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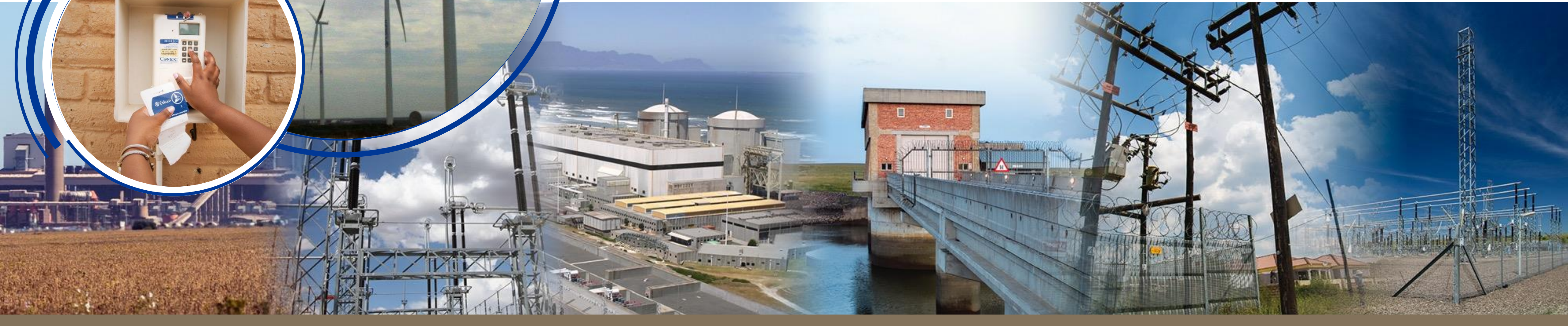
G20 SOUTH AFRICA 2025

Eskom

Grid Access Unit Overview



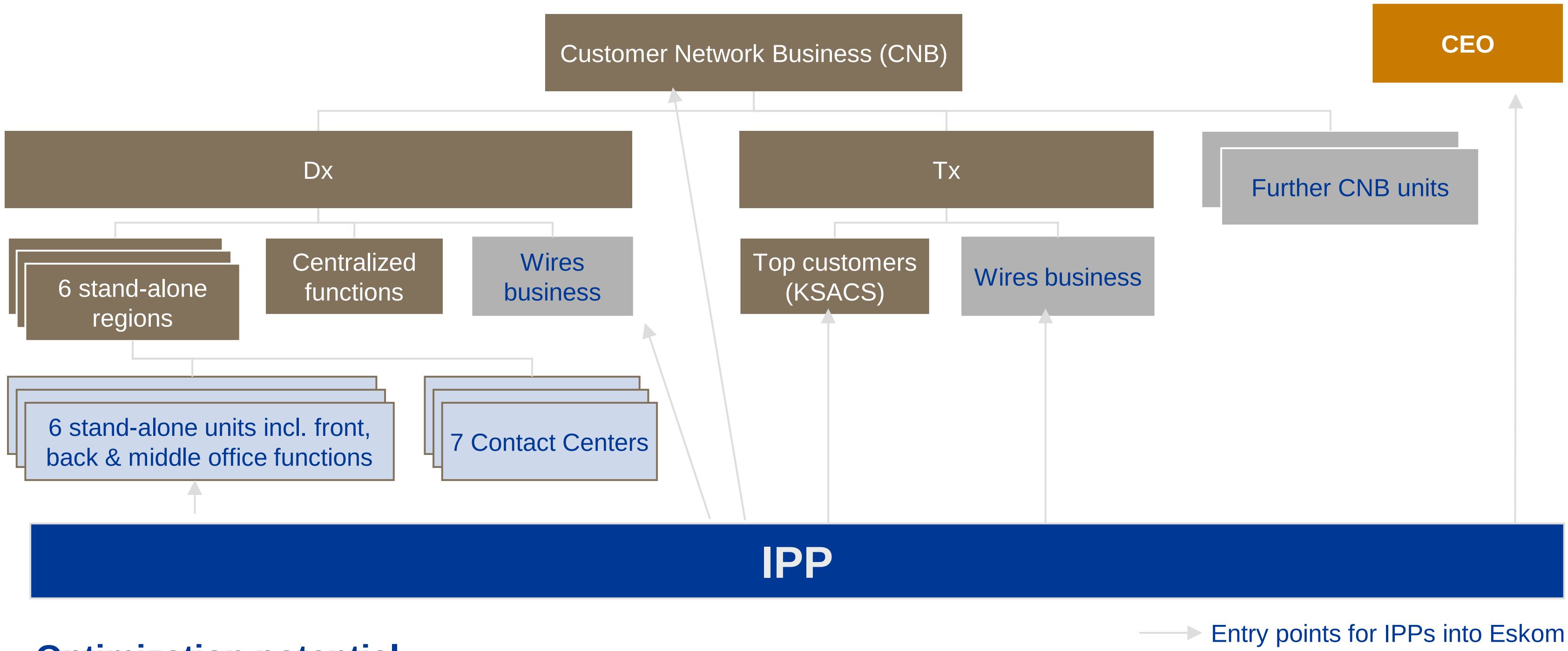
Seetsele Seetswane

19 May 2025

Once upon a time!

Eskom

Previous status quo grid access for IPPs (simplified)



Optimization potential

- No clear accountability for grid access for IPPs (for customer management and for deriving the process internally)
- Processes not defined – no clear rules
- Completely integrated in load business (including power sales)

Eskom's Response – GAU Mandate (2010)

Eskom

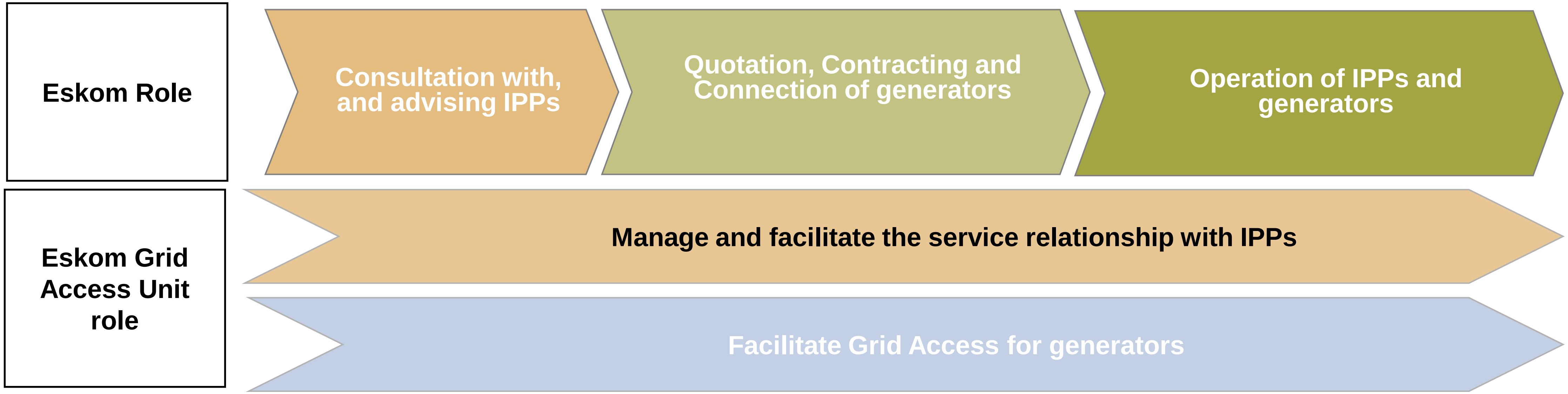
Mandate	Aspiration
Organisation and set-up of a new **Unit** that serves as **single point of contact/entry** for IPPs and services all generators needs	Establish clear accountability for IPPs within Eskom
Set up Unit with **sufficient transparency and sufficient guardrails** to guarantee non-discriminatory grid access and operations for all IPPs and generators	Achieve a fundamentally improved image of the way IPPs view the South African electricity market
Create transparency on pricing policy, network contracts, and operating agreements	Non-discriminatory grid access to enable IPPs. (>30% of overall Gx capacity by 2030)
Develop **Optimised IPP connection process**	Effective organization with end-to-end process excellence
Define **operations processes** for IPPs and generators for the future (post-grid connection)	

Establish Grid Access Unit to build trust with the market:

- Manage the overall service relationship with IPPs

-Facilitate Grid Access (end-to-end) for IPPs/ generators

End-to-end process vs Grid Access Unit role



- **Enabling and facilitating** generators and IPP grid access, and making commercial options more viable requires service relationship, stakeholder and interface management, communication
- Management and **integration** of the development of relevant and appropriate standards, processes, frameworks
- Possibility of various connection, grid access and commercial options
- Pricing frameworks (costing of connection, network strengthening, and costs to “wheel”)
- Technical capability for integration of the IPP generators
- Process and system capability, and facilitation thereof, to enable grid access
- Quotation and Contracting capability and management
- Sufficient data and information, to effectively facilitate, enable, plan and support (+ transparency)
- Requirement for **long-term viability, while dealing with current challenges**

GAU – Building capacity in a reforming industry

- Alignment along cluster for better and efficient delivery to Customers
- Capacitating the Unit: 9 new positions across the country
- Enhancing systems (XRM, ACNAC), Processes (IGCAR, Grid Connection Guideline) and People (GAU structure)
- International Benchmarking Studies through ERID
- Supporting the Energy Action Plan – NECOM
  - Industry Guidelines on Grid Capacity Allocations to be submitted to the Department of Energy and Electricity
  - Curtailment Capacity
  - E-mobility
- Disciplined execution on core deliverables
  - Reduce backlog
  - Improved KPIs and turnaround timelines
  - Improved transparency on grid allocations
  - Systems, processes, people support
- Positive stakeholder management – ongoing engagements with customers as per our stakeholder engagement plan.

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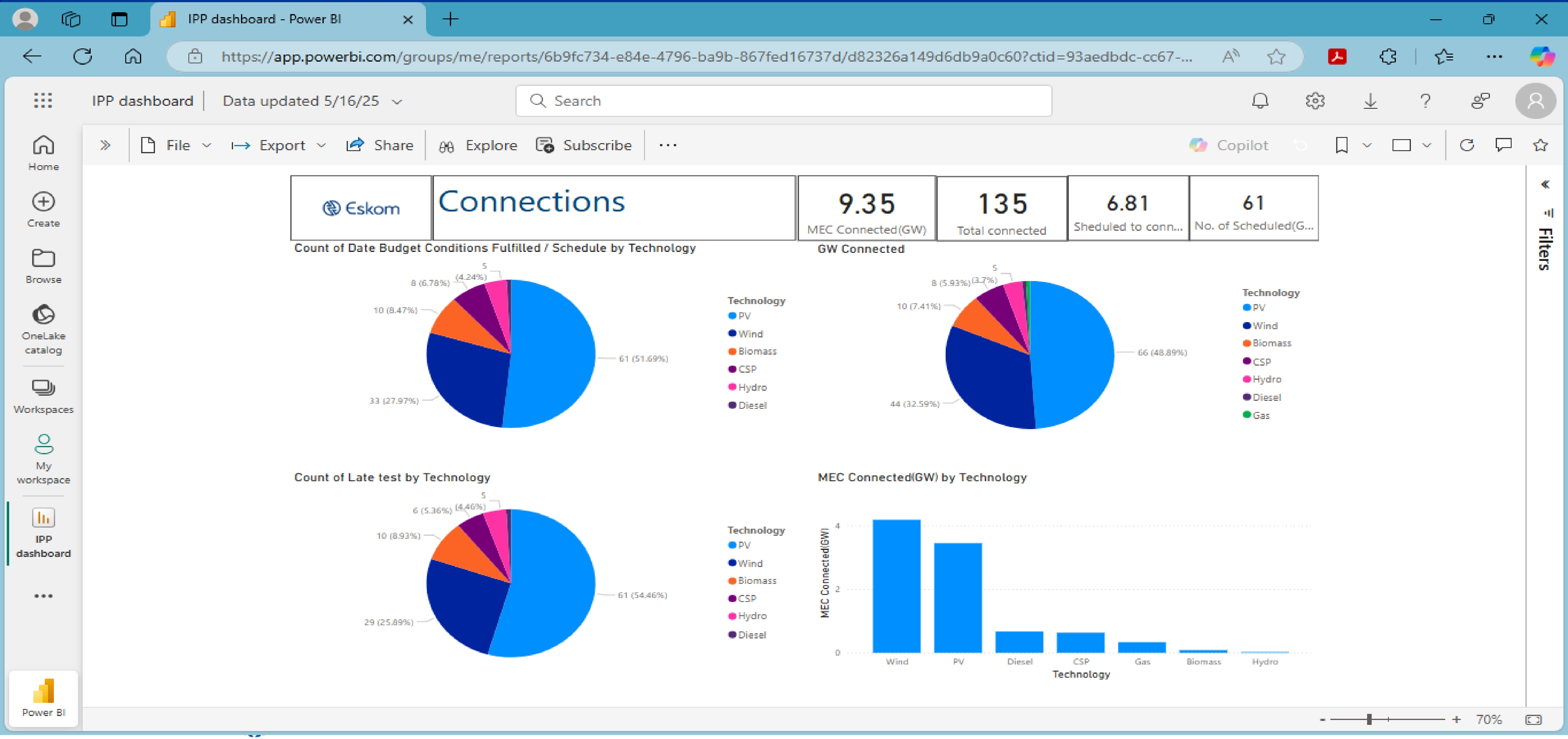
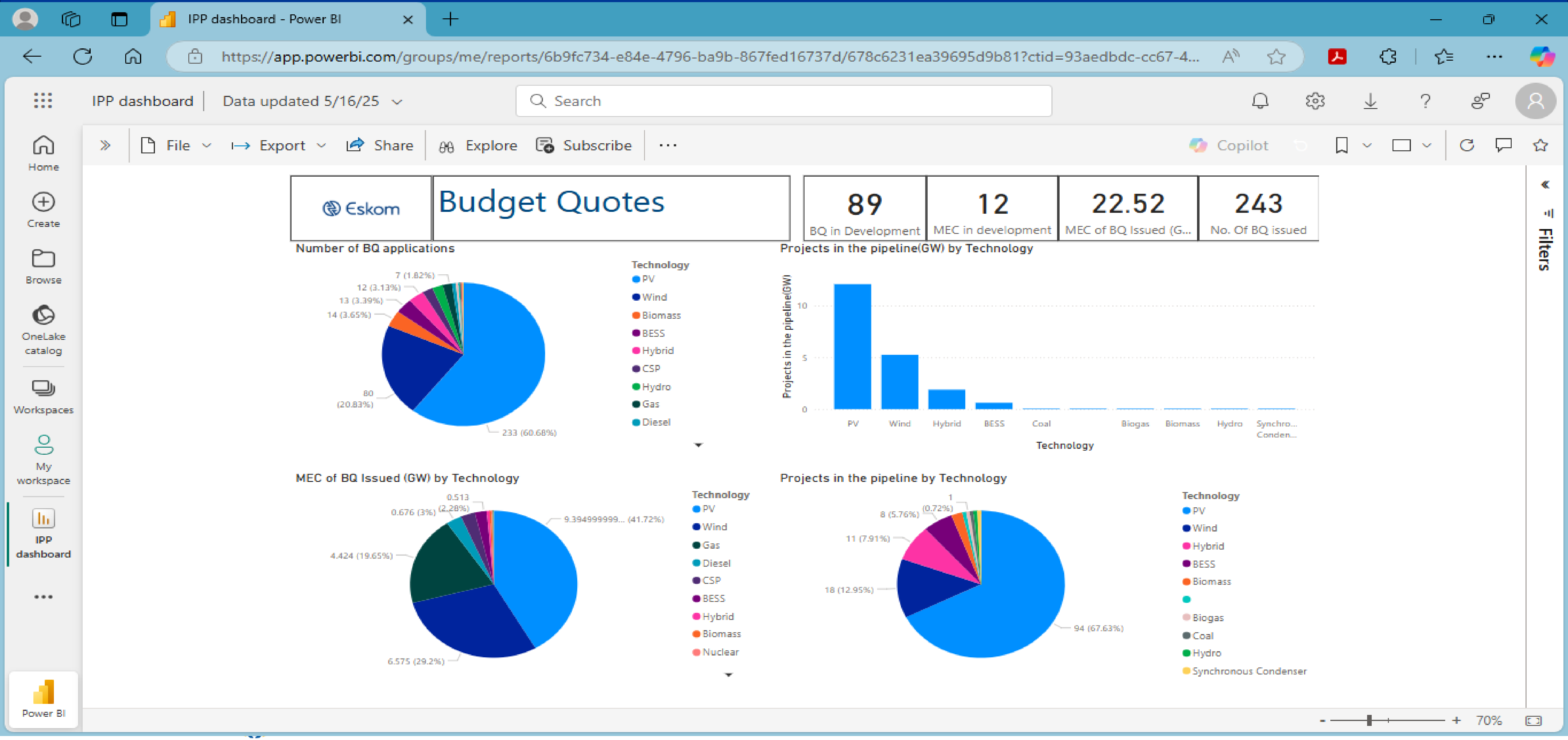
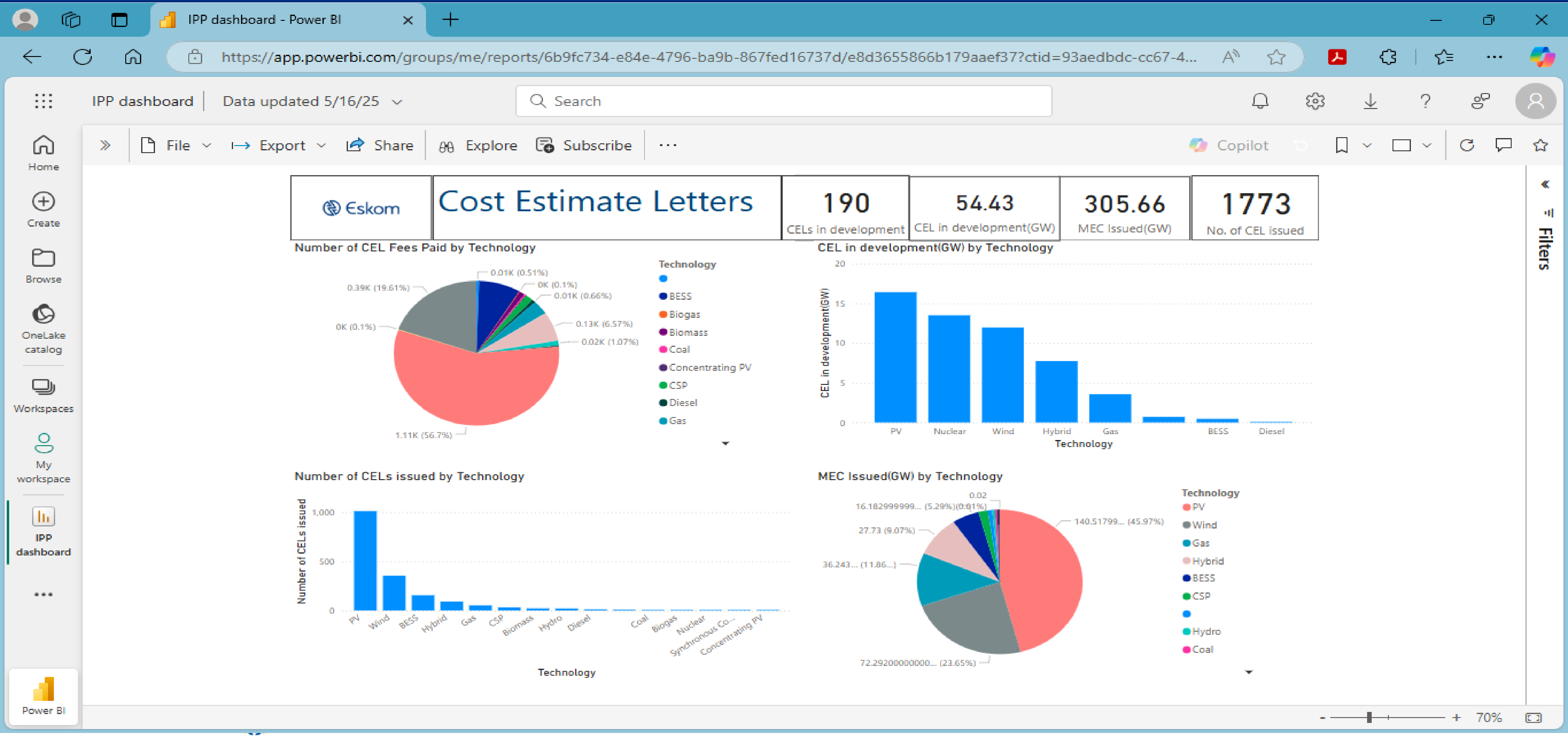
GAU Performance Highlights (2025)



GAU Performance Highlights (2025)



GAU Performance Highlights (2025)



GAU Performance Highlights (2025)

IPP dashboard - Power BI

https://app.powerbi.com/groups/me/reports/6b9fc734-e84e-4796-ba9b-867fed16737d/cfe4be304109c7850eac?ctid=93aedbdc-...

