

# ELECTRICITY PRICING AND SECTOR REFORM:

Distribution utility skills and capacities



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### **Technical Report**

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#### **About this report**

This report forms part of a series of six reports prepared by Sustainable Energy Africa (SEA) to support the work of the Presidential Climate Commission (PCC) on its stakeholder engagements on electricity pricing and sector reform.



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#### Disclaimer

This report has been prepared with all due diligence and care, based on the best available information at the time of writing (mid-2024). The views expressed do not necessarily represent those of SEA, UK PACT or the Presidential Climate Commission.

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### **Document overview**

The unbundling of Eskom and the creation of a hybrid energy market for SA has been initiated with the establishment of the National Transmission Company of SA (NTCSA), earmarking a momentous change in the electricity supply industry (ESI) in South Africa.

The traditional role of the distributor is changing from purchasing from a central supplier to purchasing and managing decentralised energy sources, and from an on-selling kWh business to a service business where the local eco systems will have a bi-directional energy flow with options of supply from multiple sources like distributed energy resources, independent power producers and wheeled power, in addition from purchasing from the traditional bulk supply.

In the absence of a government blueprint to direct the expected transformation in the electricity distribution industry (EDI), the paper evaluates the emerging changes and envisaged impacts on the sector. It provides insights and understanding as to the anticipated changing role of the future distributor in SA, to meet the requirements of a restructured industry and the introduction of a wholesale electricity market reflecting on the skills that will be required in the future dispensation.

Despite the changing business model, the current network arrangements determines that municipal electricity distributors can be connected either to the Eskom distribution and/or the transmission system. Non-eligible market participants will continue to buy from Eskom distribution, at regulated tariffs, whilst market participants will receive market prices coming from the day- ahead and inter day market in the future.

The current roles and responsibilities of a distribution company (Disco) are well known, but for the future roles in a reformed market a distinct set of new and enhanced function for the network and retail service provider is emerging. Municipalities are currently operated as a bundled distribution business and in the reformed market a clear demarcation between the wholesale (bulk purchases) and retail or local (on selling to end-customers) markets are emerging.

Enabling the secure and efficient orchestration and participation of aggregated supply options in the Discos' networks and manage the networks accordingly. These functions are typically known as the distribution systems operator (DSO) and distribution energy trader (DET) functions. The DSO and DET functions have a close symbiotic relationship. The DET typically provides the supply forecast from the available supply sources and trading regime for this, and the DSO needs to ensure the operation and maintenance of the live physical balance of supply and demand. Also noteworthy is that the Disco will have several options to procure wholesale electricity in a cost-efficient manner that will have to be explored by each Disco as to its specific circumstances and requirements.

The paper summarises the envisaged ringfenced functions with skills of the future electricity distribution business, categorised into Distribution System Operator (DSO), Network Service Provider (NSP), Retail Service Provider (RSP) and Distribution Energy Trader (DET) functions. In practice, depending on the strategic intent and operational arrangements of a particular Disco,

some of these functions may be simplified and/or combined, where permissible from a regulatory perspective, or outsourced to another Disco or service provider.

The phasing in of the market will have an impact on both the scope and immediacy of the requirement for resource capacity and capability. In the existing Discos, at least some of the baseline skills are currently available, and those Discos that are actively preparing for the market are likely to have made some progress in initiating preparation for the supplementing of existing skills to cater for specific market skills requirements.

For Discos to progress in the development of a future skills strategy, associated action plans and a training needs assessment, would need to be unpacked at a further level of detail. Discos would have to strategise and prepare to be ready to have the requisite skills to take part in the market.

## Acronyms and abbreviations

Amendment Bill	Electricity Regulation Amendment Bill
CoS	Cost of Supply
DER	Distribution Energy Resources
Discos	Distribution Companies
EPP	Electricity Pricing Policy
DET	Distribution Energy Trader
DSO	Distribution System Operator
Dx	Distribution
EDI	Electricity Distribution Industry
ERA	Electricity Regulation Act
ESI	Electricity Supply Industry
EDI	Electricity Distribution Industry
Eskom	Eskom Holdings SOC Ltd
Gx	Generation
IPP	Independent Power Producer
IRP	Integrated Resource Plan
LV	Low Voltage
MFMA	Municipal Finance Management Act
MO	Market Operator
MV	Medium Voltage
NEDCSA	National Electricity Distribution Company of South Africa
NECOM	National Electricity Crisis Committee
NERSA	National Energy Regulator of South Africa
NSP	Network Service Provider
NTCSA	National Transmission Company of SA
PPA	Power Purchase Agreement
RSP	Retail Service Provider
SO	System Operator
TUOS	Transmission Use of System
Tx	Transmission
VRE	Variable Renewable Energy

