Journey towards a Smart Utility: an eThekwini Electricity perspective

J Hunsley Pr Eng

ETHEKWINI ELECTRICITY UNIT

ETHEKWINI MUNICIPALITY

Our Vision

To be a leader in electricity distribution providing energy for the future

Our Strategy

To develop the Electricity Unit as an undertaking that maximises the value of its electricity supplies and makes effective use of all its resources

Our Mission

To provide electricity, public lighting and other energy services that satisfy our customers and community whilst maintaining sound business principles.

Electricity Sales : R 10 Billion

Electricity Purchases : R 6.4 Billion

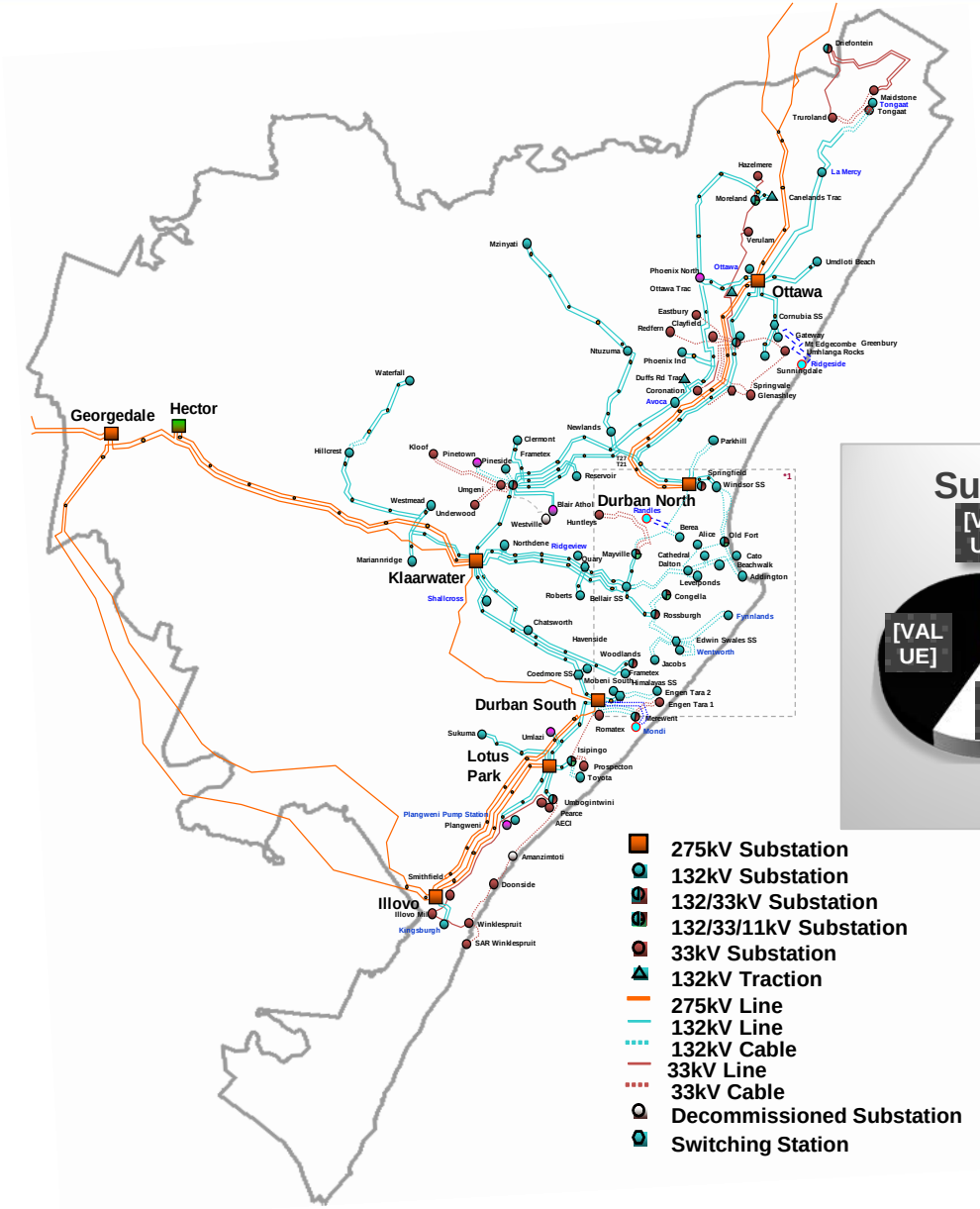
Staff Compliment 2240

Total Customers: 723 593

Maximum Demand: 1800 MW

Total Sales: 11 412 GWh

By 2030 eThekwini will be Africa's most caring and liveable city



Theft of Infrastructure.

An ageing network with increasing maintenance costs.

Fragmented excellence & duplication.

Unplanned outages compounded by growth in demand and geographic expansion.

Inability of the current grid to accommodate small scale embedded generation.

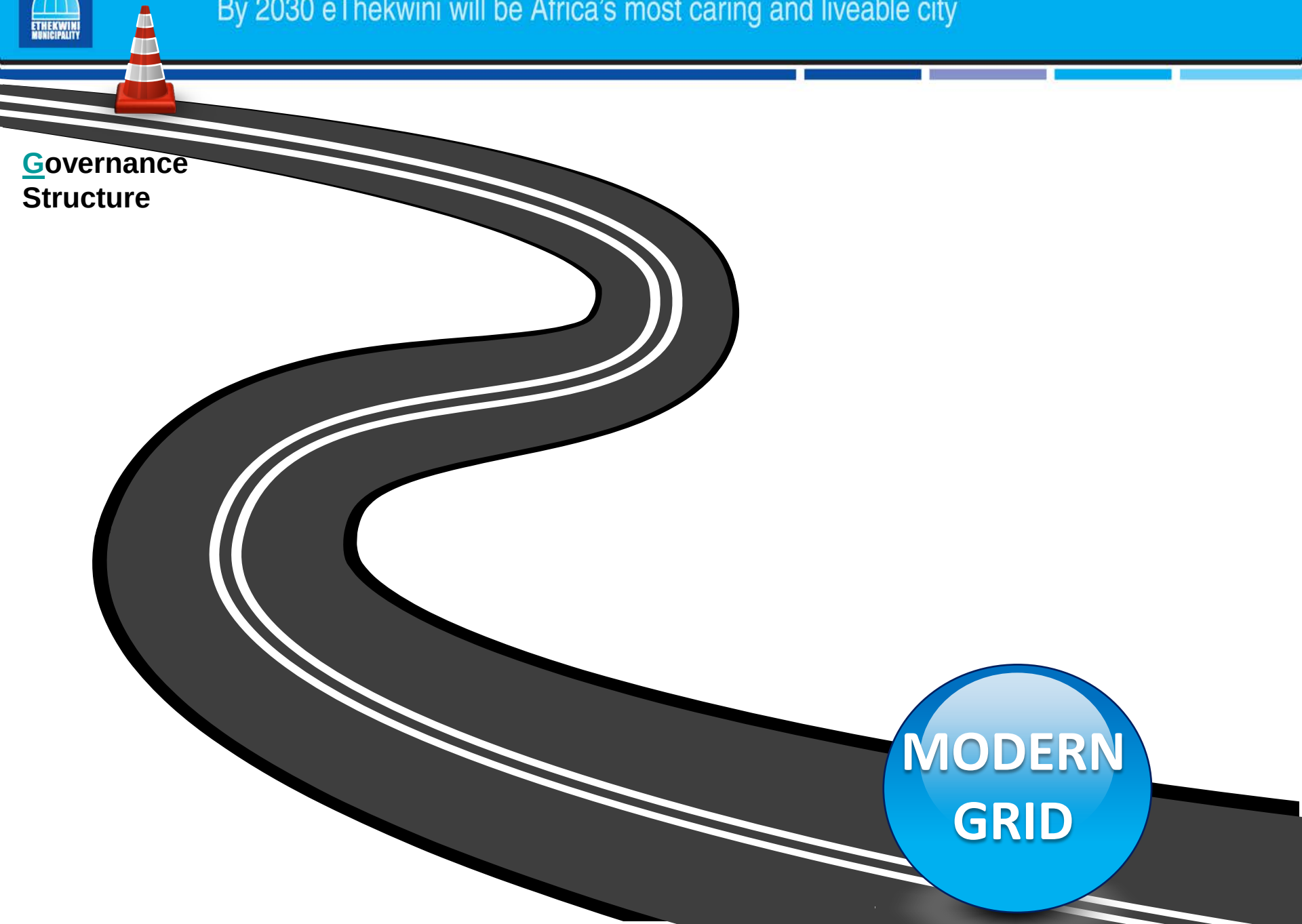
Legacy Information Technology systems with fragmented applications.

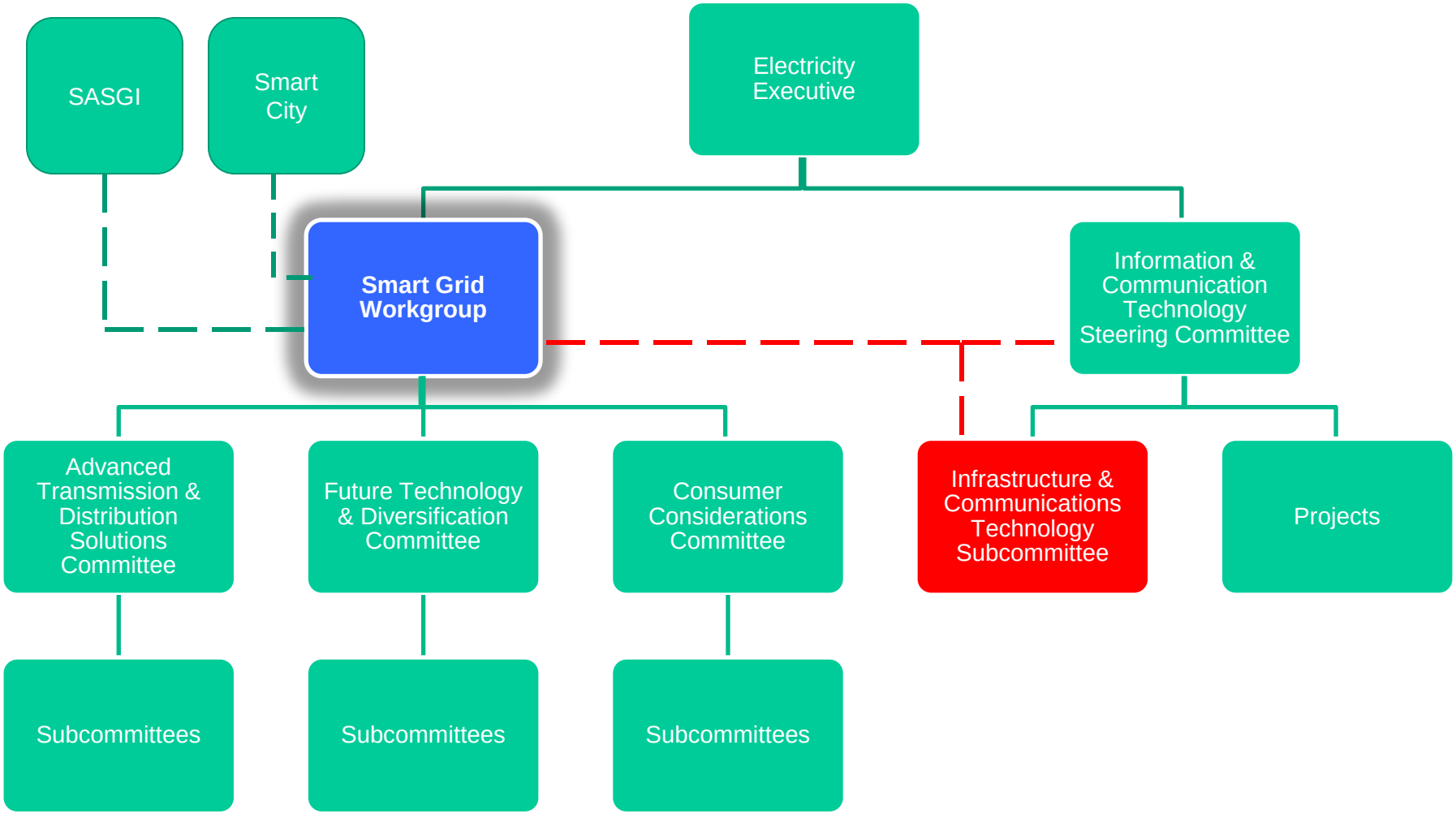
Ineffective / inadequate system performance measures.

