



Swartland Municipality Updated Draft Pilot Wheeling Framework

This document is based on a presentation made by a team consisting of J Dippenaar (SEA), M Easton-Brown (SEA), B Khonjelwayo (NERSA), and T Njuguna (Eskom) at AMEU Conference in 2022 as well as an extract from a Wheeling Discussion document from Sustainable Energy Africa in 2020.

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

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.

[Wheeling is thus actually the financial transactions representing the transportation of third-party electrical energy (kWh) over the distribution network which allows for the third-party supplier to sell this electrical energy to a customer at that customer's point of supply.]

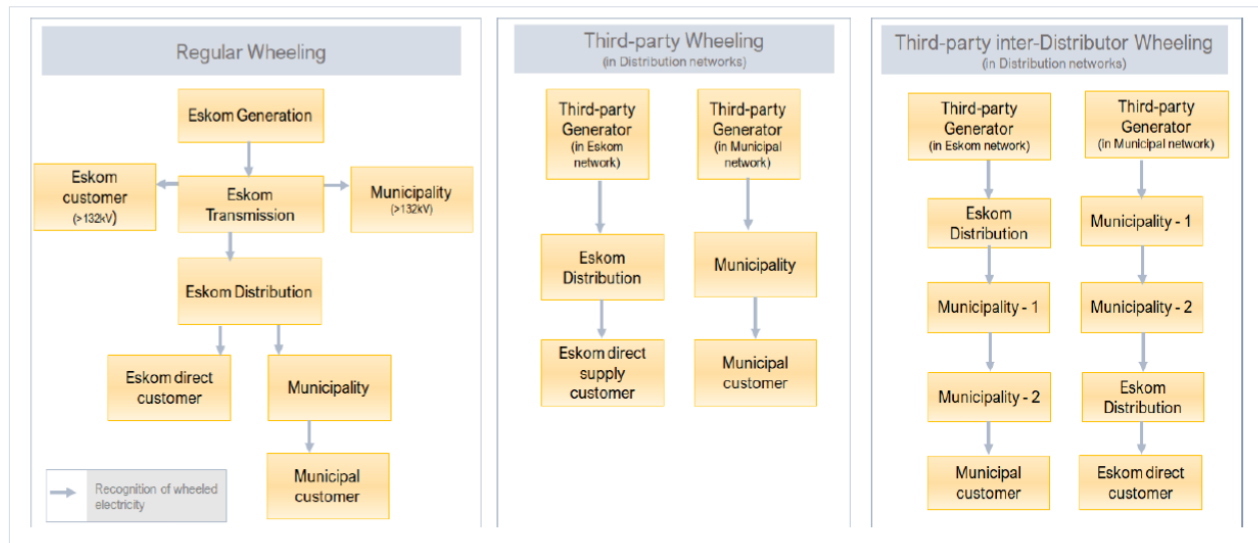


Figure 1: Types of Wheeling Transactions

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.

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 (Distribution use of System) 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).

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. Two types of tariffs based UOS charges are used, that is

- (a) explicit UOS charges for wheeled electricity, and (based on COS Study)
- (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 = $100 * (\text{Municipal tariff})$
 Municipal revenue = $100 * (\text{Municipal tariff} - \text{Eskom purchase tariff})$

Example B:

Wheeling customer pays and explicit 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 = $100 * (\text{UOS charges})$

Municipal revenue = $100 * (\text{UOS charges})$

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 = $100 * (\text{Municipal tariff}) - 100 * (\text{WEPS less losses})$

Municipal revenue = $100 * (\text{Municipal tariff}) - 100 * (\text{WEPS less losses})$

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.

To simplify the concept, we graphically represent the abovementioned wheeling billing approaches in Figure 2.