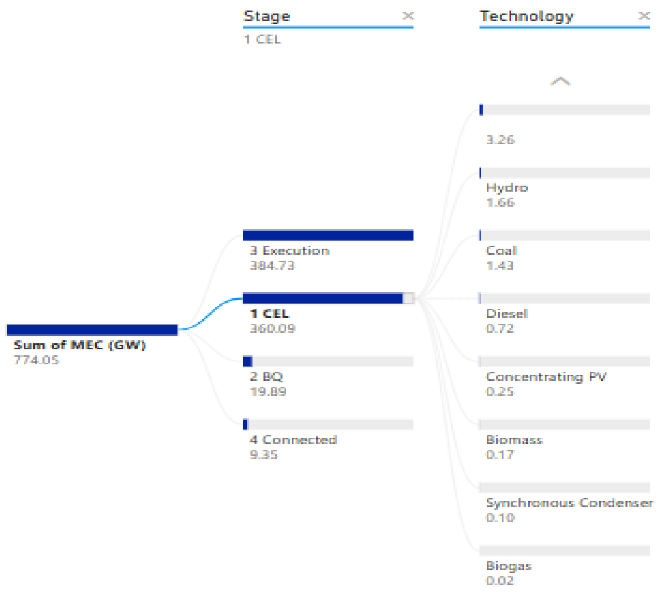
IPP dashboard | Data updated 5/16/25

File | Export | Share | Explore | Subscribe | Copilot

GAU Performance Report

19.89
Projects in the pipeline(GW)

139
Projects in the pipeline



Technology	1 CEL	2 BQ	3 Execution	4 Connected	Total
Concentrating PV	1		2		3
Biogas	2	1	2		5
Synchronous Condenser	2	1	2		5
Nuclear	6		6		12
Coal	6	1	6		13
Diesel	13		9	1	23
	10	1	14		25
Hydro	21	1	17	5	44
Biomass	22	3	15	10	50
CSP	31		36	8	75
Gas	62		68	1	131
Hybrid	129	11	130		270
BESS	160	8	165		333
Wind	385	18	406	44	853
PV	1113	94	1211	66	2484
Total	**1963**	**139**	**2089**	**135**	**4326**

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Overview of Legal/Regulatory Framework

Agreement	Parties
1.Power Purchase Agreement (PPA) - purchase of energy on behalf of DoE	**Eskom (SBO)** and IPP
2 Government Support Framework Agreement (GSFA) - government's commitment to financially support Eskom for IPP's energy purchases	**Eskom** and National Treasury
3. Direct Agreements (DA) PPA , Use of System - agreements with lenders for stepping-in rights.	**Eskom** , DPE, DoE, Lenders Agent and IPP
4 Independent Engineer (IE) Agreement – technical compliance, oversight and prudency on behalf of contracting parties.	**Eskom (SBO),** IPP & IE
5 Budget Quote – detailed costing for the engineering scope of work (grid integration)	**Eskom (GAU)** & IPP
6 Dx / Tx Connection and Use of System Agreement	**Eskom (GAU)** & IPP
7 Self Build Agreement – Option provided for IPP to build contract works (Tx/Dx)	**Eskom (GAU)** & IPP
8 Operating Agreement – governs the relationship between Eskom and IPPs on operations (Control and O&M)	Annexure to Dx / Tx CUOSA
9 Reconciliation Agreement / amendment to Electricity Supply Agreement of a municipality	**Eskom (Customer Services)** & Municipality

Thank You

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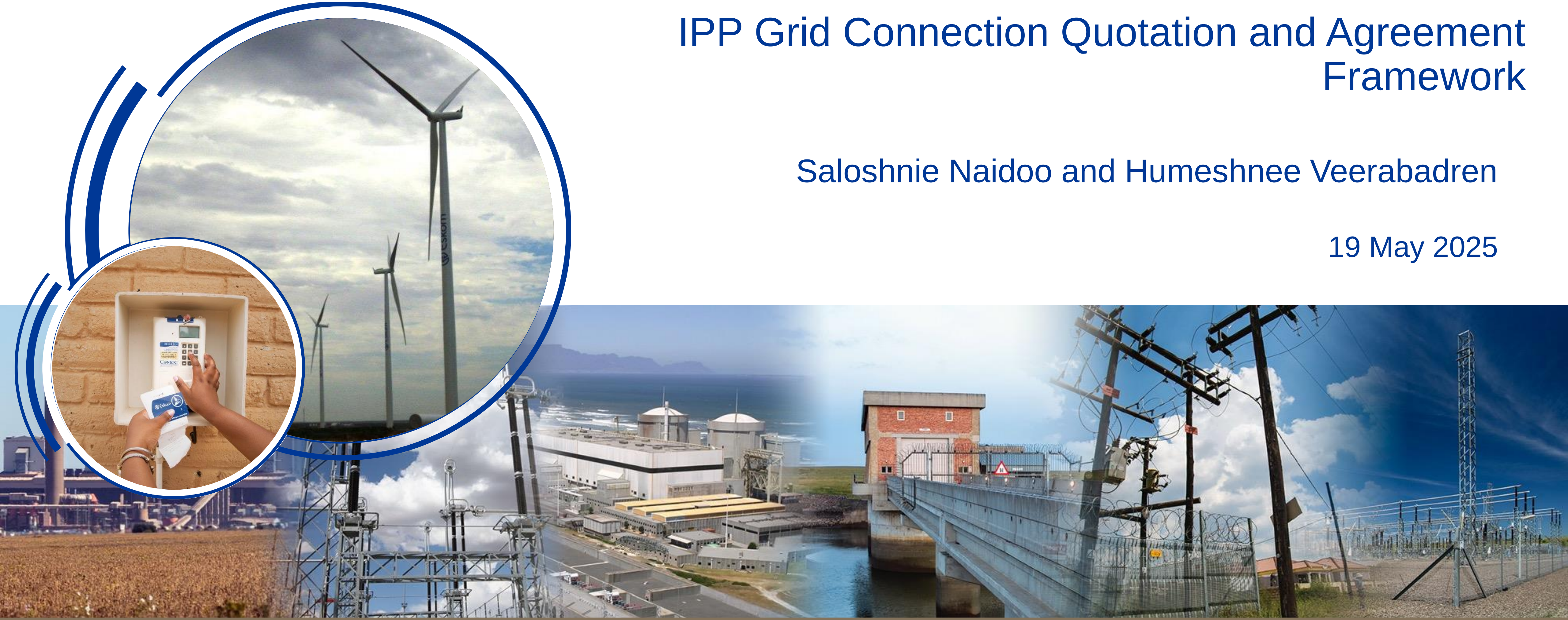
IPP Grid Connection Quotation and Agreement Framework

Saloshnie Naidoo and Humeshnee Veerabadren

19 May 2025



Contractual Framework for Grid Connection

- Cost Estimate Letter (CEL)
- Budget Quote (BQ), Connection and-Use-of System Agreement (Dx/Tx CUOSA), Self-Build Agreement (Dx/Tx SBA), and Direct Agreement (DA)
- Key Considerations for:
  - CEL
  - BQ
  - CUOSA
  - SBA
  - DA

Cost Estimate Letter (CEL)

- The **CEL is not an offer for a contract**. It is **purely illustrative** and in anticipation of a request for a BQ. It is based on engineering assumptions and issued in order to assist in making a decision to proceed to request a BQ
- The CEL is issued **subject to conditions prevailing on Eskom's Transmission and/or Distribution Systems**. At CEL stage, no capacity on the System is guaranteed or reserved.
- CEL **Validity Period is 12 Months**, however the sooner an IPP requests the BQ, the quicker Eskom can develop the BQ

Budget Quote (BQ)

- The **BQ** contains **scope of works, price and timelines**, for the Connection Works to be constructed to connect the Facility to the Dx/Tx System.
- The BQ is issued as a suite of documents, which include the **Forms of CUOSA (Dx/Tx) and, if applicable, the Dx/Tx SBA** (partially filled in)
- As soon as the IPP accepts the BQ, the **execution versions** of the above agreements should be finalized and signed (all within the BQ Acceptance Period).
- The commencement of the construction of the Eskom Connection Works is subject to the terms and conditions set out in **BQ read together with the COUSA (Dx/Tx), and if applicable the Dx/Tx SBA**.

Key Considerations for Budget Quote

Budget Quote Conditions

- **Unconditional Acceptance** of the BQ in the form of **Acceptance Letter**
- **Upfront payment of Connection Charge Estimate**
- **Furnishing of Connection Charge Guarantee** (if opted to pay in instalments) and payment of any instalment due
- **Early Termination Guarantee** (if applicable)
- **CUOSA (Dx/Tx)** signed by both parties
- If **Dx/Tx SBA** applicable, signed by both parties
- If **Dx / Tx SBA** applicable, then Contract Works / Contestable Works Securities are required
- **PPA** to be signed (Central Purchasing Agency) (Condition applicable for only Government program)

Key Considerations for Budget Quote

- All **BQ Conditions** to be fulfilled within **BQ Acceptance Period** = 120 Business Days (**BQ validity period)** for the BQ to become **effective.**
- If not, the **BQ will lapse and be of no force or effect**.
- **BQ Effective Date** is date within **BQ Acceptance Period** upon which the last of the **BQ Conditions** have been fulfilled.
- **Construction** can only **commence** once the BQ becomes **effective**.

Milestone Schedules ito BQ

- **IPP** and **Eskom Milestone Schedules** to be completed within 30 days of **BQ Effective Date**
- **Any delay or deviations** in achieving the milestones should be notified and agreed to by the Parties in writing

Connection and Use-of-System CUOSA (Dx and Tx)

CUOSA sets out the terms and conditions upon which Eskom and the IPP have agreed to:

- **physically connect the Facility** to the Tx/Dx System and,
- to allow the IPP access to and the **usage of the Tx/Dx System to export electrical energy** from the Facility against the payment(s) by the IPP to Eskom of the applicable Charges

The access to and the usage of the Tx/Dx System is subject to **compliance with all the applicable Codes and the Standard for the Interconnection of Embedded Generation**

Key Considerations for CUOSA

- The completed **Operating Procedure Manual (OPM) – Ann B to the CUOSA**, is **not a requirement** for the Execution Versions of these agreements and may be completed afterwards.
- The CUOSA can be signed with the *Form of OPM.*
- IPPs will not at this stage have the **names and contact details of staff** that must be listed to operate the plant and Eskom must determine the **optimum control mode** before the OPM can be finalised.
- **The OPM must be completed and signed by both parties before the IPP is connected** to the Dx System.
- Eskom to issue **Operational Notification (ON)** in terms of CUOSA and IPP may commence use of the Distribution System.

Self Build Agreement (SBA)

SBA regulates:

- the **construction of the Contract Works and/or the Contestable Works** to be undertaken by the IPP, and the **Monopoly Works falling under** the responsibility of **Eskom**
- the **commissioning** of the Contract Works and/or the Contestable Works by the IPP, and on completion of the Contract Works and/or Contestable Works the **handover of the plant, facilities, equipment, assets and related designs, material guarantees/ warranties, deeds** and other documentation by the IPP to Eskom

Key Considerations for SBA

- **IPP** to issue **Contract Works/ Contestable Works Completion Certificate** after completion of Contract Works/Contestable Works and pre-commissioning
- After **commissioning** of Contract Works/Contestable Works, Eskom issues its **notice of acceptance** of Contract Works/Contestable Works Completion Certificate
- **Hand-over Date** occurs after Contract Works/Contestable **Works Acceptance Date** on which **risk and benefit of Contract Works is transferred** to Eskom

Direct Agreements (DA)

- DA is an agreement between **Eskom, the IPP and the Financial Institution** which gives the **Lenders** who provide **project finance** with **step-in rights** in the event the IPP fails to perform in terms of the project and suite of agreements

Contractual Framework

- Eskom (Distribution & Transmission) operates in a **highly regulated environment** and has a regulatory **obligation not to discriminate** between its customers regarding, amongst others, prices and conditions of service, except for objectively justifiable and identifiable differences approved by the Regulator.
- Therefore, Eskom cannot tailor make agreements to suit each IPP's specific needs. **All IPPs are contracted on the basis of pre-approved templates**
- Grid Connection Agreements (CUOSA), Self-build Agreements (SBA) and Direct Agreements (DA) are **standard templates, are non-negotiable**, and are in compliance with Eskom's regulatory obligations
- Adhering to all key aspects as discussed in this presentation, will ensure **timeous Grid Connection for IPPs**

THANK YOU

SAWEA

South African Wind Energy Association

Niveshen Govender

Eskom IPP Conference

19 May 2025

SAWEA | AT A GLANCE

WHO WE ARE

SAWEA is a member-based not-for-profit industry association advocating for the accelerated growth of wind energy in South Africa. We aim to promote a better policy environment to sustain a thriving wind industry and support local participation and beneficiation.

KEY FOCUS AREAS

Policy Advocacy

Thought Leadership

Knowledge Hub

Technology Innovation

OUR MEMBERS

enel Green Power
ENGIE
MAINSTREAM RENEWABLE POWER SOUTH AFRICA
ENERTRAG
Vestas
NORDEX
acciona Windpower
SIEMENS Gamesa RENEWABLE ENERGY
sasol
GLOBELEQ
EDF renewables
G7 renewable ENERGIES
Reatile
AMEA POWER
AFRICAN CLEAN ENERGY DEVELOPMENTS
JUWI
ArcelorMittal
WKN Windcurrent PNE GROUP
GOLDWIND
M&D
voltalia
Scatec
GRI Renewable Industries
INFINITY POWER A MASDAR INFINITY COMPANY
AURORA WIND POWER
PELEGREEN ENERGY

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WIND ENERGY

Impact

SA | WIND ENERGY ACHIEVEMENTS

REIPPPP & RMIPPPP

42 wind energy projects **(4 287 MW)** procured

3 634 MW total installed capacity from **36** projects

R89.6 billion invested in wind energy

653 MW from **6** wind projects in construction as of Q2 2025

3.6 million households powered annually

23 307 job years >80% in construction

38.8 million estimate metric tonnes of CO_2 emissions avoided

33% black SA shareholding

R898 million SED and ED initiatives

46 480 GWh of wind energy contributed to the national grid

70% LCOE reduction 1.93 to **0.58 R/kWh**

84% domestic investment

R24 billion 47% of project value spent locally

Private Offtake

16 wind energy projects **(2 030 MW)** procured

158 MW total installed capacity from **2** projects

R52.1 billion estimated invested in wind energy

1 872 MW from **14** wind projects in construction as of Q2 2025

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Sources: DMRE REIPPPP Focus on Wind – Dec 2021 & IPPPP Overview as at 30 Sept 2024, available at https://www.ipp-projects.co.za/Publications

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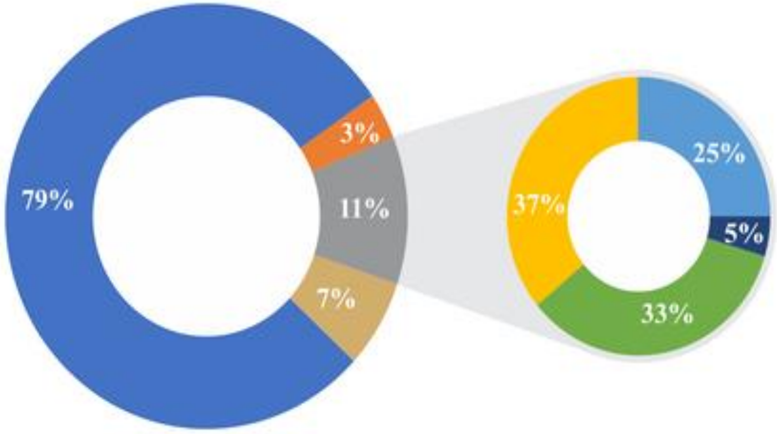
ENERGY POLICY
Reforms

POLICY FRAMEWORK | SUPPORTING WIND ENERGY

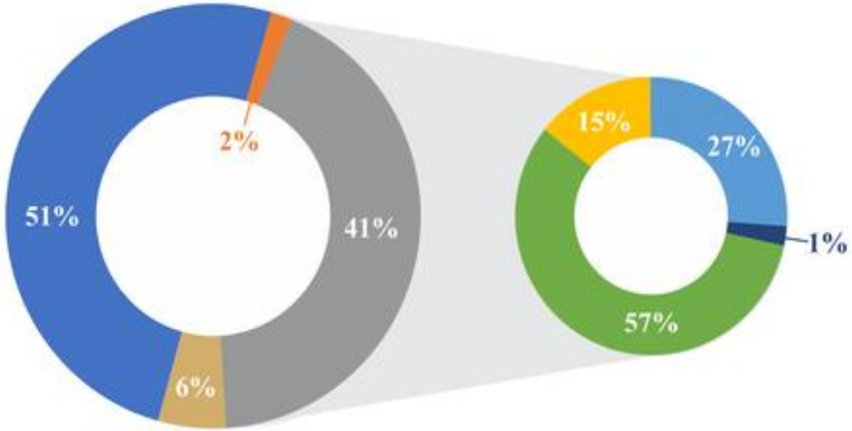
Electricity Regulation Act (ERA)	Integrated Resource Plan (IRP)	Grid Connection Frameworks	Transmission Development Plan (TDP)
• Electricity Regulation Amendment Bill • Schedule 2 Amendments • South African Wholesale Electricity Market (SAWEM) • Independent Transmission System Operator (TSO)	• Section 34 Ministerial Determinations • Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) • Risk Mitigation IPP Procurement Programme (RMIPPPP) • Battery Energy Storage IPP Power Programme (BESIPPPP)	• Interim Grid Capacity Allocation Rules (IGCAR) • Batched Connection Generation Framework (BCGF)	• Independent Transmission Projects (ITPs) • South African Renewable Energy Grid Survey (SAREGS) • Congestion Curtailment Framework

IRP2019 | VS DRAFT IRP2025

IRP 2019



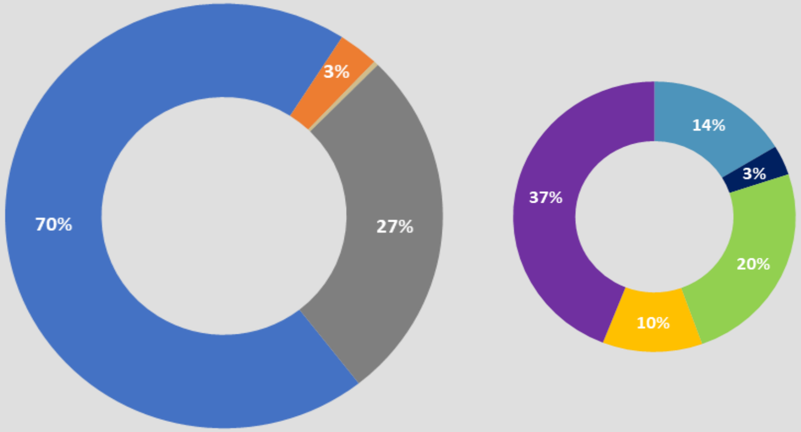
Installed Capacity 2018



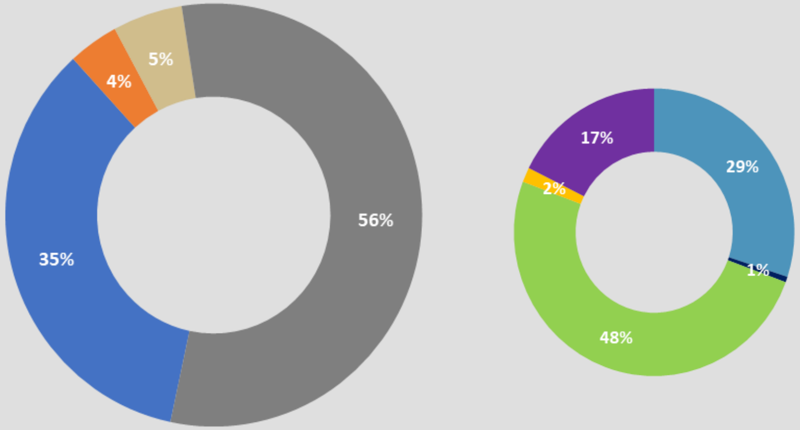
2030 Target

Draft IRP2025

Installed Capacity 2024



2042 Target



Fossil Fuels | Nuclear | Renewables | Others | Distr. Gx | Solar PV | CSP | Wind | Hydro

Source: *Draft IRP2024 Consultation Workshop – Nov 2024*

PUBLIC PROCUREMENT | OVERVIEW

2010 -2019

Launch of **Bid Windows 1 - 4**

3442MW procured, constructed and operational

3 years with no signed PPAs (2015 – 2017)

2020

RMIPPPP: Launched in 2020 to urgently bring new generation onboard

2 Hybrid projects with Wind Energy under construction totalling **150MW** of wind energy

2021

BW5 launched resulting in 1608MW of wind procured

12 wind projects procured, 6 in construction (**784MW**). 6 have not reached FC (824MW)

Aggressive Market conditions, global supply chain challenges

2022

BW6 launched with 4.1GW of wind bids submitted and no wind procured

23 wind projects bid, 0 procured

Grid constraints in wind resource-rich areas

2023

BW7 launched

2024

BW7 preferred bidder announcement – no wind yet

8 wind projects submitted totalling 1692.4 MW bid

NOTE: 1.8GW of privately procured wind projects in construction.

No new public wind energy procurement

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SA WIND ENERGY MARKET

SA | WIND ENERGY MARKET

MARKET DRIVERS

- LCOE
- Energy Security
- Paris Agreement (NDCs)
- CBAM
- Carbon Taxes
- Green Hydrogen

MARKET PARTICIPANTS

Buyers
- Offtakers
- Municipalities
- Eskom

Sellers
- IPPs
- Traders & Aggregators
- SAPP

Other
- NTCSA (TSO)
- EIUG
- RE Value Chain

WIND TECHNOLOGY

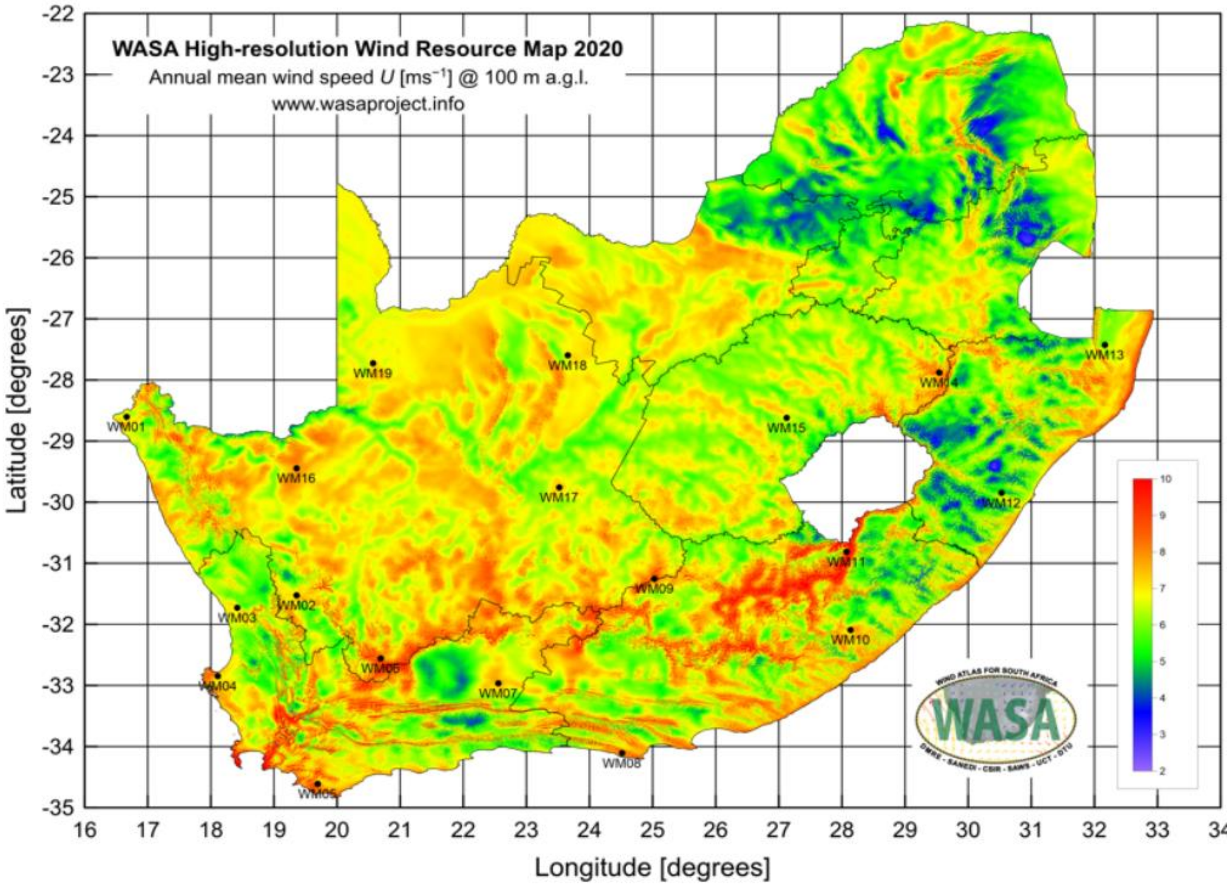
- Onshore
- Small-Scale
- Offshore

ENABLERS

- Quality Wind Resource
- Wheeling Framework
- Investment Support
- Bilateral Agreements
- Policy Reforms
- Public Procurement

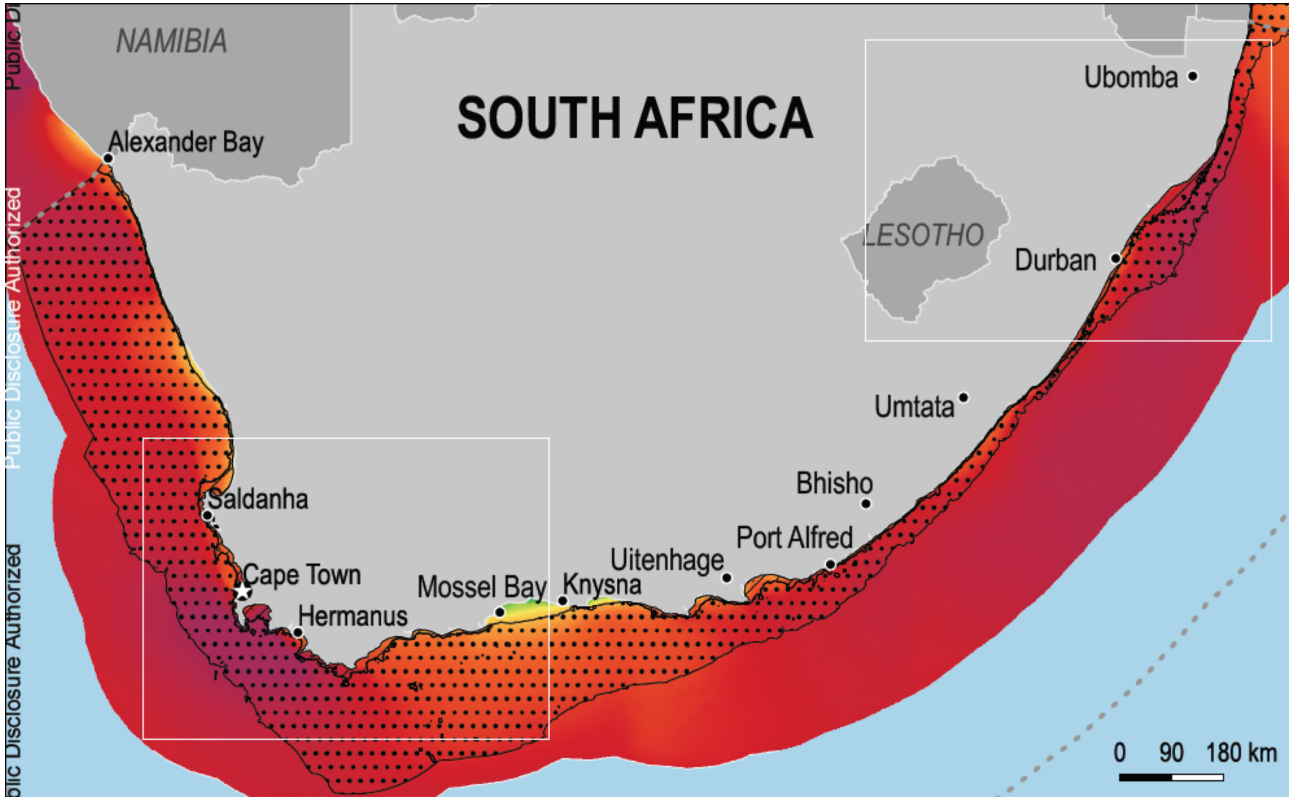
SA | WIND POTENTIAL

Onshore Wind Potential (404GW)



Source: *Wind Atlas for South Africa* *WASA*.

