

### Academic paper

## The critical role of well governed and balanced electricity wheeling in enabling energy security, reliability and industry sustainability.

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### Abstract

*Electricity wheeling facilitates bilateral power purchase agreements and integration of renewable energy sources into the grid. Wheeling supports industrial competitiveness, decarbonisation strategies, and compliance with Environmental, Social, and Governance (ESG) standards. However, the rapid uptake of embedded generation, the complexity of two-way energy flows, and existing financial and governance challenges present risks to the sustainability of this mechanism.*

*The National Energy Regulator of South Africa's (NERSA) Wheeling Rules provide a framework for fairness, transparency, and cost-reflective tariffs, but gaps remain in ensuring sufficient distributor returns, reliable payment cultures, and equitable access for vulnerable communities.*

*This paper argues that well-governed and balanced wheeling frameworks supported by feasibility assessments, stakeholder collaboration, and adaptive regulation are essential to enable energy security, network reliability, and long-term industry sustainability in South Africa.*

### Introduction

Electricity wheeling is a commercial and regulatory mechanism that enables electricity generated in one location, typically by an Independent Power Producer (IPP), to be delivered through a transmission or distribution network to a licensed distributor's customer (such as a municipality or Eskom). This arrangement separates electricity generation from supply, allowing IPPs and end-users to enter direct, bilateral contracts. As a result, electricity that was previously sold by Distributors is sold by IPPs.

Wheeling facilitates the integration of renewable energy by allowing large consumers such as mines, industrial facilities, and commercial businesses to purchase alternative electricity sources. These wheeled energy purchases are reflected as credits on their electricity bills from Distributor's.

In South Africa, wheeling is still in its early stages. Phased-in regulatory changes supported by Government programs have motivated for increased Wheeling underscored by the removal of licensing thresholds for private generation. Significantly was the 2024 Electricity Regulation Amendment Act (ERAA) that specifically treats for Wheeling empowering NERSA to regulate wheeling tariffs.

### *Wheeling rules*

The National Energy Regulator of South Africa (NERSA) introduced the Regulatory Rules on Network Charges for Third-party Wheeling of Energy (“Wheeling rules”) in early 2025 (NERSA, 2025). Currently, six Distributors have published wheeling tariffs and policies: Eskom, City Power (Johannesburg), City of Tshwane, Nelson Mandela Bay, George, and Drakenstein.

NERSA’s third-party / Wheeling rules ensures fairness and transparency in wheeling transactions. It promotes non-discriminatory access to the national electricity network and provides a regulatory foundation that improves the bankability of private Power Purchase Agreements (PPAs). The Wheeling rules require approved wheeling tariffs that are unbundled and cost-reflective designed to ensure that Distributors continue to recover the cost of networks (including losses), retail services, inter-tariff subsidies and municipal surcharges.

The Wheeling rules also require clear contractual agreements between all parties and compliance with Grid and Distribution Codes. These rules complement existing legislation, including the Electricity Regulation Act (ERA) and its amendments, the Electricity Pricing Policy (EPP), relevant Grid/Distribution Codes, and the Municipal Finance Management Act (MFMA).

### *A complex shift*

Wheeling exists within an increasingly complex and more electrified South African energy system in pursuit of a transition to a low-carbon economy. This change is founded on achieving just outcomes leveraging social equity and economic inclusion in the attainment of NetZero by 2050 (DFFE,2020, PCC, 2022).

A set of interconnected priorities drive the low-carbon transition including ensuring a stable and secure energy supply, system reliability, expanding and diversifying the energy mix combined with climate change mitigation. Further, attracting investment, promoting sustainable economic growth, and safeguarding communities in the transition all together gear for long-term environmental and social sustainability.

Concurrently, the present and evolving landscape is experiencing a dynamic interplay of competing priorities, multifaceted challenges, and rapidly evolving technological, institutional, and political relationships among stakeholders. Each adds layers of complexity to policy formulation and implementation signalling the need for greater coordination and reflexivity or regular reviews and updates.

### *Competitive pressures*

Industrial and commercial sectors face growing pressure to decarbonize their supply chains to stay competitive in global markets. One effective strategy is sourcing renewable electricity, through Wheeling which helps reduce emissions and avoid carbon taxes in local and export markets. This is whilst adhering operations to Environmental, Social, and Governance (ESG) requirements.

