# Calculating fair use-of-system charges for Wheeling

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**Abstract**

*The energy transition is marked by a growing number of electricity consumers procuring energy directly from Third-party generators (usually privately owned) and requiring the Eskom and municipality distribution networks for transport or to wheel the purchased electricity. The value exchange in electricity wheeling involving Eskom, municipalities, third-party generators, and consumers requires a context where all participants are fairly treated.*

*Prevailing regulations governing the South African Electricity Distribution industry (EDI) enables a basis for fair Wheeling transactions amongst participants by aiming to satisfy consistent and transparent Wheeling implementation aligned to applicable laws and national policies. Notwithstanding, as the ESI is evolving, regulatory and operational gaps are to be expected. To calculate fair use-of-system charges requires compliance to existing regulations whilst contending with diverse Distributors' operating contexts. Increasing understanding of wheeling and treating for related implementation challenges is an opportunity to support a just energy transition in the EDI.*

*This discussion paper explores the cost-of-supply framework as a basis to calculate fair use-of-system charges and the opportunities it presents to evolve the sustainability of wheeling charges. Included is a consideration a pragmatic billing approach for Wheeling. In closing, some opportunities to expand on the existing regulatory framework for Wheeling are outlined.*

## 1. A compelling case for Wheeling

Municipalities are obligated by law to facilitate the wheeling of electricity in their licensed areas of supply. Wheeling can enable consumers to procure electricity from third-party generators and reduce their carbon footprint by purchasing electricity from renewable generators.

Wheeling customers in the long run can mitigate against rising electricity prices through long-term bilateral agreements and support increased investment in private generation capacity. Internationally, the evolution of the electricity sector signals that network services are set to become the main revenue earner for Distributors. As such, wheeling is an imperative and Distributors need to respond supported by sustainable wheeling charges.

## 2. Wheeling in Distribution networks

Wheeling is the transport of electricity from a generator to a load via a third-party network. Wheeling does not necessarily mean that the same electrons entering the network from a generator will be used by the load. Instead, it is a financial transaction where electricity injected into the network by a generator is recognised at a specific value within the time of use (TOU) period, and this value is transferred to the load/customer. This is because after electrons are injected into a transmission network, they are not easily traceable to a specific generator amidst other electricity supply by various generators at the same time.

In South Africa, the distribution network service providers (Distributors) are Eskom Distribution and Municipalities (Local Authorities). Wheeling in Distribution networks refers to electricity supply involving a third-party generator selling electricity to a customer situated in a Distributor's network.

A third-party generator may be located or embedded in a municipal network whilst the consumer is in an Eskom network and vice-versa. Both the generator and consumer can be in either an Eskom or Municipal network. A consumer may therefore need to wheel energy using the generator's municipal network and then through an Eskom network to eventually receive the wheeled electricity at their connection located in yet another municipal network; this is referred to as inter-distributor wheeling. See Figure 1 for the different types of wheeling transactions.