## **Glossary of terms**

DER	Distributed energy resources (DER) are small- scale electricity supply units or demand resources interconnected to the distribution grid that are located on the consumer's side of the meter.
DET	The Distribution Energy Trader is the division that operates an energy trading platform for the purchases of energy and demand resources from customers and generators and thus enables energy trading transactions in the Disco.
DSO	DSO (or distribution network operator) is responsible for coordination and operating the local grid and is responsible for the management of all energy from generating resources including DER's, to end customers.
Hybrid market	A 'multi market' where both a competitive market and a regulated electricity supply exist. The competitive market can contain elements of both central and self-dispatch. Our understanding of the term 'hybrid market' in the Amendment Bill is that it infers a multi-market approach that is in practice the same as a hybrid market model.
Network service provider	The provider of the network (wires) infrastructure to transport energy for commercial purposes.
<b>Retail Services</b>	Means the selling of electricity in the retail or local market to end customers
Trader (energy)	A licensed entity that buys and sells electricity in the market and acts as a broker between customers and generators.
TSO	The operator of the national transmission network and part of the NTCSA
Wheeling	Wheeling is the transportation of electricity from a seller to a buyer through a network owned by another party.
Wholesale market	Involve the sale of electricity amongst generators, resellers and designated customers
Wires services	The network or infrastructure business as part of the distribution value chain

## **1** The changing electricity sector

#### **1.1 Overview**

The electricity distribution sector in South Africa is finding it increasingly difficult to perform its broad mandate effectively, including the provision of basic services, whilst ensuring long term sustainability. The cause of this unsustainable situation is multi-dimensional and include elements such as operational inefficiencies, infrastructure backlogs, revenue management challenges, substantial capacity and skills constraints and the ongoing burden of equitable redistribution in post-Apartheid South Africa. In addition to these internal challenges, the energy landscape in South Africa is changing rapidly, driven by the unbundling of Eskom's, the entry of new participants<sup>1</sup> and the establishment of an electricity market.

Consequently, the distribution business model is changing from the purchase of energy from a single or limited supplier base, and the sale thereof at a mark-up, to that of dealing with multiple suppliers and the resultant variable pricing, bringing numerous challenges as well as opportunities. The purchasing of power in a market-based model; and the controlling of the distribution and consumption of energy within a distributed energy network, to balance generation with consumption based on real time demand, will become a core business requirement of electricity distributors as the market develops and DER on distribution networks increases. To give effect to the changing business model for distributors, a clear demarcation between the wholesale (bulk purchases) and retail (on selling to end-customers) markets, the activities thereof, are required.

This paper supplements the paper *Electricity Pricing and Sector Reform: Electricity Reform and Market Basics* within this series of papers but focuses specifically on the changing role of the distribution sector and defines the future functions and roles that is emerging from the industry reform and the creation of the envisaged market in SA. The functional areas of the emerging new roles in distribution are explored with a view of identifying some of the skills sets that will be required for this change in the business model.

### **1.2 The changing role of the future distributor**

Figure 1 provides a simplified view of how the traditional role of the distributor is changing from purchasing from a central supplier to purchasing and managing decentralised energy sources, and from an on-selling kWh business to a service business that needs to adapt to technological changes from analogue to digital, and generation resource changes from fossil fuel dominance to variable renewable energy (VRE). This means that the new local eco- system will have a two – way energy service business, instead of a buying and selling (one– way flow) only.

<sup>&</sup>lt;sup>1</sup> New participants include independent power producers (IPPs), distributed energy resources (DER) and energy traders



Figure 1: The changing role of the future distributor

As the operating model changes, the skill set required by the Disco needs to adapt to cater for the two-way energy flow from the energy market (traditionally from Eskom bulk supply), Distributed Energy Resources (DERs), external IPPs that wheel energy on the distribution networks, and customers acting as prosumers that contribute their excess power (mostly variable) into the distribution grid. In this emerging unbundled environment, a Disco may be an active participant in both the wires and retail functions<sup>2</sup>; with separate licenses to operate as the network service provider (NSP) and the retailer, all within defined geographical areas of operation.

The distribution sector in South Africa has reached this operating model crossroad, due to emerging disrupters (DER, decentralisation, digitisation, etc.) and the imminent introduction of the energy market. Blueprint documents to guide the establishment and operationalisation of the distribution market do not exist, leading to various stakeholder interpretations and disparate publicly articulated points of view.

Figure 2<sup>3</sup> reflects the anticipated network connection arrangements, in which the municipal electricity distributors can be connected to the Eskom distribution<sup>4</sup> and/or the transmission system<sup>5</sup> and the arrangement for possible market participation options or operating as regulated Discos.

<sup>&</sup>lt;sup>2</sup> It may be that the Disco chooses not to be involved in all parts of the value chain (wires and retail) <sup>3</sup> For further context, see the paper *Electricity Pricing and Sector Reform: Electricity Reform and Market Basics* within this series of papers, which covers the typical governance processes in market liberalisation and the current change drivers informing the changing distribution landscape in South Africa.