Offshore Wind Potential (901GW) – 49GW Fixed; 852GW Floating



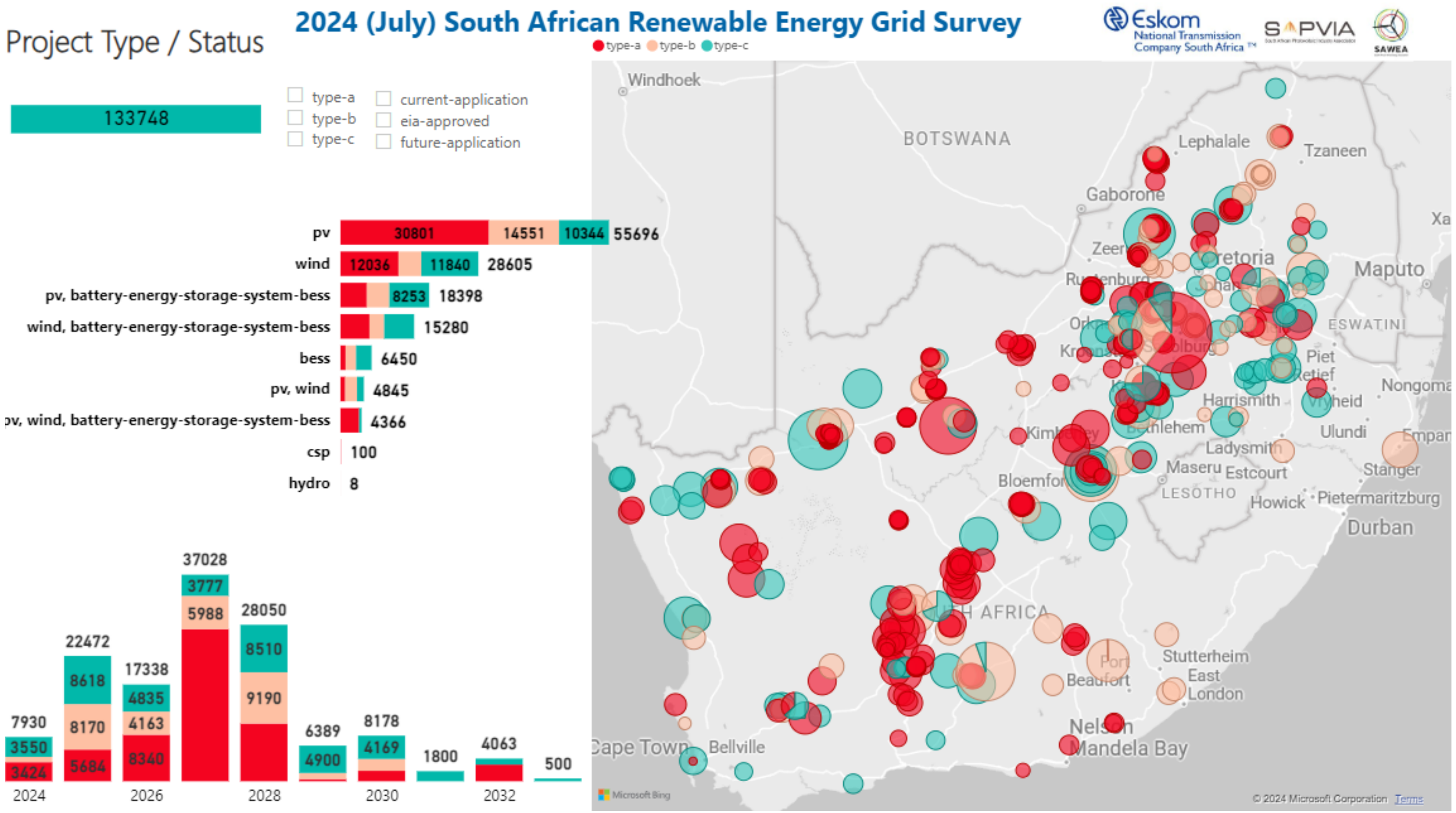
Source: *World Bank Offshore Wind Technical Potential for SA*

PROJECT DEVELOPMENT | PIPELINE

South African RE Grid Survey 2024

Total 53 096 MW of Wind Projects in SA

Type of Project	South Africa
Pure Wind Projects	28 605 MW
Wind + BESS	15 280 MW
Wind + PV	4 845 MW
Wind + PV + BESS	4 366 MW
Total	**53 096 MW**



Source: *2024 SA Renewable Energy Grid Survey – July 2024 South African Renewable Energy Grid Survey – Eskom NTCSA*

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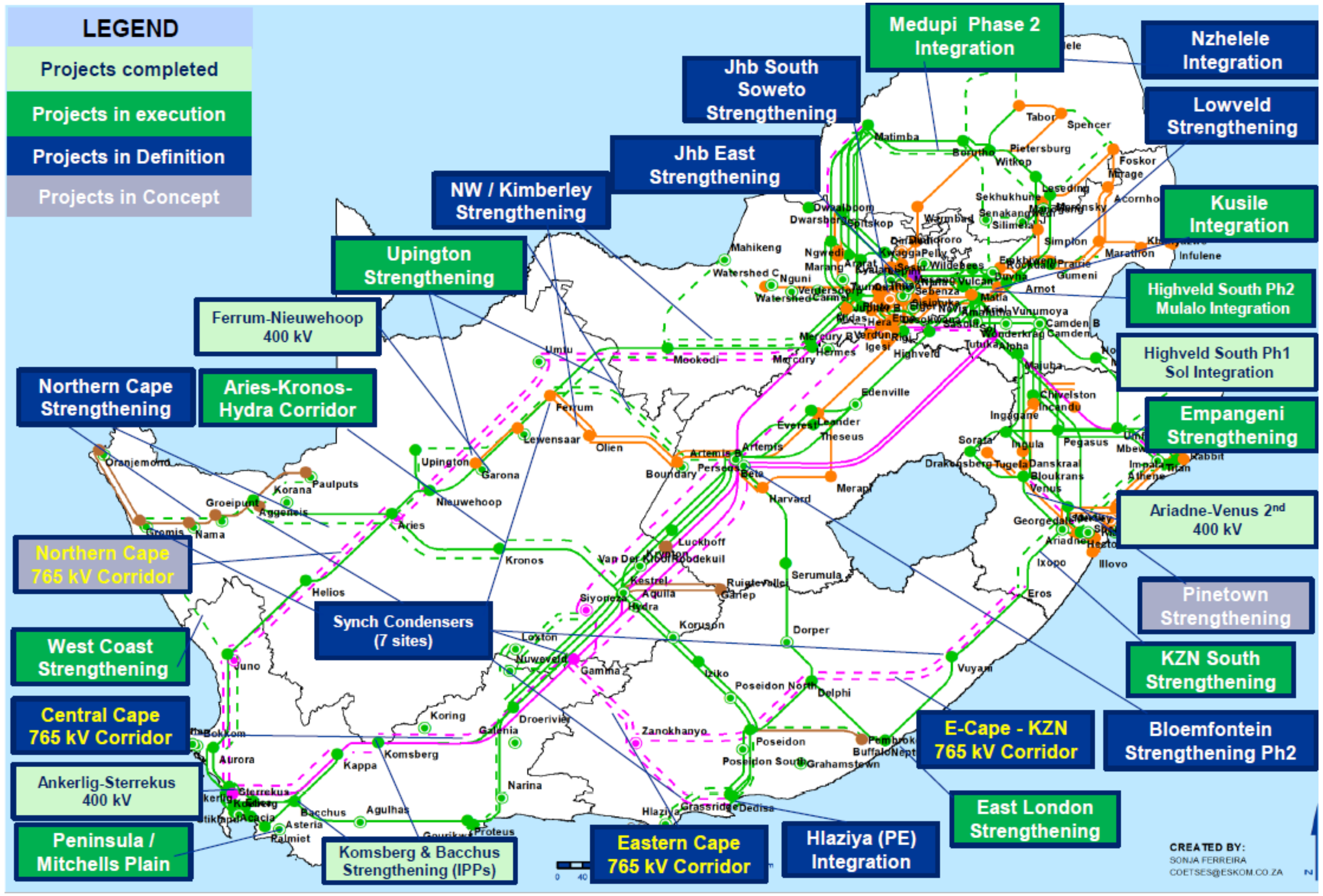
TRANSMISSION DEVELOPMENT PLAN



- Transmission Development Plan Outlines **14000km** of new Transmission lines by **2034**
- To account for **133GW** of Renewable Energy in **SA Renewable Energy Grid Survey** (SAREGS) 2024
- Urgency to resolve grid constraints in wind resource rich regions
- Utilising mechanisms such as **Curtailment** in the short term to unlock **3.4GW in WC and EC**
- Unlock capacity through **13GW** prioritised **transformer projects** by **2030 and 24GW via expedited projects by 2033**
- Resource, capacity constraints, CAPEX and servitude acquisition remains an issue
- Utilising **Independent Transmission Projects** (ITPs) to alleviate pressure on NTCSA to provide all Tx infrastructure
- **Misalignment** between **TDP** and **IRP**
- Key Target: ITPs prioritise wind congested regions

INDUSTRY | KEY CHALLENGES

1.
Lack of grid capacity and grid access allocation

2.
Policy reform alignment with implementation in the regulatory environment

3.
Port-to-site logistics in the construction of new wind projects

4.
Creating an investor-friendly local manufacturing environment

5.
Creating a workforce with the necessary training and competencies for the wind industry

GRID CAPACITY AND ACCESS | HURDLES

GRID CAPACITY CONSTRAINTS

		CONTEXT / WHY?	WHERE ARE WE	NEXT STEPS
INCREASE CAPACITY	Congestion Curtailment	Unlocks > 3 GW of wind projects in WC & EC	Approved by NERSA on 29 April 2025	Implementation framework and timelines required to guide industry
INCREASE CAPACITY	TDP/ITP	IRP & SAREGS guided figures, aggressive TDP roll out required	ITP Regulations in public comment phase 1164km of ITPs in BW1 Nov 2025	Future ITP BWs to focus on wind constrained areas Align TDP with latest IRP
INCREASE CAPACITY	Global Best Practices	*Applying global best practice contributes to energy security and sustainability*	*Global expert participation in SAWEM, potential to workshop across the entire utility value chain*	*Study tours, MoUs and more industry 'workshopping'*
ALLOCATION	Transparent Grid Allocation Queues	Transparency in grid allocation offers prospective generators foresight to be grid ready, offers investors security	Exploring the practicality of an online public portal to inform grid applicants of their queueing position	Commence with implementation and rollout of portals
ALLOCATION	IGCAR + BCGF Changes	Appropriate rules for grid allocation paves the way for investor certainty, rapid implementation and quicker roll out of new Gx	IGCAR requires revision. BCGF is under development	Industry feedback and recommendations to be included and changes effected

GRID CONSTRAINTS | INDUSTRY CONSIDERATIONS

Grid Allocation

Non discriminatory access to the grid
- Non-discriminatory grid access regardless of the buyer and consistently applied to all generators in alignment with ERA and the move to a liberal market.

Clear and Consistent Grid Allocation Rules
- Transparent and consistent revocation processes and stakeholder consultation for changes.

Developing a Transparent Grid Access Queue
- Based on 'first ready, first served' principle
- Queue to be publicly visible and actively managed.

Regular Review of the of GCCA
- Annual review with quarterly updates to improve planning certainty.

Consistent Application of Rules
- Requirements should be equally applied to avoid submission delays, hampering consistency.

Congestion Curtailment

- Clarification on **how** the curtailed capacity be **allocated** to **new projects - Timelines** for implementation.
- **Impact** on **existing generators** and **PPAs.**
- Curtailment **calculation methodology** – quantifying **compensation** and how curtailment will be practically applied.

Investment Support & Guarantees

Compensation for New TX Node Initiators
- First IPP should be reimbursed proportionally when others connect.

Resolving Grid Bond & Guarantee Concerns
- Improve Grid Bond mechanism to ensure effectiveness
- Use guarantees to appropriately manage "grid risks", at large, and regulate behaviour.
- Remove potential duplication of guarantees across different project phases
- Create conditions for IPP recourse for delays (outside its control) that impact project timelines.

GRID CONSTRAINTS | INDUSTRY CONSIDERATIONS

CEL & BQ issues

Avoiding and limiting scope creep

- Timelines to get from CEL to BQ.
- Reduce project interdependencies to avoid delays cascading.

Minimising scope and costing differences between CEL and BQ

Creating recourse mechanisms for IPPs

- Lack of recourse for IPPs should Eskom not meet BQ timelines.

Standardising framework for BQ payment schedules

- Consistent approach across all projects recommended.

Procedural Bottlenecks

- **Improving client communication and response times**
  - Standardising response times and proactive communication with industry/Eskom Customers.
- **Improving inter-divisional (Eskom Dx and NTCSA) consultation to align planning and prevent inconsistencies**
- **Consistency in application of rules by GAU and clarification of departmental roles**
- **Review of project agreements to ensure readiness for market changes**

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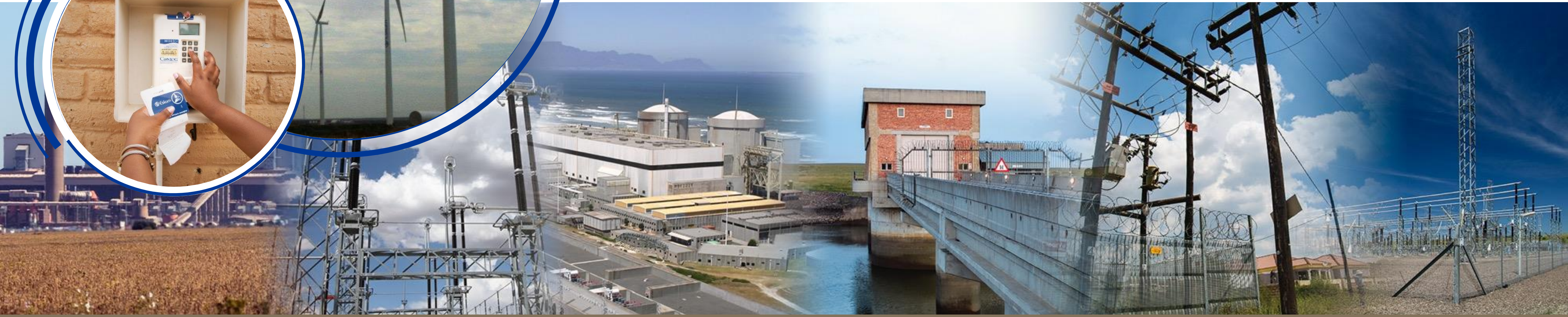
South African Wind Energy Association

THANK YOU

JOIN US FROM 21-23 OCTOBER AT CTICC2 TO FURTHER THE CONVERSATION

WINDABA

Self-Build Project Acceptance Process and Lessons Learnt



Lucy Sangweni PrEng

Chief Engineer: High Voltage Powerlines Engineering

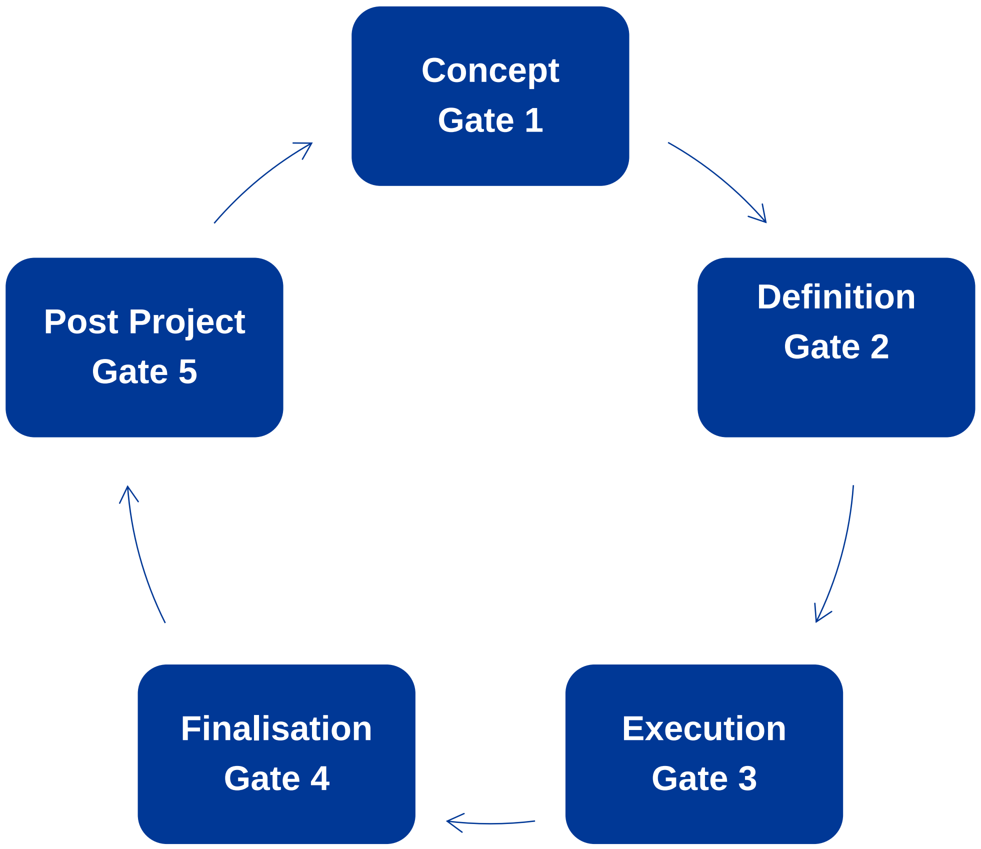
19 May 2025

Purpose

- ✓ To provide the business with guidelines and tools to use in integrating Self-Build Independent Power Producers (IPP) projects, into the grid.
- ✓ To provide lessons learnt from ***actual experiences*** relating to Self-Build IPP projects within Eskom.
- ✓ Ensure that lessons learnt are **Captured, Recorded and Distributed** to the organisation, to make effective use of them as a platform for effective controls and efficient mechanisms.
- ✓ *To determine what problems occurred and how those problems are to be avoided in the future **by not making the same mistakes over and over again.***

Procedure for Self –Build Projects

- **Project Life Cycle Model**



Procedure for Self –Build Projects

The Concept Phase

- ✓ The project is CRA approved; Gate 1 unlocked
- ✓ Appoint the core project stakeholders with valid professional registration and relevant experience.
- ✓ **Eskom to arrange a stakeholder identification meeting (SHIM)**
- ✓ Develop viable design alternatives
- ✓ Conduct risk identification for each alternative
- ✓ Submit concept design alternatives to Eskom for checking
- ✓ Prepare and submit for DRT
- ✓ Obtain Eskom DRT approval for the preferred concept design.
- ✓ Provide Job Cost Estimate as per WBS numbers
- ✓ **Eskom Obtains quotations for monopoly works**
- ✓ Provide project management plan
- ✓ Submit Environmental Assessment approval
- ✓ **Eskom prepares and submit to IC for DRA gate unlocking.**

Procedure for Self –Build Projects

The Definition Phase

- ✓ The project is DRA approved; Gate 2 unlocked
- ✓ **Eskom prepares and issues a Budget Quotation (BQ) to the Developer**
- ✓ Issue Budget Quote acceptance letter.
- ✓ Prepare a detailed final design
- ✓ Submit Health and safety plan
- ✓ Submit environmental management programme
- ✓ Submit project master schedule
- ✓ Prepare a detailed risk analysis and quantification
- ✓ Compile and submit final design package to Eskom for checking
- ✓ Prepare and submit for DRT
- ✓ Obtain final design DRT approval
- ✓ Arrange for FDP handover meeting
- ✓ **Eskom prepares and submits for ERA gate unlocking**

Procedure for Self –Build Projects

The Execution Phase

- ✓ The project is ERA approved; Gate 3 unlocked
- ✓ Procure Material
- ✓ Arrange Construction kick off meeting
- ✓ Execute site preparation/establishment
- ✓ Construct the asset
- ✓ Manage delivery of the project
- ✓ Provide Safety, health and Environment Management
- ✓ Conduct Quality Inspections
- ✓ Monitor and report progress
- ✓ Conduct pre-commissioning testing
- ✓ Confirm operational readiness
- ✓ Commission/energise the asset
- ✓ Compile and submit the As-Built data to Eskom
- ✓ **Eskom prepares and submits for asset handover gate unlocking**

Procedure for Self –Build Projects

The Finalisation Phase

- ✓ The project is Asset Handover Approved; Gate 4 unlocked
- ✓ Transfer the asset to Eskom's name
- ✓ Close-Out the project
- ✓ Evaluate project performance
- ✓ **Eskom prepares and submit for FRA gate unlocking**
- ✓ Disband the project Team

The Post Project Phase

- ✓ The project is FRA Approved; Gate 5 unlocked
- ✓ Eskom Operates and Maintain the asset
- ✓ Eskom conduct business solution review
- ✓ Eskom ensures benefits realisation
- ✓ Eskom prepares and submits for Benefits Realisation Approval**.**

Lessons Learnt Summary Table: Network Engineering & Design

Success	Challenges	Risks/Impacts	Recommendations
1. Successfully commissioned multiple IPP projects.		i. Diverse expertise among team members raises high levels of learning, morale, and thus increases quality planning. ii. Effective and transparent decision-making.	i. Maintain
	2. Late appointment of design consultants	i. Designers are not familiar with the project requirements and are pressured to deliver overnight. ii. Short engineering timelines iii. Sub-standard designs and incomplete designs get delivered iv. Project delays cripple in	i. Appoint design consultants at the initial stage of the project i.e., during project site acquisition. ii. Design consultants must assist in the selection of the feasible site for the project. iii. Environmental approval applications must consist of preliminary design concepts.
	3. EPC contractors appointed at a later stage while design consultants are appointed earlier.	i. Contractor and design consultants not synchronized.	i. EPC Contractor and Design consultant must be appointed at the same time. ii. Contractors must fully engage design consultants during construction. iii. Design Consultant must provide construction support.
	4. Appointment of inexperienced design consultants	i. Consultants not abiding to engineering principles and providing substandard professional service. ii. On job training and overworking Eskom engineers. iii. Prolonged design review process	i. Appoint qualified experienced design consultants with professional registrations. ii. Design consultants must carry out their engineering obligations with professionalism, follow engineering standards, and always apply due care when developing designs.

Lessons Learnt Summary Table: Network Engineering & Design

Success	Challenges	Risks/Impacts	Recommendations
	5. Changing design consultants before project completion	i. Important information falls within the cracks due to communication break down and improper handover. ii. New consultants need time to familiarize themselves with the projects iii. New consultant copies the former consultant's designs without understanding their engineering philosophy. iv. Poor engineering designs executed. v. Lack of engineering accountability vi. Project delays and wasteful expenditure.	i. Self-Build Agreement requires that design consultants be appointed from concept to construction. ii. Change of design consultants once the project has started is not allowed. iii. Use of another consultant's work is not allowed. iv. Enforce Grid Access Rules.
	6. Change of Scope at DRA stage	i. Restarting the project registration process and redesigning resulting in design errors and project delays. ii. Puts more administration work within Eskom	i. Freeze project scope once CRA is approved. ii. No design changes to be accepted unless site conditions which were unforeseen during the initial evaluation deems it necessary.
	7. Budget quote unrealistic delivery deadlines and lack of understanding Eskom's project governance process.	i. Pressurizing Eskom to have ad-hoc meetings and compromising Eskom's operations.	i. Design Consultants to familiarize themselves with ESKOM's Project Life Cycle Model Requirements and seek clarity from Eskom if necessary. ii. Eskom to provide a refresher Self - build project process during the project kickoff meeting (SHIM).