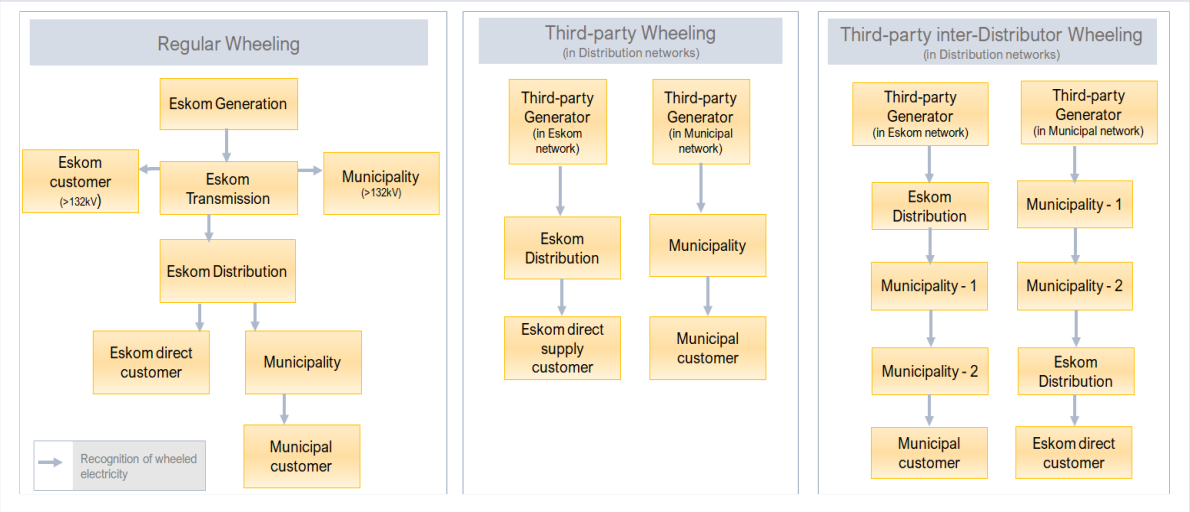


**Figure 1: Types of Wheeling transactions**

Distribution network services involve providing the capacity to transport and transform the electricity supply to voltage levels at which receiving loads can consume. This requires that Distributors provide voltage regulation services, invest in installation and refurbishment of transformers, cables, and lines. This is whilst ensuring the appropriate maintenance and operations for safe, available, dependable, and connected supply to consumers or customers connected in their networks.

The nature of transmitting electricity is one where line losses occur meaning that less energy is received at the off-take point than injected by the generator. Further, in a distribution licensed area of supply, depending on the consumer's voltage of supply, associated network costs will differ and that the costs of providing distribution network services are not identical across Distributors.

The constitution empowers municipalities to distribute electricity and states that this service should be provided fairly and equitably to all customers. Distributors are by law through the Electricity Regulation Act (ERA), obligated to provide non-discriminatory access to their networks for third parties and may only raise charges approved by NERSA. At the same time, Distributors are conferred conditions under which access may be allowed, receipt of contributions from network users for strengthening or upgrading and payment for network use.

# 3. Enabling fair wheeling through COS studies

Regulations and methodologies specific to wheeling include the National Energy Regulator of South Africa (NERSA) Regulatory rules on network charges for third-party transportation of energy, the Tariff code, and the NERSA Cost of Supply (COS) framework. The Third-party rules and Tariff Code both require COS studies as the basis for calculating Distributor Wheeling charges. Additionally, the Tariff code requires that DUOS charges for generators and loads (consumers) are based on the same COS study. And, for inter-Distributor wheeling raising of DUOS charges is limited to the immediate distributor where the end-customer is connected.

The Cost of supply (COS) framework guides the development of COS studies for all licensed distributors enabling a consistent approach for the calculation of Wheeling charges. The COS framework also provides for a comprehensive recognition Distribution network costs that include shared costs, municipal surplus, operating costs, network line losses, repairs and maintenance (R&M).

According to the COS framework, demand-driven distribution network costs are to be allocated using maximum demand using the average and excess (A&E) method. The A&E method enables that every connection contributes to networks costs relative their maximum demand. Detailed unit costs from COS studies can be used to evaluate future possibility of <11kV wheeling charges and to separate technical and non-technical line losses costs. Further, COS studies may be expanded to separately cost embedded generators to enhance an understanding of their impact on distribution network costs.

There is an additional opportunity through COS studies for customers that only receive a network service from Distributors to contribute to the Municipal Surplus similar to other municipal customers. This can be achieved by redistributing the municipal surplus during the COS study by allocating portions of the Municipal surplus to energy, retail, and network costs. The required explicit provision of municipal surplus in municipal tariffs can still be adhered to by separately outlining the embedded municipal surplus.