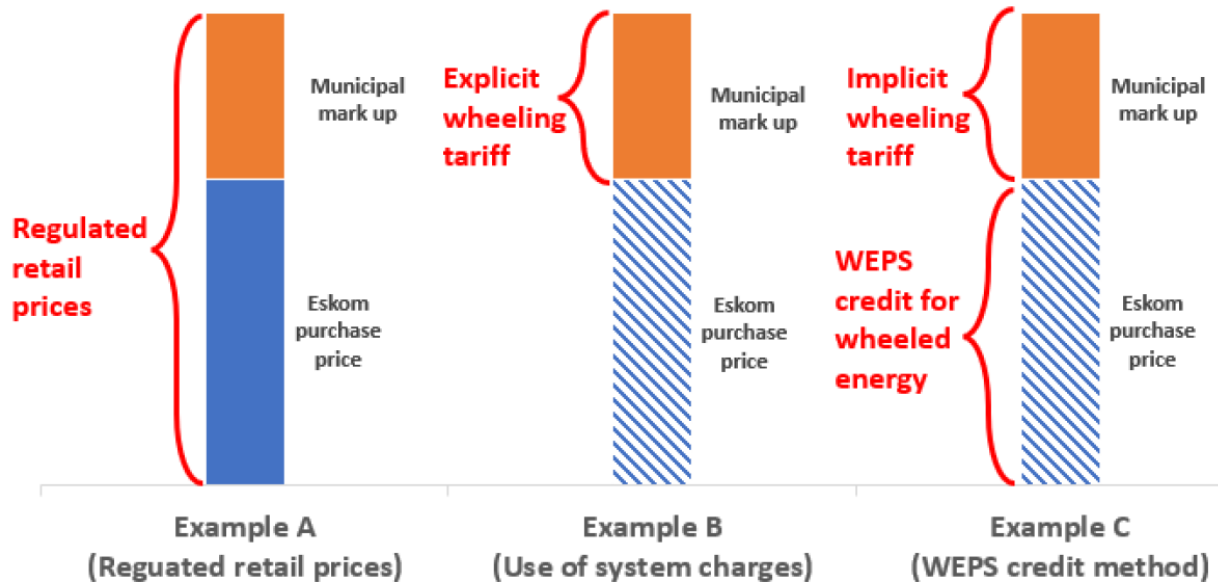


Figure 2: Graphical representation of wheeling billing alternatives

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 markup reflecting distribution network costs and retail costs.

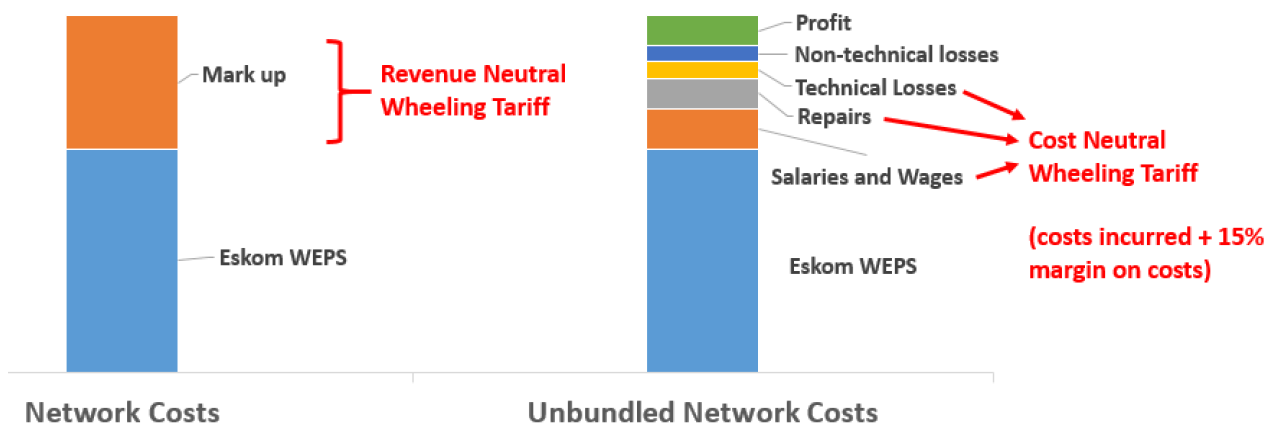
In Example B, the customer consumes wheeled energy and the municipality bills the customer a c/kWh wheeling tariff (UoS charge) for each unit of wheeled energy.

