AEDU Namibia Conference
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“Building a resilient and harmonized distribution industry through innovation and technology”

Presented by :
Vehonga Ndura – CENORED
Jochen Roeber – PCE

Power Factor Correction on CENORED MV Networks

STUDY AND ASSESSMENT

Overview Presentation Discussion and Overview

- Project Background – DRIVE & NEED
- Theory and Modelling
- NETWORK AREA and SELECTED MV Retics
- Network Assessment
- PERFORMANCE / Improvement References
- Modelling of Networks / Protection
- Results and Assessment
- Financial Overview
- Conclusion

Project NEED

The key drivers are the

economic aspect, to **reduce the overall DEMAND charge**, which is excessive due to very poor Power factors- in the region of 0.5 for certain retics.

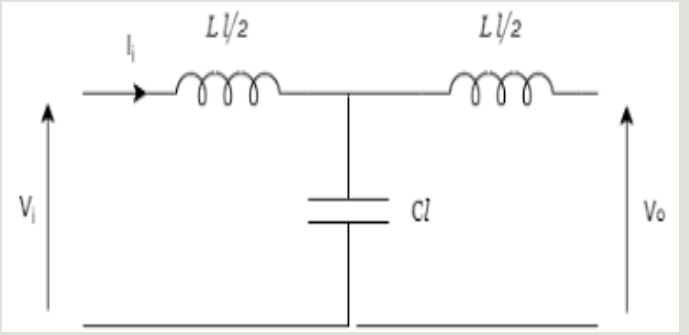
Additional some energy / losses charges can be avoided.

Several shunt installations are non-operational and need to be identified, causes of failure understood and be re-activated.

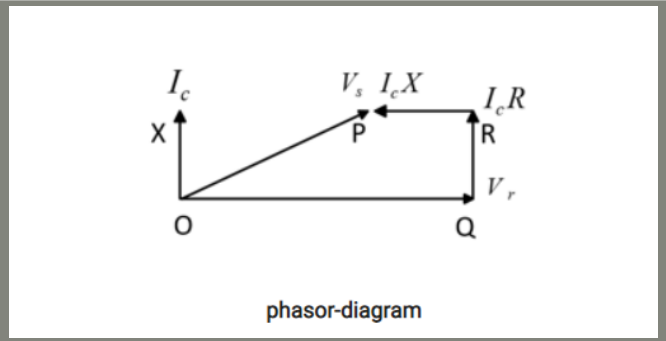
Ferranti (Line Charging) Effect .. …. Where's the problem?

"For long *MAINLY* TX / but also DX (Transmission and Distribution) Lines the receiving end voltage is greater than the sending end voltage during **light load** or no-load operation - Under No-load or light load condition, **the capacitance associated with the line generate more reactive power than the reactive power which is absorbed**, hence Vr > Vs. This effect is known as Ferranti effect"
Further, high LINE CHARGING becomes excessive for longer distances >300-500km. Higher Voltages (33kV) Distribution Lines are affected for CENORED's System.