Increasing compliance requirements with respect to quality of supply and service, finance, health, safety and environment.

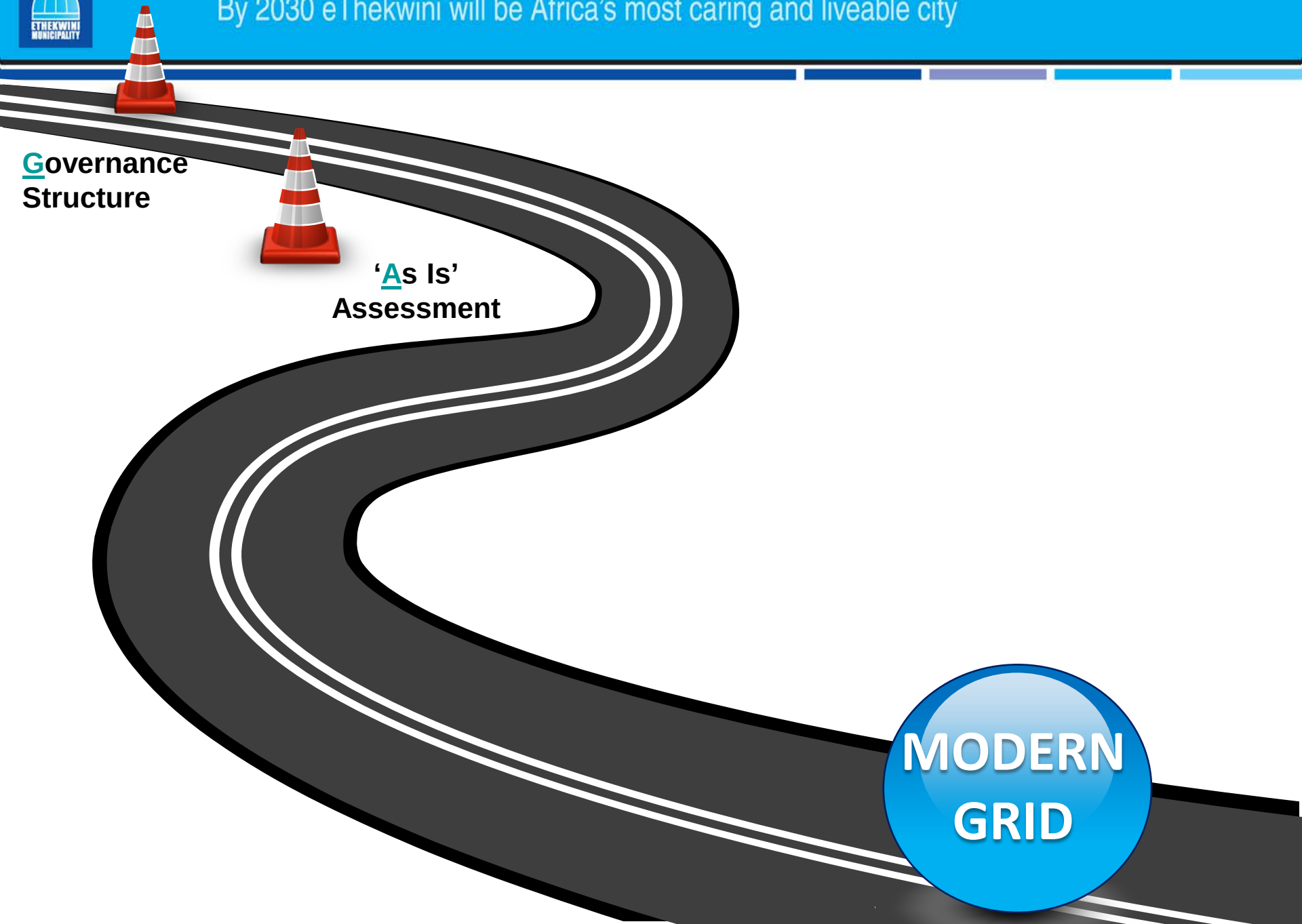
Lack of institutional memory as a result of experienced employees retiring without the necessary skills transfer to other employees or systems.

Governance Structure



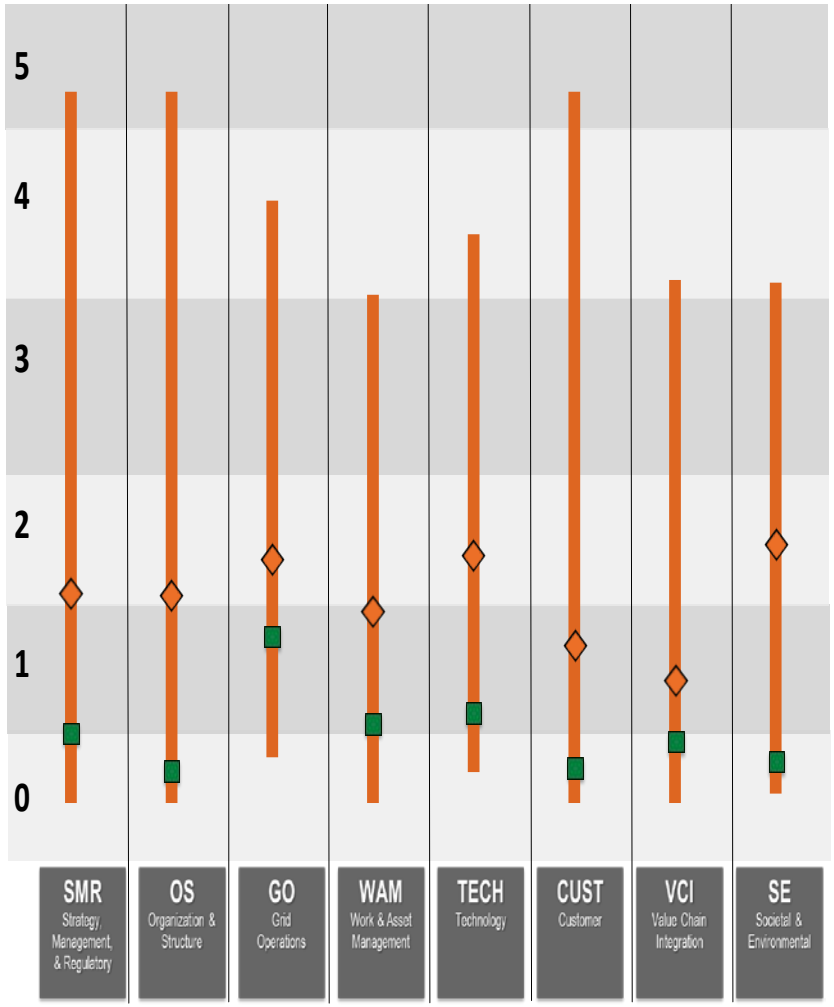

SASGI
Smart City
Electricity Executive
Smart Grid Workgroup
Information & Communication Technology Steering Committee
Advanced Transmission & Distribution Solutions Committee
Future Technology & Diversification Committee
Consumer Considerations Committee
Infrastructure & Communications Technology Subcommittee
Projects
Subcommittees
Subcommittees
Subcommittees

a) Developing a high level vision of what an eThekwini smart grid might look like and the challenges it would help address;
b) Evaluating options pertaining to grid intelligence;
c) Ascertaining the level of international experience of smart grids to date and future plans;
d) The assessment of smart grid related developments within the South African electricity supply industry;
e) Establishing a baseline position ie. assessing the current network capability for smart grid applications;
f) Proposing research, development and deployment opportunities that should be pursued in the immediate future to ensure readiness to deploy smart solutions;
g) Considering pilot projects and evaluating the results from pilot projects;
h) Determining the high level costs and benefits of developing smart grids;
i) Providing input to standards and specifications; and
j) Developing a smart grid action plan which will –
    a) Set out detailed actions required to implement the strategy; and
    b) Define roles and responsibilities for the different smart grid role players


Governance Structure
'As Is' Assessment
MODERN GRID

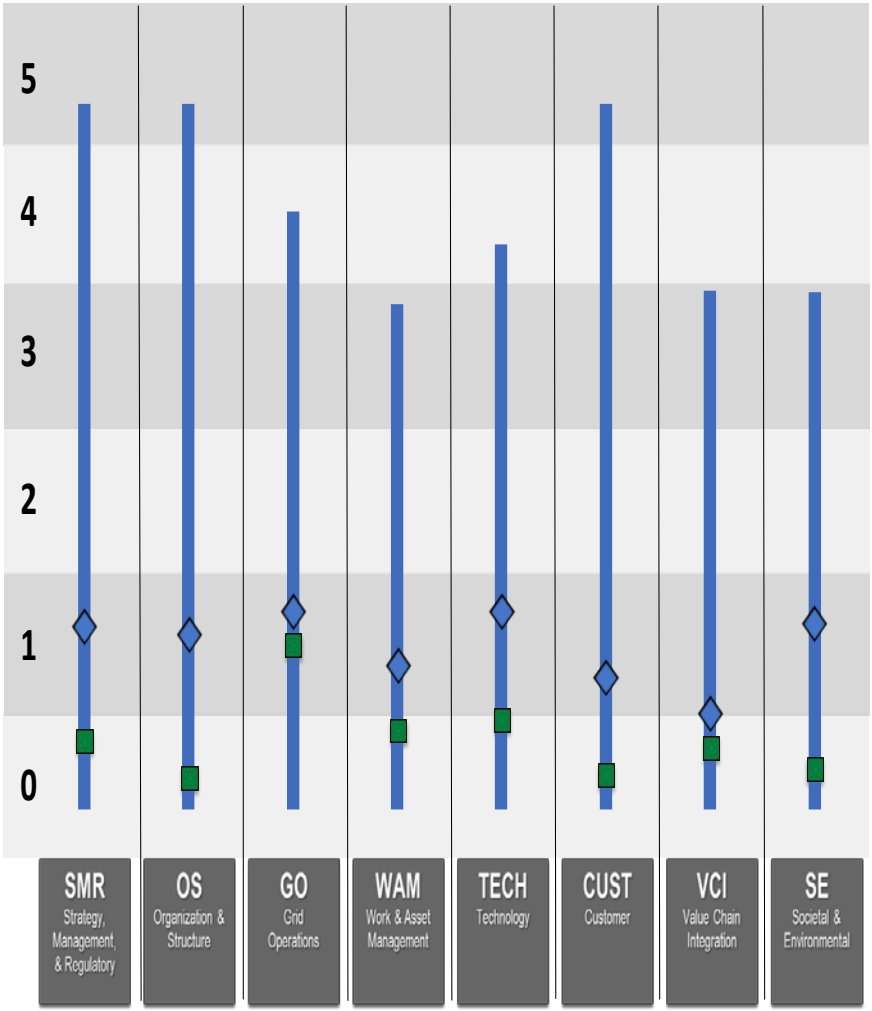
By 2030 eThekwini will be Africa's most caring and liveable city