<sup>&</sup>lt;sup>4</sup> Future National Electricity Distribution Company of South Africa - NEDCSA

<sup>&</sup>lt;sup>5</sup> National Transmission Company of south Africa - NTCSA



Figure 2: Emerging Distribution Industry Model for South Africa

The future energy market, as envisaged in the ERA Act<sup>6</sup>, will function as the wholesale market in which eligible Discos can participate with the retail market function, which serves as the Disco's link to end customers, that can have several permutations. Each Disco will be required to assess their strategic intent and operational capacity in determining participation in each of the suite of distribution service options. This selection will determine the specific additional skill requirements needed for the individual Disco's participation in the reconfigured distribution sector.

The diagram illustrates that some municipalities that may be non- eligible market participants will have pro-consumers and normal customers with DER connected to their networks. It is anticipated that they will buy at regulated tariffs. For others that may be eligible market participants may be connected to either the transmission or distribution<sup>7</sup> grid with pro-consumer, normal customers and DER connected to their grid. In both cases power could be wheeled through the networks to end customers. Market participants will receive market prices coming from the day- ahead and inter day market. It is not foreseen that municipalities would be able to operate in both areas simultaneously.

The diagram further illustrates that in addition to the current operating model requirements, additional functional areas in the operations and trading in the Discos are emerging and each of these functional areas will require new skill sets, which will be elaborated on in Chapter 4 of this paper.

<sup>&</sup>lt;sup>6</sup> The ERA Bill was passed by the NCOP on 16 May 2024 and signed into legislation on 16 August 2024 by President Cyril Ramaphosa.

<sup>&</sup>lt;sup>7</sup> The transmission grid is defined as voltages above 132kV. Only a few municipalities purchase power on voltages above 132kV and is as per definition connected to the transmission grid, whilst the rest will be connected to the distributions grid – predominantly to NEDCSA.

### **2** Current bundled distribution functions

### 2.1 Distribution network and retail service provider

Municipal electricity distributors currently mostly operate as a bundled business, in which the typical network and retail functions are not disaggregated, or ringfenced, as separate operating units. A further complexity in some municipalities is that selected core functions of the electricity distributor business may be provided by other operating units in the municipality that are outside of the electricity distribution division of the business. Municipal financial services, often combined across multiple revenue generating services, are potentially the most complex interface in ringfencing the electricity network and retail functions.

Under a reformed sector structure, each municipal electricity distributor is envisaged to have a distinct network business and retail business. The network business, responsible for the operation and maintenance of the network, will require a separate and distinct distribution license, and will remain a fully regulated business. This part of the business is most likely to be responsible for the distribution systems operation's function, more commonly known as the DSO function. As a result of being fully regulated, the network business can provide municipal electricity distributors with predictable returns based on cost-of-service considerations, provided that the network performs effectively, efficiently, and reliably.

The retail business, responsible for the procurement of energy for subsequent resale to end users, will require a separate and distinct trading license, and is likely to remain wholly or partially regulated. The procurement function may be included as part of the retail business, or may be a separate function within the Disco, depending on the organisational strategy and design. However, the resale of wholesale electricity to residential customers is likely to be a wholly regulated component of the business for many years to come. The Distribution Utility Management value chain reflects the sequential set of primary and support activities that the Disco currently performs to turn inputs into value-added outputs for its external customers. These generic activities are depicted in the Figure 3.



Figure 3: Utility Value Chain - current retail and wires

### 2.2 Current functional requirements as per the Distribution System Operating Code

Current functions are well known and the Distribution System Operating Code, Version 6.1 (2019), for example provides extensive details of the role and responsibilities required of participants in the operation of the distribution system. The code is explicit in defining the scope as being applicable to all users of the distribution system, including distributors, embedded generators, generators, end-use customers, traders/retailers, resellers, and any other entities with equipment connected to the distribution system, such as the transmission national service providers and the transmission system operator.

It defines responsibilities around economic, reliability and security requirements; contingency planning; power quality; operation under normal and abnormal conditions; outages and safety requirements. As a code, it defines the operational practises that all Discos (municipal and Eskom distribution) need to follow. In specifying the activities required of participants in the operations of the distribution system, the code serves as a baseline of the distribution system operations skills requirements for licensees, across all activities defined in the electricity distribution value chain. It is hence important to unpack the additional or enhanced functional requirements in a reformed market.