Lessons Learnt Summary Table: Network Engineering & Design

Success	Challenges	Risks/Impacts	Recommendations
	8. Resisting to implement Eskom's requirements	i. Submission of non-compliant designs. ii. Unnecessary disputes iii. Escalated complaints iv. Rogue working relationships v. Project delays.	i. Designs must conform to ESKOM's requirements in addition to the national engineering standards. ii. Design consultants must be conversant with the Self-build Agreement and the Design Requirement standard.
	9. Use of non-standard and uncertified designs/components	i. Non-standard components require certification tests to be performed before the design may be accepted. ii. Testing phase takes long and prolongs the design phase, which contributes to delayed project implementation.	i. Use standard components as much as possible. ii. Work closely with Eskom engineers from start to finish, if in doubt, contact Eskom. iii. IPP must handover the project with enough spares for non-standard components.
	10. Not involving Eskom during the Environmental Impact Assessment (EIA) process.	i. Acquiring corridors with EIA conditions that are not viable, which require amendments that lead to prolonged delays.	i. Consult Eskom DX Land Development as an interested party during the EIA process. ii. Both Eskom Dx and NTCSA representatives should be involved where a project concerns both entities.
	11. Submission of incomplete or irrelevant Environmental Authorization documents.	i. Delays in reviewing the environmental document, finalizing designs and executing the project. ii. Not adhering to Environmental and Land& Rights requirements.	i. Handover meeting between the Developer's environmental consultant and Eskom Land Development is required

Lessons Learnt Summary Table: Execution Phase

Success	Challenges	Risk/Impacts	Recommendations
	12. Finalizing designs without Environmental approvals	i. Environmental requirements are not considered in the design. ii. Re-designing during construction iii. Project Implementation Delays	i. Final designs must be submitted after all environmental authorizations have been obtained. ii. Conditionally accepting final designs is not allowed at Eskom. iii. Eskom must reject designs with incomplete environmental approvals.
	13. Constructing powerlines on routes not approved by the EA or Landowner.	i. Project delays due to retrospective changes in the EA ii. Redesigning during the construction phase. iii. Wasteful expenditures. iv. Possible penalties imposed by the DEA	i. No final design shall be accepted by Eskom unless all Environmental approvals and Land &Rights approvals have been obtained. ii. No construction shall commence unless all environmental and Lands & Rights approvals have been obtained. iii. Conditional acceptance of an FDP is not authorized.
	14. Contractors bypassing Design Consultants during construction and seeking design solutions directly from Eskom.	i. Design Consultant's professional responsibility and accountability fall away. ii. Project Change Request approval gets delayed.	i. Design consultants is responsible for implementing any project change request and remains accountable. ii. Communication protocols for Self-Build projects must be always preserved.

Lessons Learnt Summary Table: Execution Phase

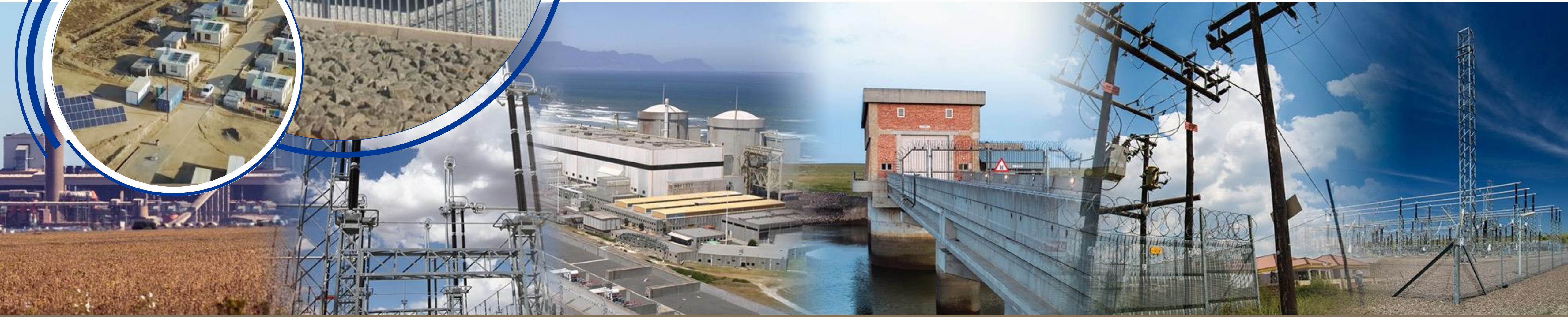
Success	Challenges	Risk/Impacts	Recommendations
	15. Disregarding the approved Final Designs.	i. Incorrect material used during construction. ii. Constructing assets that do not conform to engineering standards, undermining the safety of Eskom employees, public and the environment. iii. Plant premature failure and operational issues iv. Breach of the Self-Build Agreement v. Violation of the Engineering Profession Act 46 of 2000.	i. Contractor must use the approved design document to order material. ii. Design consultant to verify the correctness of the material to be ordered and delivered. iii. Stop the project iv. Enforce the Self- Build Agreement v. Report misconducts. vi. Uphold professional ethics in your conduct.
	16. Short notice outage requests.	i. Delayed project commissioning	i. Present the expectations of both parties (Eskom and the Developer) at the construction kickoff meeting ii. Monitor the project construction schedule iii. Apply for outages in advance.

Thank you!

Navigating the Just Energy Transition and an evolving energy landscape

Malcolm Van Harte

19 May 2025



Agenda

- **Distribution at a glance**
- Current outlook
- Our future
- Eskom Renewable programmes

Eskom Distribution at a glance…

Eskom

MANDATE
To power economic growth through the provision of reliable electricity and related energy services to our customers in a sustainable manner

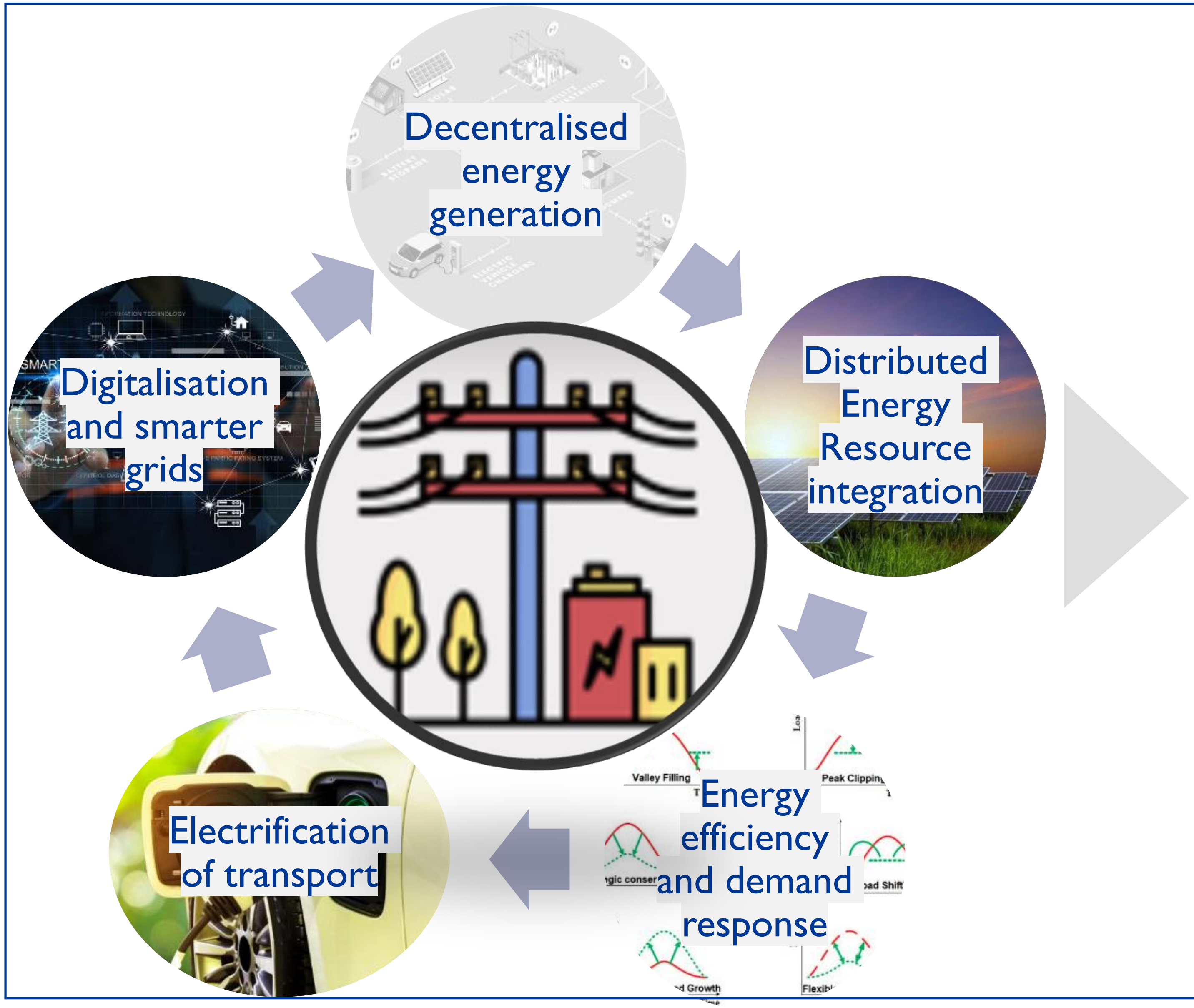
VISION
Together, creating exceptional value for customers, by distributing reliable, secure and sustainable energy and related services

MISSION
A profitable organisation by selling electricity and related energy services that are desirable to our customers to deliver the value they seek

STRATEGIC OBJECTIVES	GOALS	INITIATIVES / INVESTMENTS
Pursue financial and operational sustainability	Fix Current Business	Drive turnaround plan, address municipal debt, cost-reflective tariffs, collections and losses
Embrace Customer Centricity	Put the Customer at the Centre	Invest in online customer platforms that meet and exceed customer energy service needs efficiently
Facilitate a competitive future energy industry	Prepare for Competition	Invest in DSO / DET capabilities for Dynamic Network Operations that enables an open energy market
Modernise our power system	Leverage Technology	Invest in grid modernisation with smart meters, microgrids, BESS, EVs etc.
Strive for net zero emissions by 2050 with an increase in sustainable jobs	Transition Responsibly	Invest in Grid Health for growth in loads and generators

OUR VALUES: Zero Harm · Integrity · Innovation · Sinobuntu · Customer Satisfaction · Excellence

The Distribution Network will be the heart of the Energy Transition Drivers



- **New technology** introduce opportunities and risks
- Distributor will be at the **epicenter of the Digital & Energy Transformation**
- **EDI reform** is imperative for industry and government to ensure encourage participation and support the efficiency
- The **digital revolution** in the electricity sector has introduced new technologies, **increased data, heightened cybersecurity** and **privacy risks, and optimized data engineering for supporting digital initiatives.**
- Big data and AI in **energy management optimize** systems and cut unnecessary electricity use.

Agenda

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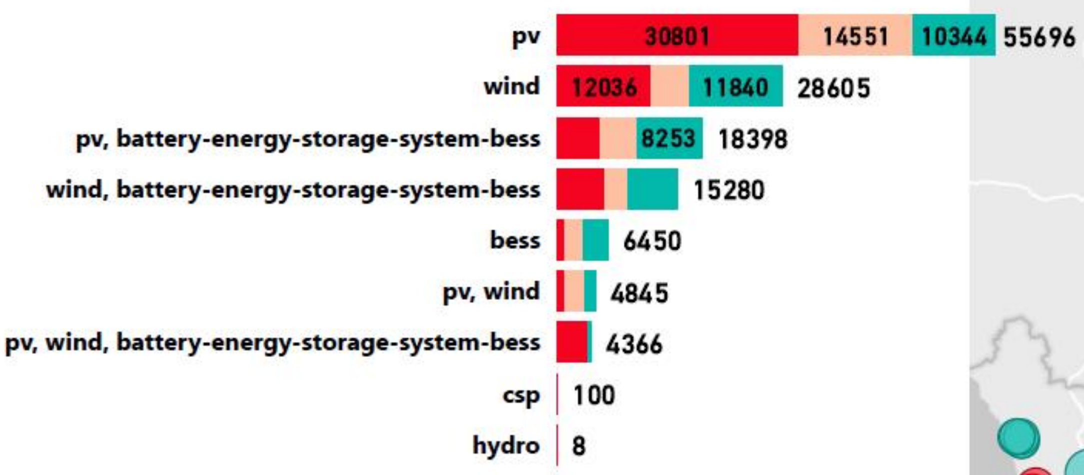
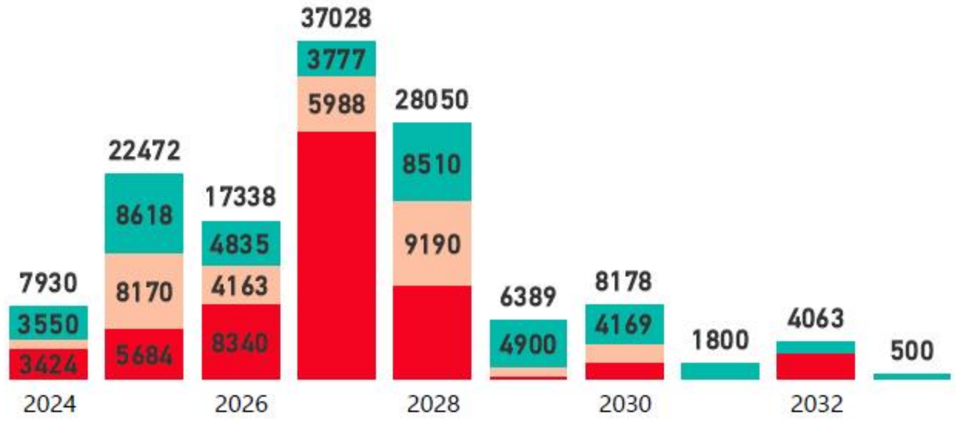
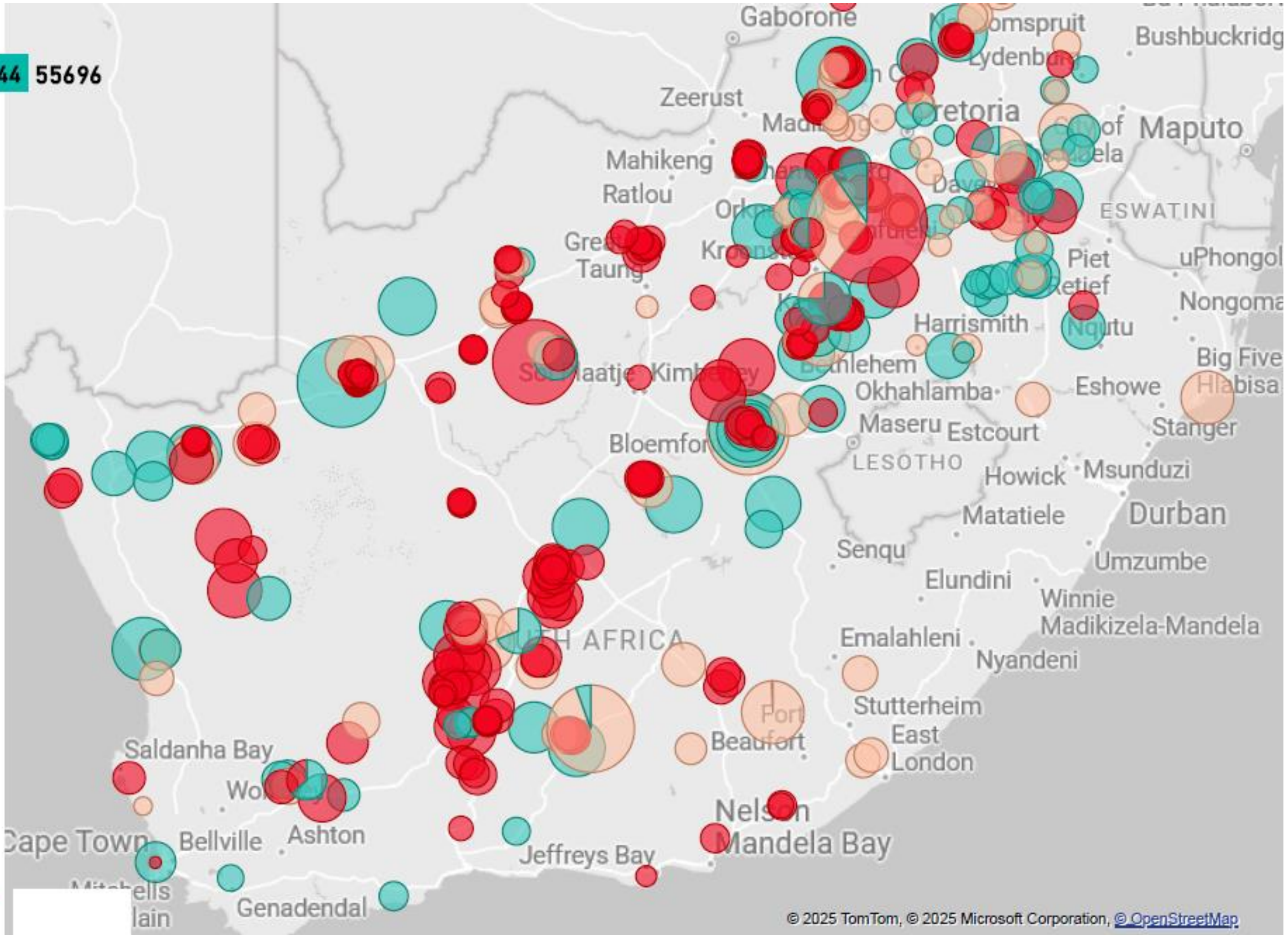
Industry Survey: Interest in MW per Resource Type (2024)

Eskom



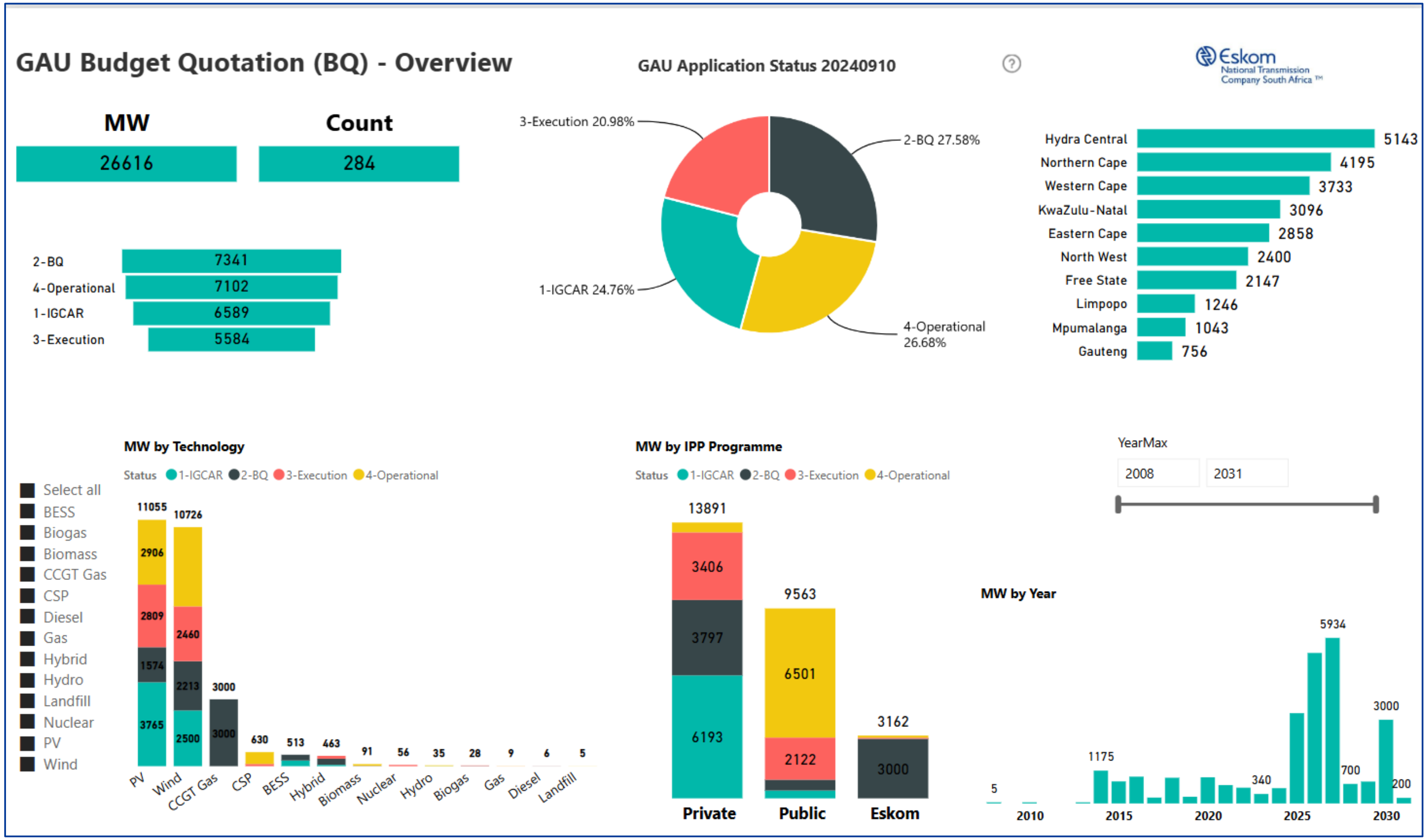


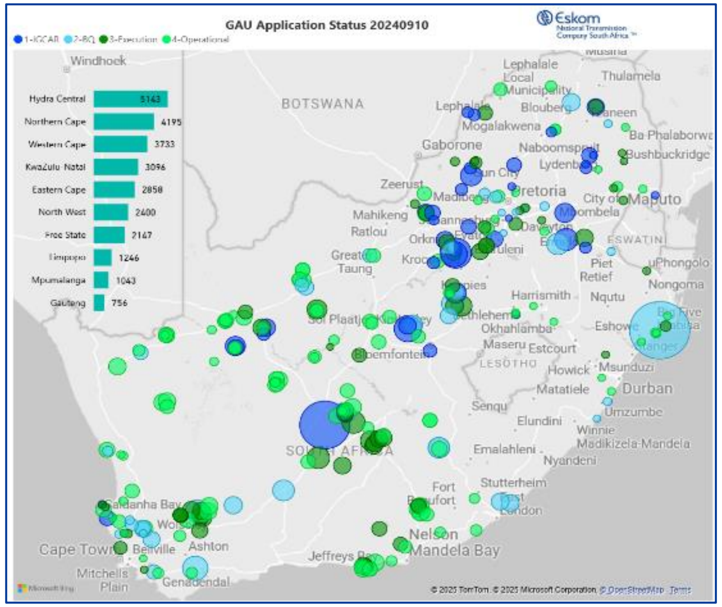


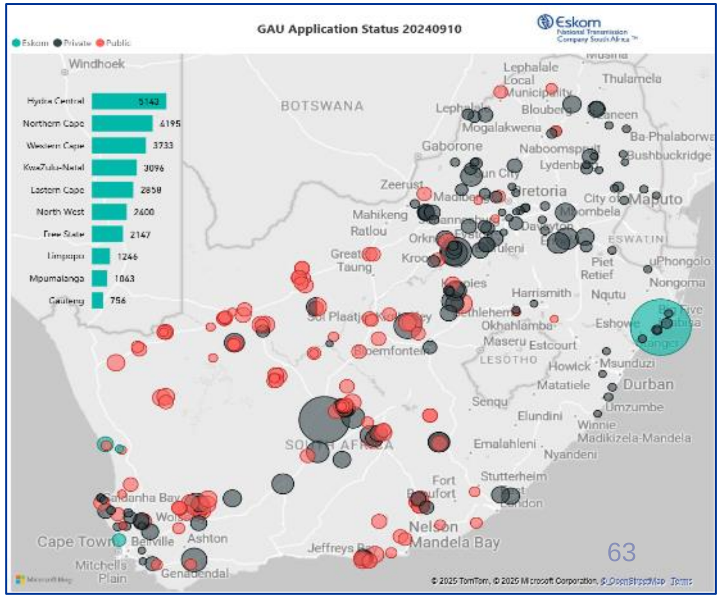
Renewable Energy Grid Survey Power BI Report

Grid Access Unit Applications Overview

Indication of the current Order Book for private and formal bid window applications



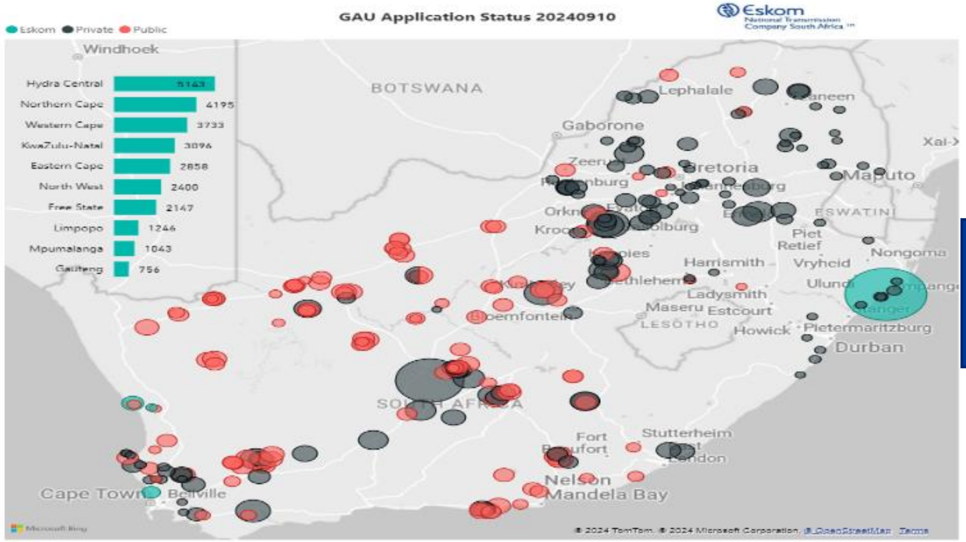




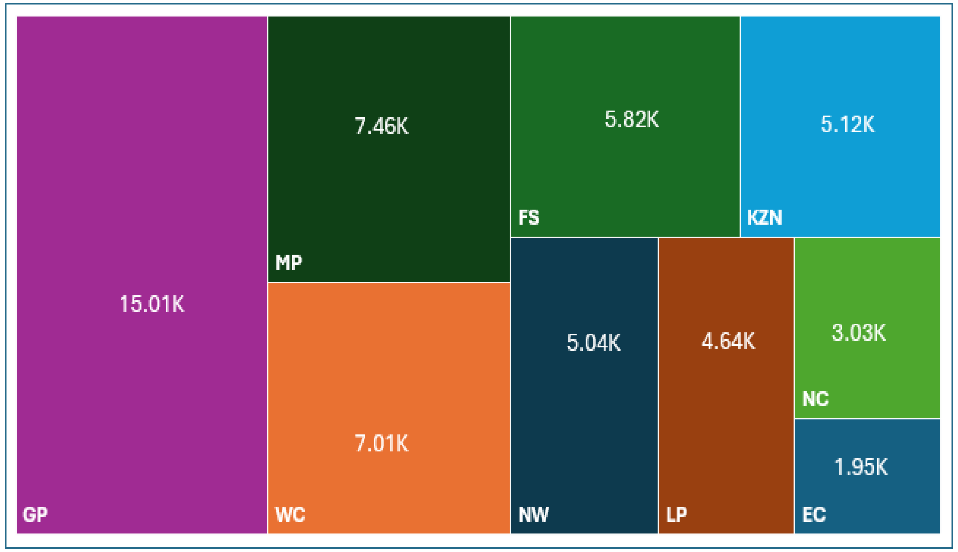
Grid Access Unit Applications Power BI Report

Translating the building blocks for the energy transition into action….