SGMM Peer Community



Peer average eThekwini Municipality, Electricity Unit

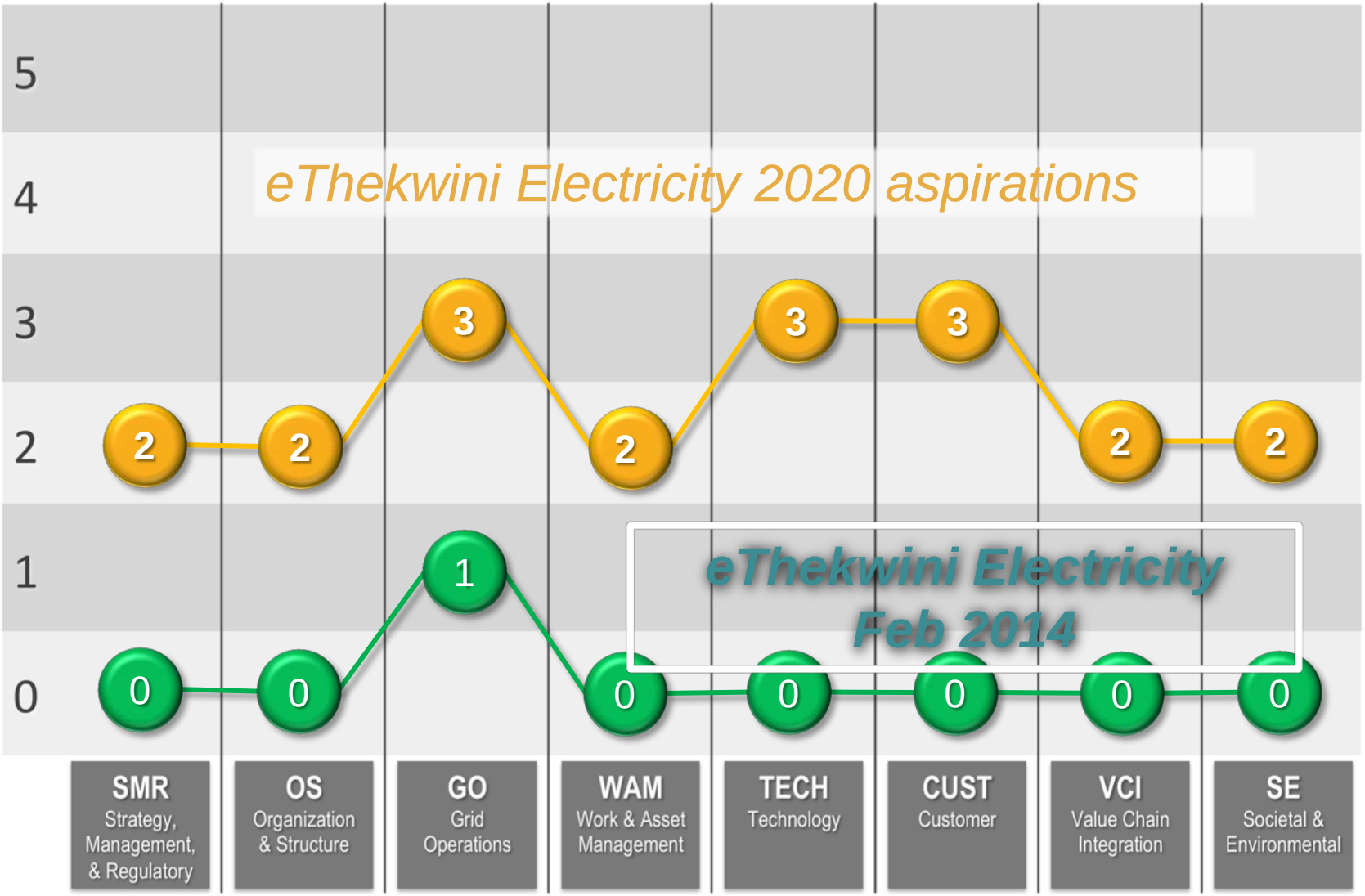
SGMM Community Data (All)



Community average eThekwini Municipality, Electricity Unit

Overall observations

- The eThekwini Team is committed to explore opportunities to enhance their overall business performance and sustainability;
- Numerous technology implementation initiatives are taking place within eThekwini Electricity which is commendable;
- The technology implementation initiatives are not necessarily taking place as an integral part of an integrated smart grid strategy;
- The survey results reflects the level of "inconsistency and absence" of an integrated technology deployment approach (level of silo approach);
- The approval and adoption across Lines of Business (LOB) of the smart grid Vision, technology deployment plan and an integrated implementation strategy, will significantly contribute to the smart grid maturity level of the utility;
- It is essential to focus on the employee participation and the business structure alignment to support the smart grid journey;
- The eThekwini Team demonstrated commitment to the smart grid maturity assessment process and the participation was outstanding.


5
4
3
2
1
0
eThekwini Electricity 2020 aspirations
eThekwini Electricity Feb 2014
2 2 3 2 3 3 2 2
0 0 1 0 0 0 0 0
SMR Strategy, Management, & Regulatory
OS Organization & Structure
GO Grid Operations
WAM Work & Asset Management
TECH Technology
CUST Customer
VCI Value Chain Integration
SE Societal & Environmental

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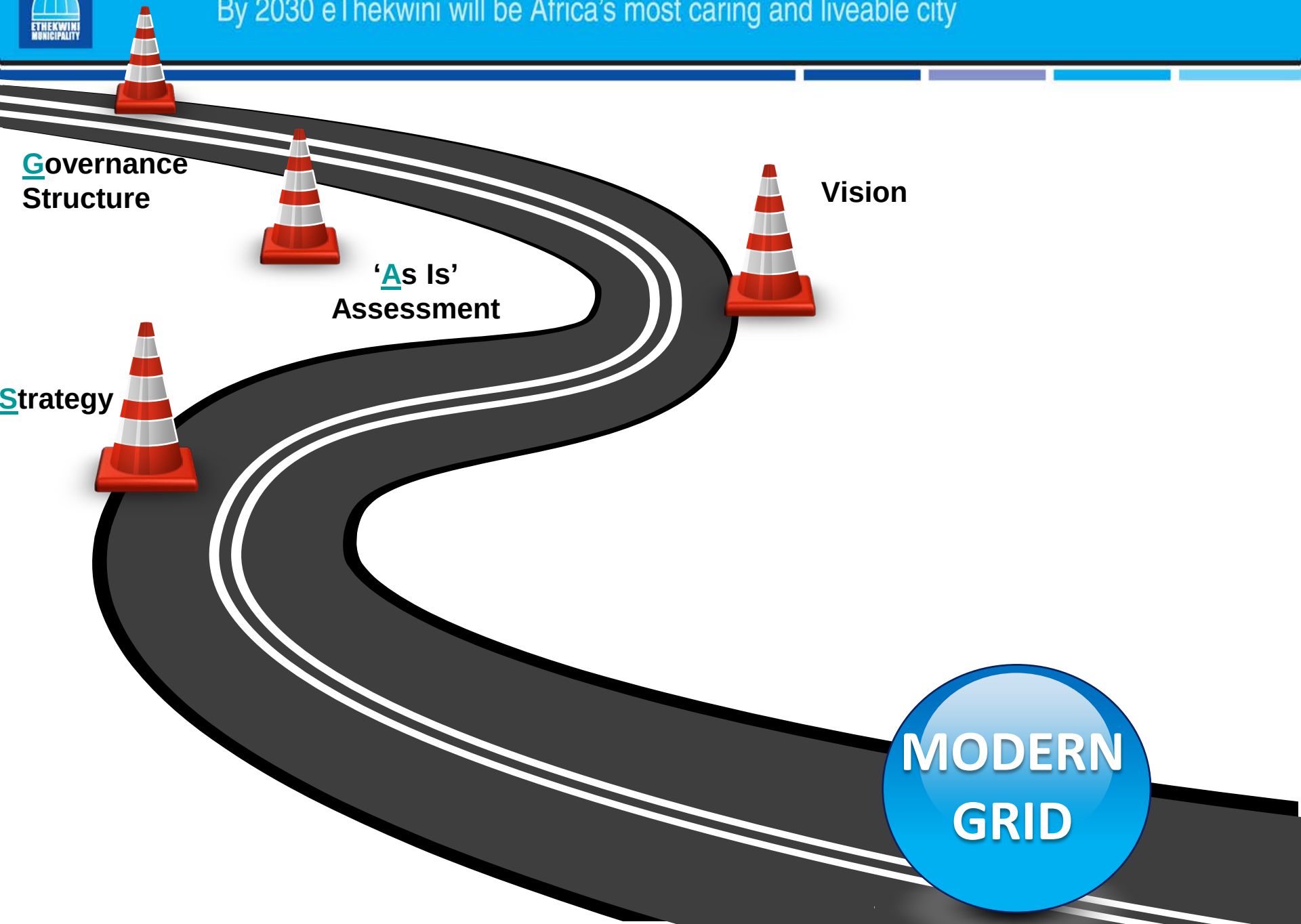

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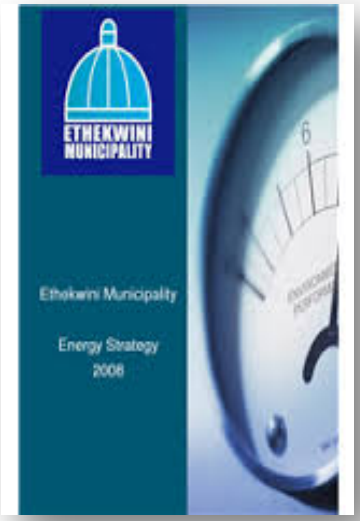

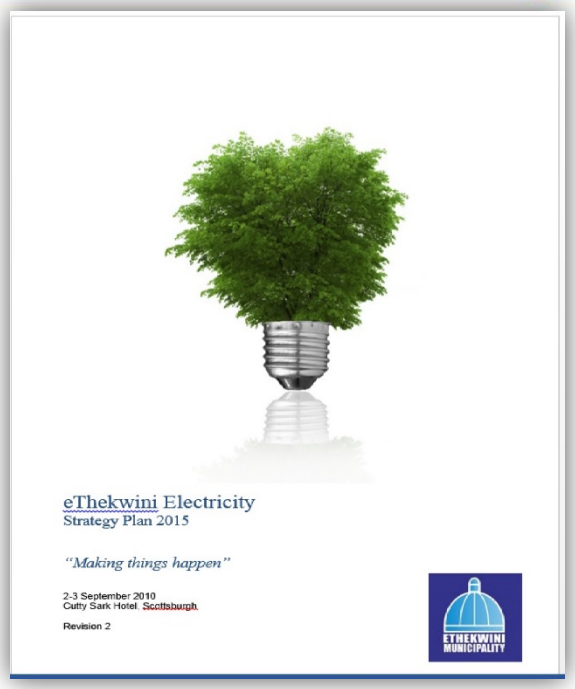

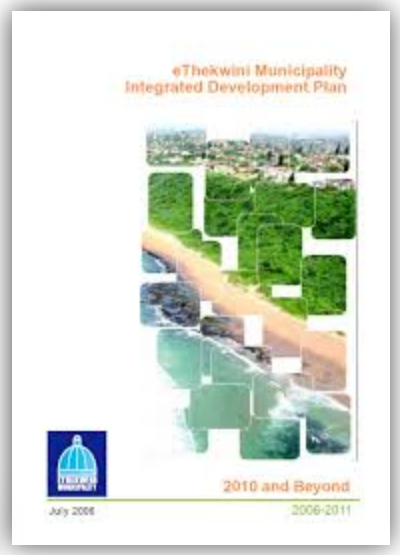

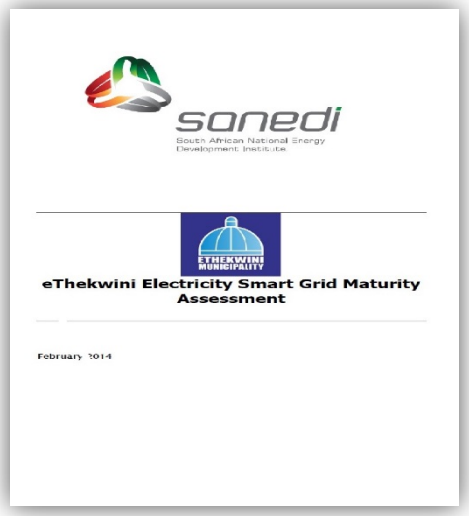

Vision Statement:

"Provider of a resilient, self-reliant, reliable and sustainable grid, enabling seamless access to customer and grid information."