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

Note that WEPS is used when the generator is connected to the Eskom network. With Municipal connected generators the norm is to use the Megaflex Tariff (the tariff at which the Municipality purchases energy from Eskom)

Since Swartland has not done a Cost of Supply study recently (in the past 5 years) we are not in a position to utilise the explicit (unbundled Network Cost) method to determine explicit Use of System (UOS) charges. The implicit method (Revenue Neutral) makes use of already approved retail tariffs to charge the generator for the use of the system and thus other customers are not burdened by the agreement with the generator.

The figure below illustrates the difference between revenue-neutral and cost-neutral wheeling tariffs.



In the absence of unbundled costs, municipal distributors can still enter into 'fair' wheeling agreements by utilising the revenue-neutral approach. The foundation of this approach is to protect municipal revenue since this is considered "the full cost of operating the network" as required by the EPP. The municipality's billing process for a revenue-neutral wheeling agreement can be simplified into the following three steps:

1. The customer is charged in full (as usual) for all energy consumed
2. The customer is credited for wheeled energy to the value of avoided purchases i.e. Eskom purchase costs less distribution technical losses
3. The customer is charged an additional administration charge to cover the cost of the wheeling transaction

If the generator is located within the municipality's distribution network then the municipality will need to meter the amount of electricity generated on a TOU meter. At the end of each month, the municipality credits the customer to the value of the avoided purchases for this wheeled energy at

Eskom Megaflex Time-of-Use tariffs. The municipality then credits the customer this amount less distribution losses.

The following steps are proposed to welcome wheeling in a municipal electricity utility:

1. Develop a Wheeling Framework
2. Develop a Wheeling Tariff that ensure municipal revenue is reasonably protected
3. Develop the legal capacity to evaluate and agree on a reasonable Use of Systems Agreement

Swartland Guideline

Since no national Wheeling framework has been approved by NERSA yet, Swartland has decided to provide a guideline for energy wheeling and to pilot the process for a year or two. This guideline describes the process and requirements for third party energy providers to wheel electrical energy through Swartland municipality's network. The guideline will be regularly reviewed and amended, as technical and financial capacity is built through approved applications by third-party energy providers, experience gained from other municipalities, possible changes to the Eskom Megaflex Tariffs or the Municipal Tariff structure after the completion of a Cost of Supply Study. This is to avoid entering into unsustainable agreements that has the potential of eroding the municipalities income stream.

To focus our attention as part of this guideline we will focus on the case where both the generator and the customer is embedded in the municipal network and no involvement from Eskom is required.

Any agreement in terms of this guideline will have to comply/adhere to the licence conditions and any other legislative requirements that might be applicable.

The project will rely on standards already developed for IPPs connecting to the Eskom distribution Grid. This will ensure minimal technical risk for Swartland municipality and ensures compliance with all relevant technical standards.

While there are various wheeling scenarios the Pilot project will focus on generators and off-taker (end use customer) both connected to the municipal network. The involvement of Energy Traders as the middleman between the generator and the municipality is also possible but we will not be exploring that option during the pilot project.