In addition, Power Purchase Agreements (PPAs) with private renewable generators play a critical role in securing long-term energy pricing, aligning decarbonisation objectives with energy supply, supporting environmental goals whilst helping safeguard jobs and sustaining economic productivity. However, the Wheeling penetration is limited given the low number of Distributors with fully fledged Wheeling services.

### *Leaving no one behind*

The South African Low Emissions Development Strategy (LEDS) highlights affordability and equity as central challenges in the low-carbon transition, underscoring the need to align climate action with national socio-economic development goals (DFFE, 2020). Of South Africa's 18 million households (Stats SA, 2022), 61%, approximately 11 million, are unable to afford electricity for basic needs (Keneilwe, 2025).

The LEDS strategy underscores the necessary realisation of co-benefits such as job creation, skills development, and capacity building particularly in vulnerable and marginalised communities. To achieve this requires targeted support, including access to finance for municipal and community-level adaptation and mitigation efforts (DFFE, 2020).

Crucially, the transition must not exacerbate energy poverty or undermine affordability (DFFE, 2020). This is especially relevant for the access to renewable energy for vulnerable and less affluent communities including informal settlements given they are less attractive to private investors. These communities rely on ensuring that Wheeling does not undermine the role of distributor inter-tariff subsidies and municipal surcharges used for public services, which would further restrict their access to energy both in terms of connection and affordability as well as basic services.

## **Need for sustainable solutions to Wheeling realities**

### *Emerging complexities from variable and embedded generation*

The draft 2023 Integrated Resource Plan (IRP) outlines a 2030 electricity landscape that includes 6.3 GW of embedded generation and an additional 8.1 GW of new solar and wind capacity (IRP, 2023); Market projections suggest that private generation could reach 10 GW by 2030 (GreenCape, 2025). Notable is that in 2024, Solar PV from the private sector reached 6.1GW (Burger, 2024). This changing electricity trajectory highlights a growing need for sustainable wheeling and grid readiness to support decentralised energy flows.

Managing electricity distribution networks will become more complex due to the rapid growth of renewable energy sources like solar and wind. These sources are variable and increasingly unpredictable, especially as climate change intensifies weather patterns (Landwehr, Lennard & Engelbrecht, 2025). Traditional power grids were designed for one-way energy flows from large, centralized power plants. But today the shift of energy flows in both directions increases pressure on aging infrastructure and the risk of curtailment (Ejuh Che et al., 2025). This is whilst growing the challenge of balancing demand and supply in

### *Fair returns and cross-subsidies*

To keep up, significant investment is needed to upgrade networks and invest in storage to handle these dynamic energy flows whilst building resilience. The principles in the NERSA Wheeling rules are favourable to electricity Distributors. They require cost-reflective tariff structures with Wheeling charges that reflect actual network usage (voltage level, distance, losses), prevent unfair cross-subsidisation between wheeling and non-wheeling customers and are based on NERSA's Cost of Supply (CoS) methodology.

To ensure that electricity distributors can recover fair returns the Wheeling rules allow for tariffs to cover additional capital expenditure required to support wheeling, such as investments in

grid upgrades, smart meters, and digital systems. The rules also support regular tariff reviews to ensure responsiveness to market changes, including shifts in demand, the integration of renewable energy, and the adoption of new technologies like energy storage and electric vehicles.

However, there is reason to question whether current effective network charge levels are sufficient to support these emerging needs. For instance, under NERSA's MYPD6 decision, Eskom Distribution was granted a 4% rate of return for the 2026 financial year. This is notably lower than international benchmarks—Delhi, India offers a 16% post-tax ROE (DERC, 2017), while Brazil's WACC is at ~7.5% (EDP, 2023).

As wheeling grows, it's worth asking whether users of distribution networks are paying less than the true cost of service and if they are receiving unintended subsidies. If IPPs and wheeled energy off-takers /or Distributors' end-customers benefit from below cost network charges, this could misrepresent the full cost of alternative power sources. Consequently, this below-cost situation may threaten long-run Distributors' financial health and grid reliability.

There is an opportunity to provide greater clarity in NERSA's wheeling rules, Tariff code, and allowed revenue recovery methodology regarding the appropriate level of returns that electricity distributors should recover through network charges. This includes for both traditional electricity sales and wheeling tariffs. Clearer guidance would help ensure fair cost recovery, support grid sustainability, and maintain transparency in the pricing framework.