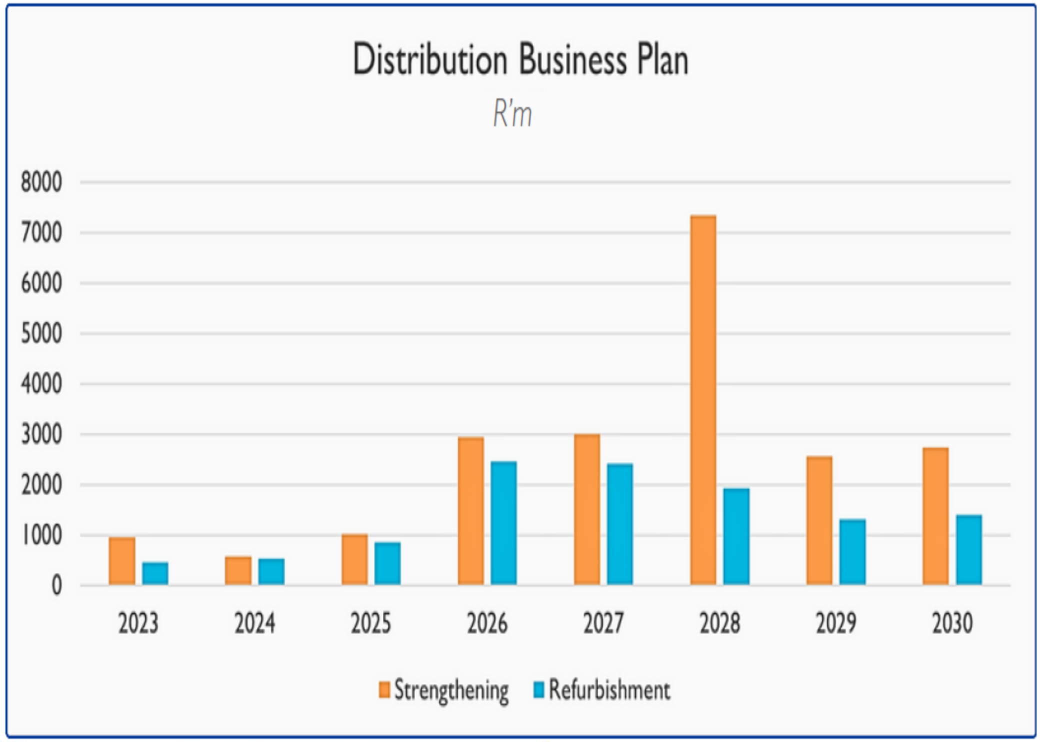
GAU Applications Status



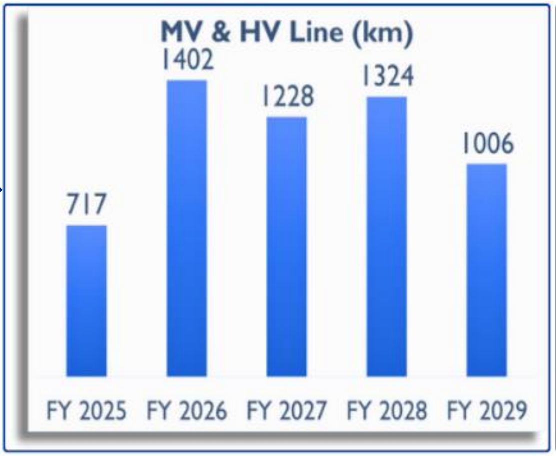
Distribution Hosting Capacity at HV level (GW per Province)

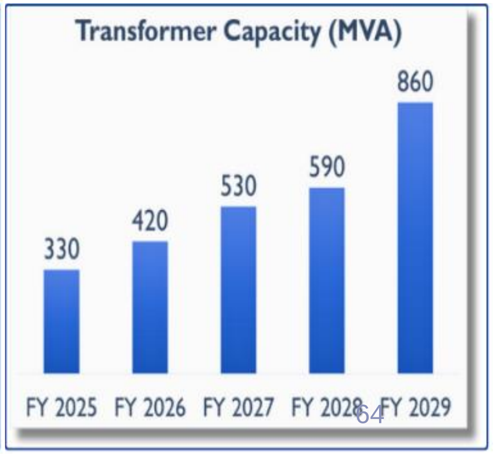


Distributed Generation interest translated



Creating additional capacity

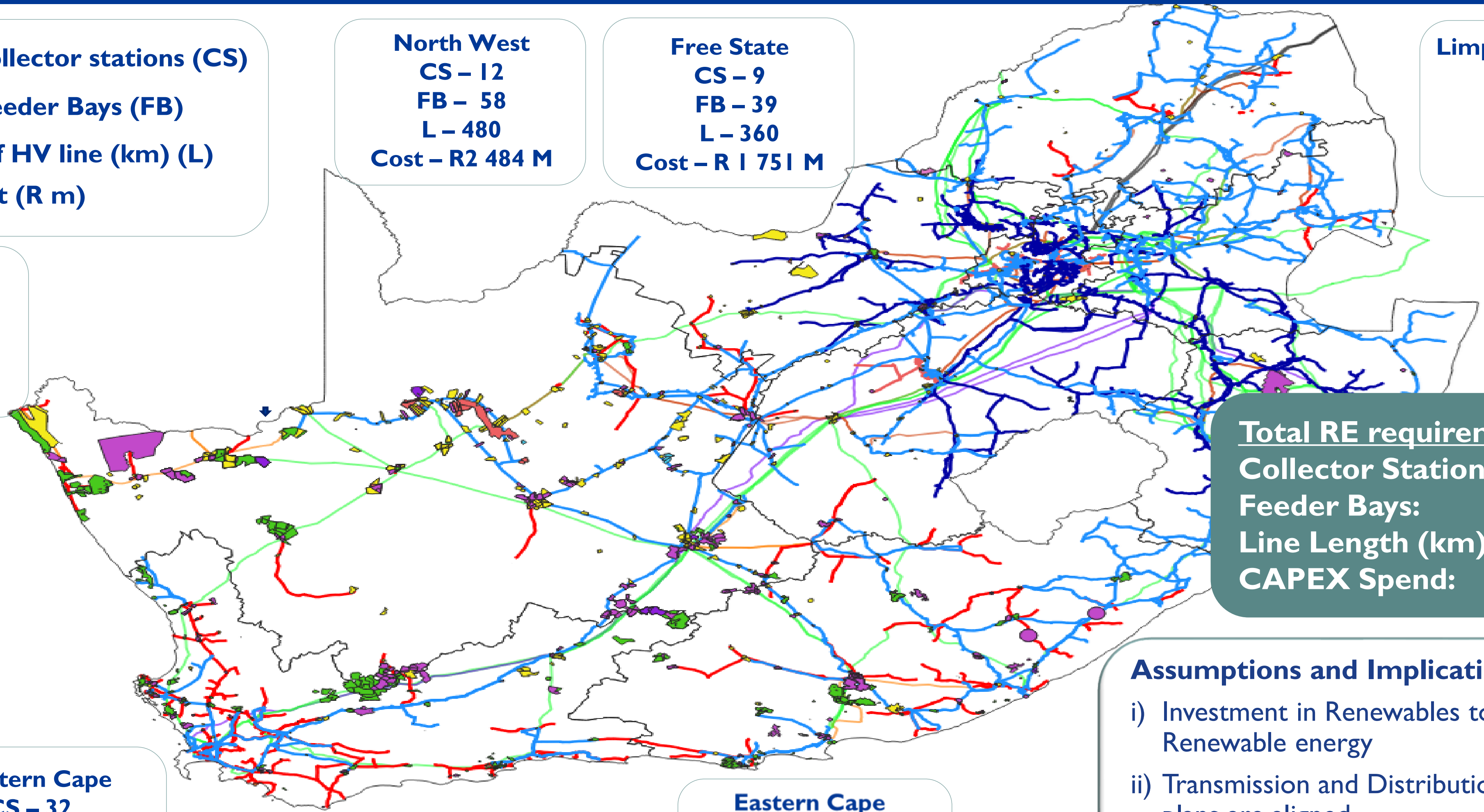




Eskom Distribution's Infrastructure Development Plan (Grid Expansion) for next 10 – 20 years for DG/RE integration

Dx Plan aligned to TDP

- No. of Collector stations (CS)
- No. of Feeder Bays (FB)
- Length of HV line (km) (L)
- Total Cost (R m)



Northern Cape
CS – 56
FB – 340
L – 2 200
Cost – R13 697 M

North West
CS – 12
FB – 58
L – 480
Cost – R2 484 M

Free State
CS – 9
FB – 39
L – 360
Cost – R 1 751 M

Limpopo, KZN, Mpumalanga
CS – 15
FB – 45
L – 450
Cost – R1 887 M

Western Cape
CS – 32
FB – 210
L – 1 360
Cost - R 8 031 M

Eastern Cape
CS – 28
FB – 175
L – 1 180
Cost – R7 536 M

Total RE requirements

Collector Stations:	160
Feeder Bays:	916
Line Length (km):	6 430
CAPEX Spend:	R 37 598 M

Assumptions and Implications:

i) Investment in Renewables towards 2050 > 60% Renewable energy

ii) Transmission and Distribution network expansion plans are aligned

iii) Translates to approximately R3bn per year at peak. Conservative R1bn investments annually will keep pace with Just Energy Transition goals

Source: Dx

Agenda

- Distribution at a glance
- Current outlook
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The evolving role of the Distribution

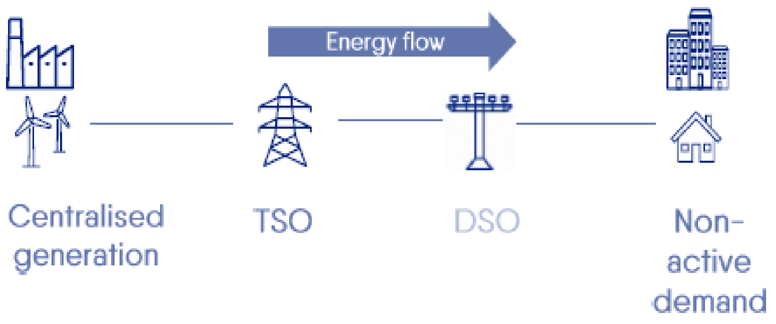
The energy transition implies a major change in the operations of the distribution network:

DSOs are a core partner to the key involved stakeholders of the energy transition, specifically with customers:

Traditional power system

- Unidirectional electricity flow
- Passive distribution network
- Limited share of renewables
- No smart grid or smart home/appliances

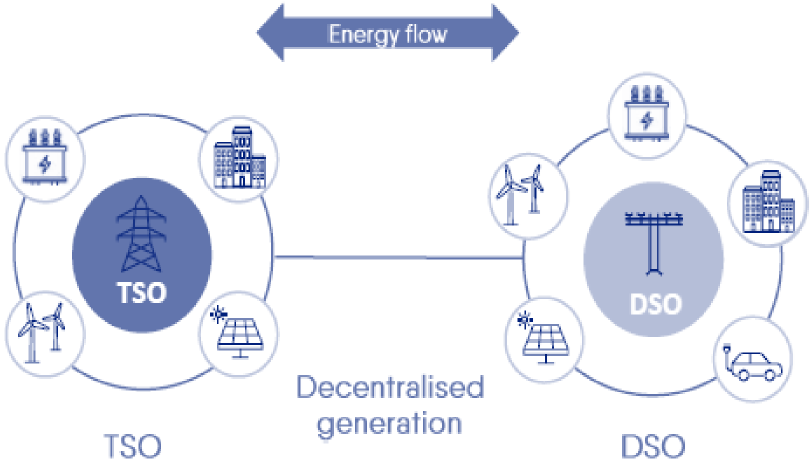
From a uni-directional model...

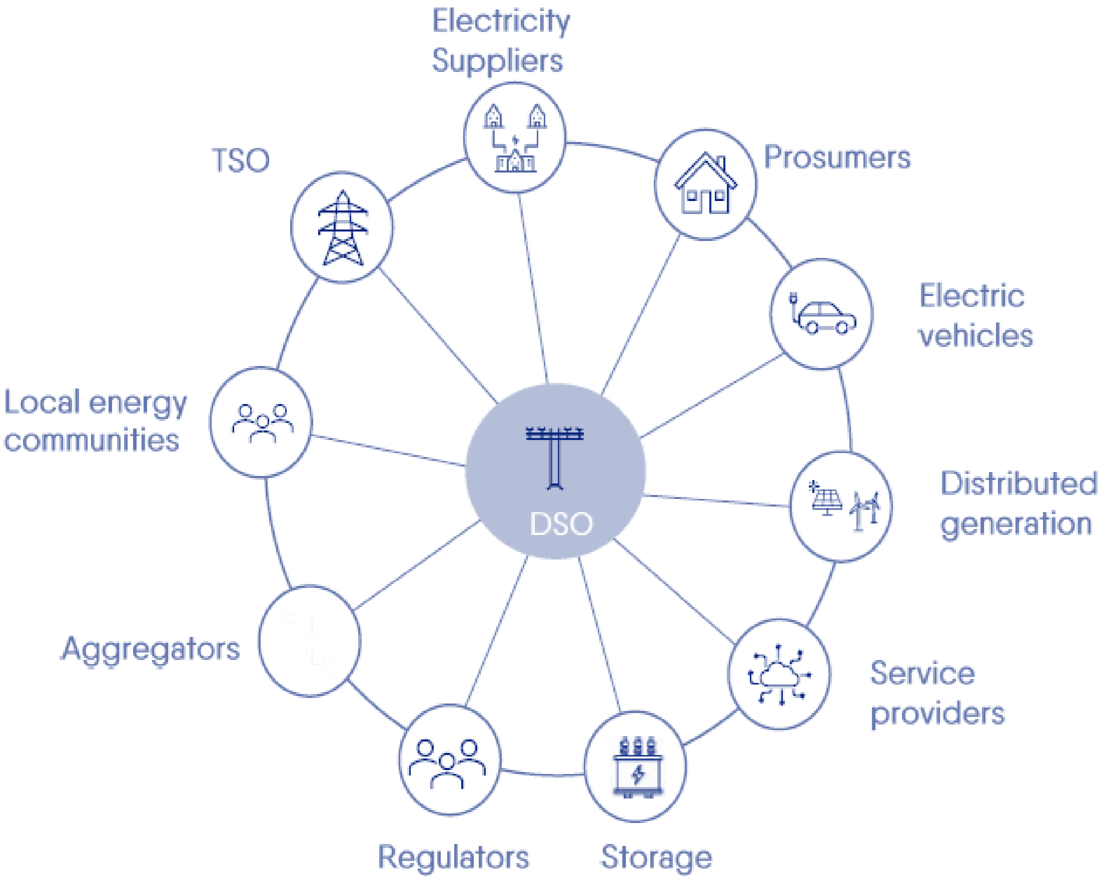


Modern power system

- Strong increase of RES installation and smart appliances
- Bi-directional electricity and data flow
- Active distribution network
- Active demand and new demand response capabilities
- Innovative services
- One system approach

To a bi-directional model...





Within the evolving ESI, Distribution is also undergoing structural changes

Eskom

Transmission

Current Distribution Set-up

Customers

Residential, Commerce, Industry, Agriculture, Munics, Mining

New Distribution Business Model

EDx Change

- Distribution Market & Trade
- Standard Offer, Wheeling PPAs,
- DSM, Aggregation and VPP
- Ancillary services, Balance Responsible

EDx Grids

- System operator
- Grid access, use-of-system, capacity reservation, ancillary services

EDx Edge

- Behind the meter services
- Customer Centricity
- Energy Resale/ Retail
- Edge offerings

EDx Serve

- Public Service Obligation
- Electrification
- CSR
- Supplier of Last Resort

Stimulus Programmes

- Balance Responsible
- Demand Response
- Portfolio Wheeling
- Virtual Wheeling
- Dynamic Pricing
- Energy Arbitrage
- DDP – TDP aligned
- BESS
- Modernised Grid + ICT
- Dx Grid Code
- Use of System Charges
- EACS
- PPAs
- AMI
- RE-PURPOSE INEP + 150 kwh FBE

Competition – "potential Grids & Change customers"

- Distributed Generation/ Micrograds
- Prosumers
- Market traders

Customers

- Residential
- Commerce/ industries
- Agricultural
- Mining
- E-mobility
- Munics/ Metros

PPA - Power Purchase Agreement, DSM – Demand Side Management, VPP – Virtual Power Plant, CSR – Corporate social responsibility, CPA – central purchasing agency,

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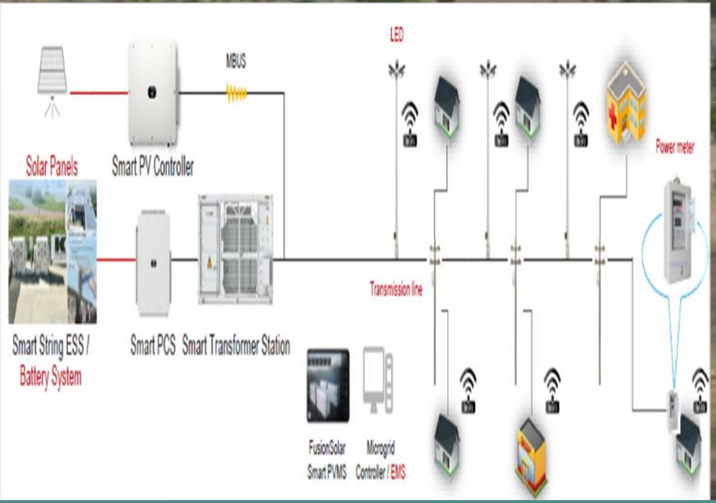
MoEE, Eskom & Huawei's proposed FusionSolar Microgrid Solution - Madimbo and Madvete Village

Eskom

South Africa_Green Digital Village Proposal

Huawei FusionSolar Smart Microgrid Solution - For Green, Resilient Power & Network



Solar 472kWp
PCS 500kW
BESS 1169kWh

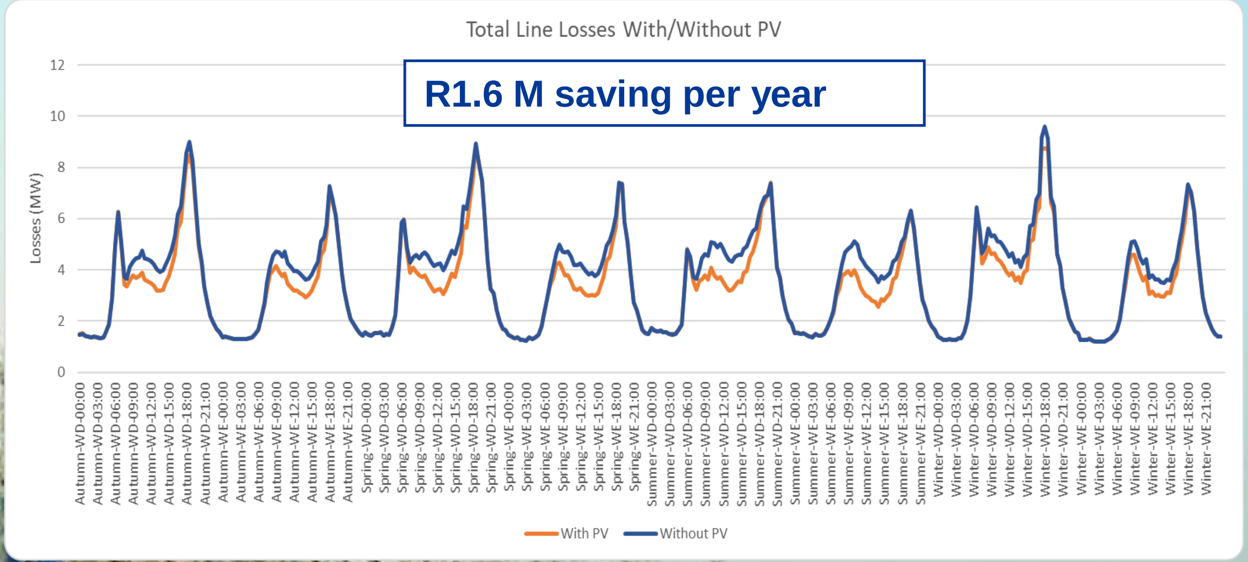
Solar 229kWp
PCS 300kW
BESS 566kWh

Microgrids…building resilience in our grids

- ❑ Reduce the cost to serve indigent communities
- ❑ Microgrids used as an off-grid solution in remote areas (e.g. back up supply for clinics and hospitals)
- ❑ Grid-tied microgrids for grid strengthening
- ❑ Microgrids as a product offering to customers

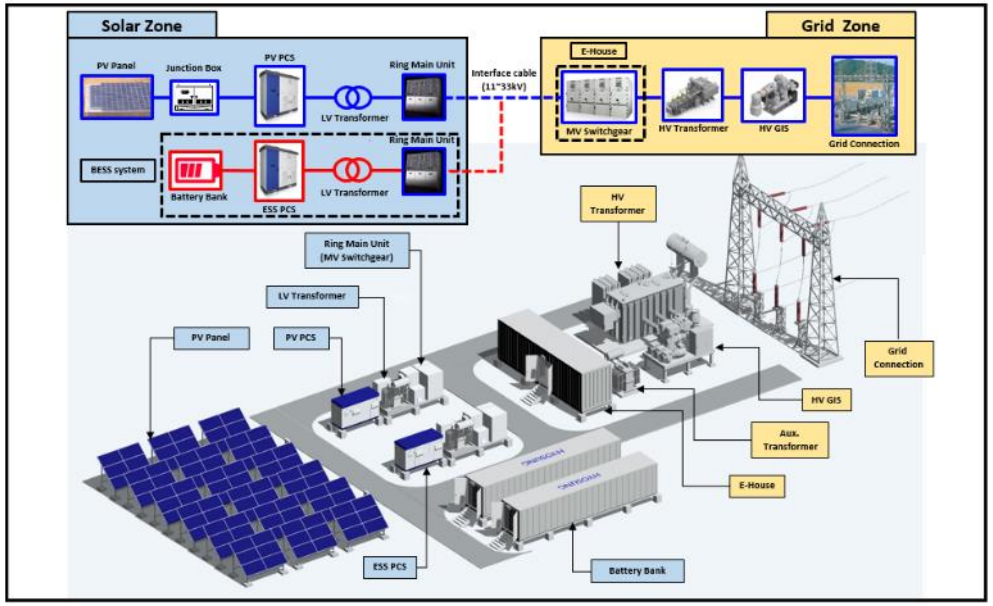
Huawei Digital Power, South Africa

Pongola PV(25MWp) will positively impact Distribution power system – voltage, losses reduction, reduce aux charging of BESS & increase QoS



<u>Utility-Scale Solar plant is key To Renewables Integration</u>

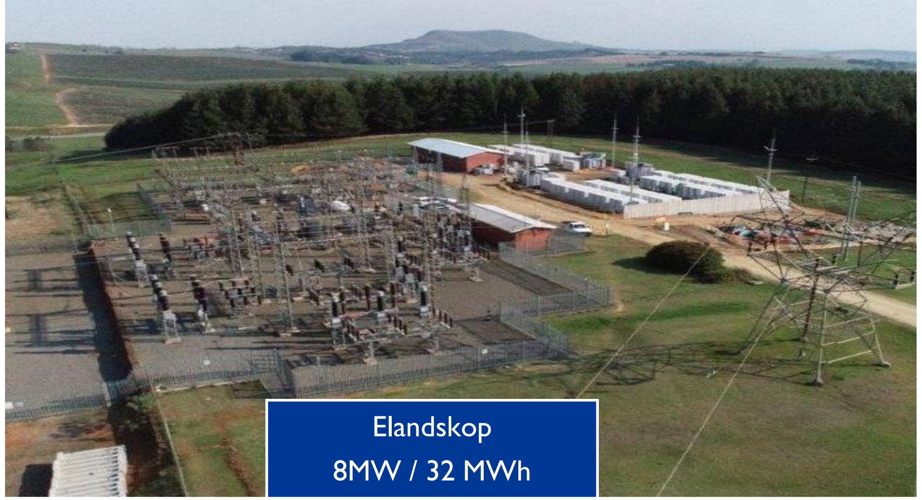
- ❑ PV plant providing energy, a loss reduction in incoming 132kV lines, loss reduction equates to a R1.6M saving per year
- ❑ Pongola BESS Active Power in MW for aux supply is estimated at 40MW
- ❑ PV plant at Pongola SS will positively impact 132kV voltages across the 132kV system.
- ❑ Optimistic LCOE.