All applications for wheeling will be handled on a case-by-case basis

Swartland Requirements

- As a start, only generators connected to the municipal grid will be allowed to wheel electricity.
- Generators to connect at 11 kV at one of the main distribution substations in the municipality.
- All cost applicable to the connection of the generator to the grid will be for the generators account
- Wheeling will only be considered for generators > 1 MVA, SSEG < 1 MVA will not be allowed to wheel energy during the pilot program
- Traders will only be allowed once the municipality has built up some skills and experience in the wheeling of energy.
- The Generators must adhere to NERSA's rules and regulations in terms of registration, wheeling as well national legislation, regulations and codes.
- For the pilot program a generator cannot wheel to more than one customer.
- The Off-taker needs to be connected to the municipal network in the same town as the generator
- For the Generator Tariff 16 (TOU Wheeling Tariff) will apply (once approved by NERSA)
- The customer needs to be on a Tariff 10 (TOU tariff). Any cost to convert to the applicable tariff and changing of meters will be for the Customer's account.
- The billing will be reconciled half hourly on TOU consumption.
- Any off-taker may not receive any electrical energy from more than one third party energy provider.
- Any electrical energy not consumed by the off-taker will not be credited, i.e. no banking of energy will be allowed and no compensation will be paid, to the generator

The contracts/agreements mentioned below must be signed before wheeling can take place.

1. Generator registration at municipality
2. The Generator needs to register with NERSA as a generator and for Wheeling
3. The Generator to connect at an 11 kV Main Infeed substation
4. A grid impact study needs to be performed for the Generator's cost and signed off by an independent Registered Professional Engineer. Results to be submitted to the municipality for evaluation
5. Before connecting to the municipal grid, the generator needs to do a Quality of Supply study (at the busbar where the connection will be made) to determine the baseline and the generator to install a permanent QOS recorder on the busbar for continuous monitoring of the QOS parameters
6. The generator will need to comply to the various codes (Distribution Network Code, Renewable Power Plant Code, NRS 084 etc)

The generator will be responsible to sign a Use of System agreement (UoS) that will include the following:

- Network charges
- Development/Capital charges
- Tariff charges (includes all basic and demand charges for supply from the municipality to the generator).

The Customer (Off-Taker) will be responsible for
 Signing a PPA with the generator
 Amended the supply agreement with the municipality

Limit on total capacity.

An allocation of Swartland Municipality's notified maximum demand (NMD) per infeed substation will be allocated to third party energy providers for wheeling purposes. This value is set to **25%** of the NMD per substation.

- For the Malmesbury infeed substation this limit is set a 5.75 MVA based on a NMD of 23 MVA.
- For Klipfontein substation the limit is 1.5 MVA,
- For Darling this will be 1.375 MVA,
- For Moorreesburg it will be 2.125 MVA and
- For Yzerfontein 1.05MVA.

The total allocation will not exceed 9.675 MVA.

The tariff will be surplus neutral plus for the municipality. Any additional charges for wheeling added by Eskom to the municipality's account will be for the off takers account.

ACCOUNTING

Accounting for wheeling will be done as follows:

Municipal distribution grid connected Generator:

Eskom bill:

- Eskom's bill will automatically reduce because less energy will flow from Eskom to the municipality as the energy will be generated by the Generator connected after the Eskom meter.
- The amount of energy reduction in the Eskom bill will include the reduction in the losses as the flow of energy through the networks closest to the Eskom supply will reduce.

- There will however not be a clear adjustment in the Eskom bill, the consumption quantities will simply be less.

Generator Bill.

- The generator will be billed for Network Charges only.
- The Energy wheeled will be reflected on the bill but no charges will be applied (for transparency and used in the customers bill)
- The generator will receive a separate bill for the supply of energy to the generator from the municipality.

The Off taker Bill

The bill at the standard tariff applicable to the customer (TOU Tariff) will be charged

- An additional Basic charge will be levied to cover the additional costs relating to transacting the wheeled energy for both the off-taker and the generator.
- Network Charges and KVA demand charges will be charged as per TOU Tariff
- Energy will be charged as per TOU tariff based on energy going through the meter
- An energy credit will be applied for the wheeled energy at the Eskom Megaflex ToU charges less Municipal Energy losses%, as applied to Swartland by Eskom to the network where the customer is connected.
- The Credit cannot exceed the Energy Charges as per the TOU Tariff applicable to the customer.