#### *Benefiting from payment reliability*

While NERSA's Wheeling Rules provide guiding principles and compliance obligations, they do not prescribe specific payment terms such as billing cycles or credit periods. These are left to bilateral, supply and connection agreements. Distributors and their officials are legally obligated to recover revenue and manage customer payments by the Public Finance Management Act (PFMA) and the Municipal Finance Management Act (MFMA).

A reliable payment culture is critical to the long-term success of electricity wheeling. Without timely and consistent payments across the value chain, weak settlement may result between generators, off-takers, and Distributors. Consequently, Distributors may face cash flow constraints limiting their ability to maintain networks and invest in upgrades.

For example, if a customer receiving wheeled energy delays or fails to pay their electricity bill, they may still receive energy credits that reduce their charges. Meanwhile, the distributor continues to bear the costs of operating the physical grid, covering network losses, and managing the wheeling process without receiving payment. This creates a financial gap and places strain on the Distributor and weakens the case for wheeled energy.

#### *Making Wheeling work - feasibility and risk responsiveness*

Evaluating and treating for feasibility of policy changes, programs and regulations is an essential ingredient for successful outcomes in the low-carbon energy transition. By integrating feasibility into both design and implementation helps prevent failure, reduce resistance, and supports transformation. Feasibility refers to the degree to which a policy or regulation can be realistically adopted, operationalised, and sustained within prevailing institutional, economic, political, and social contexts (Howlett and Ramesh, 2014).

Feasibility is particularly crucial in the energy transition in which regulation must balance competing interests: attract investment, ensuring affordability, protect vulnerable consumers, and advance decarbonisation. Success depends not only on the technical soundness of policies or regulations but also on their fit with existing governance structures and socio-political dynamics (Meadowcroft, 2009). Importantly, embedding feasibility in regulatory and policy development allows for adaptive, iterative approaches that adjust to institutional and societal learning (Gallagher et al., 2012).

Wheeling feasibility needs to therefore account for several interconnected issues to ensure wheeling is both financially viable and operationally sustainable. First, Distributors need to be able to recover sufficient network returns to cover rising costs associated with managing a more complex grid. This is especially with increased bi-directional energy flows, intermittency, voltage control challenges whilst supporting the balancing of supply and demand.

Secondly, the feasibility of implementing unbundled tariffs across all distributors must be carefully assessed. Electricity tariffs are essential for continued recovery of network costs, network losses, inter-tariff subsidies, and municipal surcharges whilst enabling wheeling credits. Since wheeling is a new service it requires upgrades to billing systems, installation of appropriate meters, improved metering data management, and technical to service staff training.

At the same time, there is need for stronger credit control and debt management processes to address the risk of non-payment by wheeling participants. For most Distributors, these are entirely new functions and involve new and additional costs. Therefore, the financial feasibility of funding these interventions must be considered as part of the broader wheeling implementation.

## **Conclusion**

Wheeling has the potential to become a cornerstone of South Africa's low-carbon transition, linking renewable generation with industrial and commercial demand, while simultaneously advancing competitiveness and social equity. Yet its success depends on more than technical design, it requires governance structures that ensure fair cost recovery for Distributors, prevent unintended subsidies, and safeguard vulnerable consumers through cross-subsidies and affordability mechanisms.

As renewable penetration increases and energy flows become more complex, distributors will need significant investment in infrastructure, digital systems, and skills to maintain reliability. Furthermore, payment reliability and financial prudence across municipalities, Eskom, IPPs, and end-users remain critical to sustaining the Wheeling value chain. Embedding feasibility into policy and regulatory frameworks, alongside regular stakeholder reviews, will be crucial in managing risks and adapting to evolving contexts.

Regularly reviewing the wheeling landscape through a shared Electricity Distribution Industry (EDI) platform that includes all key stakeholders consisting of policy makers, regulators, and implementers, like the AMEU, would be valuable. This collaborative approach would support timely risk response and encourage professional dialogue and joint problem-solving toward sustainable solutions. From this context, there is potential to improve cost efficiency and operational consistency through shared systems and standard practices.

This includes the opportunity to innovate and develop a shared wheeling system allowing Distributors to benefit from shared infrastructure, reduced duplication of effort, and collective learning. Ultimately, well-governed, transparent, and adaptive wheeling arrangements can balance the imperatives of energy security, decarbonisation, and socio-economic development. This will ensure that no one is left behind in South Africa's energy transition.

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