The Distribution utility scale Battery Storage projects are key to renewable integration into the network

Hex River
20MW / 100 MWh

Pongola
40MW /190 MWh



Elandskop
8MW / 32 MWh

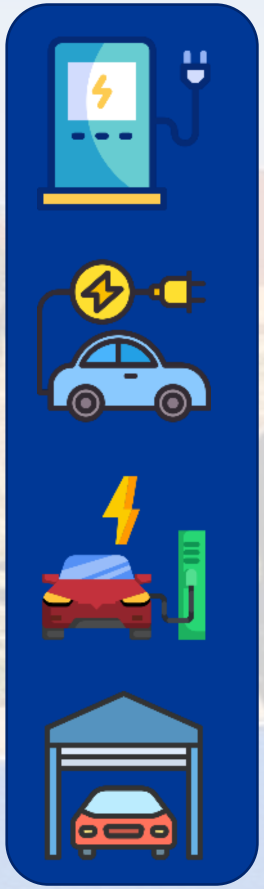
Skaapvlei under construction
80MW / 320 MWh

Utility-Scale Storage Key To Renewables Integration

- ❑ Incentives will emerge to stimulate battery support for ancillary services and prevent supply curtailment
- ❑ Batteries will be developed in conjunction with renewables in isolated power systems for reliability, flexibility and management, and resilience measures

Distribution aims to replace fleet with Electric Vehicles and create public charging infrastructure

Utility-Scale EV Key To Renewables Integration



EV charging customer offering in the residential sector

Launch a large-scale incentive programme to deploy EV charging infrastructure

EV vehicle fleet to identify opportunities for electrification.

Make-ready incentive for the electrification of public transport and/or private company fleets

Distribution will be installing of solar carports in the open parking area for visitors

Cluster	FY26	FY27	FY28	Total
Cape Coastal	6	6	6	**18**
Central East	7	8	9	**25**
Gauteng	10	15	15	**40**
Gemma	5	5	5	**15**
LimLanga	10	16	16	**42**
DISTRIBUTION	**38**	**50**	**51**	**140**

Eskom has made a commitment to be an anchor for electric vehicles (EVs) to make a positive contribution towards local market stimulation, and a pilot project for fleet electrification is being executed in Distribution.

Green Attribute Programme - Prosumers which are customers with registered renewable energy (Solar PV, Wind, Hydro etc.) generation facilities are eligible to participate.

- Green Attributes Programme will show your commitment to a **sustainable future** in reducing **greenhouse gas emissions** and supporting a cleaner environment Eskom grid services (i.e. net-billing, wheeling, banking etc.).

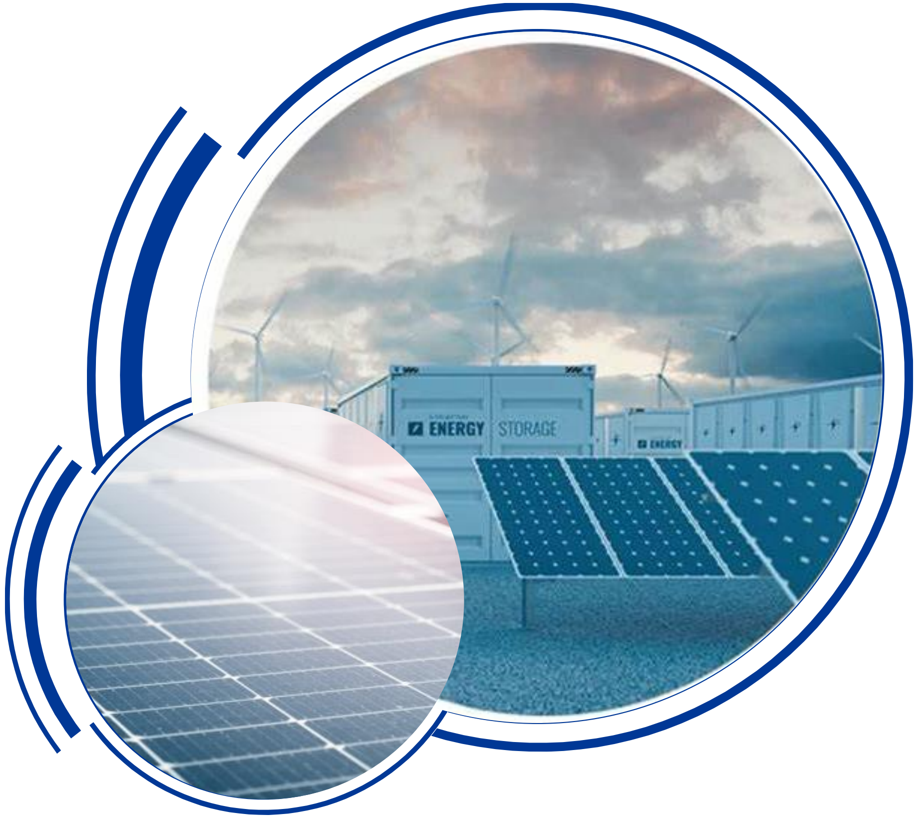
- Green Attributes are the **credits, benefits, emissions reductions attributable** to a specific generation facility that can reduce conventional fossil fuel generation carbon emissions.

South Africans can contribute to improving global climate change and ensure environmental benefits for current and future generations.

Gearing up for the future….

Summary

- Distribution is supporting the Eskom Just Energy Transition strategy and embedding the strategy in its customer offerings
- The Electricity Supply Industry is evolving, and Distribution is gearing up for the future…the playing field be different
- Distribution is modernising, refurbishing and innovating the Distribution Grid and a programme will be developed to achieve these objectives
- Distribution will play a significant role in providing access for customers to enjoy a greener future
- Flexible management of DER is key to unlocking the energy transition
- The interface of the DSO with the customer and the TSO is crucial to ensuring a stable and sustainable grid



Thank you

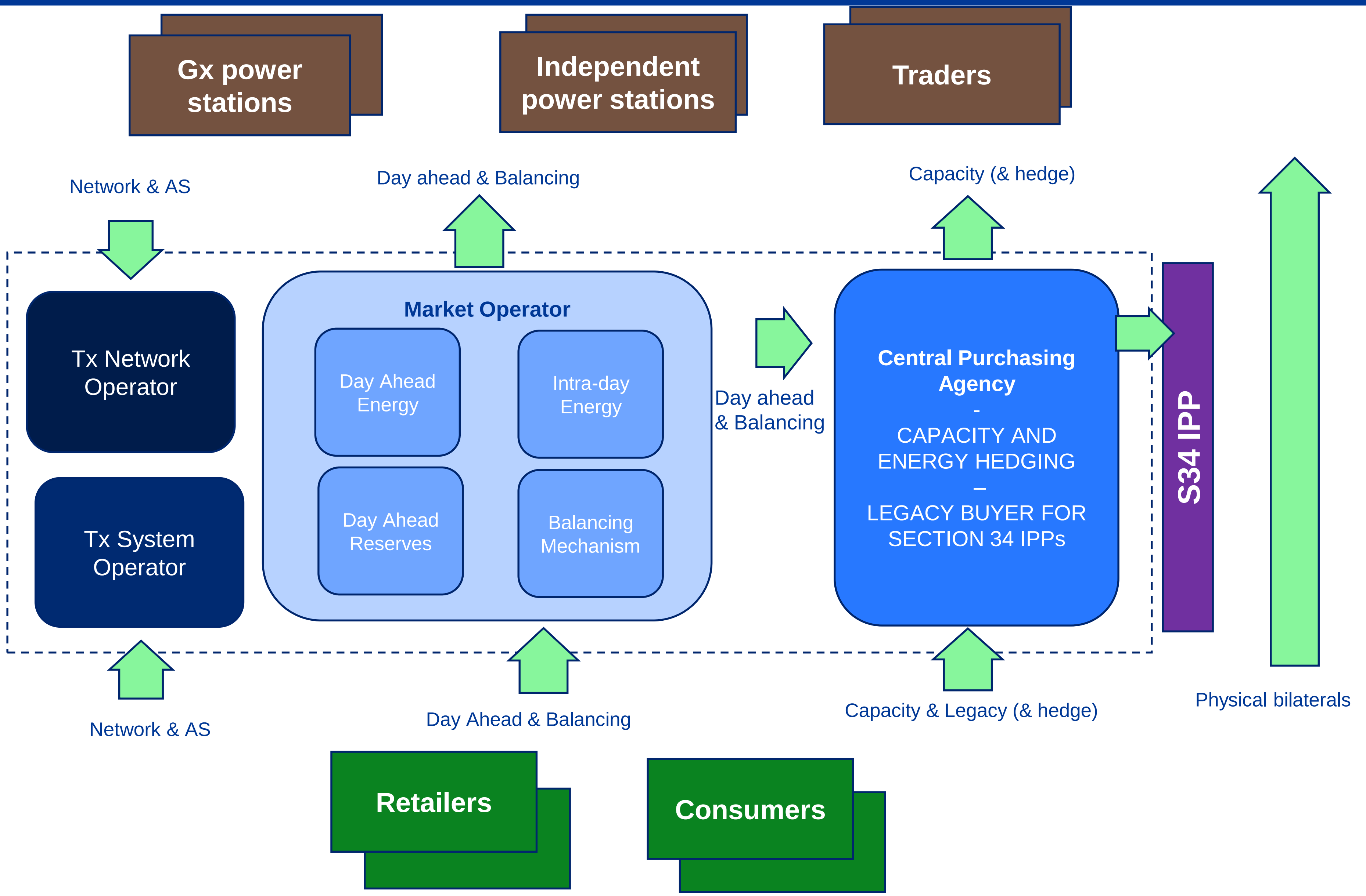
Eskom
National Transmission Company South Africa ™

Impact of the ERA Amendment -Market Code

Presented by: Keith Bowen

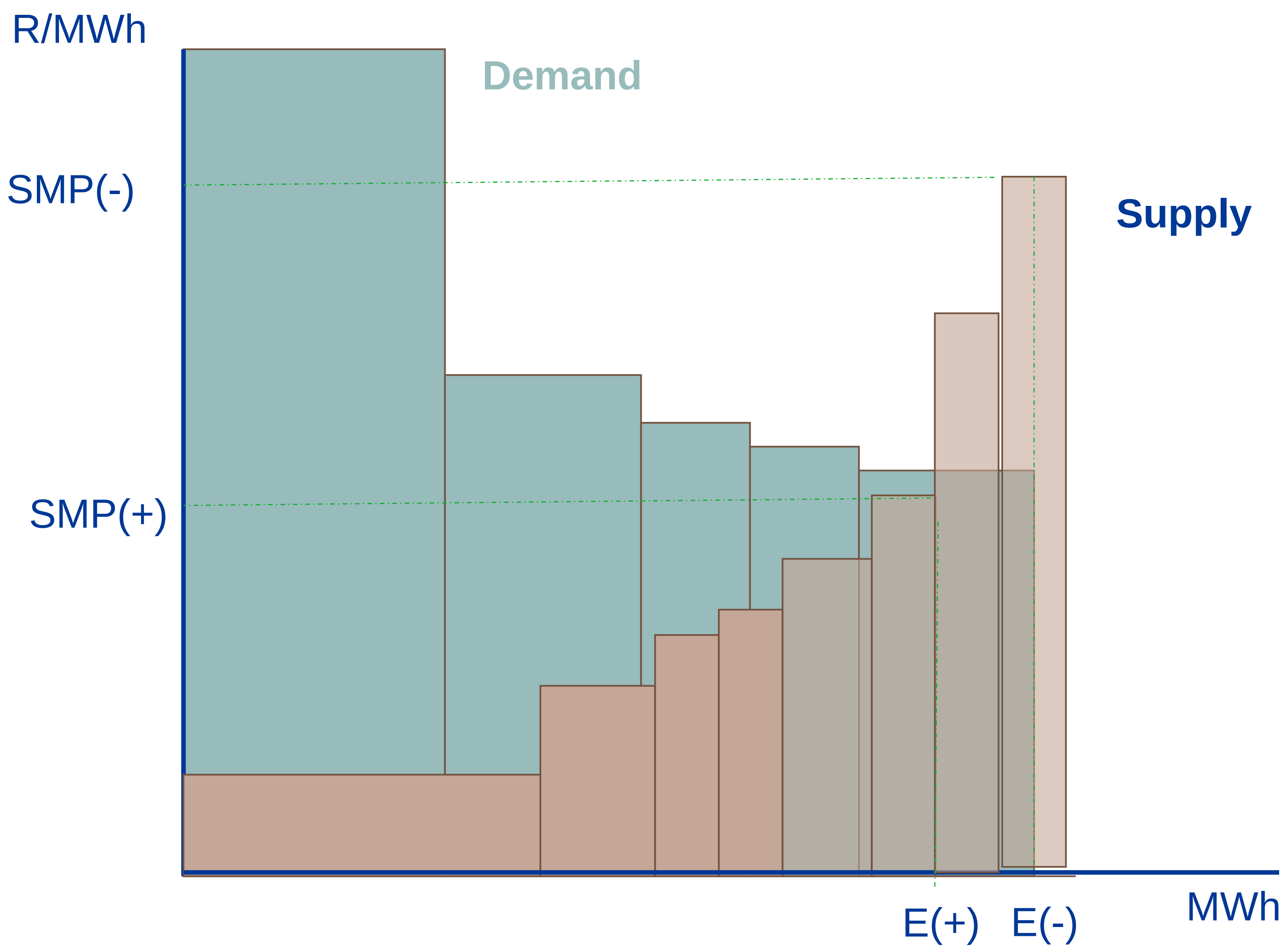
Date: 19 May 2025

Proposed multi-market model



Day-ahead Market: Supply side and demand side

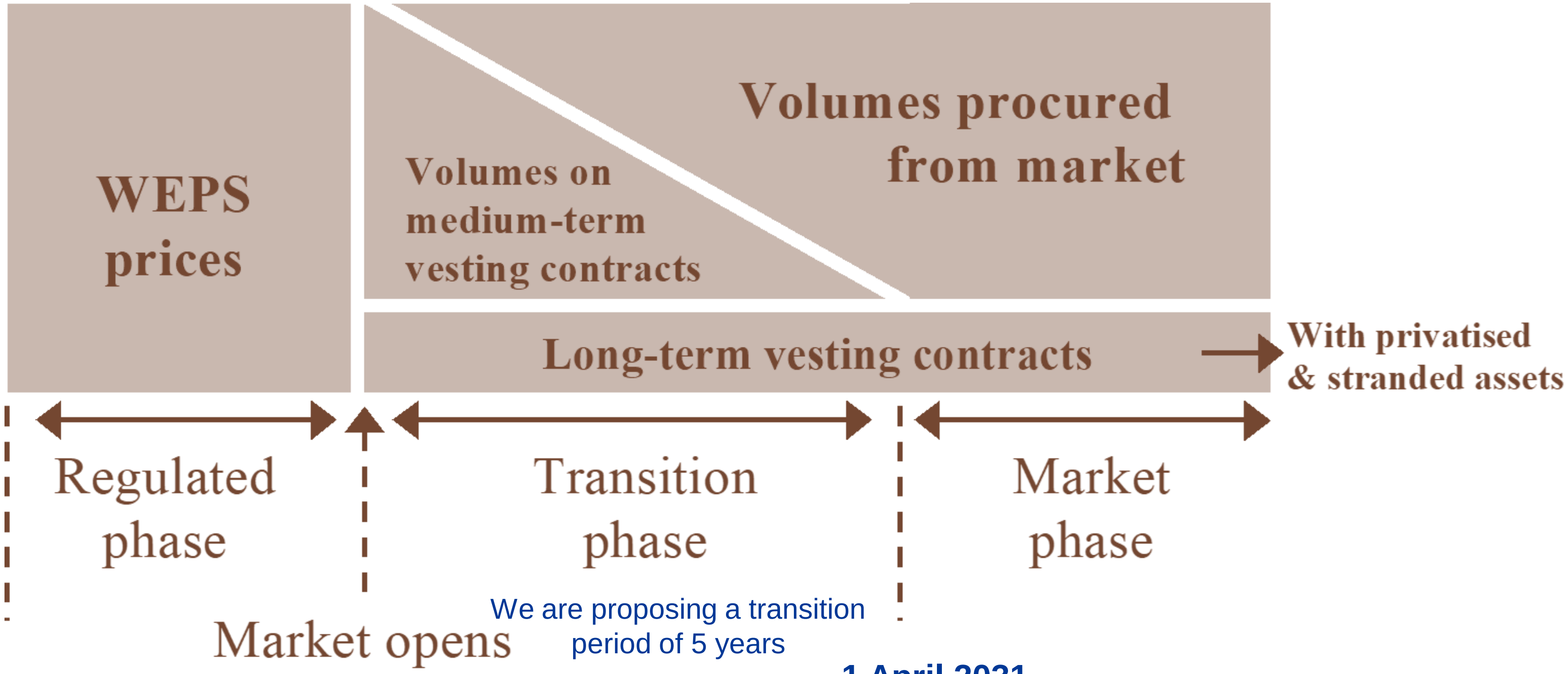
Eskom National Transmission Company South Africa ™



- Supply curve: price increments offered by generators / traders, bound by technical parameters
- Demand curve: expected demand for consumers / traders / retailers adjusting for price responsive capability
- Price set by marginal generator (after accounting for price responsive demand and technical parameters / constraints)

Transition: Vesting contracts

Eskom National Transmission Company South Africa ™



We are proposing a transition period of 5 years

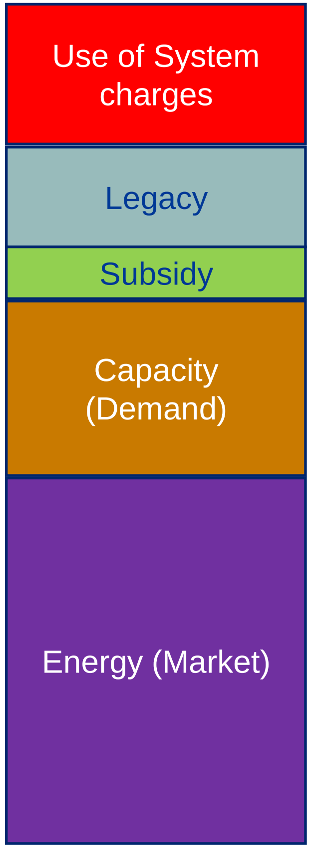
1 April 2026

1 April 2031

- Vesting contracts are aimed at curbing the exercise of market power by the generation companies, to promote efficiency and competition in the electricity market for the benefit of consumers.
- With the vesting contracts, generation companies are committed to sell a specified amount of electricity at a specified price
- This removes the incentives for generation companies to exercise their market power by withholding capacity to push up spot prices in the wholesale market.
- Vesting contracts can manage the transition to full competition in electricity and manage the financial risk of market participants.