Sample Bill for High Season and Low Season (Calculated on 2023/24 Tariffs)

Wheeling Framework Billing Example				High Season (August)									
Before Wheeling				High Season (August)									
Eskom Bill at Source Substation (@11kV)				Off-Taker Bill @ 11kV				Generator					
Admin Charge	R/Day	31	223,36	6 924,16	Fixed Cost	2196,13	2 196,13						
Tx Network Charge	R/kVA	23 000	14,72	338 560,00	Maximum Demand R/kVA	3977,5	283,36	1 127 064,40					
Dx Network Charge	R/kVA	23 000	28,65	658 950,00									
Network Demand Charge	R/kVA	20 261	54,31	1 100 365,68									
Ancillary Service Charges	R/kWh	8 558 763	0,0071	60 767,22									
Electrification + Rural Subsidy	R/kWh	8 558 763	0,139	1 189 668,06									
Connection Charges	R	1	3 993,00	3 993,00									
Energy Consumption				Energy Consumption									
Peak Energy Charge		kWh	Rate	R	Peak	352 468	5,5494	1 955 985,92					
Standard Energy Charge					Standard	844 112	1,6811	1 419 036,68					
Off Peak Energy Charge					Off Peak	1 199 817	0,9127	1 095 072,98					
Total		8 558 763		17 715 659,20	Total	2 396 397		4 470 095,58					
Total Charges				21 074 887,32	Total Charges				5 599 356,11				
Vat @ 15%				316 123,31	Vat @ 15%				839 903,42				
Total Eskom Bill				21 391 010,62	Total Bill to Off Taker				6 439 259,52	Total Bill to Generator			
										0			
After Wheeling				High Season (August)									
Eskom Bill at Source Substation (@11kV)				Off-Taker Bill @ 11kV				Generator					
Admin Charge	R/Day	31	223,36	6 924,16	Fixed Cost	2196,13	2 196,13						
Tx Network Charge	R/kVA	23 000	14,72	338 560,00	Maximum Demand R/kVA	3977,5	283,36	1 127 064,40					
Dx Network Charge	R/kVA	23 000	28,65	658 950,00									
Network Demand Charge	R/kVA	20 261	54,31	1 100 365,68									
Ancillary Service Charges	R/kWh	8 558 763	0,01	60 767,22	Basic Charge	500		500					
Electrification + Rural Subsidy	R/kWh	8 558 763	0,14	1 189 668,06									
Connection Charges	R	1	3 993,00	3 993,00									
Energy Consumption				Energy Consumption									
Peak Energy Charge		kWh	Rate	R	Peak Energy	352 468	5,5494	1 955 985,92					
Standard Energy Charge					Standard Energy	844 112	1,6811	1 419 036,68					
Off Peak Energy Charge					Off Peak Energy	1 199 817	0,9127	1 095 072,98					
Total		7 346 323		15 908 640,95	Total	2 396 397		4 470 095,58					
Total Charges				19 267 869,06	Total Charges				5 599 356,11				
Vat @ 15%				289 018,04	Vat @ 15%				839 903,42				
Total Eskom Bill				19 556 887,09	Provisional Bill to Off Taker				6 439 259,52				
					Credit to Off Taker (Eskom Megaflex - Losses @ 5,28%)								
					Peak Charge				70 494	5,403302	380 898,24		
					Standard Charge				422 056	1,636667	690 765,08		
					Off Peak Charge				719 890	0,888947	639 944,38		
					Total Credit				1 212 440		1 711 607,69		
					Final Bill to Off-Taker				4 727 651,83				
					Note: The rebate/Credit is limited to the maximum of Energy Charges billed by the Municipality								
Total Energy Wheeled				kWh									
Peak		70 494											
Standard		422 056											
Off Peak		719 890											
Total		1 212 440											
Reduction Before/After				1 834 123,53	Reduction Before/After				- 1 711 607,69	Increase Before/After			
										2 196,13			