Provider – as an integral agent of service delivery, the utility is called to serve

Resilient – a grid that is able to withstand or recover quickly from network failures as well as disasters

Self-reliant – a grid that requires no human intervention but is able to seamlessly detect and automatically restore itself

Reliable – performing admirably without any interruption

Sustainable – economically and environmentally viable without compromising quality

Seamless – convenient and ease of access

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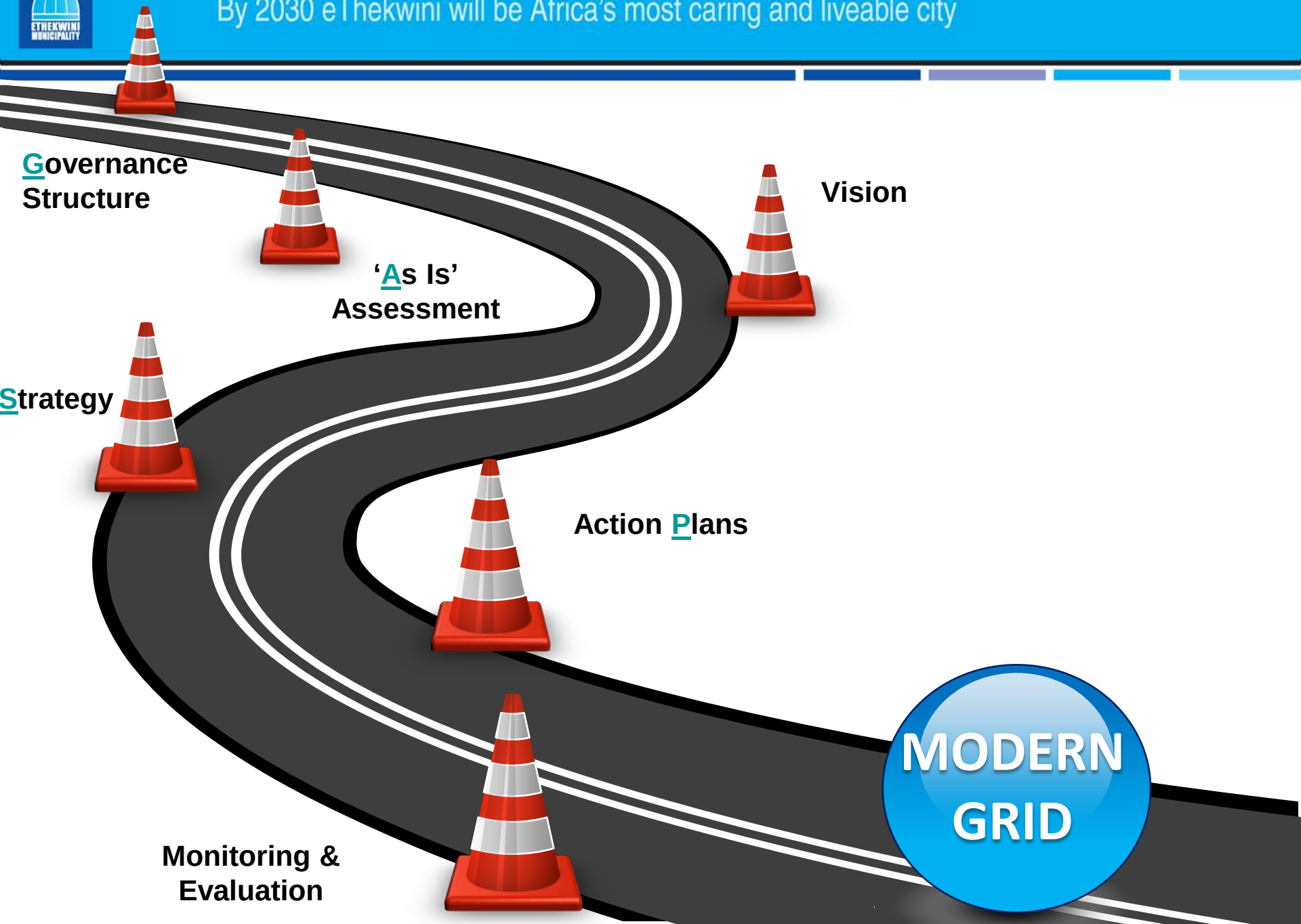

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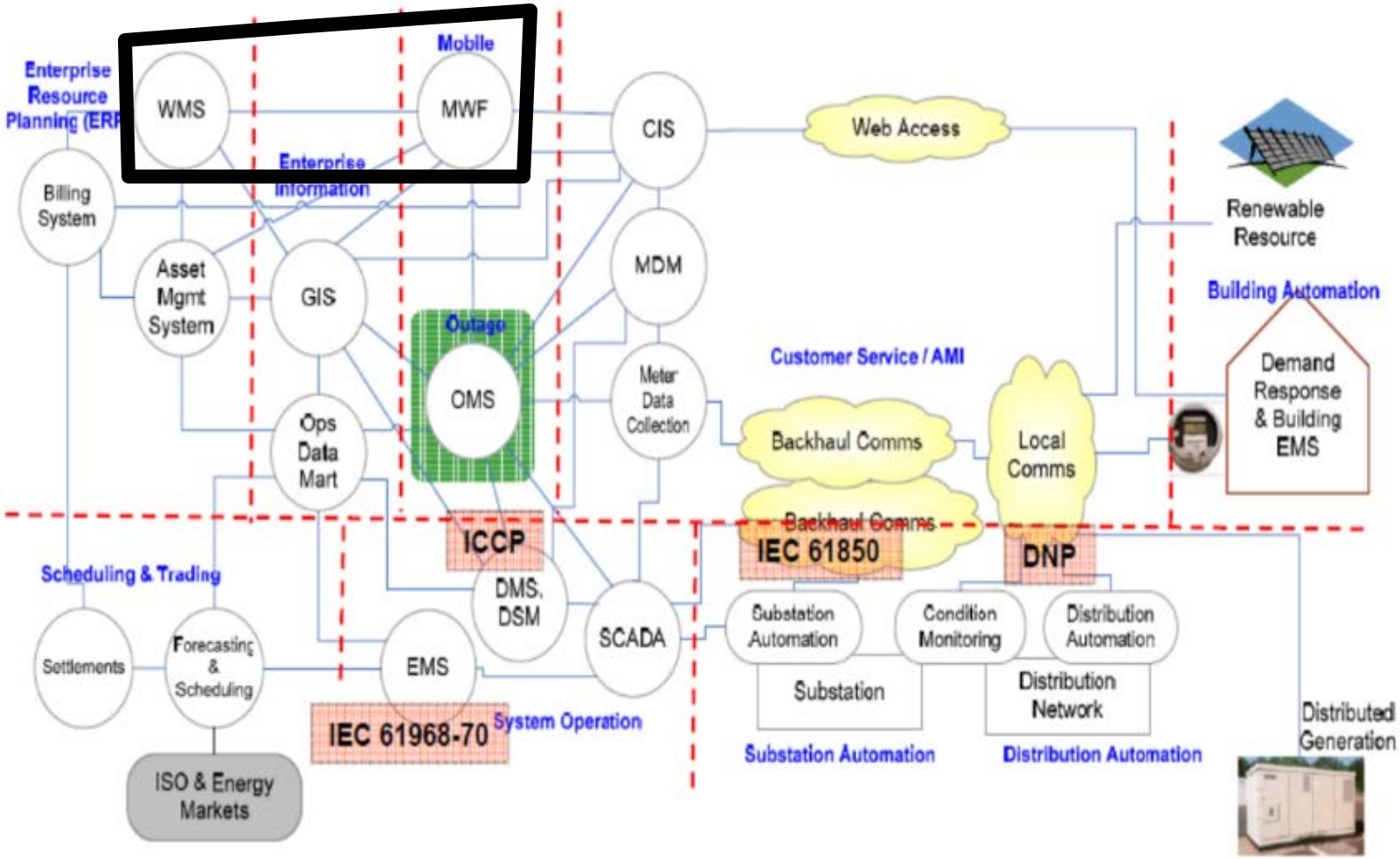
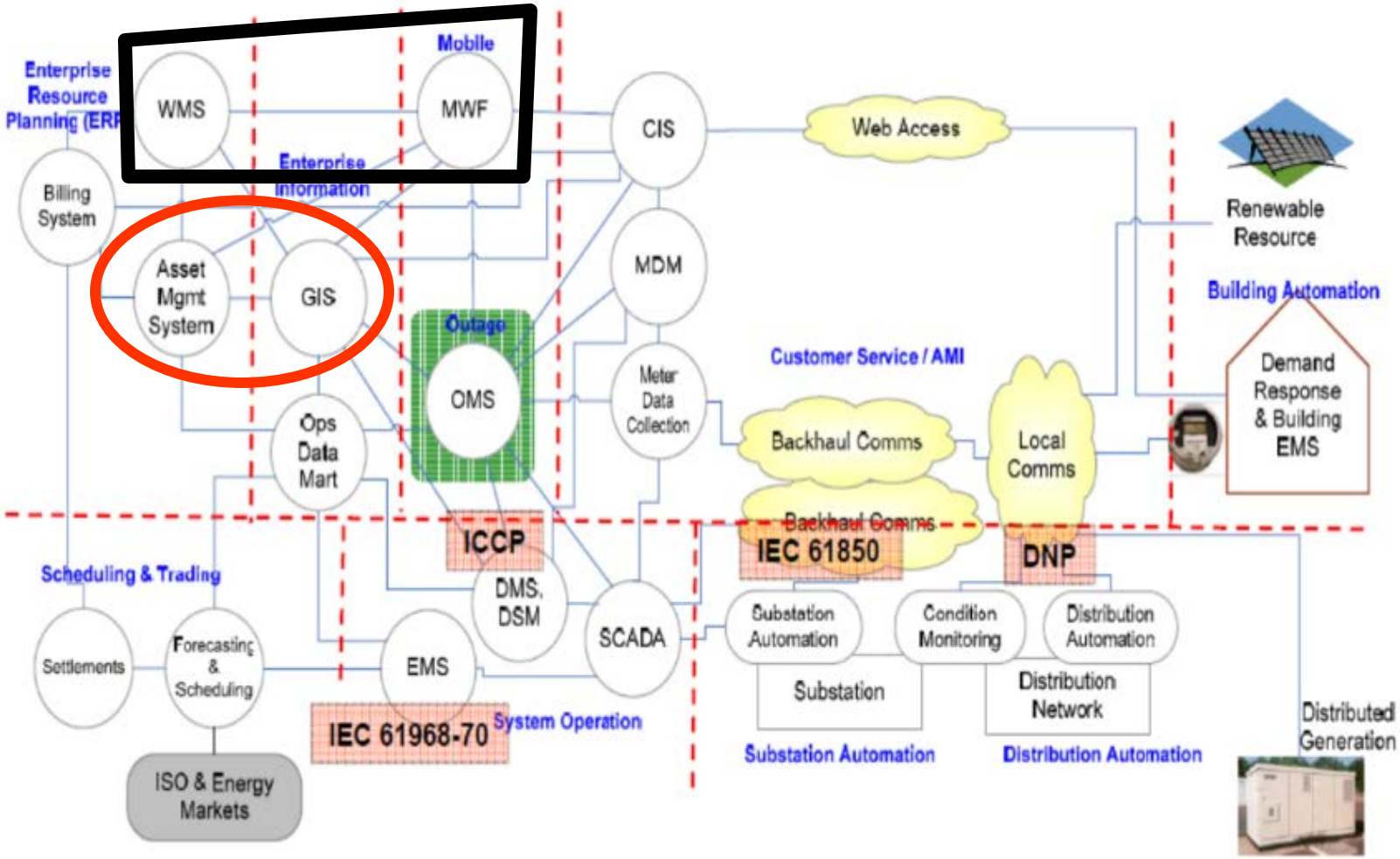


