69TH AMEU CONVENTION

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CSIR International Convention Centre

Confronting South Africa's Electricity Crisis in the context of a 'Balanced Just Energy Transition' (BJET) and the need for a reliable and resilient national electricity grid

Grid management systems – Digitalisation journey for Distributors

Boitumelo Motaung

Smart Grid Senior Advisor

Eskom

Portia Zulu

Smart Grid Senior Advisor

Eskom

What is digitalization?

Digitalization is the process of leveraging digital technologies to transform a business model, creating new revenue streams and value-producing opportunities. This involves integrating digital tools and systems into various aspects of a business's operations, from management and communication to production and customer service.

Objectives of digitalization

Improve customer experience

- Retaining and attracting more customers is always the number one priority for all businesses. Methods to engage our existing and potential customers methods include all kinds of media like emails, social media, mobile apps, much more.

Transform business processes

- The business processes should be such as to reduce the friction in all possible areas as much as is possible. Hence, the smoother our business processes, the better it is for us to handle our customers and concentrate on the more important aspects of the business.

Optimize infrastructure operations

- Infrastructure in place and upgrades will enable the OT equipment to communicate with the IT systems. the business will ensure the integrate of the new technologies with the existing resources for optimum usage of infrastructure operations.

Utilize analytics

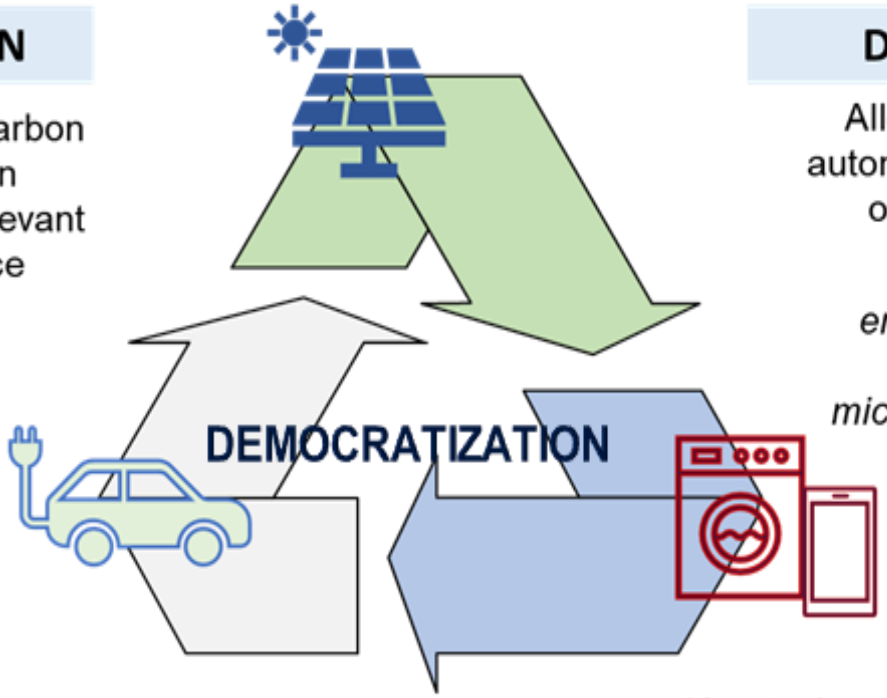
- Analytics is an important tool for business processes. Therefore, analytics help us with keeping a check on the performance of the new improvements .Also, organization needs analytics to make sure the decision-makers receive accurate reports at the correct time.

Drivers of digitalization

DECARBONIZATION

Critical to long-term carbon emission reduction goals and will be a relevant distributed resource

Key technologies:
Electric vehicles, vehicle to grid/home, smart charging, heat pump



DECENTRALIZATION

Allows for open, real-time, automated communication and operation of the system

Key technologies:
energy efficiency, solar PV, distributed storage, microgrids, demand response,

DIGITALIZATION

Allows for open, real-time, automated communication and operation of the system

Key technologies:
Network technologies (smart metering, remote control and automation systems, smart sensors) and beyond the meter *(optimization and aggregation platforms, smart appliances and devices, IoT)*