### **3** Future distribution functions in a reformed market

#### 3.1 Future wires requirements as network service provider

The distribution network business is a natural monopoly, comparable to the NTCSA that operates the transmission network. However, in the case of the distribution network, licensing of the network is assigned to 167 municipalities and Eskom distribution for clearly defined and distinct areas of supply. In this regulated network business, municipal electricity distributors will need to ensure that their respective networks perform effectively, efficiently, and reliably to fulfil the role of network service provider. The Approach to Distribution Asset Management (ADAM) Reports of 2008 and 2014 highlighted the poor performance of many distributors' electrical networks, as well as the considerable backlog in network maintenance and refurbishment. More recent reports suggest that, if anything, the maintenance and refurbishment backlog is growing<sup>8</sup>.

For the distribution networks to accommodate DER and to thrive as network service providers for wheeling, substantial capital investment in the networks, and associated technology attention will be necessary. It is also important to note that network design criteria will also have to be different to cater for power flowing from different directions into networks to end customers. The Disco would also have to operate the local network differently when purchasing from multiple sources, allowing wheeling and the remainder from either a National Electricity Distribution Company of South Africa (NEDCSA) or the market operator. For the latter they will have to consider the adoption of new technologies and mechanisms to manage their power system more effectively, to ensure the ability to perform the role of DSO.

Typical distribution network preparedness requirements include network studies for DER integration, stability/frequency analysis, and local municipal grid analysis to address capacity constraints and congestion.

#### 3.2 Future retail requirements

All Discos will be exposed to the future bi- directional energy flow and their metering and billing systems would have to cater for this. Also, tariffs systems would have to be unbundled in the wires and retail components of the tariffs so that purchases from different suppliers at different rates as well as wheeling can be accommodated.

For those participating in the market each municipal Disco needs to estimate how much energy is needed to meet customer demand for next day delivery and the optimal price to pay for this volume of electricity. Different from the current purchases arrangements is that power requirements would need to be balanced with customers' needs (in real time) by the Disco and hence will have an energy balancing responsibility when purchasing power, a knowledge of blending the optimal mix of wind, solar, storage, and thermal from own sources required versus the quantum required from the market, which requires an awareness of the mini-IRP<sup>9</sup> principle. This purchasing from the market will require a range new commercial contractual

<sup>&</sup>lt;sup>8</sup> The JET IP Programme Office has reported in NECOM Workgroup 9 an estimate of a R150 billion backlog in distribution electrical infrastructure maintenance and refurbishment requirements.

<sup>&</sup>lt;sup>9</sup> In this respect, the mini-IRP (Integrated Resource Plan) refers to the local optimization of bulk power procurement from several sources in the most optimal way to meet local demand requirements.

arrangements like trading, clearing and settlement of purchasing requirements, all requiring new skills in the Disco.

### 3.3 Emerging new functions (DSO and DET) in the distribution industry

In addition to the core wires and retail functions for the current bundled distribution business, distinct changes related to the wholesale and retail market are emerging. Municipal Disco networks are currently mostly managed with no specific consideration of the complete system (across the ESI value chain), as there is no real trading<sup>10</sup> or a market requirement in the local<sup>11</sup> (or wholesale<sup>12</sup>) market yet. Following the establishment of the market, and the growing participation of DER at local level, whole system facilitation will be necessary. The maturity, or the level at which this participation is likely to take place, will differ across South Africa. This is specifically relevant to the municipal Discos, as each entity reacts to the emerging disrupting forces that impact on the traditional business model and adopts a specific approach to private participation in the electricity distribution sector. Levels of VRE penetration vary across municipalities, but it is expected that as this business case exponentially improves, and energy security remains under pressure, the VRE implementation trend will accelerate, and Discos will have to prepare to increasingly accommodate these functions and services.

In most cases the normal trend of supply following demand will change, as the owners of VREs will, as far as possible, utilise power from their installations as it becomes available, and/or utilise storage options, (although these options are limited at present in the broader SA environment). Accurate forecasting of predictable local demand will be key to achieving balancing equilibrium. Discos will have to mitigate unpredictable customer load as far as possible by utilising incentivised and punitive tariff to do so.

Critical considerations in the provision of new or enhanced services and functions, beyond the current core wires and retail functions, include:

- Enabling the secure and efficient orchestration and participation of aggregated supply options in the Discos' networks and manage the networks accordingly. These functions are typically known as the distribution systems operator (DSO) and distribution energy trader (DET) functions.
- Clear and constant communication flow between DSO and transmission systems operator (TSO) on possible DSO grid constraints and capacity requirements.
- Visibility and management of the 11kV and LV distribution networks will be essential as the bi- directional (two-way) flow of energy increases. It is expected that this will be a core extension of the current services performed by the existing network control room functions of the larger Discos. However, an existing dedicated, formal and technology driven control environment is notably absent in the smaller municipal Discos, which

<sup>&</sup>lt;sup>10</sup> Currently municipal Discos' trading is limited to the traditional bulk purchasing of kWh and the selling on to end customers.

<sup>&</sup>lt;sup>11</sup> This report interprets the local market or retail market as the sale to the end customers primarily in a distribution network.