KEMA

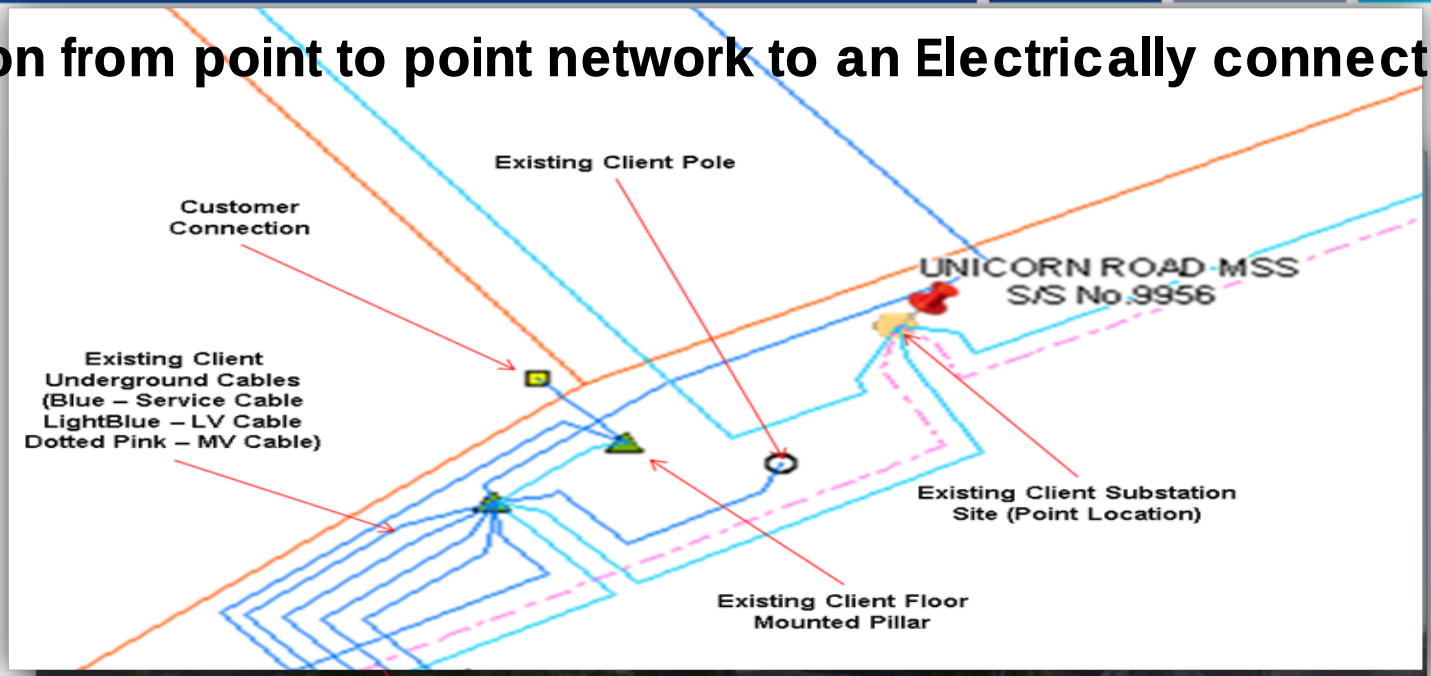
EAM Solution

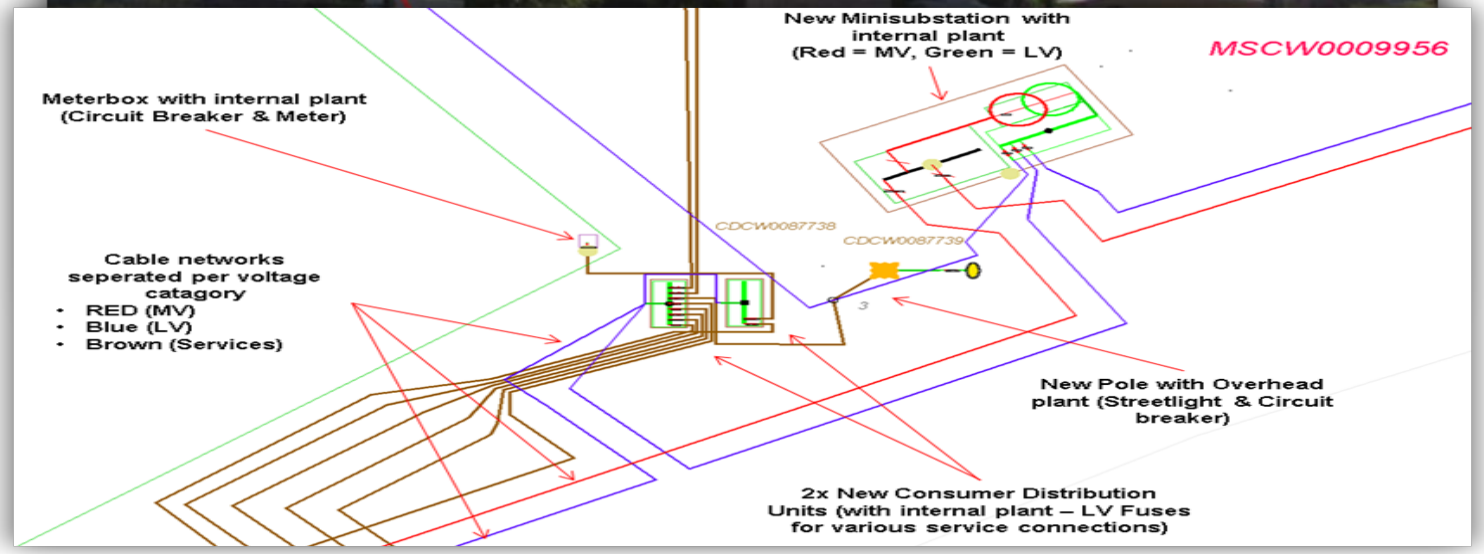
Integration Platform	Integration Platform Services
	Integration Platform Foundation


Enterprise Resource Planning (ERP
WMS
Mobile
MWF
CIS
Web Access
Billing System
Enterprise Information
Asset Mgmt System
GIS
MDM
Renewable Resource
Building Automation
Outage
OMS
Meter Data Collection
Customer Service / AMI
Demand Response & Building EMS
Ops Data Mart
Backhaul Comms
Local Comms
Backhaul Comms
ICCP
IEC 61850
DNP
Scheduling & Trading
DMS, DSM
SCADA
Substation Automation
Condition Monitoring
Distribution Automation
Settlements
Forecasting & Scheduling
EMS
Substation
Distribution Network
Distributed Generation
IEC 61968-70
System Operation
Substation Automation
Distribution Automation
ISO & Energy Markets

KEMA

Transition from point to point network to an Electrically connected network





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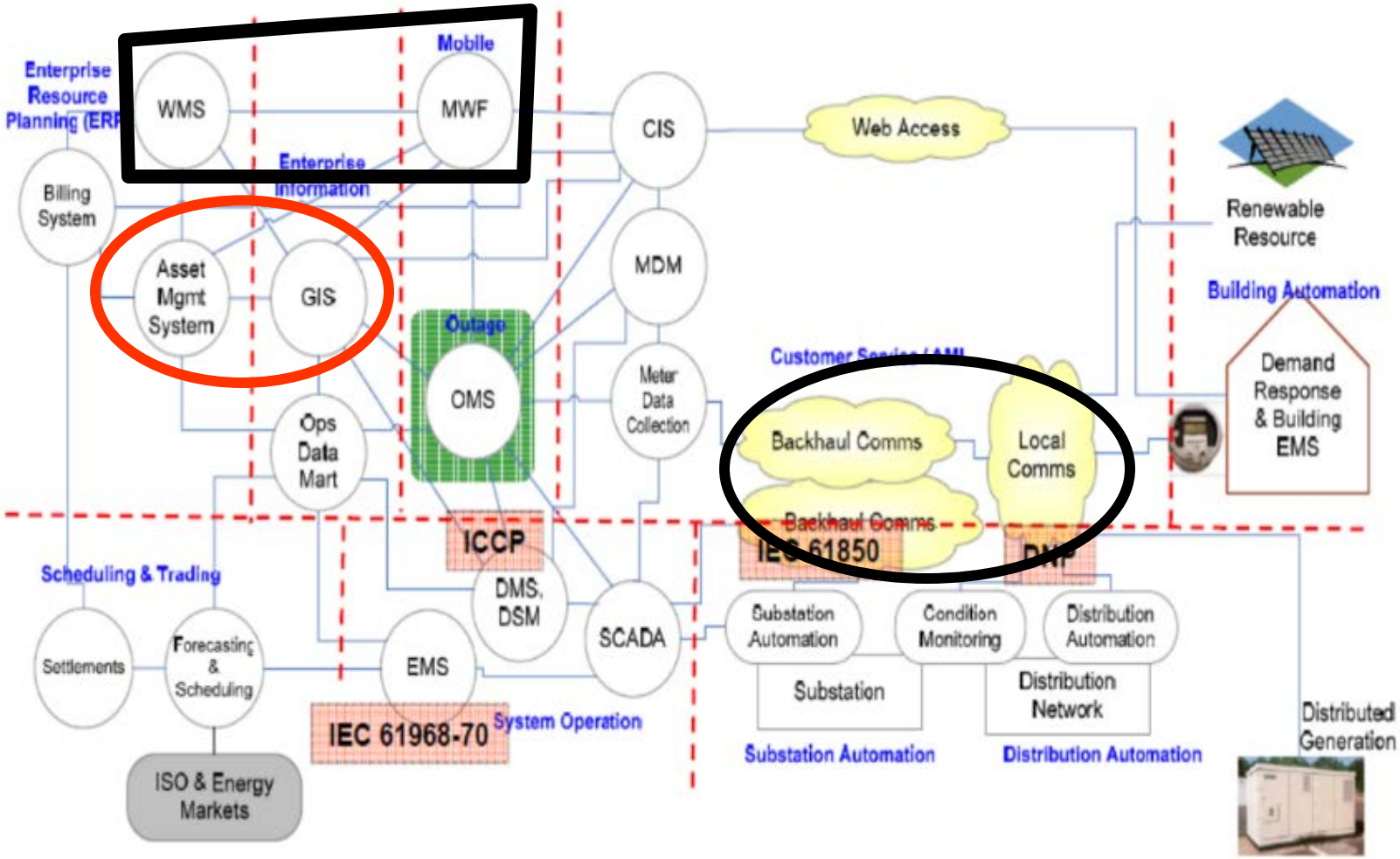
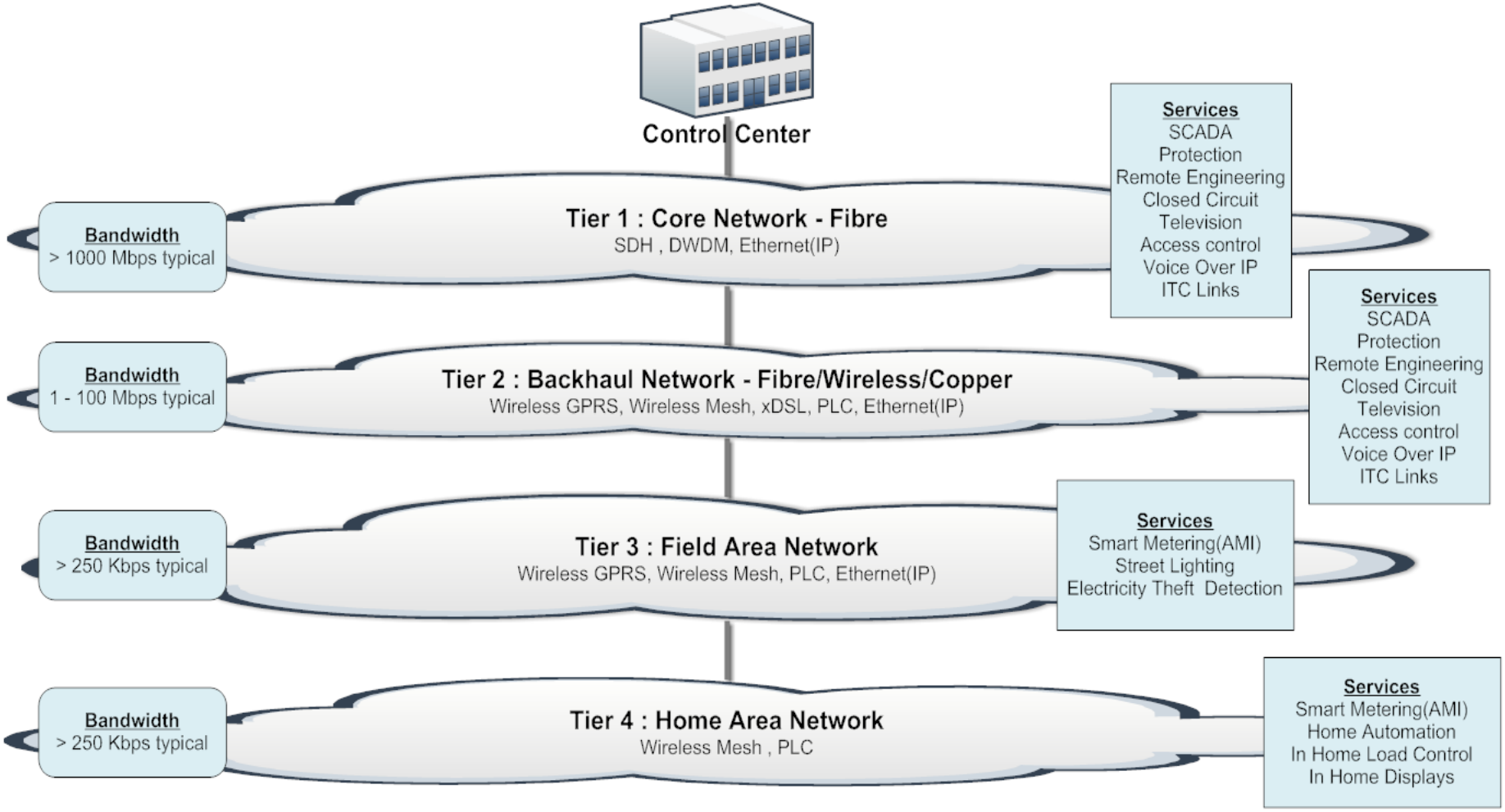