Current challenges faced by distributors

- Ageing infrastructure
- Reactive maintenance,
- Growth in electricity demand
- Limited input/outputs which limit access to data to support decision making.
- Limited real-time visibility over the network.
- Limited control over the network.
- Overall system vulnerability to inaccuracies
- Integration of new energy sources or new equipment causes downtime due to the complex hard wiring required to ensure compatibility.
- Single flow of electricity so generation surpluses are not effectively leveraged.
- High cost of repairing or replacing large, aged equipment required in an analogue system.
- Loss of revenues resulting from inaccuracies in meter readings

Benefits of digitalization

Asset management

- Near real time monitoring of asset condition with remote, connected sensors.
- Use of robots of various types (including drones) for asset inspections. This includes remote control and / or AI driven autonomous operations.
- Use of data analytics and AI to interpret asset condition data.
- Use of real time monitoring and robotics to improve asset security, preventing or responding effectively to theft and damage.

Customer Operations

- Demand management capabilities, balancing supply and demand, and offering customers more options.
- Customer interaction channel served by a chat bot - already a basic one in place,
- Automation of data collection from customer interactions, e.g. identifying / verifying which feeder a customer is on when a fault is logged.
- More effective proactive customer notifications.
- Automation of customer interactions and product operations

Digitalization

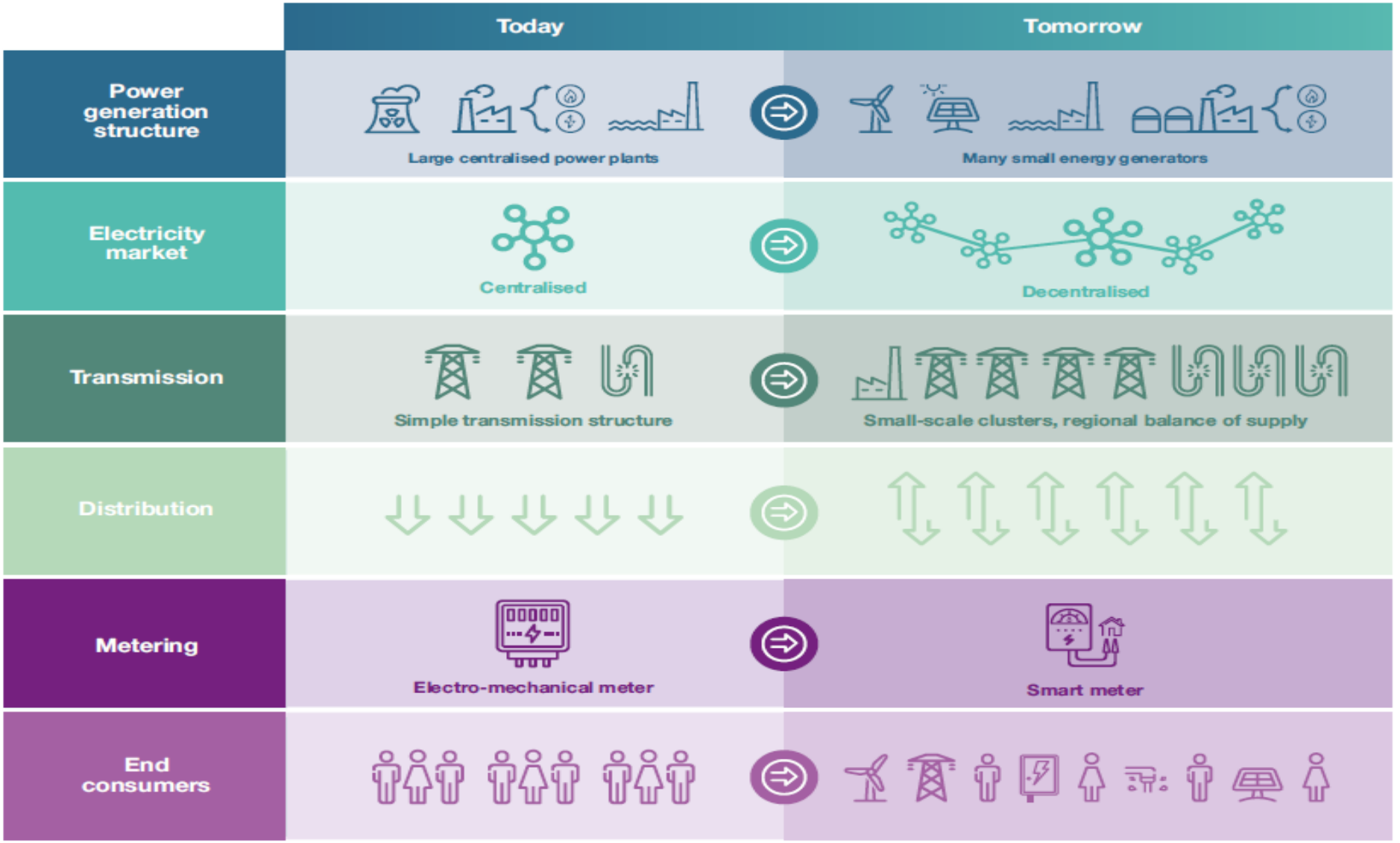
Grid Operations

- Reduction of operations costs by increased remote control and / or autonomous operations.
- Automation of operations to maintain and less dispatch able renewable generation increases.
- Real time monitoring of the operating state of the grid and using this to better optimize operations.
- Early detection, diagnosis and correction of faults.
- Increased verification of operating and maintenance activities.

Grid management and Operations

- Use of AI for forensic insights and response
- Nerve centre and response supporting real time decision making.
- Supply chain optimization and security