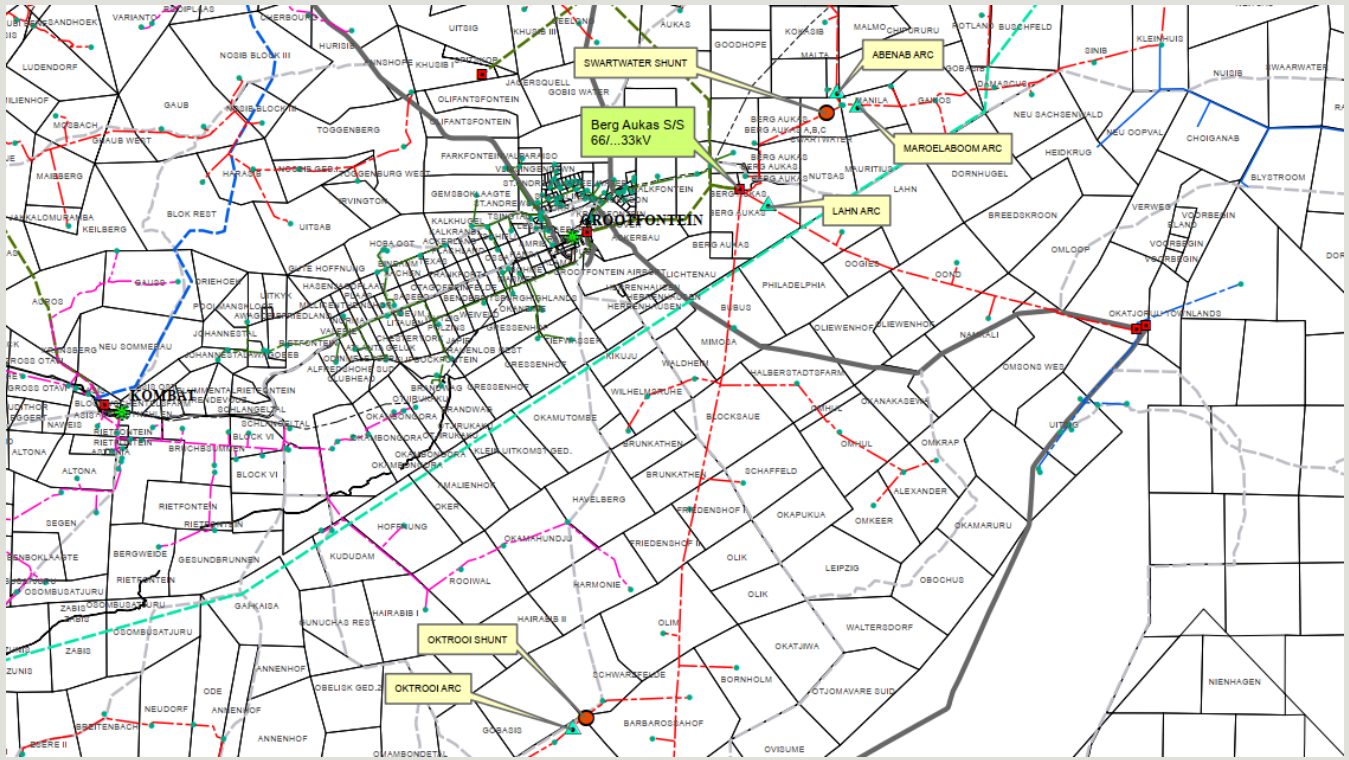
Impact of Voltage, relate to Q = **V^2** / X i.e. Xc = V^2 / Q,
hence to focus on CENORED Distribution systems at 33kV only



Theory and Modelling



	Retic	VOLTAGE	Distance	Column1
1	TSCHUDI	33kV	387	km
2	PLATVELD	33kV	459.5	km
3 & 4	KAMAJAB	33kV	277.6	km
5&6	MT Etjo and Okamatapati	33kV	405	km
7	BERG AUKAS	33kV	222	km
8	Khorixas Palmwag	33kV	335.966	km
9	Ombika Halali	22kV	86	km
10	KOMBAT VALLEY22kV	22kV	227	km
			2400.066	km