Communication Networks Strategy

Private, Integrated, Multi-tier, Hierarchical communication network



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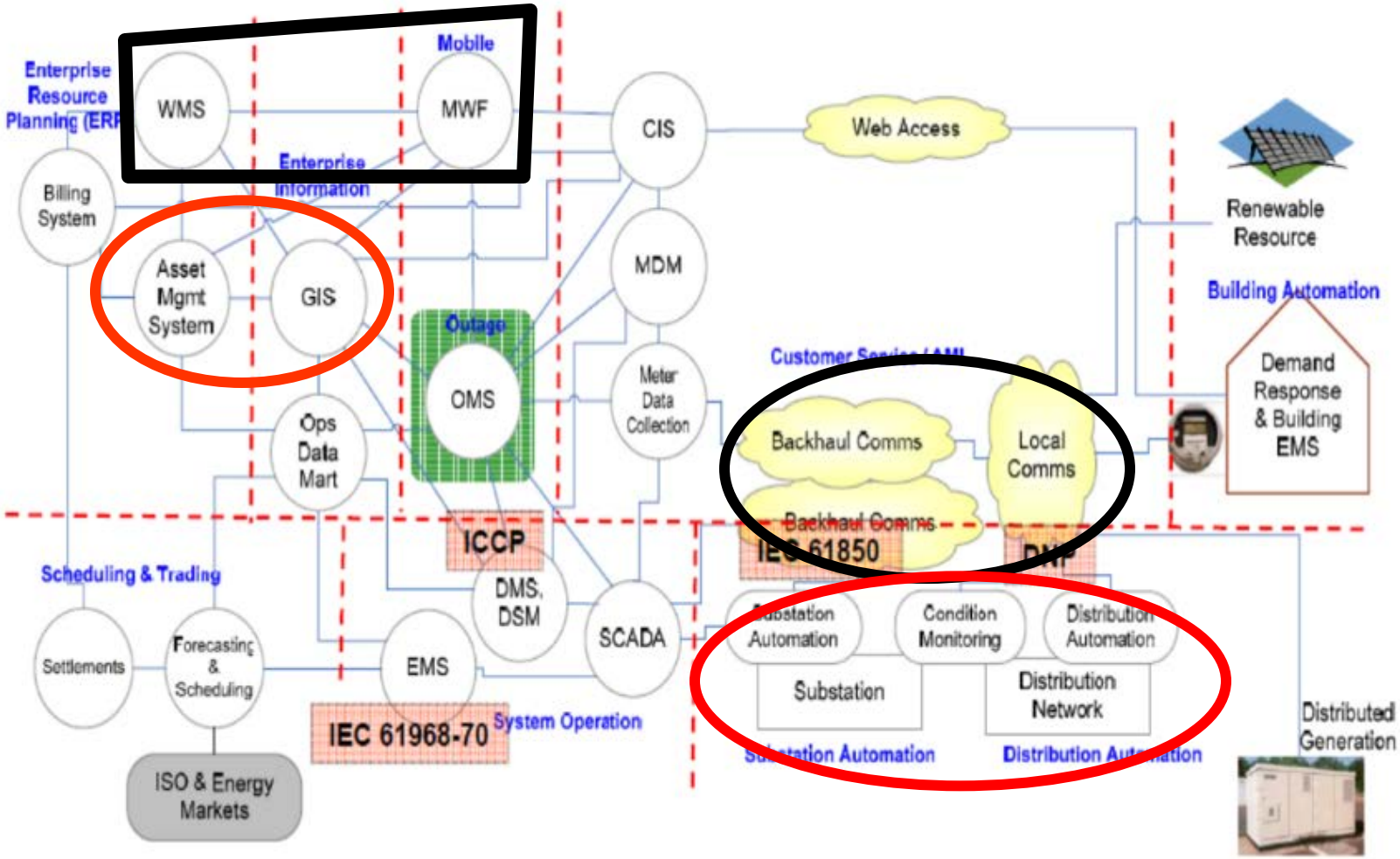
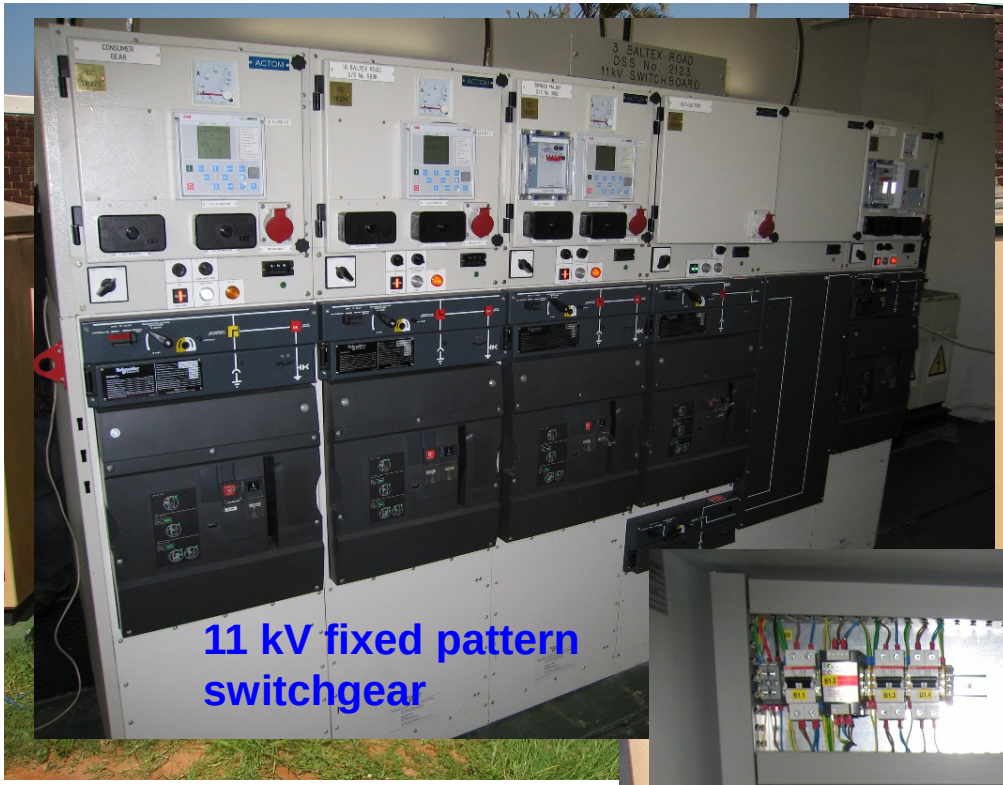
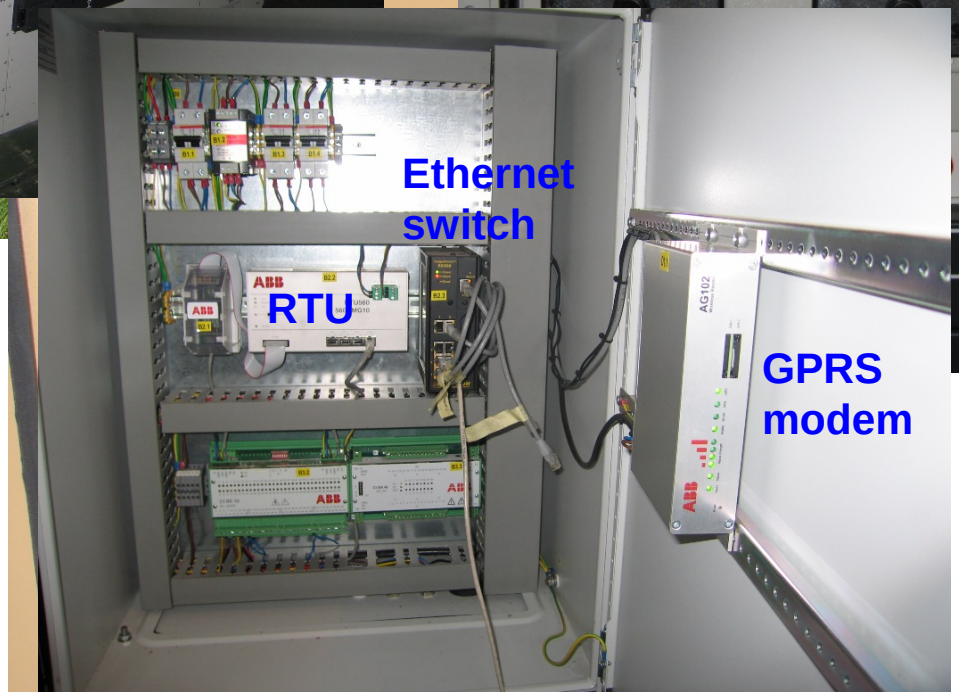
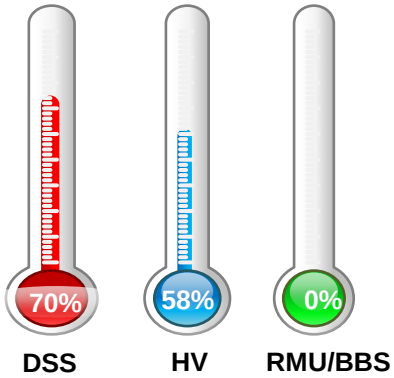