Summary of where the distributors are heading to transition to a smarter grid

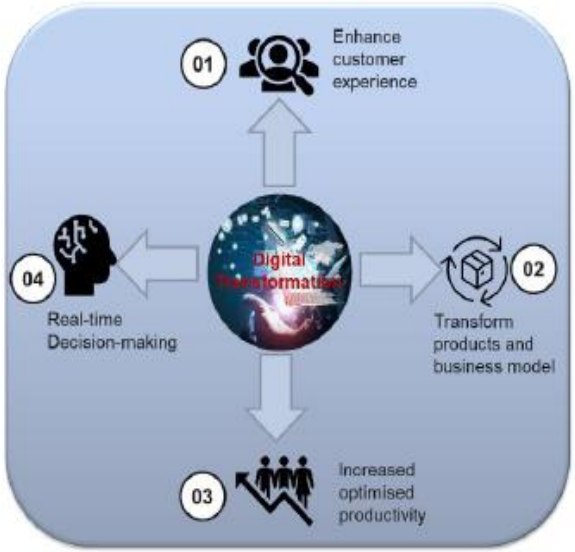


Key digitalization steps:

1. Assessment and Planning	Begin by assessing the current state of your operations, technology, and data infrastructure. Identify areas that can benefit from digitalization and set clear goals and objectives.
2. Smart Grid Implementation	•Invest in smart grid technologies that enable real-time monitoring and control of the electrical grid. This includes advanced metering infrastructure (AMI), distribution automation, and grid management systems.
3. Data Management	•Implement robust data management systems to collect, store, and analyze data from various sources. This data will be essential for making informed decisions and optimizing grid operations.
4 Customer Engagement	•Enhance customer services through digital channels. Offer online billing, outage reporting, and energy usage insights to improve customer satisfaction.
5. Predictive Maintenance	•Utilize data analytics and machine learning to predict equipment failures and prioritize maintenance efforts, reducing downtime and costs.
6. Cybersecurity	•Strengthen cybersecurity measures to protect critical infrastructure from cyber threats and ensure the integrity of data and operations.
7. Renewable Integration	•Develop the capability to integrate renewable energy sources into the grid seamlessly. This may involve grid modernization and energy storage solutions.
8. Advanced Analytics	•Use advanced analytics and AI to optimize load forecasting, demand response, and energy distribution, leading to improved efficiency and cost savings.
9. Regulatory Compliance	•Stay updated with regulatory requirements and ensure that your digitalization efforts comply with industry standards and regulations.
10. Training & Workforce Development	•Train your workforce to operate and maintain digital systems effectively. Invest in the skills needed for data analysis, cybersecurity, and emerging technologies.
11. Continuous Improvement	•Continuously assess and refine your digitalization strategy based on performance metrics and evolving technology trends.
12. Collaboration	•Collaborate with other stakeholders in the energy sector, including other utilities, government agencies, and technology providers, to share knowledge and resources.