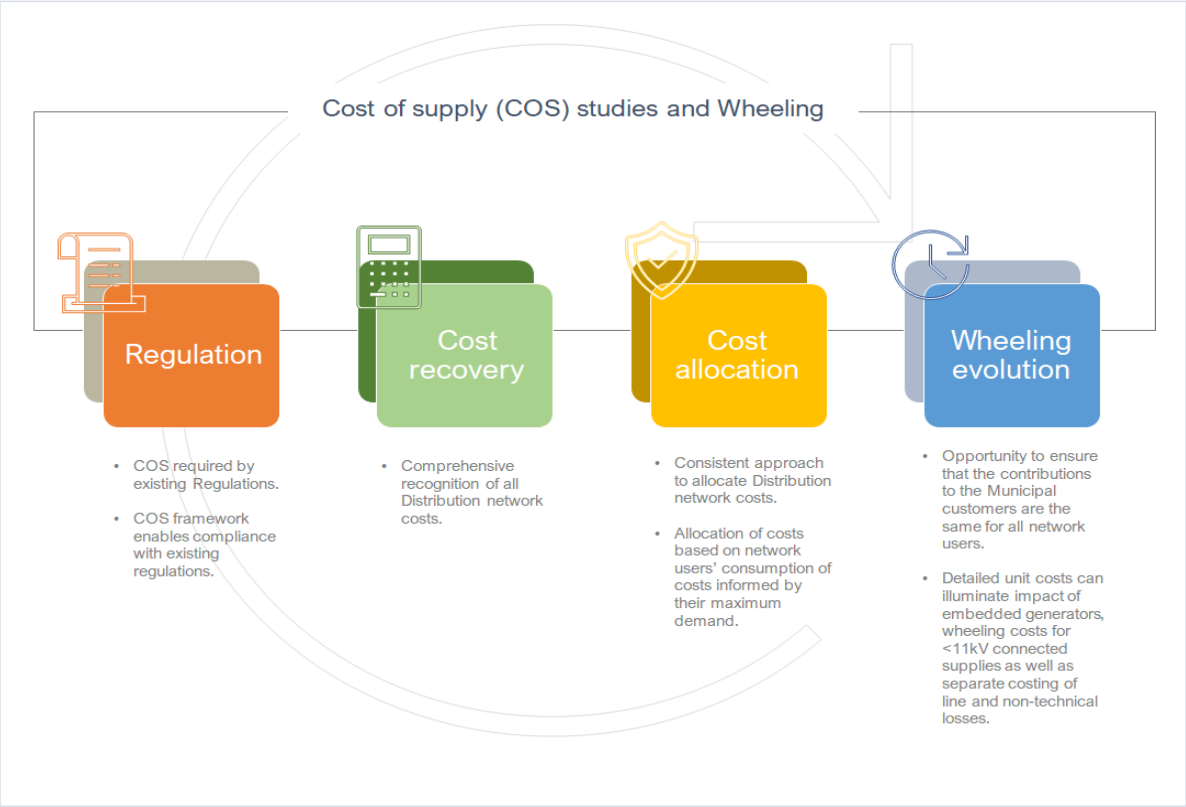


**Figure 2: Enabling Sustainable Wheeling with the COS Framework**

# 4. Pragmatic billing for Wheeling transactions

Accompanying the pursuit of consistent costing for explicit DUOS charges is the present need to enable wheeling through billing treatments. This may alleviate the long lead-times associated with the billing system changes whilst ensuring Distributor Wheeling revenues and associated cost recovery. The pragmatic approaches are aimed at recognizing wheeled energy whilst recovering use of system (UOS) costs.

The two types are use of tariff based UOS charges that is (a) explicit UOS charges for wheeled electricity, and (b) implicit UOS charges recovered through existing tariffs by crediting wheeled energy less losses. The manner in which the billing is performed differentiates the two approaches and this is explained sequentially using the following examples A, B, C and D.

### Example A: Non-wheeling customer

Municipalities procure electricity at Eskom standard tariffs and then sell it to their customers at the Municipal tariffs which include costs incurred by the Municipality to procure, transport, provide retail services and recover the municipal surplus.

**Example A:** Customer A consumes 100 kWh at Municipal tariffs.

- Customer A bill = 100*(Municipal tariff)
- Municipal revenue = 100*(Municipal tariff - Eskom purchase tariff)

### Example B: Wheeling customer pays explicit an UOS charge

Under this approach, the customer receiving wheeled electricity pays an explicit UOS charge for each unit of wheeled electricity. The customer pays the generator directly for the wheeled electricity volumes.