3 BALTEX ROAD
DSS No. 2123
11kV SWITCHBOARD
ACTOM
11 kV fixed pattern switchgear

COATES BROS
DSS No. 2707
ACTOM
WoodBeam
10.14.209.13
IEC 61850 relay


Ethernet switch
ABB
RTU
AG102
GPRS modem


70%
58%
0%
DSS
HV
RMU/BBS

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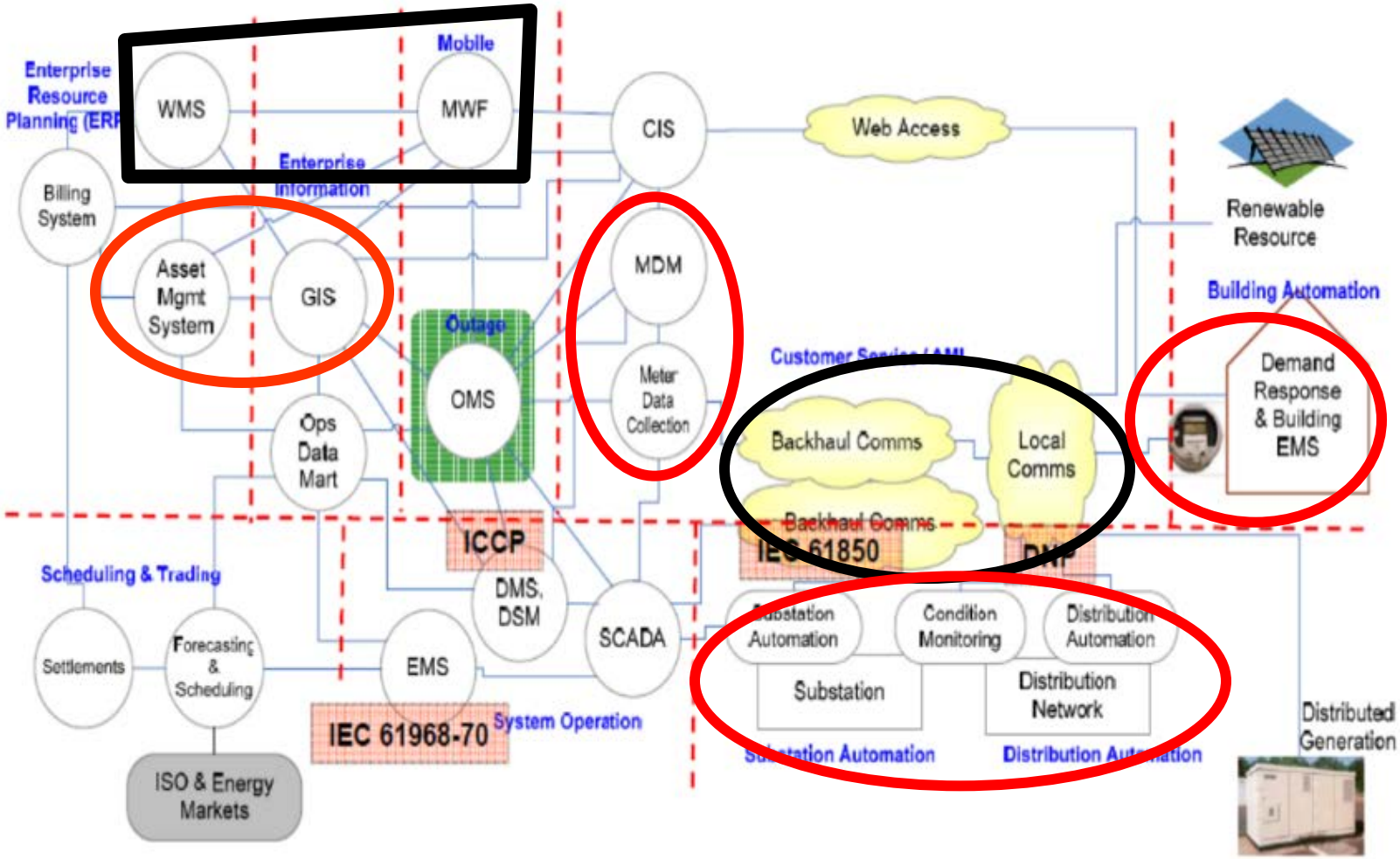

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Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug

Manage Programme

PMO

Establish the PMO

Develop Business Case

Develop Roll-out Strategy

RFP Mgt

Issue Smart Meter Back-end RFP (MDMS with MVMS)

Issue Smart Meter RFP approx. 5000 metering end points

Evaluate and Select MDMS with MVMS Supplier

Evaluate and Select Meter Supplier

Mobilize MDMS with MVMS Supplier Resources

Order approx. 5000 metering end points

Deploy and Test 50-500 meters

Change Mgt

Journey Management (Internal and External)

Develop Communication & Change Management Plan

Organisational Re-design

Design New Process Training Materials

Plan training delivery

Execute Training for New Processes

Process Changes

"As-is" Business Processes

"To-Be" Business Processes

AMI use case documents

Systems Integration

Assess As-is Systems Architecture

Design System Architecture (Solution conceptual Design)

Design System Architecture (Solution Technical Design)

Setup environments (Test/Dev/Train/Prod)

Design Test Plan and Approach

Implement eTE System Development

Test eTE System Development

System Integration Testing

Support eTE System Dev

Implement new Back-End Systems (MDMS with MVMS)

Customer Engagement & Marketing

Customer Engagement Plan

Design Marketing Materials

Execute Customer Engagement

Execute Training for New Processes

Implement Process Changes – Customer Services

Field Deployment

Select Suitable Sites for Implementation

Perform Field Readiness Inspection

Execute Field Readiness (data cleansing, field audits kiosk refurbishment, installation of new kiosks)

Install Communications

Deploy approx. 5000 Meters

In-Home Technologies | Communications | Smart Meters | Back Office | Customer Interface

- AMI Back processes and technologies
- System Processes and technologies
- Service Management processes and technologies

Security and Systems Management

- Customer Interface Unit (CIU) and load control devices at the customer premise

Local Area Network (LAN) – Field network providing comms from meter to WAN access point

- Wide Area Network (WAN) – used for backhaul of data to Back Office

Smart meters AMI Master Station Systems

- Meter Data Management systems

- Integrated Voice Response
- Operations Centre

- Set of Enterprise Services

1 | 2 | 3 | 5 | 7

Integration

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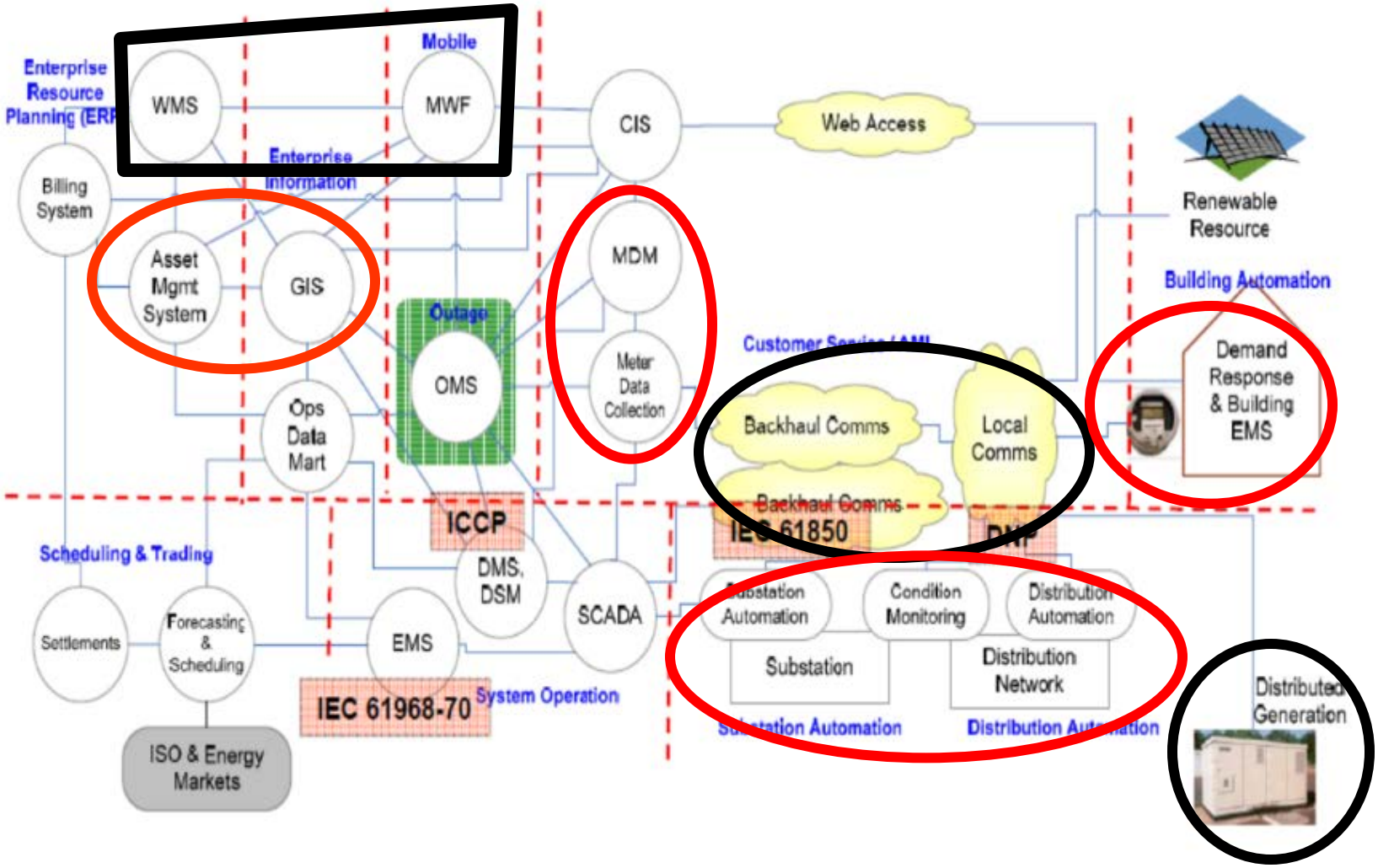


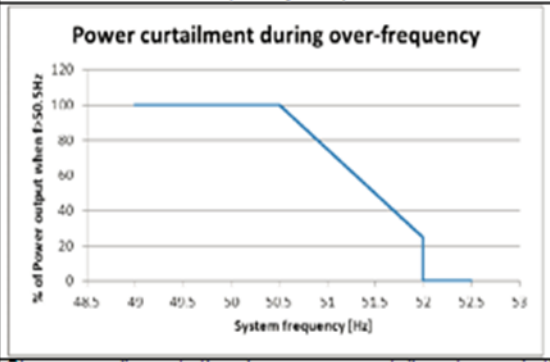
KEMA

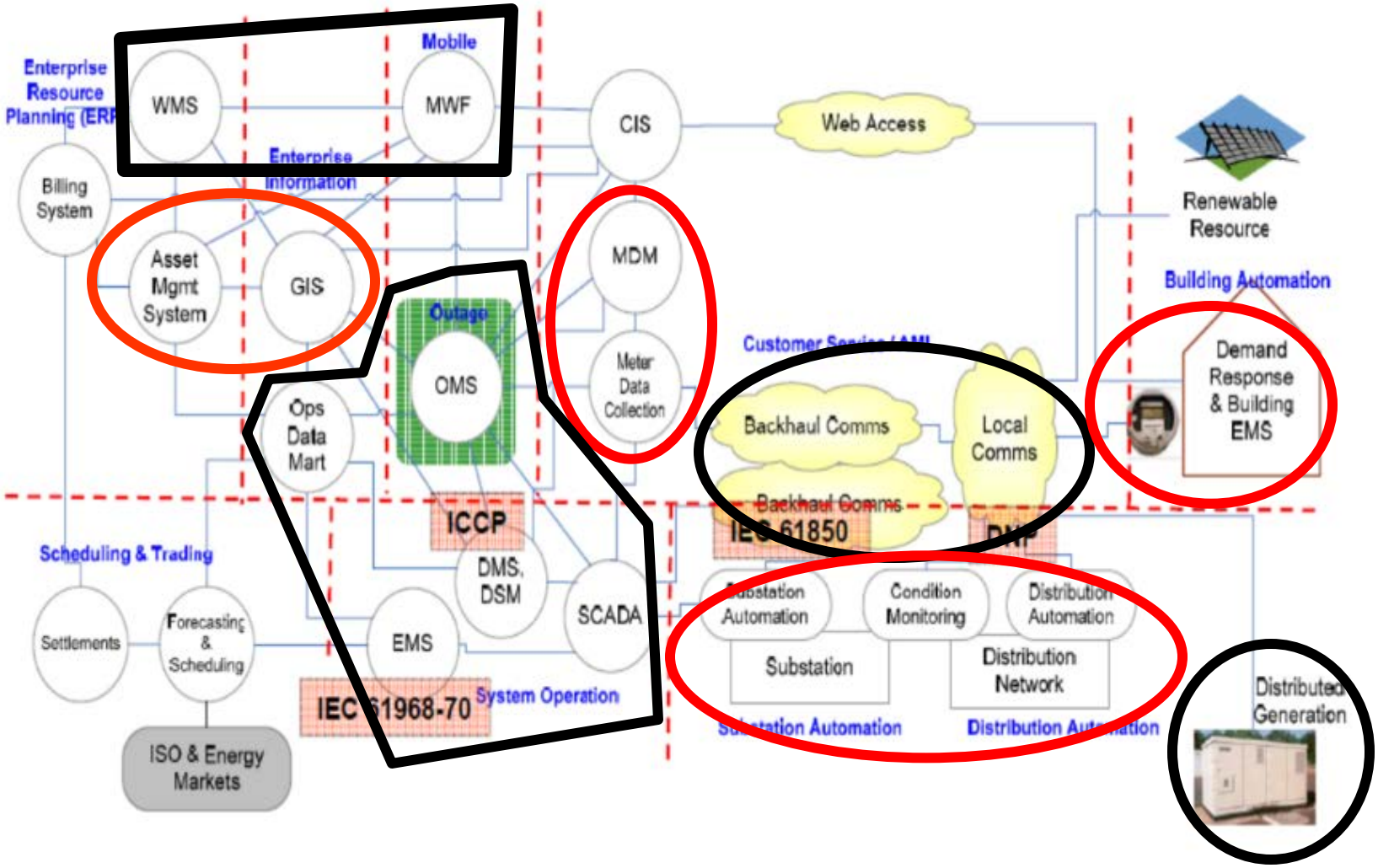
1	**Lack of policy to integrate to current business**
2	Lack of Specialised skills and dedicated resources
3	Lack of knowledge of generation tariffs
4	Buy in from internal staff
5	Contractual and legal obligations
6	Revenue protection for municipalities
7	Incorporate in to By Laws
8	Response to customer queries
9	Meter Installations/reading/billing
10	**Impacts to the existing distribution network design and performance**
11	Reporting requirements to Regulator
12	Safety Standards
13	Technical Standards