NB: digitalization journey is an ongoing process, and staying agile and adaptable is crucial to successfully navigate the changing landscape of the electricity distribution industry.

Smart Grid Growth to enable the transformation journey



Load Flow Calculation
FLISR
VVO
ML
AI
State Estimator
DMS DER Tools
DL
Micro Grid Pilot
Data Mining
Dx Equipment Monitoring
SSEG
Mobility Tools
Fault Level Calc
Customer interaction
Forecasting Tool
Dynamic Pricing
BEMS
CVR
Proactive exception reporting
HEMS
DERMS
Ripple Relays
BESS
Power Factor Correction
EV Monitoring & Control
RMU with RTU for SSEG on cables
DGSL
BESS Dynamic Modelling
Remote Interrogation of protection devices
Interactive Social Media
APM Tool
Smart Meters
Dx Automation
Sensors and IEDs
Smart Grid Architecture
Governance/Documentation
Implementation Plan
Supporting software
Training/Skills Dev.
Dx Substation Automation
Remote Control and Engineering
Substation Data Concentrators
Smart Electricity Platform
ADMS
(Core Capabilities)
Analytics Capability
MDMS
Fibre Optics
HES
National Digital Wireless Networks
Dx Historian

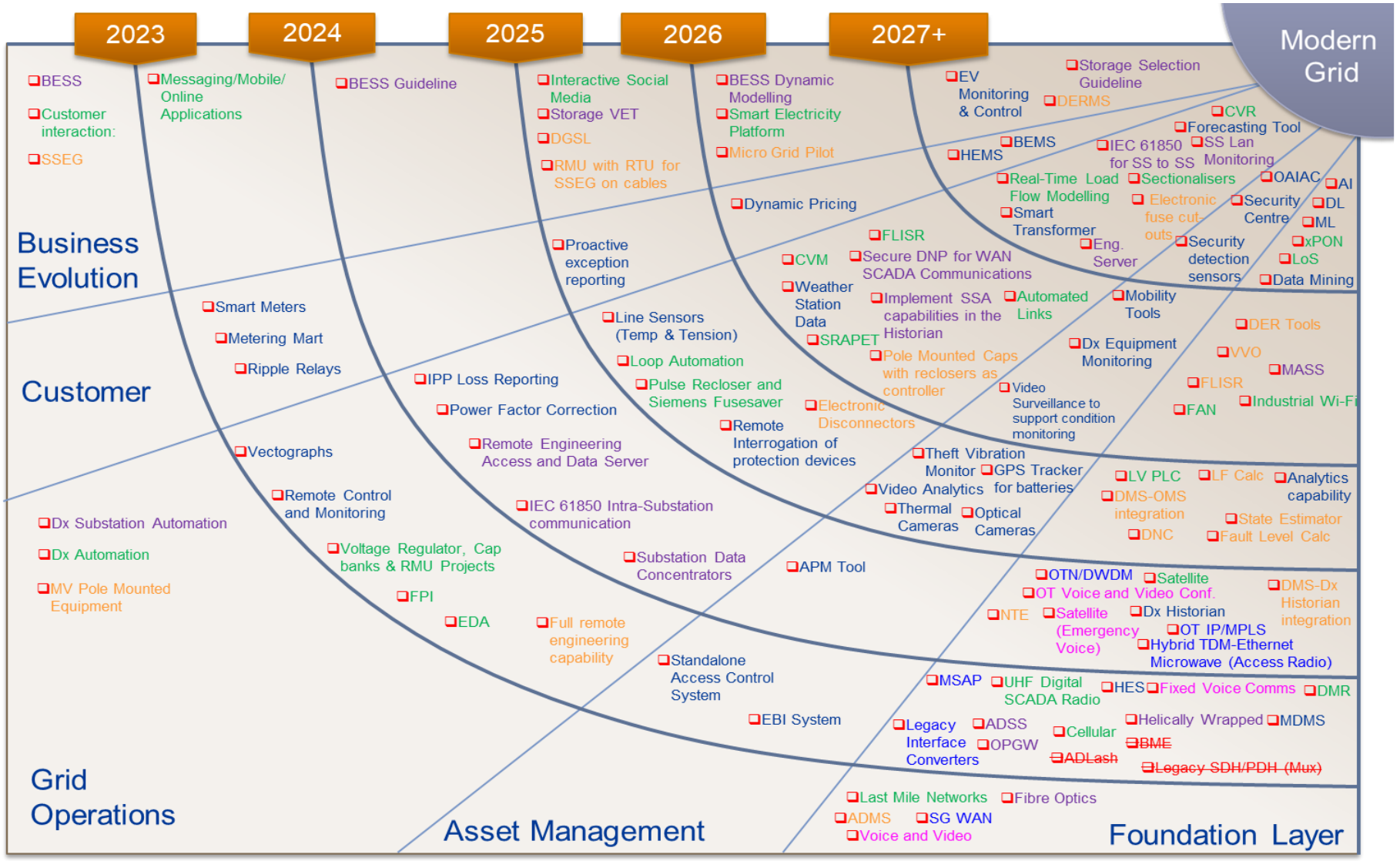
Technologies that enable Smart Operations