**Example B:** Explicit UOS: 100 kWh is wheeled to customer B using a wheeling tariff

- Customer B bill = 100*(UOS charges)
- Municipal revenue = 100*(UOS charges)

### Example C: Wheeling customer pays an implicit use of system charges

This approach is also referred to as the “WEPS credit method”. The customer is billed in full at the Municipal tariffs for all electricity through the meter, Municipal supplied and wheeled electricity. Then, the customer is credited at the Eskom’s purchase price (i.e., WEPS less losses ,) for the portion of the wheeled electricity. The customer pays the generator directly for the wheeled electricity volumes.

Following the “WEPS credit method” is far simpler and does not require an introduction of a new tariff. The UOS charge is already recovered through normal prices, and the billing system is adjusted to credit the customer at the WEPS credit rate for all energy wheeled less losses, since the municipality did not have to purchase this electricity from Eskom and recognize the cost of line losses.

**Example C:** Implicit UOS: 100kWh is wheeled to customer C using “WEPS credit method”

- Customer C bill = 100*(Municipal tariff) - 100*(WEPS less losses)
- Municipal revenue = 100*(Municipal tariff) - 100*(WEPS less losses)

The WEPS method approach requires that all wheeling customers must be on a time-of-use tariff and should be billed in full for all energy received (wheeled and non-wheeled energy). At the end of the billing period, the wheeling customer should be credited for all wheeled energy received excluding losses at Eskom’s WEPS TOU energy rate.

Below is an extract from Eskom's tariff book showing the WEPS rate excluding losses at which Eskom credit's their customers. This is the credit that will be passed through onto the municipal bill if a customer within the municipality is receiving energy from an Eskom-connected generator.

| Active energy charge excluding losses [c/kWh] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High demand season [Jun - Aug] | | | | | | Low demand season [Sep - May] | | | | | |
| Peak | | Standard | | Off Peak | | Peak | | Standard | | Off Peak | |
| | VAT incl | | VAT incl | | VAT incl | | VAT incl | | VAT incl | | VAT incl |
| 421.95 | 485.24 | 127.82 | 146.99 | 69.41 | 79.82 | 137.64 | 158.29 | 94.73 | 108.94 | 60.09 | 69.10 |

**Figure 3: Extract from Table 2 of Eskom's tariff book showing WEPS credit rates**

To simplify the concept, we graphically represent the abovementioned wheeling billing approaches in Figure 4. Example A shows the regulated retail prices that customers pay when purchasing electricity from the municipality. The regulated retail prices in Example A cover Eskom purchase costs as well as the municipal mark up reflecting distribution network costs and retail costs. In Example B, the customer consumes wheeled energy and the municipality bills the customer a c/kWh wheeling tariff (UoS charge) for each unit of wheeled energy. In Example C, the municipality charges the customer the full, regulated retail prices for wheeled energy, and at the end of the month, the customer's bill is reduced by WEPS (credited) for each unit of wheeled energy received. From the municipality's revenue perspective, Example B and C are equivalent.