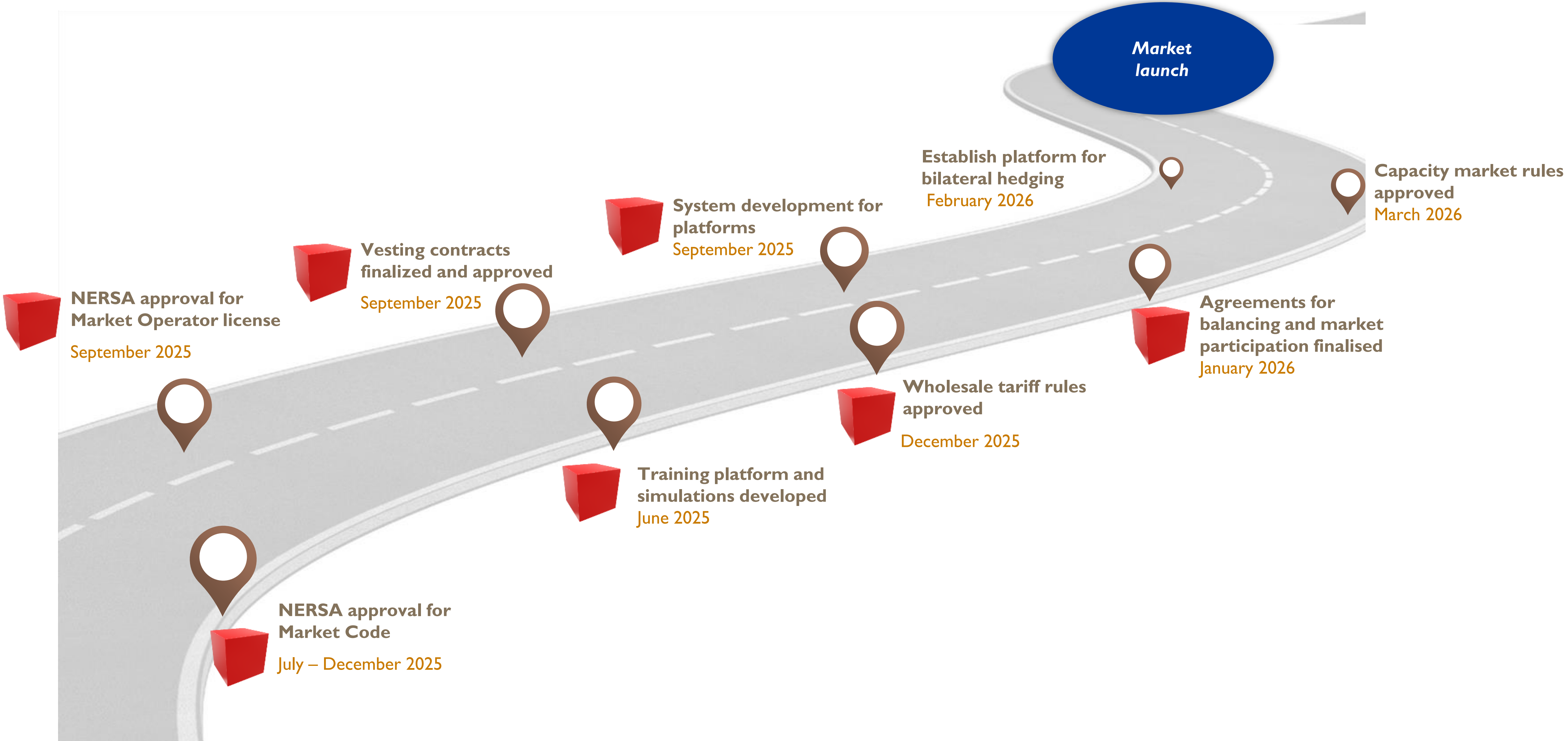
Wholesale tariff - transition

- **Network charges (Tx & Dx)**
  - Connection charges
  - Network utilisation (demand and fixed)
  - Losses recovery charge
  - Ancillary services
- **Legacy charges**
  - Recovery of legacy costs (REIPPP, stranded assets)
  - Potentially a fixed charge
- **Subsidy charges**
  - Recovery of approved policy subsidies in tariffs, potentially including NPAs
  - Potentially a fixed charge
  - Requires a National Subsidy Framework
- **Generation Capacity or Standby charge**
  - Reflects the fixed costs elements of standby for system support
  - Charged as a demand charge on rolling 12-month maximum hour demand
  - Could also have a TOU component
  - Impacted by diversity of usage
- **Energy tariff**
  - Market price (or time-of-use differentiated tariff for downstream vesting contracts)



Proposed structure

South African Wholesale Electricity Market (SAWEM)
Market Operator Roadmap



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Conclusion

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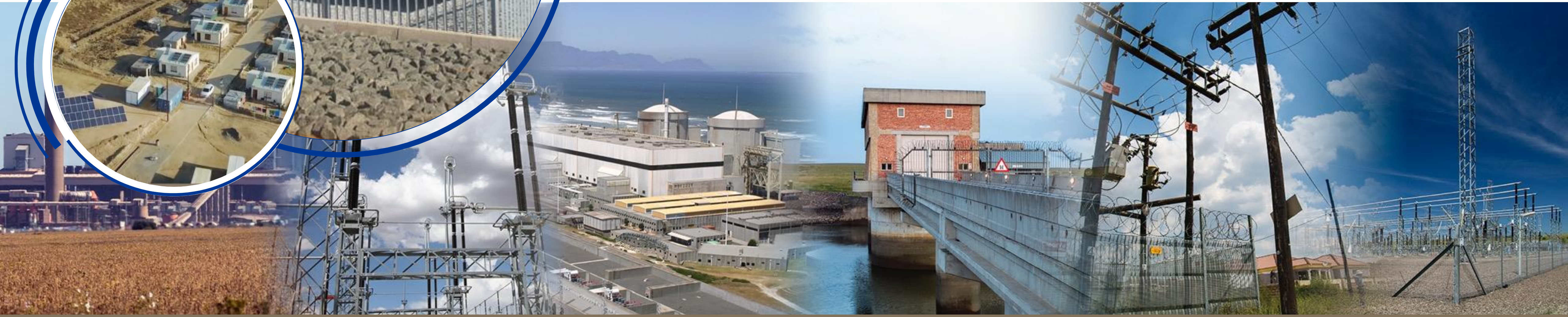
Dx IPP Connection Studies: New RVC Standard for BESS, vRE and Dispatchable Plants



Monde Soni (Chief Engineer, Network Planning)

19 May 2025

Introduction

- Inverter based resource – fault contribution
- Unintended consequences that come with IBR – “medical side effects”
- Grid forming inverters?? Readiness??
- Context of this presentation:
  - DER
  - IBR
  - Voltage quality
- Previous BESS Bid Windows:
  - Eskom Dx BESS
  - ESIPPPP1
  - ESIPPPP2
  - ESIPPPP3

Eskom	Standard	Distribution

Title: **RAPID VOLTAGE CHANGE LIMITS AND MODELLING PROCEDURE FOR BESS AND GENERATORS**

Unique Identifier:	**240-171000460**
Alternative Reference Number:	**N/A**
Area of Applicability:	**Engineering**
Documentation Type:	**Standard**
Revision:	**1**
Total Pages:	**28**
Next Review Date:	**May 2030**
Disclosure Classification:	**Controlled Disclosure**

Compiled by	Approved by	Authorized by
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Date: 06 May 2025	Date: 6 May 2025	Date: 6 May 2025
		Supported by SCOT/SC
		Kurt Dedekind
		Planning SC Chairperson
		Date: 06 May 2025

PCM Reference: **N/A**

SCOT Study Committee Number/Name: **Planning Study Committee**

VVT vs RVC

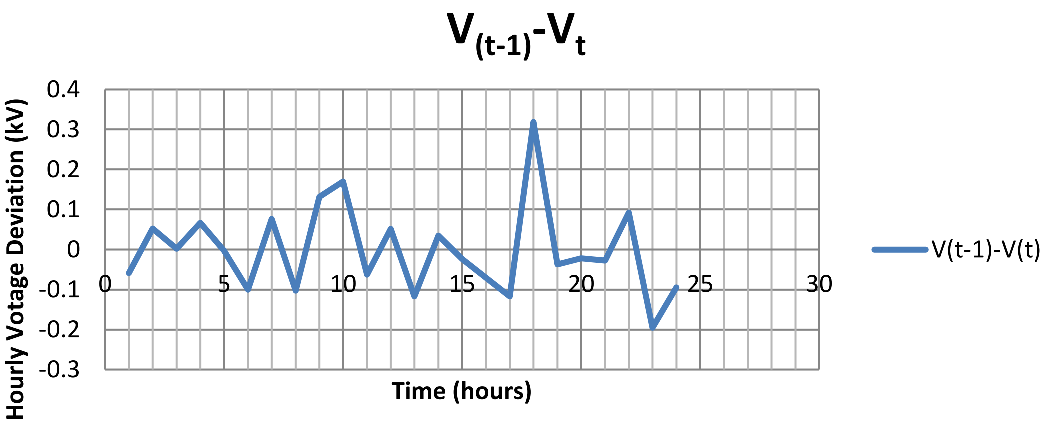
VOLTAGE DEVIATION

The voltage deviation is a percentage steady state voltage that results from the application and operation of the DER on the busbars of the network in the study area where the DER is being proposed.

$$Voltage\ Deviation = \frac{Bus\ voltage\ with\ DER - Bus\ voltage\ no\ DER}{Bus\ voltage\ no\ DER} x\ 100\%$$

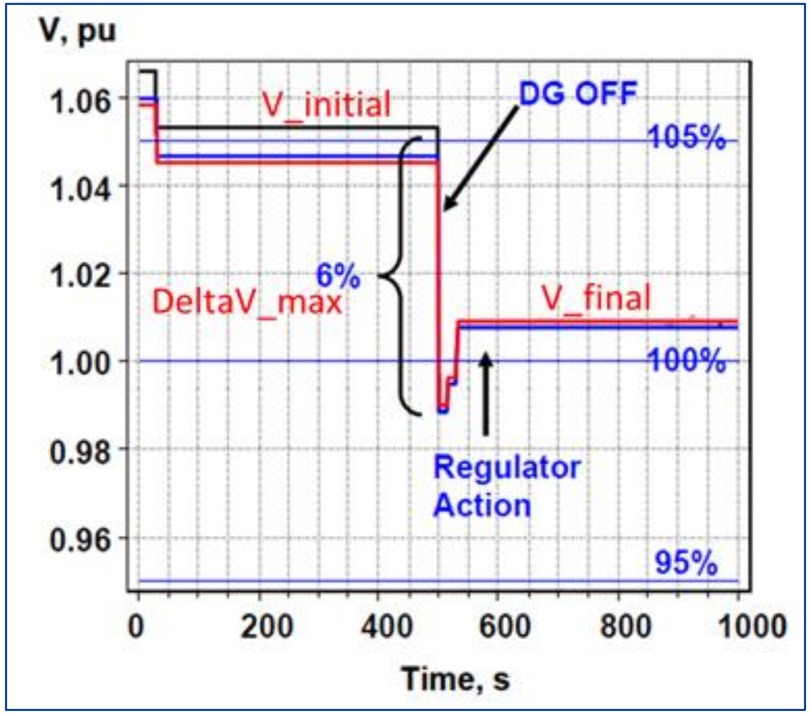
"N-0" STEADY STATE VOLTAGE VARIATION/PROFILE/REGULATION

Continuous time-series variation of the voltage caused by the DER operation (charging-idle-discharge) in steady state.



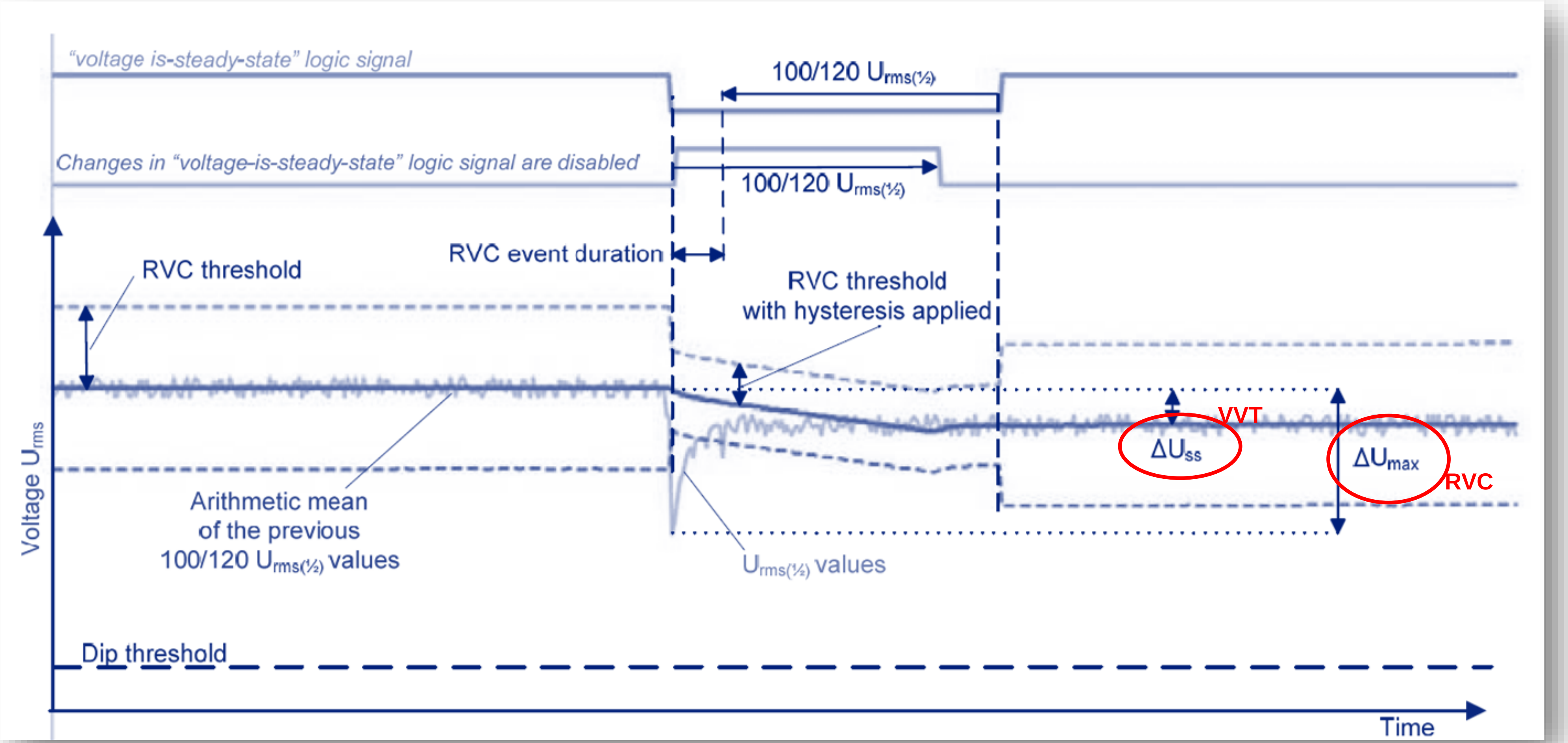
'DeltaV_max' (or RVC)

An immediate voltage change that is experienced by the network when the DER changes its power output suddenly/ trips. A phenomenon takes place before voltage correction by OLTC, capacitor banks and voltage regulators takes place.



RVC Demonstration

"Not to labour the point…"



Source: J. Barros, et al. *Rapid Voltage Changes in Power System Networks and their Effect on Flicker*

Other Indicators and **Significance**

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- ‘N-1’ VOLTAGE DEVIATION
- NETWORK STIFFNESS CRITERION
- SHORT CIRCUIT RATIO (SCR)

II. RVCs IN POWER SYSTEM NETWORKS

RVCs can be caused by switching operations such as motor starting, capacitor banks switching on/off, load switching or transformer tap-changer operations. In addition, they can also be induced by sudden load variations or by power output variations from distributed energy resources such as solar or wind power systems. Fig. 1 shows examples of RVCs associated with motor starting and capacitor switching [2].

The main effect of RVCs is on flicker, but other non-flicker effect as malfunction of control systems acting on voltage angle, braking or accelerating moments from motors or impairment of electronic equipment have been reported in the literature [8].

Source: J. Barros, et al. *Rapid Voltage Changes in Power System Networks and their Effect on Flicker*

Let us use the correct terminology: $\boxed{\text{RAPID VOLTAGE CHANGE (RVC)}}$

RVC Limits – What Informs Them…

- Rapid Voltage Change
  - Ref: Rapid Voltage Change Limit for Bess Integration Studies for Planning - 240-146900837
  - RVC Limit = 5% (General Limit for Dispatchable Plants)
  - 3% RVC limit for vRE
  - Assessed at Points of Connection (POC) and Points of Common Coupling (PCC)
  - RVC to be assessed at BEFS operating power factor under lead, lag and unity
  - Test power factor to be determined by BESF category as per BESF Code
  - Distribution Planning RVC limits for ancillary services support - NRS048-2, NRS048-4

NRS048-4

Table F.3 – Rapid voltage change emission limits

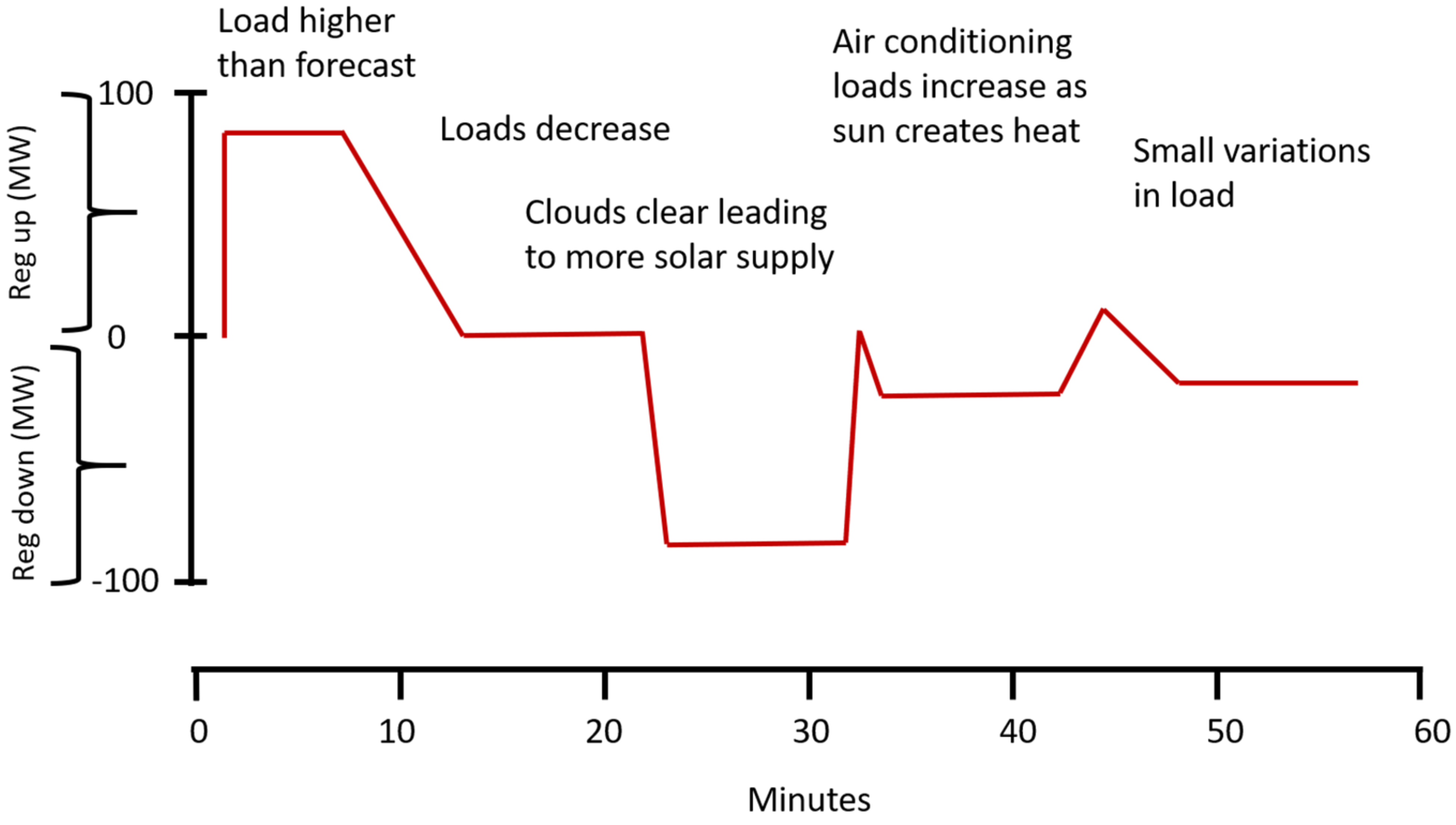
1	2	3
Number of changes per hour	$\Delta U_{dyn}/U_n$ (%) (see note)	
r	MV/LV	HV
$r < 1$	4,00	3,0
$1 < r \leq 10$	3,00	2,5
$10 < r \leq 100$	2,00	1,5
$100 < r \leq 1000$	1,25	1,0

NOTE Where
ΔU_{dyn} is as defined in F.3.3.1; and
U_n is the actual r.m.s. voltage.

Reserve type	Typical dispatches	RVC Limit MV (%)	RVC Limit HV (%)
Instantaneous	2/day	5	4
Regulating	300/hour	1.25	1.0
Ten minute	3/day	5	4
Supplemental	1/day	5	4

What do these limits mean? That the plant cannot be connected?? NO!

BESS Operation – Regulating Frequency Simplified



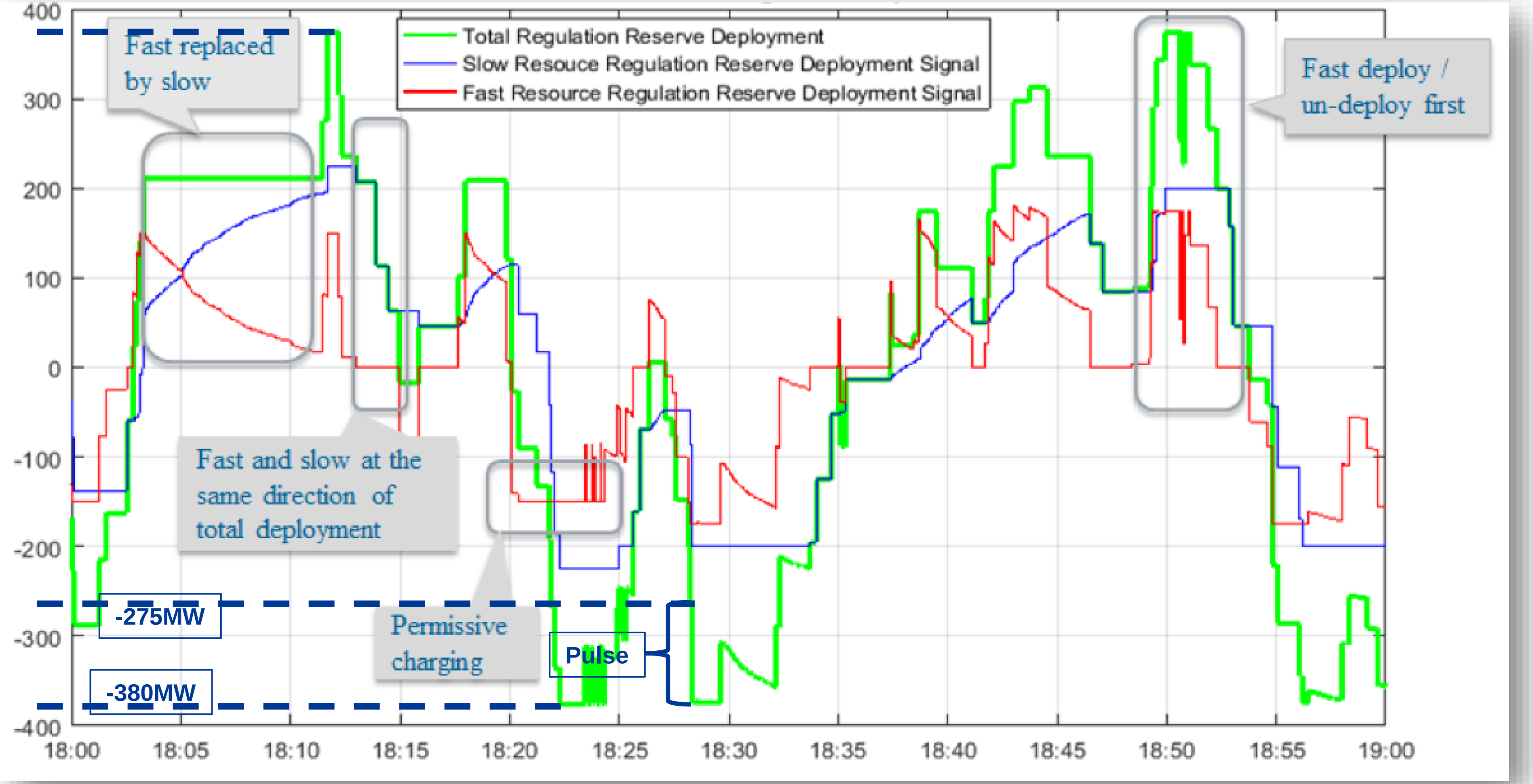
Explaining the RVC Limit for Ancillary Service – Regulating Reserve

Hypothetical scenario

- BESS Size = 380MW
- Iterative process to determine MW for Regulating reserve
- MW Capacity compliant to 1% RVC limit (RR) is 105MW
- Thus, 28% of the capacity

Notes:

- Pulse size
- Number of pulses per hour
- Use of BESS capacity
- Net-zero energy over 1 hour



Source: Y. MA, et al. Automatic Generation Control (AGC) Enhancement for Fast-Ramping Resources, CIGRE US National Committee 2019 Grid of the Future Symposium

How to Do RVC Test Correctly

- Committed IPP Projects (BQ Accepted) must be active on the Casefile
- **OU Case file maintenance is very important – ensures similar version for all planners**
- In case of BESS, remember to set **operating limits** to (-ve and +ve)
- RE/BESS **Capability Curve** (for specific category) must be included
- **Load flow**: Power Factor = 0,95. **Local Controller = Constant V**
  - LG-HL (Evening Discharge): PV = 0; Load = 1scale (in the surrounding network – Mining load excluded) BESS, Wind
  - HG-LL(Midday Charge and Discharge): PV=max; Load = 0.5scale (Mining load excluded) BESS, PV, Wind
  - Record thermal loading and voltage
- **RVC**: Power Factor = 0.95 (2 scenarios are critical). **Local Controller = Constant Q**
  - Evening Discharges @ 0.95PF (Mvar Export) BESS, Wind
  - Midday Charges @ 0.95PF (Mvar Import) BESS,
  - Record the highest RVC on the Capacity Confirmation Sheet
  - If RVC exceeds 5, use a Double Circuit line. If this doesn't help, then the project is not compliant

Linking with BESS IPP Bid Window

- IPPO's Evaluation Price => **no room for error**

Rapid Voltage Change category	0 ≤ x ≤ 1 %	1 < x ≤ 3%	3% < x ≤ 5%	x > 5%
RVC Factor	1,00	1,20	1,30	Grid Code Non Compliant

- **Unintended consequences:** Building around and blocking access to strategic infrastructure (MTSs and Collectors) – **NOT GOOD**

Extracted: CEL General Conditions…

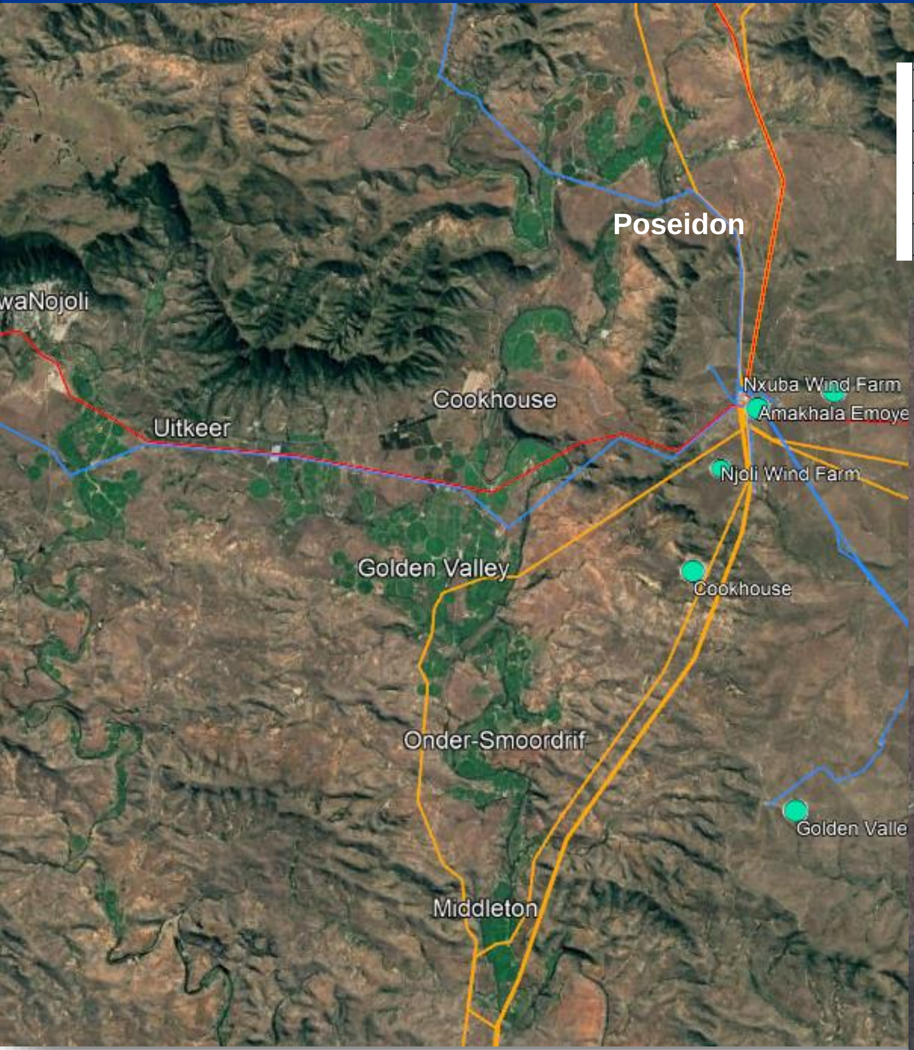
C.8.4 General Conditions

- The Indicative Cost Estimate is based on the best available assumption information at the time of producing the quote. Eskom Transmission reserves the right to review the recommended solution and provide the customer with a new quote should the input assumptions materially change or new information come to light.
- 2km setback between Eskom Transmission infrastructure and IPP infrastructure is required.