Progressive Expansion of Technologies

Smart Grid Initiatives

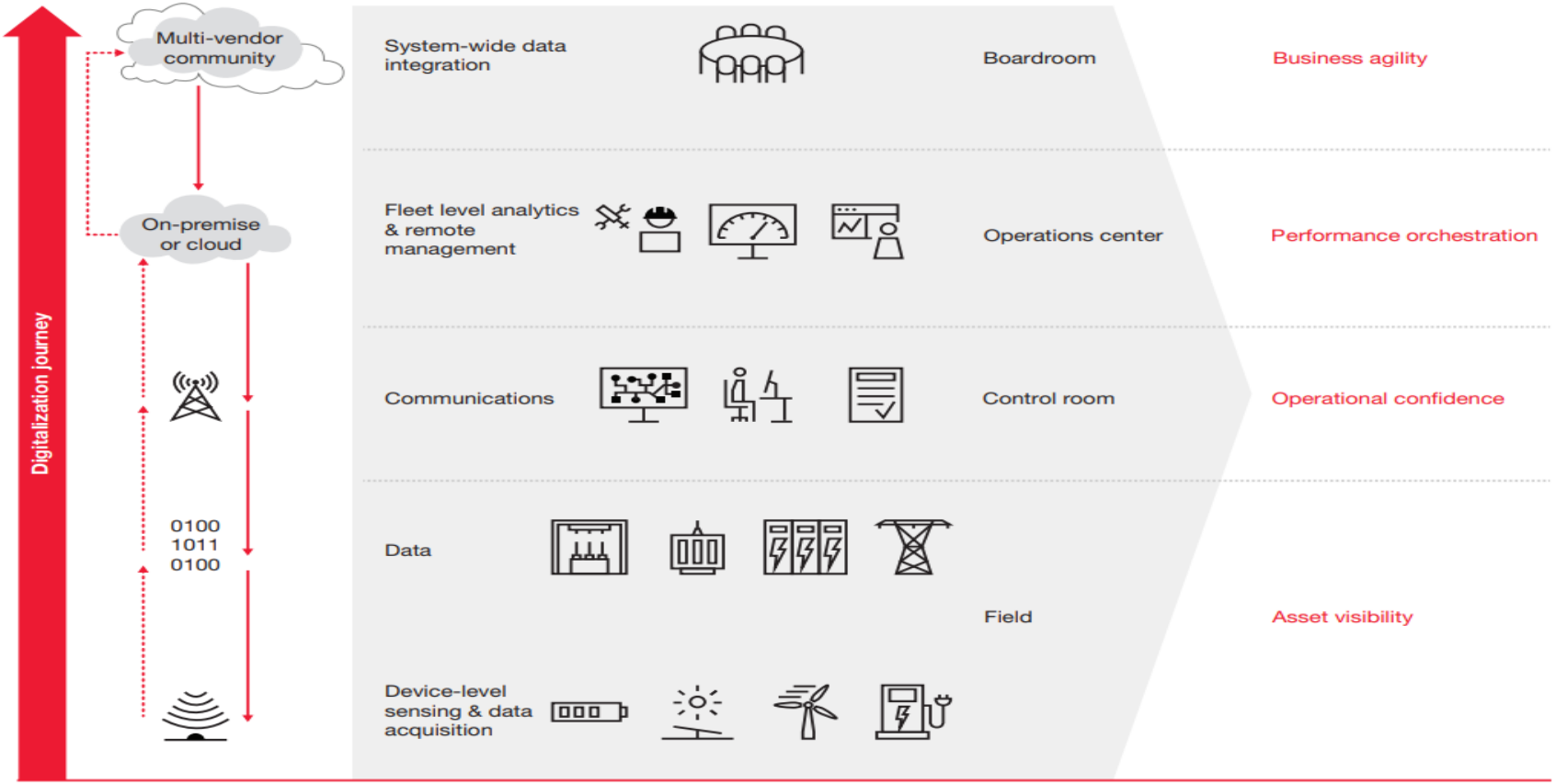
Technologies that enable data collection, remote engineering, automation.