<sup>&</sup>lt;sup>12</sup> The wholesale market involves the sale of electricity amongst generators, resellers, traders and "direct" customers.

then requires the building of this advanced technical capability from a much lower skills and experience base.

- The DSO and distribution DET13 functions have a close symbiotic relationship. The DET typically provides the supply forecast from the available supply sources and trading regime form this, and the DSO needs to ensure the operation and maintenance of the live physical balance of supply and demand.
- The DET has the responsibility to facilitate the participation of the local DER, while factoring in what power has been contracted in the market, sourced from other IPPs (long term bilateral procurement) through wheeling agreements, as well as sourced from embedded generation.
- A much more digitalised approach to operational technologies will be required for the LV and MV networks of a Disco, to effectively manage network operational requirements.
- Capacity constraints of networks will have to be managed not only for loads, but also for DER and other embedded energy transfers over the Discos' networks. Possible curtailment may be required, and/or additional storage, or external export to the wholesale market when local demand is met, and excess power is available.
- With increasing DER, the local system will need non-traditional service support known as ancillary services. The DET will need to make contractual allowances for ancillary services, as well as ensure operational applicability and readiness when needed for balancing, to ensure network reliability and security in real-time.
- As the volume of DER increases within the local network, the requirement for closer to real time trading increases. Trading in longer-term markets needs to be increasingly complemented by trades in the day-ahead and intraday market, placing an increasing pressure on the DET to ensure the securing of the correct, least cost, generation option mix. As tariffs will still be regulated, the provision of affordable services to the Disco's customers will play an ever-increasing role.

The structure of the relationship between the wholesale and local retail market will differ for those Discos that purchases power in the regulated market and those that choose that will take part in the open market. Figure 4 shows the relationship between the wholesale and retail markets for Discos.

<sup>&</sup>lt;sup>13</sup> DET and Distribution market operator (DMO) are often use interchangeably. For this report we use DET as a consistent reference.



Figure 4: Anticipated relationship between wholesale and retail within the Disco

The diagram provides the relationship between the wholesale and retail (local) market for those that do participate in the market. Within the local market the DSO will be responsible for the operations of the local grid and the direct relationship with the systems operator on the wholesale side. The DSO will take care of all physical connections of the energy flow from NTCSA and/or NEDCSA (the traditional bulk supplies), IPP's and DER and need to take care of the power scheduling and balancing across the distribution networks of the utility.

The DET will be the primary contract with the market operator and will focus on the transactions (all commercial contracts) between of all the different bulk purchases, both from the market as well as from other bulk sources including wheeling transactions and internal DER purchases.

What is noteworthy that from a skills requirement point of view a completely new skill sets will be required for a range of different contractual arrangements for power at different tariffs, financial settlements in a bi-directional power flow. Settlements that will have to take place in time as the majority of these will come from VRE. Grid constraints for various power infeed into the distribution network will require more sophisticated network planning and forecasting will be a new focus area as to ensure balancing of supply and demand, as local market maturity increases. These skillsets are significantly different from the traditional one-way power flow from central to decentralised customers where the variable collective demand of the municipal utility was supplied by Eskom.

#### 3.4 Distributor power procurement options

Municipal electricity distributors, in the role of a retailer, have several options to procure wholesale electricity in a cost-efficient manner, based on information synthesised from draft

legislation and position papers available in the public domain. While the broad structure of options is unlikely to change fundamentally, the possibility of revisions is acknowledged. The options, as currently understood, are as follows:

- Procure electricity from the wholesale market, through the Central Purchasing Agency, or an equivalent government-administered entity (e.g., a new state-owned enterprise acting as a wholesale buyer on behalf of some municipal electricity distributors), *and/or*
- Procure the services of an external party who will act as an agent on behalf of a municipal electricity distributor for participating in, and efficiently procuring electricity from, the competitive wholesale market. The external party could undertake all, or part, of the required functions on behalf of a municipal electricity distributor and could include the likes of private traders or other capable municipal electricity distributors (acting as traders themselves). A typical example will be the utilisation of a trader on behalf of the municipality to fulfil some retail requirements, *and/or*
- Develop their own capabilities for participating in, and procuring from, the wholesale electricity market. In this case, municipal electricity distributors' retail business will need to develop strong capabilities in such areas as: energy hedging and risk management (including contracting), resource planning, energy forecasting and scheduling, market settlement processes, and market/regulatory compliance.

It is expected that the future NEDCSA will procure from the market and may have own generation and/or procurement from DER and other embedded generation.

#### 3.5 Municipal distributor market participation viability assessment

It is anticipated that the Market Operator will develop criteria (that will be approved by NERSA) to specify threshold requirements for municipal electricity distributors' to be in the market. The qualifying criteria are likely to include, technical capabilities and financial capabilities to participate in the market with trading obligations.