- **What's coming (Draft IRP)**
  - **2000MW of new BESS is proposed**

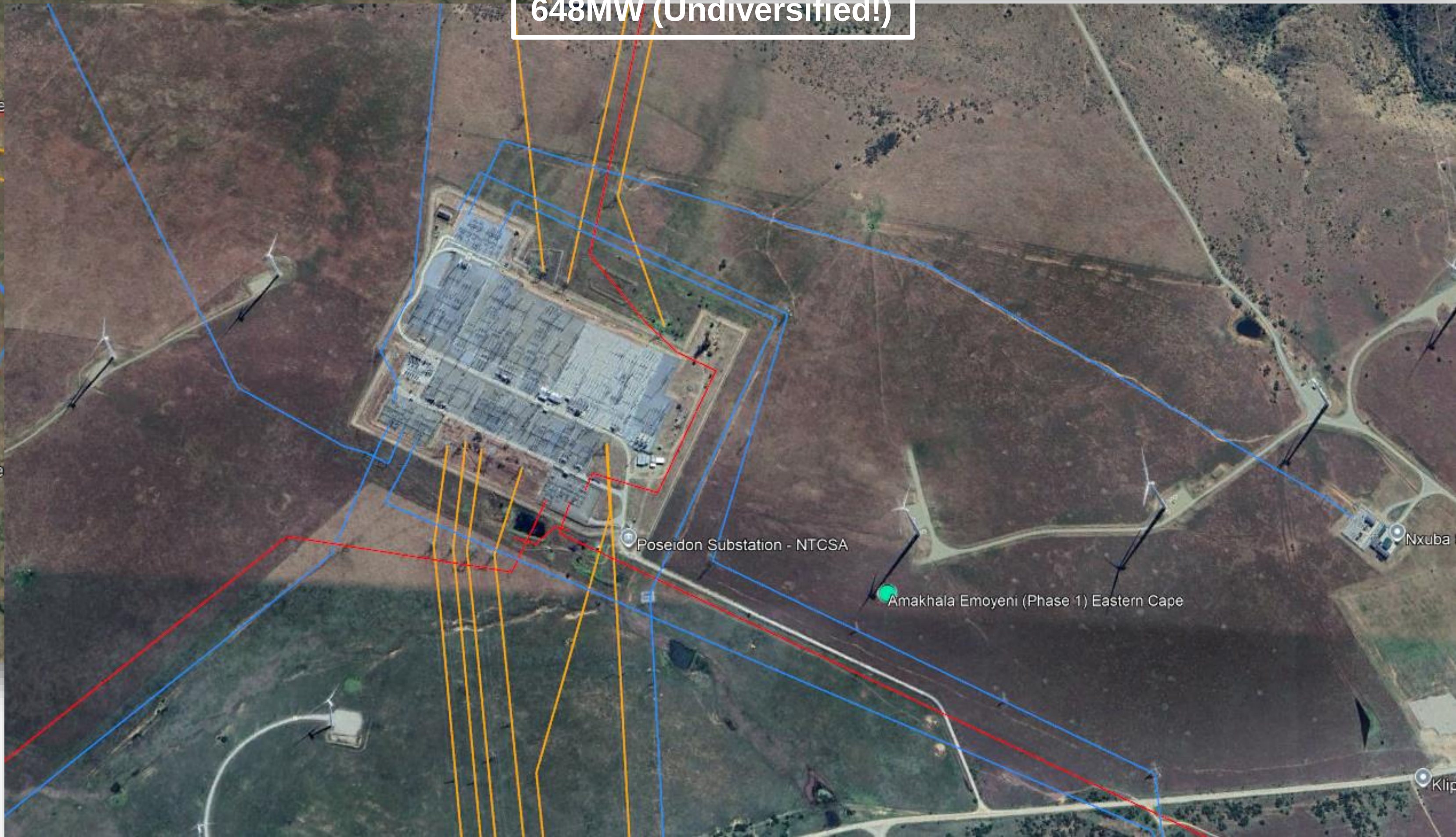
I.O.N…

#not to labour the point



Cookhouse	Wind	140	RE IPP 1	Poseidon	Operational
Waainek	Wind	23.86	RE IPP 2	Poseidon	Operational
Amakhala Emoyeni (Phase 1) Eastern Cape	Wind	140	RE IPP 2	Poseidon	Operational
Nojoli Wind Farm	Wind	87	RE IPP 3	Poseidon	Operational
Golden Valley Wind	Wind	117.72	RE IPP 4	Poseidon	Operational
Nxuba Wind Farm	Wind	138.9	RE IPP 4	Poseidon	Operational

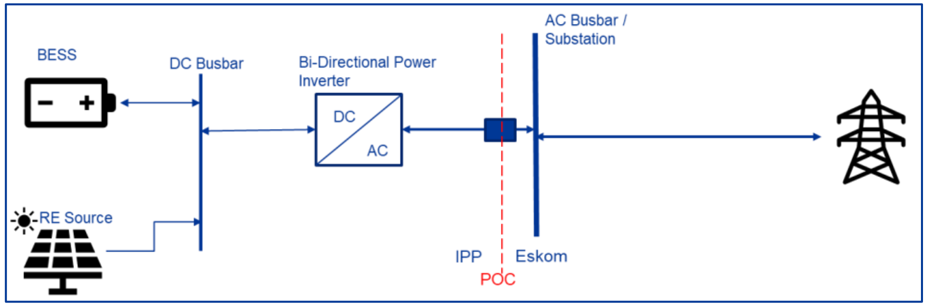
648MW (Undiversified!)



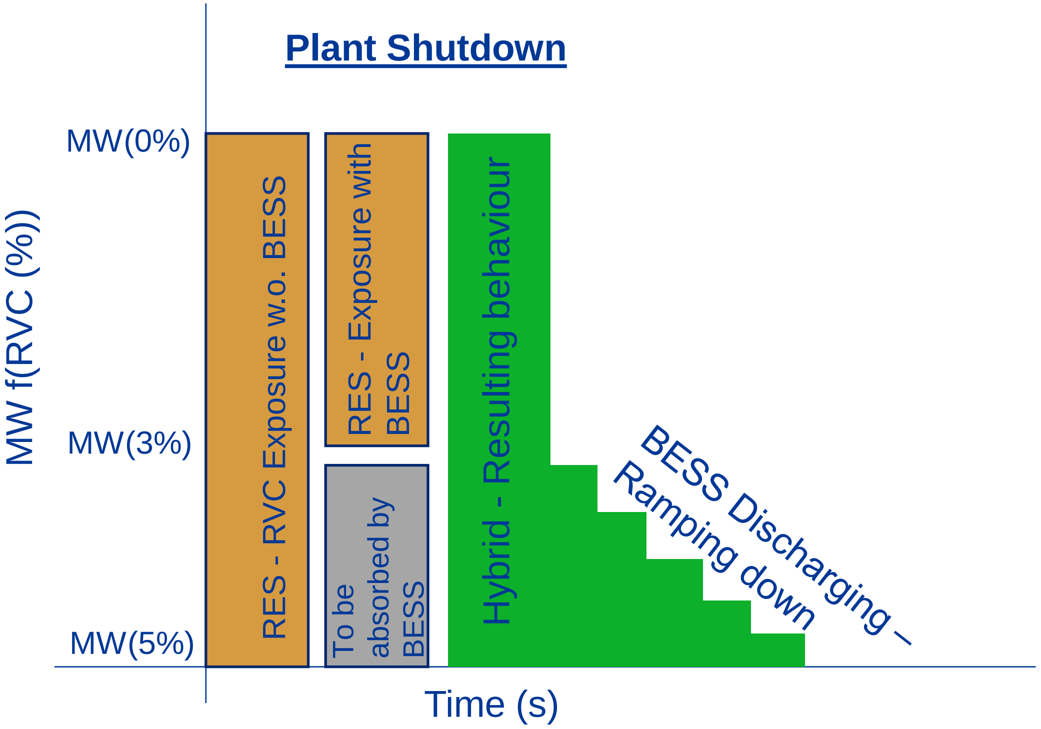
Hybrid Plant Sizing: BESS and RE Hybrids

Concept: Size Calculation for Hybrid Plants

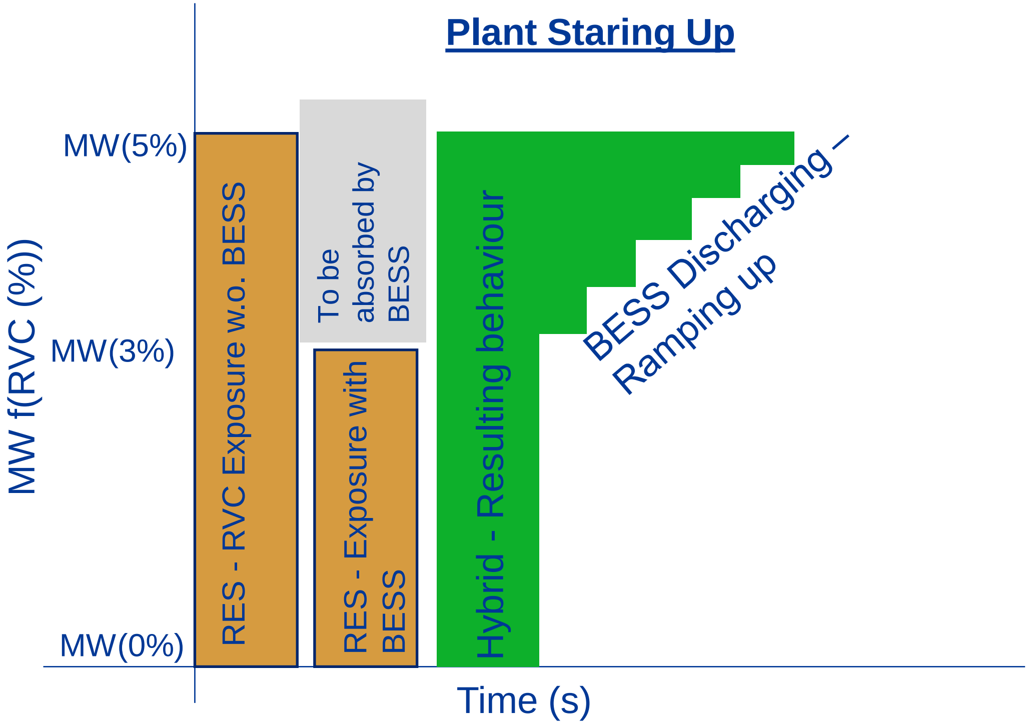
Typical configuration – DC Coupled



Plant Shutdown

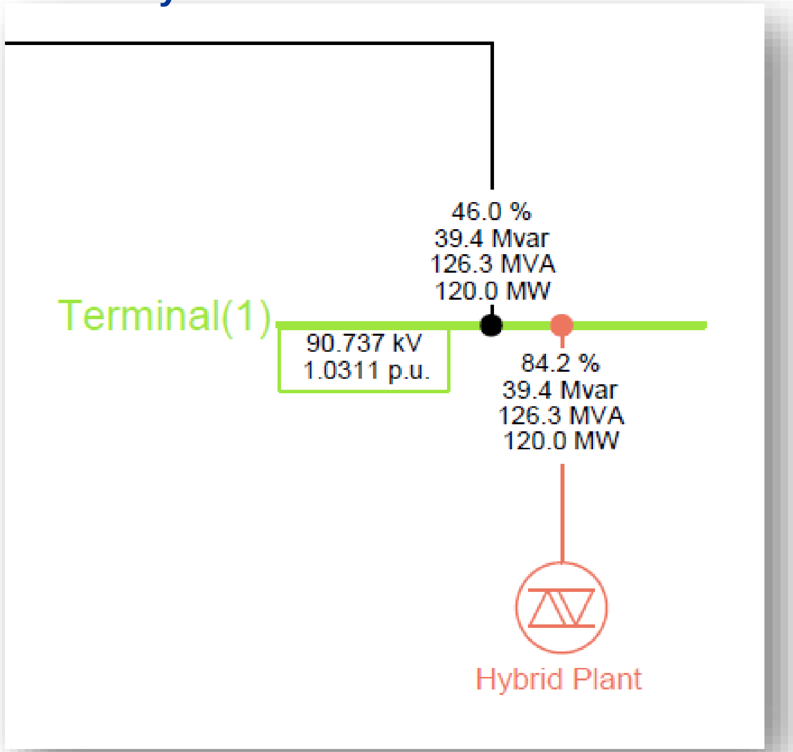


Plant Staring Up

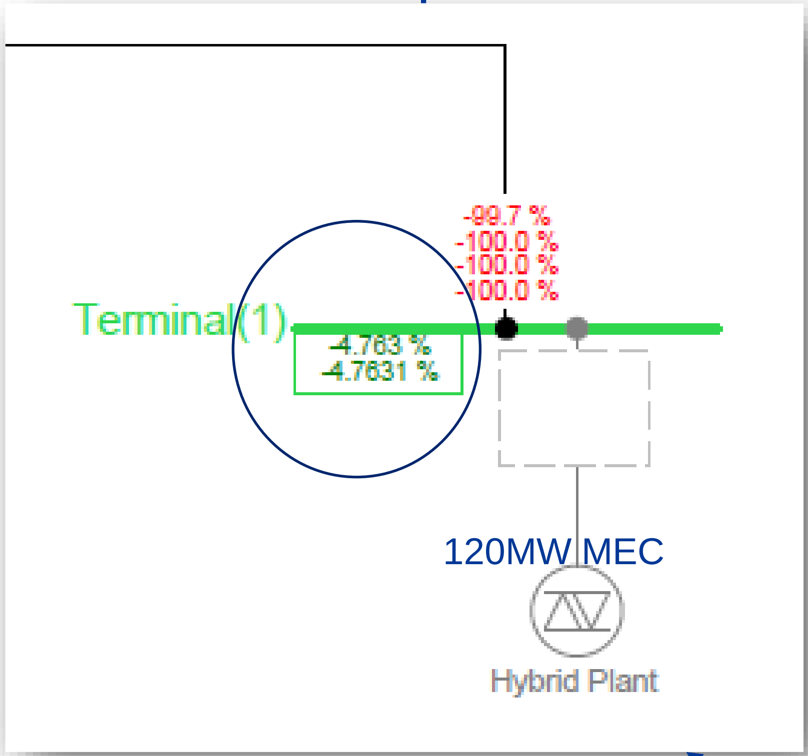


Example: Size Calculation for Hybrid Plants

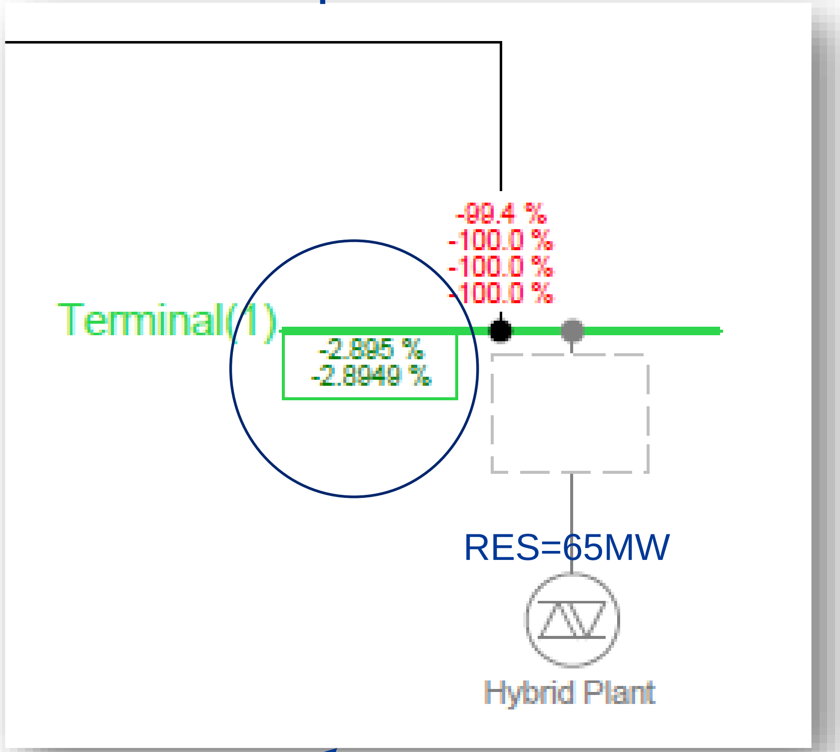
Hybrid Plant Load Flow



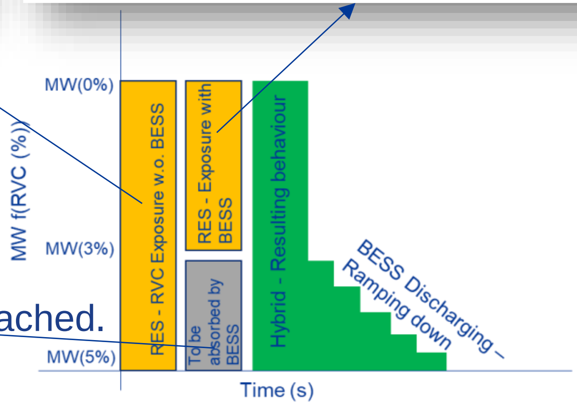
RES - RVC Exposure w.o. BESS



RES - Exposure with BESS



- Hybrid plant MEC = 120MW
- RES corresponding to 3% RVC = 65MW
- Thus BESS = 120MW – 65MW
  - =55MW
- NB: The combined MEC of 120MW is not to be exceeded as the RVC limit of 5% has been reached.



SOME PERSPECTIVES FROM **EPRI** WORKING GROUPS…

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Benchmarking Utility Actions: What is being done today?

Part 2: Customer-owned DER

- Adopt **latest version of IEEE 1547** to enable more active voltage support from DER.
- Limit voltage fluctuations from intermittent DER using **non-unity power factors**.
- As part of the DER interconnection process:
  - Include **voltage step-change evaluations**, where DER output is dropped, and the resulting voltage changes are analyzed.
  - Verify **settings and placement of existing voltage regulation equipment**, adjusting set points and usage as needed, in addition to installing new regulation equipment to handle increased DER capacity.

EPRI

EPRI Perspective…still more Q's than A's

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Myth: DER will increase the cost of distribution voltage regulation.

- *Can changes in regulation deadband or DER settings to ease over-sensitive tap changing operations?*
- *What about 40-200 operations/day, even very high annual tap operations (30,000) should field for 16 – 20 + years?*
- *What is your failure experience? Do you run to failure?*
- *Could maintenance or repair help? What's are the cost tradeoffs? Has anyone put a value on voltage quality? What was it?*

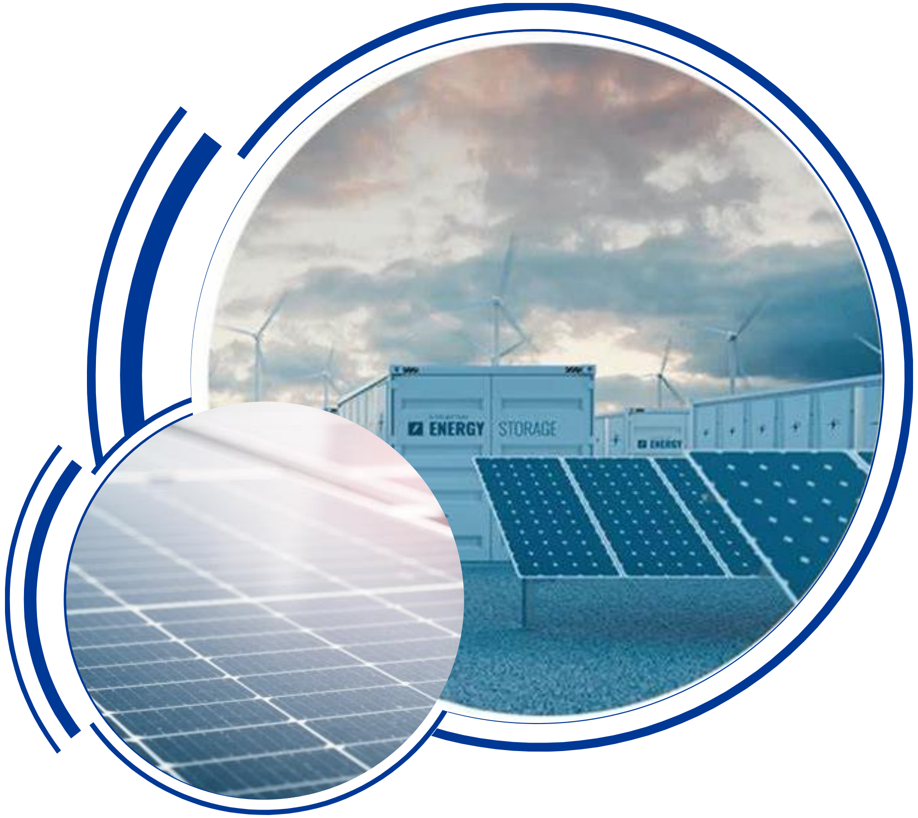
EPRI

Concluding Remarks

- VVT vs RVC: appropriate use of terms
- RVC Standard is OUT
- Must ensure uniform approach throughout!
- Case file management is key – Fault levels to align with Tx
- Planning studies (grid impact) are about worst case – at the moment anyway…
- RE IPPs are required to have reactive power control too (among others)

Table 1: RVC limits for different Sources

Generator type	Applicable Limits
BESS	≤ 5%
Dispatchable Generators	≤ 5%
Variable Renewable Energy	≤ 3%
Hybrid RE and BESS (Single POC)	≤ 5%
Hybrid RE and BESS (separate POCs)	≤ 5% for BESS, ≤ 3% for vRE



Thank you