships and promoting a more just and sustainable energy future.

Conclusion

In the analysis of the two case studies, it became clear that the Cookhouse wind farm and the Longyuan-Mulilo wind farm (sites 1 and 2) negotiated different paths to establish an international partnership. For each wind farm, regardless of the partnership, the foreign partner initially experienced challenges in negotiating the unique BBBEE requirements of the REIPPPP. The 40% South African ownership clause of the REIPPPP is particularly complicated and challenging to introduce when the foreign partner is a majority shareholder attempting to secure a US dollar-denominated loan. In this instance, the foreign partner must weigh the value of establishing a local subsidiary of their company and then determine the implications of securing international finance in the name of a new entity. Longyuan, for instance, had to forgo a US dollar loan from the China Development Bank and instead sought out local finance from South African commercial banks, in view of the fluctuating rand–dollar exchange rate.

In both case studies, the wind farm implemented an EPC turnkey contract with a foreign supplier. Through these contracts, the foreign partner assumes responsibility for the wind farm's construction, operations and maintenance and can decide how it sources components and personnel.

In line with three principles underlying South Africa's conception of the just energy transition, the article considered the contribution of these wind farms to distributive, restorative and procedural justice.

To promote distributive justice, new policy provisions must support wind farms in transitioning from foreign components and resources to local alternatives. Forced policy prescriptions, as indicated in the initial formulation of the bidding window, would further constrain a sector already in crisis. For instance, the current ambiguity about BBBEE requirements does not foster long-term investor confidence. In addition, the current reliance on the wind farm company to initiate local skills development projects or drive local manufacturing does not allow the country to produce the components or skilled resources needed to satisfy the needs of the IPP. There is, therefore, a need to complement the programmes initiated by the IPPs and expand, at scale, the skills development

programmes aligning the developed skills to those demanded by wind farms. Foreign companies must also be committed to employing those locals after they complete the training programmes.

Each wind farm has employed different turbine models unique to the manufacturer. The Cookhouse wind farm employed a multi-make service contract with Suzlon but continues to source Suzlon components. IPPs should be encouraged to enter into such contracts, as they create the opportunity to transition from a foreign manufacturer to a local alternative. To further advance restorative and distributive justice, the government must incentivise manufacturers like Suzlon and Longyuan to establish South African factories to service their local farms and future developments.

Another crucial component of all the wind farms was the sustainable socioeconomic development of the communities within which they operate. Through community trusts, the reviewed wind farms have channelled funds to programmes that address the needs of local communities. In addition to promoting renewable energy adoption and energy security in South Africa, the impact of such activities on restorative justice is considerable. These wind farms also significantly contribute to advancing procedural justice, given various socioeconomic programmes focusing on inequality and poverty driven by community trust involvement.

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Note on contributors

Mr Krish Chetty is a research manager at the Equitable Education and Economies Division of the Human Sciences Research Council (HSRC).

Dr Yul Derek Davids is a research director in the HSRC's Developmental, Capable & Ethical State (DCES) division and an advisory member at the Department of Applied Legal Studies at Cape Peninsula the University of Technology (CPUT).

Professor Modimowabarwa Kanyane is the executive dean of the Faculty of Management, Commerce and Law at the University of Venda.

Dr Thanyani Selby Madzivhandila is a research director under the Democratic, Capable and Ethical State Division of the HSRC.

Ms Tahiya Moosa is a researcher in the Inclusive Economic Development programme at the HSRC.

Lebohang Ndaba is a junior researcher in the Developmental, Capable and Ethical State (DCES) research division at the HSRC.