The market's design, structure, rules, and retail regulations prescribed by NERSA will all inform the capabilities that a municipal electricity distributor's retail business will have to acquire to participate in the market. These capabilities are further informed by the approach that each municipal electricity distributor adopts for procuring wholesale electricity. It is also expected that the Discos will have to furnish some form of payment guarantee for contracting with, and receiving power from, the market. For municipalities that are already financially constrained, this may be an onerous requirement, but necessary to ensure the long-term sustainability of the market.

Given the current uncertainties as to exact market participation requirements, municipal preparedness initiatives, and any market participation viability assessment, should be based on a suite of best practice criteria, further contextualised to accommodate the specific legislative, regulatory and operating circumstances of municipal electricity distributors in South Africa.

#### 3.6 Summary of functions for skills gap identification

Following the analysis and discussion in the previous sections, Table 1 summarises the emerging functional requirements for wires, retail and procurement in a reformed industry.

Table 1.5	Summary of	emerging new	(enhanced)	wires and	d retails	functions
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Wires	Retail
<ul> <li>Local grid planning</li> <li>Energy forecasting and scheduling.</li> <li>Capacity to transport more kWh.</li> <li>Congestion (and capacity constraints) analysis.</li> <li>Capex investment (expansion and refurbishment) plan.</li> </ul>	<ul> <li>Power forecasting capabilities</li> <li>Supply forecast requirements</li> <li>Understanding/optimising of energy mix.</li> <li>Determination of ancillary requirements</li> <li>Least cost options analysis and mix (energy optimisation)</li> <li>Market analysis</li> </ul>
<ul> <li>Network Operations</li> <li>Enhanced network operations and maintenance</li> <li>Flexible and efficient operation of the distribution system</li> <li>Network studies for DER integration.</li> <li>Stability and frequency analysis.</li> <li>DER local grid connection requirements.</li> <li>System balancing requirements to ensure network reliability and security in real-time.</li> <li>Scheduling and dispatching of DER's.</li> <li>NSP for wheeling</li> <li>Open grid access enablement</li> <li>IPP curtailment and local loadshedding</li> </ul>	<ul> <li>Power Purchases</li> <li>Develop DER/ refit/ feed-in/ netting tariffs as applicable</li> <li>Contracting for wholesale bulk: IPP, market (CPA) and wheeling from outside licensed area.</li> <li>Own plant procurement.</li> </ul>
<ul> <li>Network Performance</li> <li>Communication between DSO and TSO for capacity, energy and system coordination/stabilisation</li> <li>Ensure network visibility within 11kV and LV networks for 2- way energy flows</li> <li>Review and manage appropriate suite of performance indicators for enhanced operations.</li> </ul>	<ul> <li>Customer Interface</li> <li>Customer education on new products (eg electric vehicles), services and tariffs.</li> <li>Compensation schemes for prosumers.</li> <li>Behind the meter services (smart home).</li> <li>Customer contracting: pro-consumers, DER and others</li> <li>Localised business model evaluation to respond to customer profile changes.</li> </ul>
	<ul> <li>Energy Trading</li> <li>Operate Internal trading platform</li> <li>Facilitate energy aggregation (from DER, Storage, Virtual plant and others) and sale to off-takers</li> <li>Energy hedging and risk management.</li> <li>Contract and manage wheeling requirements</li> <li>Local Market financial settlement.</li> <li>Power contracting in the wholesale and local market</li> <li>Power trading and arbitrage (settlements).</li> <li>Tariff and contractual requirement for wheeling</li> <li>Unbundled tariffs</li> </ul>

### 4 Skills gap identification in the reformed sector

### 4.1 The changing skills set

The responsibilities and functions for Discos defined in the Distribution System Operating Code, was developed before the emergence of current thinking and draft legislation on the introduction of an electricity market for South Africa. It is thus important to consider the new emerging functions and the change in the role of DSO within the Disco. This role needs to be more closely align to the role of the transmission system operator (TSO), with a more active balance management role in the local distribution system<sup>14</sup>.

As contemplated by the new ERA Act, market participants will have a balancing responsibility for the whole system at transmission level, but responsibility for more localised balancing will most likely be placed, in many instances, in the distribution networks. Per definition, most of the VRE IPPs are physically located on the distribution network. As more DER, in the form of VRE's, becomes part of the normal functioning of distribution networks on lower voltages, congestion management and energy exchange challenges will become increasingly evident at a local distribution grid level. These challenges, amongst others, would have to be managed by the local DSO.

The changing business model and introduction of the market results in new activities that need to be accommodated in distribution business operations. The increasing bi-directional flow, mostly supplied from VRE, directly impacts on the active management of distribution networks, allowing trading in the local distribution market, the broader wholesale market and retail spheres of the industry. It thus becomes important to consider the typical functions that will become part and parcel of the normal operation of distribution networks of the future.