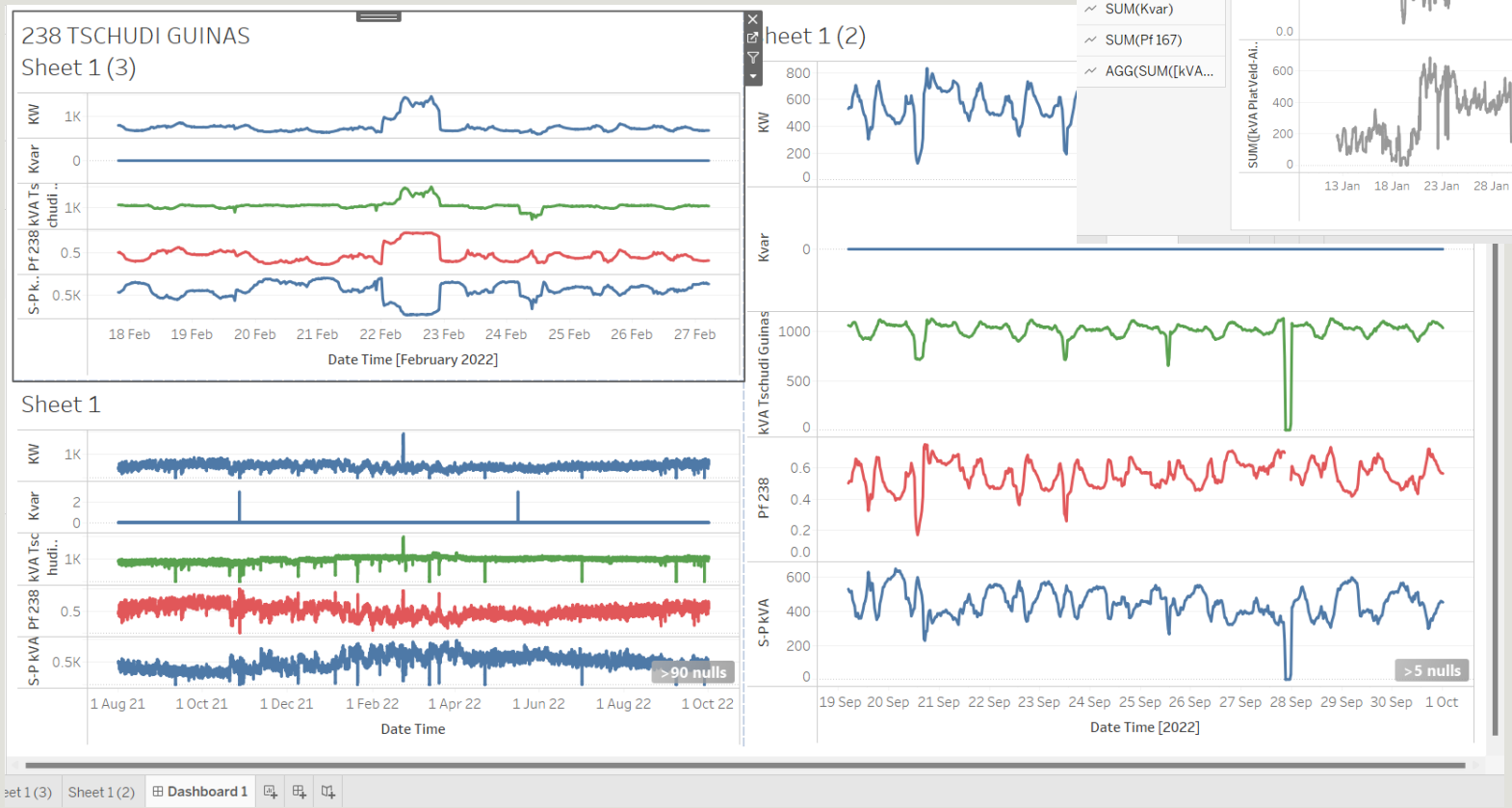
- Operating Drawings references
- LOAD PROFILES from Model Data
- PROTECTION SETTINGS / SIMULATION DATA INPUT