Foundational Layers


2023
2024
2025
2026
2027+
Modern Grid
BESS
Customer interaction:
SSEG
Messaging/Mobile/ Online Applications
BESS Guideline
Interactive Social Media
Storage VET
DGSL
RMU with RTU for SSEG on cables
BESS Dynamic Modelling
Smart Electricity Platform
Micro Grid Pilot
Dynamic Pricing
EV Monitoring & Control
Storage Selection Guideline
DERMS
CVR
Forecasting Tool
BEMS
HEMS
IEC 61850 for SS to SS
SS Lan Monitoring
Real-Time Load Flow Modelling
Sectionalisers
OAIAC
AI
Electronic fuse cut-outs
Security Centre
DL
ML
Smart Transformer
Eng. Server
Security detection sensors
xPON
LoS
Data Mining
Business Evolution
Proactive exception reporting
FLISR
CVM
Secure DNP for WAN SCADA Communications
Weather Station Data
Implement SSA capabilities in the Historian
Automated Links
Mobility Tools
SRAPET
Pole Mounted Caps with reclosers as controller
Dx Equipment Monitoring
DER Tools
VVO
MASS
FLISR
Industrial Wi-Fi
FAN
Video Surveillance to support condition monitoring
Smart Meters
Metering Mart
Ripple Relays
Line Sensors (Temp & Tension)
Loop Automation
Pulse Recloser and Siemens Fusesaver
IPP Loss Reporting
Power Factor Correction
Electronic Disconnectors
Remote Interrogation of protection devices
Remote Engineering Access and Data Server
Customer
Vectographs
Theft Vibration Monitor
GPS Tracker for batteries
Video Analytics
Thermal Cameras
Optical Cameras
LV PLC
LF Calc
Analytics capability
DMS-OMS integration
State Estimator
DNC
Fault Level Calc
Remote Control and Monitoring
IEC 61850 Intra-Substation communication
Dx Substation Automation
Dx Automation
MV Pole Mounted Equipment
Voltage Regulator, Cap banks & RMU Projects
FPI
EDA
Full remote engineering capability
Substation Data Concentrators
APM Tool
OTN/DWDM
Satellite
OT Voice and Video Conf.
DMS-Dx Historian integration
NTE
Satellite (Emergency Voice)
Dx Historian
OT IP/MPLS
Hybrid TDM-Ethernet Microwave (Access Radio)
Standalone Access Control System
MSAP
UHF Digital SCADA Radio
HES
Fixed Voice Comms
DMR
EBI System
Legacy Interface Converters
ADSS
OPGW
Cellular
Helically Wrapped
MDMS
BME
ADLash
Legacy SDH/PDH (Mux)
Grid Operations
Asset Management
Last Mile Networks
Fibre Optics
ADMS
SG WAN
Voice and Video
Foundation Layer

Digitalization journey

Digitalisation enables data from sensors to be used to enhance decision-making throughout the utility.



Conclusion

- Energy market evolution is disrupting current utility revenue streams and business models consequently pushing digital transformation of energy utilities.
- Utilities must re-examine their business models, to survive and thrive in the evolving industry. Digital transformation capabilities enable utilities to evolve their products, to improve their benefits to its customers and ourselves.
- The process of digitizing the grid will be a lengthier process in SA than it has been in more developed regions due to financial constrains.

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Thank you!

Association of Municipal Electricity Utilities (Southern Africa)
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IGNITING EXCELLENCE