In most municipalities electricity is a division of the total organisation, and the skills are a subset of the skills of the greater municipality. The electricity division operate in a larger corporate environment and the development of skills will have to found alignment across the relevant directorates. Its most unlikely that some of the integrated skills that will be required for a reformed market, especially those that stretch beyond the traditional engineering services will be developed and rendered exclusively within the electricity division. In several municipalities these are provided on a shared basis and is one of the challenges identified by National Treasury that hampers accountability and performance of the metros in SA. This may slow down the readiness of the eligible municipality to fully take part in the market.

Table 2 provides a summarised view of the envisaged ringfenced functions with skills of the future electricity distribution business, categorised into Distribution System Operator (DSO), Network Service Provider (NSP), Retail Service Provider (RSP) and Distribution Energy Trader (DET) functions. The activities and initiatives of each function are listed, as well as the value proposition, or core intent, of each function.

<sup>&</sup>lt;sup>14</sup> Distribution System Operator and Distribution Energy Trader (DSO/DET); AMEU/SAIEE joint virtual webinar. Al'louise van Deventer Eskom. 16 August 2022.

The phasing in of the market will have an impact on both the scope and immediacy of the requirement for resource capacity and capability to meet the specified activity requirements. In the existing Discos at least some of the baseline skills are currently available, and those Discos that are actively preparing for the market are likely to have made some progress in initiating preparation for the supplementing of existing skills to cater for specific market skills requirements, albeit in the early stages of development. As market-related legislation, regulation and rules develop and become more structured and final, Discos will need to be agile in adapting skills requirements to meet the specific market structure that is agreed on and is then operationalised for South Africa.

New Functions	Activities and Initiatives	Value Proposition	New Skills
Distribution System Operator (DSO)	<ul> <li>Operate an active distribution system (DERs, battery energy storage systems, embedded generation, micro grid).</li> <li>Balance supply/demand for distribution.</li> <li>Scheduling/dispatching of DERs.</li> <li>Voltage and/or frequency control.</li> <li>Demand and supply flexibility.</li> <li>IPP curtailment.</li> <li>Plan and execute load-shedding.</li> <li>Manage and procure ancillary services.</li> </ul>	<ul> <li>Operate the distribution system.</li> <li>Balance the distribution system.</li> <li>Dispatch energy.</li> <li>Manage flexible products (demandside management and virtual power plants).</li> </ul>	<ul> <li>Operational digitisation (networks)- Special engineering OT/ Systems Architect.</li> <li>Special and advance engineering skills for flexible products – business modellers/analysts and data analysts.</li> <li>Legal and contractual for curtailment, settlements and contracts for services.</li> <li>Integrators of multiple systems in distribution.</li> </ul>
Network Service Provider (NSP)	<ul> <li>Safe and reliable operation of the power systems.</li> <li>Energy wheeling.</li> <li>Data coordination and telecoms.</li> <li>Network metering services.</li> <li>Planning and design of power systems.</li> <li>Operations, planned maintenance, refurbishment, commissioning and faults.</li> <li>Network creation.</li> <li>Manage and mitigate technical losses.</li> </ul>	<ul> <li>Network planning, creation, and operations and maintenance.</li> <li>Network metering and billing.</li> <li>Manage distribution use of system charges for wheeling.</li> </ul>	<ul> <li>New analytic engineering and statistical skills in power and load forecasting.</li> <li>Energy Scheduling and balancing based on VRE generation, market purchases, pro-consumers and usage patterns.</li> <li>Load flow (2 - way) contractual and adjustments though networks (legal, engineering and commercial).</li> </ul>
Retail Service Provider (RSP)	<ul> <li>Wholesale and retail purchases and sales.</li> <li>Sales and usage forecasts.</li> <li>Retail planning.</li> <li>New connections.</li> <li>Customer interactions.</li> <li>Revenue management, billing and collections.</li> <li>Manage non-technical losses.</li> <li>Product services – smart home/business (behind the meter service).</li> <li>Point of sale – electric vehicles.</li> </ul>	<ul> <li>Customer interactions.</li> <li>New connections.</li> <li>Tariffs (retail administrative, capacity, energy).</li> <li>Charges (network access and connection charges).</li> <li>Revenue protection.</li> <li>Bi- directional metering and billing contracts and accounting</li> </ul>	<ul> <li>Power purchase and sale contracts (commercial, regulatory and legal skills).</li> <li>Customer interface/relations, commercial and marketing skills for retail products (e.g. DSM, behind the meter services, smart homes and electrical vehicles.) Integrators of multiple systems in retail services.</li> <li>New connections for new service offering (Contract management, financial [ funding] and marketing).</li> <li>Special engineering, accounting and commercial skills for unbundled Tariffs (retail administrative, capacity, energy).</li> <li>Commercial, new accounting and legal skills for customer charges (DER/ IPP network access and connection charges).</li> </ul>
Distribution Energy Trader (DET)	<ul> <li>Trading platform.</li> <li>Energy trading and arbitrage (settlements).</li> <li>Energy aggregation (virtual power plant).</li> <li>MO interaction.</li> </ul>	<ul> <li>Facilitator of open and accessible market.</li> <li>Energy arbitrage.</li> <li>Aggregation.</li> <li>Power Transactions.</li> </ul>	<ul> <li>OT and IT skills, blended with commercial for trading and settlements.</li> <li>Special Engineering, commercial and accounting (and auditing) for energy aggregation and arbitrage.</li> </ul>