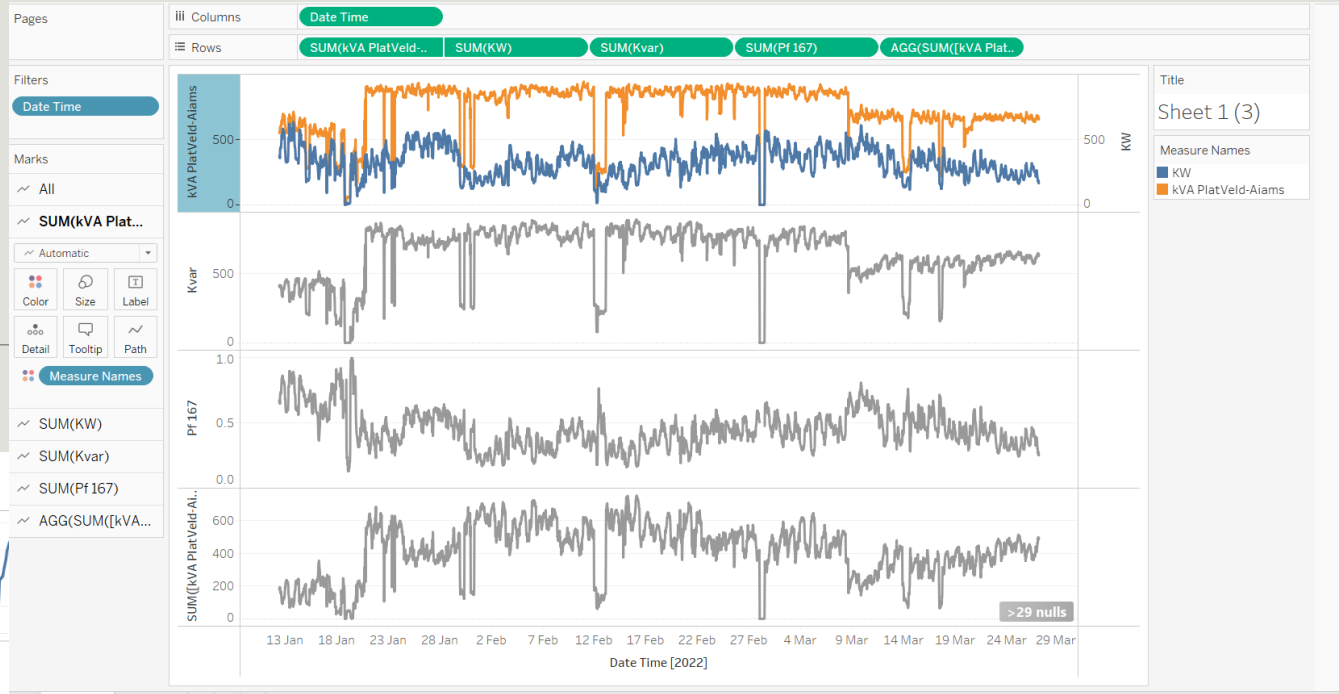
NETWORK AREA and SELECTED MV Retics – DATA INPUT