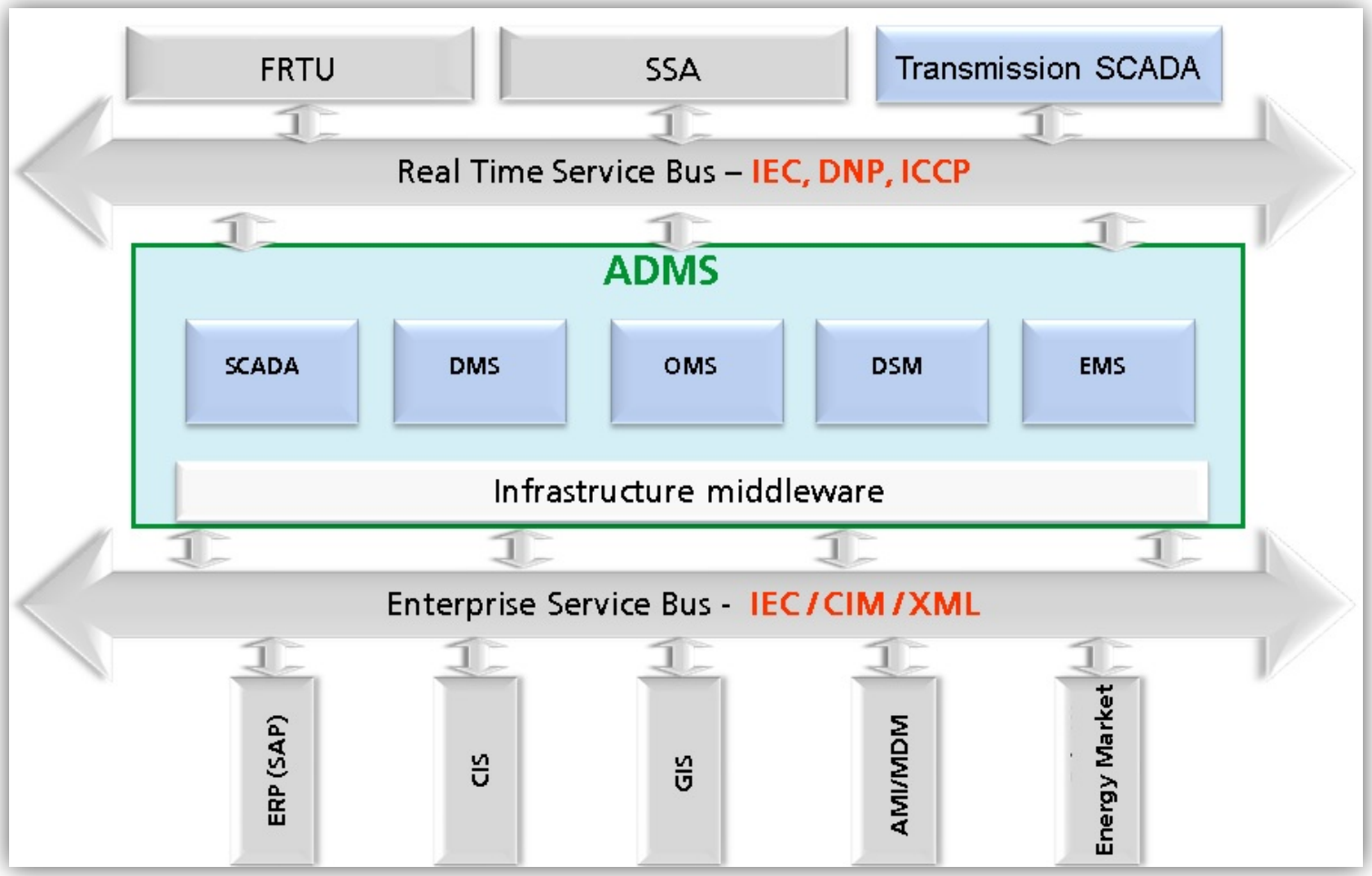
Grid Code Compliance Criteria for Category A1 RPP

Energy/Fuel Source for Embedded Generation:	PV	Wind	Fuel Cell	Bio mass	Other (specify)
Installed Capacity					
Existing Supply Capacity					
NOTE: RPP greater than 4.6 kVA must be balanced three phase					

No.	Criteria		Comply Yes/NO
1	Capable of operating within the voltage range of -15% to +10%		
	Disconnection criteria		
2	RPP shall disconnect if network frequency is higher than 52 Hz for longer then 4s		
3	RPP shall disconnect if network frequency is lower than 47 Hz for longer then 200ms		
4	RPP shall remain connected to the grid during rate of change of frequency up to and including 1.5 Hz per second		
	Reconnection criteria		
5	The voltage at the POC is in the range of -15% to 10% of Vnorminal		
6	The frequency is within the range of 49 Hz to 50.2 Hz		
	Maximum Disconnection times		
7	***Voltage Range (at POC)***	***Maximum Trip Time (Seconds)***	
	V > 50%	0.2	
	50% ≤ V ≥ 85%	2	
	85% ≤ V ≥ 110%	Continuous Operation	
	110% ≤ V ≥ 120%	2	
	120% ≤ V	0.16	

	Power Frequency Response Curve	
8		
	Show compliance to the above power curtailment curve in the RPP specification sheet	
10	The RPP is capable of supplying rated power (MW) for power factors ranging between -0.95 to +0.95 measured at the POC	
11	The Power Factor shall be set at Unity unless otherwise specified	
12	The RPP is dimensioned and equipped with the necessary protection function so that the RPP is protected against damage due to fault and incidents on the network	
13	The RPP shall be equipped with effective detection of islanding operation in all systems configurations and capability to shut down generation of power in such condition within 0.2 seconds. Islanding operation with part of the grid is not permitted	


Enterprise Resource Planning (ERP
WMS
Mobile
MWF
CIS
Web Access
Billing System
Enterprise Information
Asset Mgmt System
GIS
MDM
Renewable Resource
Building Automation
Outage
OMS
Meter Data Collection
Customer Service / AMI
Demand Response & Building EMS
Ops Data Mart
Backhaul Comms
Local Comms
Backhaul Comms
ICCP
IEC 61850
DNP
Scheduling & Trading
DMS, DSM
SCADA
Substation Automation
Condition Monitoring
Distribution Automation
Settlements
Forecasting & Scheduling
EMS
Substation
Distribution Network
IEC 61968-70
System Operation
Substation Automation
Distribution Automation
Distributed Generation
ISO & Energy Markets



Source: ADMS Smart Grid Solution for Electricity Distribution Networks

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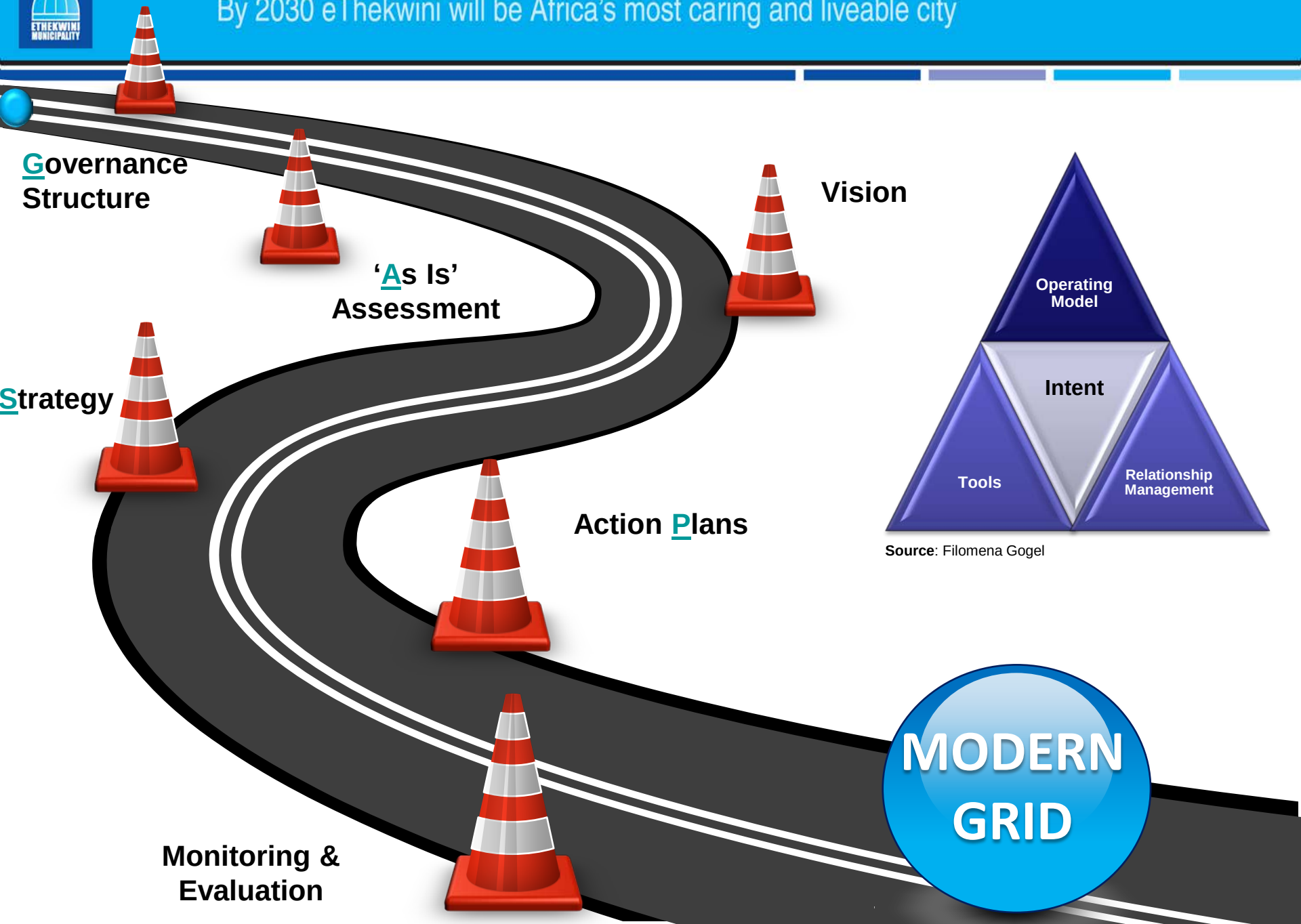

Source: Filomena Gogel

Thank You

Siyabonga

Dankie !!!