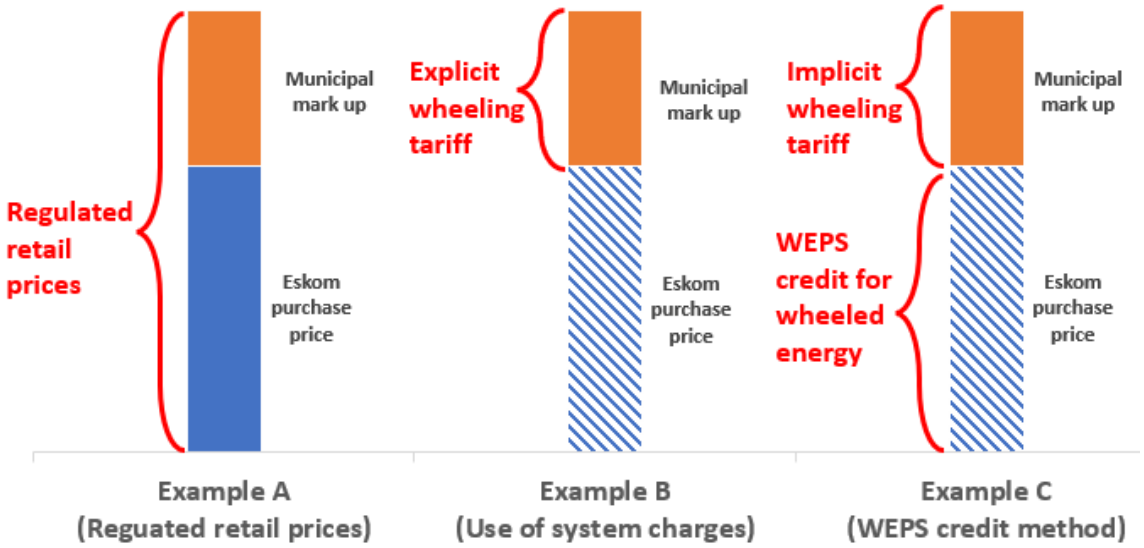


*Figure 4: Graphical representation of wheeling billing alternatives*

Existing regulations require that municipalities treat wheeling customers the same as non-wheeling customers. Wheeling customers should continue to contribute to Municipal network operating costs including the municipal surplus. Investigating the prudency of the costs included in Municipal tariffs will assure customers and can be achieved through cost of supply studies.

## 5. Considerations to develop regulations

With the rapid growth of Wheeling transactions and the global evolution of the sector, the following opportunities are identified to enable fairer and sustainable Wheeling charges into the future.

**Wheeling to low voltage customers**

With the outlook that Distributors revenues will in future be dominated by providing network services investigating the limitations of wheeling to low voltage customers can be supported through COS studies amongst other matters including the implementation of cheaper smart metering alternatives. Low voltage wheeling will enable pooled buying of renewable energy generation, such as community solar, increasing the energy generation ownership opportunities.

**Inter-tariff subsidies**

The treatment for subsidies in the Third-party rules is limited to Eskom and exempts Wheeling generators from paying inter-tariff subsidies that are common across Distributors. Consequently, there is need for clarity on how subsidies are treated and especially when Wheeling in Municipal networks. Under the proposed pragmatic billing approach for wheeling, subsidies continue to be recovered via c/kWh volumetric energy charges for the use of the grid, in line with the principles contained in prevailing regulations.

**Impact of generators on Distribution network line losses**

The reduction of line losses is a benefit attributed to embedded generators assuming closeness to loads. With remote location of some renewable generation technologies, evaluating the associated line losses consumed to reach loads is a developmental area. The impact of local generators on losses is not known and the proposed pragmatic wheeling approach does not consider the reduction in technical losses.

**Annual adjustment to explicit DUOS charges**

The NERSA's Municipal Guideline and Benchmark and ERTSA regulate annual adjustments to tariff rates and charges for Municipalities and Eskom respectively. The annual adjustments to the UOS in the Third-party rules are however different for Generators and consumers (off-takers) with the first at end March and the latter indexed to the Consumer Price Index (CPI). This is whilst annual increases of DUOS charges contained in electricity tariffs are dependent on NERSA annual tariff increase decisions. This is a gap that would result in different levels of UOS for third-party generators and off-takers.

Cost representative year-on-year changes to Wheeling and all retail charges can benefit electricity pricing sustainability. Current annual electricity tariff regulations follow that all tariff charges increase by the same average increase over 12-months. This is unless there is a NERSA approved tariff restructure that results in differentiated increase across tariffs charges and for individual customers but at the average the same increases are experienced. Wheeling charges that do not track the increases to other electricity tariff charges not only result in different generator and load DUOS charges but also create a cost recovery gap with related potential financial risks to Distributors.

# 6. Conclusion

By understanding distribution network services costs improved visibility of Wheeling costs can assist the evolution of the regulation and fair practices to inform Wheeling charges. The use of the COS framework as a guide can assist resolve issues related to the recovery of the municipal surplus and DUOS charges cost representativity.

Information from COS studies can be used to inform further developments of Wheeling regulations including advising the urgently needed Wheeling framework for Distributors. In the interim, immediate billing needs can be treated by pragmatic billing approaches that balance Distributor revenue neutrality with the need to treat wheeling customers equally to non-wheeling customers.

Facilitating fair wheeling aligns with the country's emissions reduction targets by encouraging investment in renewable generators given fairer use of system charges for Wheeling.