#### Table 2: Envisaged functions for the DSO, DET, NSP and RSP

#### 4.2 Functional activity requirements - consolidated areas of focus

For Discos to progress in the development of a future skills strategy, their associated action plans and training needs, would need to be unpacked at a further level of detail. This will have to be informed by the specifics of the individual Disco's current business operating model, and the future market strategy they want to adopt before a skills gap analysis can be conducted. To assist in this assessment process, key elements of each of the four functions in the future electricity distribution business model are reflected in Figure 5.**Error! Reference source not found.**Each of the four functions are shown with a 'traffic- light' assessment of the likelihood that most municipal Discos will opt for, and have the capacity to perform, each of the functions:

- The NSP and DSO roles are the most likely services to be retained, and are coded green, as these services have a higher degree of commonality with existing services provided, albeit with new, or enhanced, activities added to the core functions.
- The RSP is coded yellow, largely because specific decisions will need to be made by each Disco with respect to the procurement of energy. It is most likely that most smaller municipalities will opt for procurement through NEDCSA for the immediate future, given that other options require higher entrance criteria and enhanced municipal capacity to manage the associated activities.
- The DET is coded red, as this function represents the most advanced market participation component, and may require MFMA amendments, in which the municipality must meet trading qualification criteria, ensure that capacity and skills support the decision, and that high market trading risk is mitigated.



Figure 5: Distribution Market Model Functions Option Analysis

A further influencing factor in the level of market participation and the associated upskilling process, is the current state of municipal experience and concomitant resourcing in the various functions. Current business operational activities that are at least partially aligned to future

activities will have a significant positive impact on the quantum of the step change in operational activities that are required to comply with the market-based operating model. For example, municipal Discos that currently have a fully functional control centre, with arrangements to deal with multiple sources of generation and demand-side management, are already optimising their purchasing patterns to some extent. This experience in the application of the baseline concepts that underpin the DSO role will immediately put these Discos at a distinct advantage in preparing for the expanded DSO role. Similarly, municipal Discos that have implemented cost of supply tariffs and have a strong energy sales forecasting function, are better placed to perform more complex energy consumption forecasting role in the future RSP environment.

Notwithstanding current experience in baseline functions, an active planning and decisionmaking process underpins any Disco's preparation for ongoing distribution operations in a market model operating regime. The typical process steps to be followed in working towards preparation for an upskilling initiative within a Disco are reflected in Figure 6.



Figure 6: Skills Enhancement Strategy Process Steps

What is evident from the illustrative process is that identification of the new skills requirements, and the implementation of a structured and cohesive skills enhancement strategy, are preceded by essential Disco strategic planning and decision-making processes. Without strategic direction and an understanding of what services the municipal Disco intends to provide in a market-driven operating model, any focus on skills development is likely to be misdirected.

### 5 Conclusion and way forward

Not all municipalities will be eligible to take part in the envisaged energy market for South Africa, irrespective of enabling legislative amendments. A large number will continue to purchase wholesale power via NEDCSA as the only option available to them and will have to continue to provide electricity services to their defined customer base within a regulated tariff regime.

For those that qualify to participate in the wholesale electricity market, and choose to exercise this option, a distinct set of new skills and competencies will be required to support the expected new functional structure of the Disco. Whether each qualifying municipal electricity distribution business chooses to operate in all these new functional areas, or to contract out some of these services, will be a function of the individual municipality's maturity, risk appetite and interpretation of the potential benefits of participation in the market. For these active market participants, it is expected that there will be a conscious and planned transition from the current set of internal skills to a revised and/or new skill set required to operate in this new retail environment.

Regardless of whether municipal electricity distributors choose to compete in the wholesale electricity market, or remain in the regulated market, selected core functions of the Disco would have to be strengthened to operate in a changing business model. Further, as indicated in the amended ERA licensing framework definitions and the electricity pricing policy (EPP) frameworks, some unbundling of the wires and retail businesses will be required as Discos gradually move away from the bundled on-selling kWh business model. To ensure the ongoing sustainability of the municipal electricity distribution business, it is important for municipalities to strategise on their specific approach to skills retention and development, and actively prepare to ensure that appropriate skills and competencies are available to flourish in a changing electricity distribution operating model.

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