Network Assessment

LOAD PROFILE ASSESSED FROM PROFILE

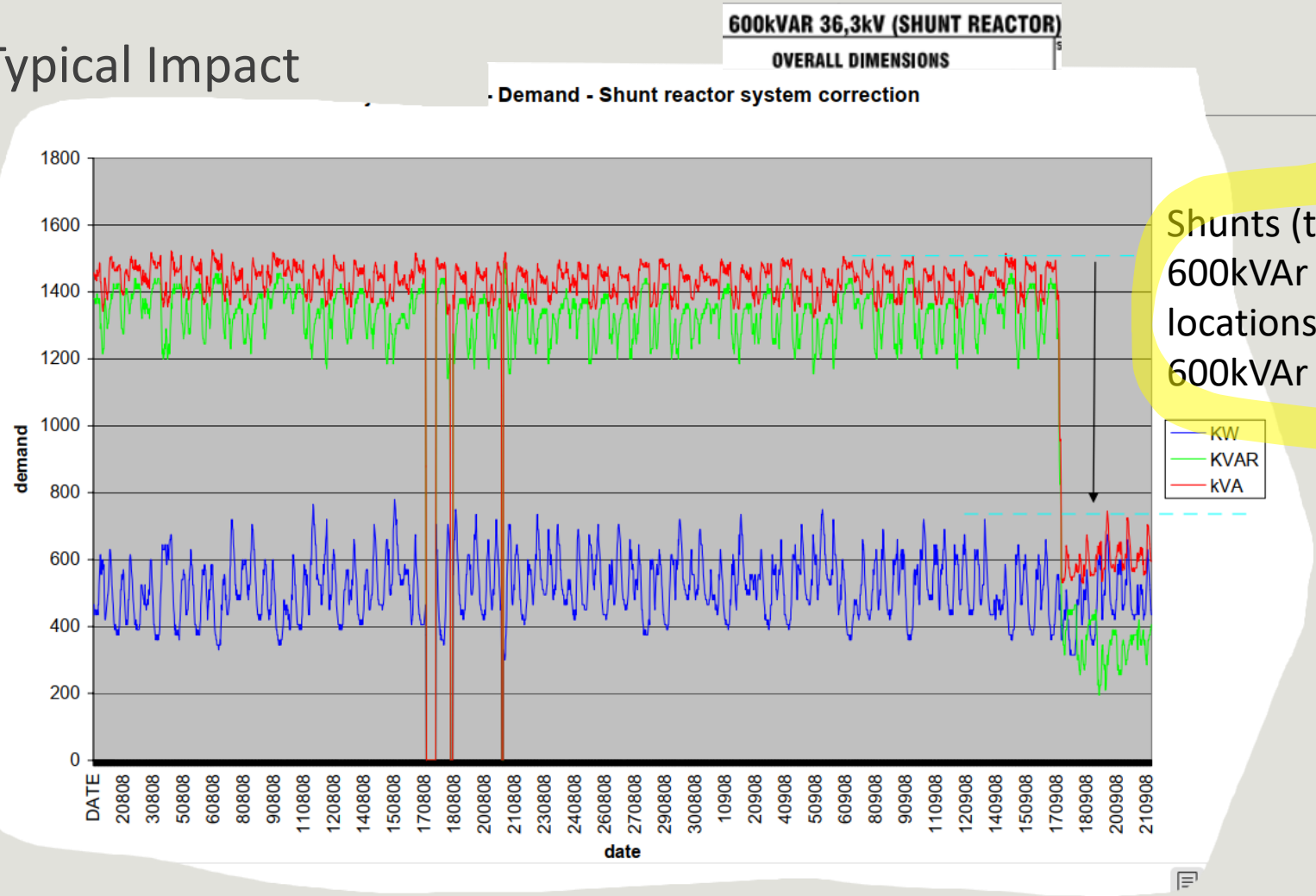
DATA - PERFORMANCE INDICATORS



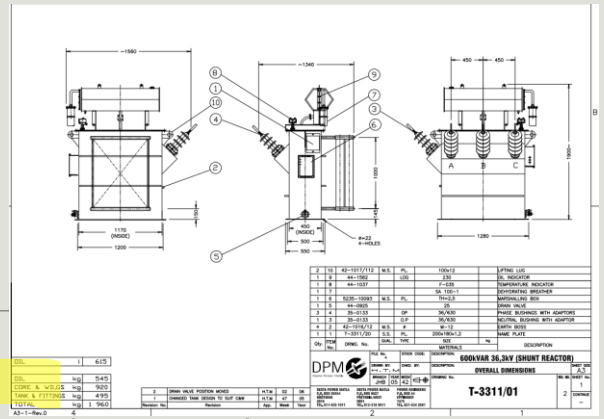


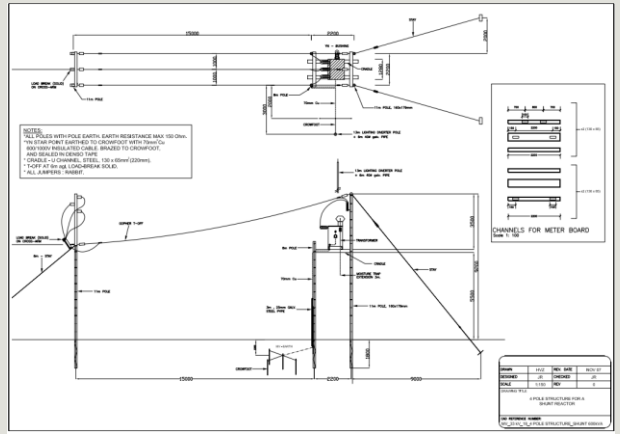
PERFORMANCE / Improvement References – WHAT & HOW?

Typical Impact



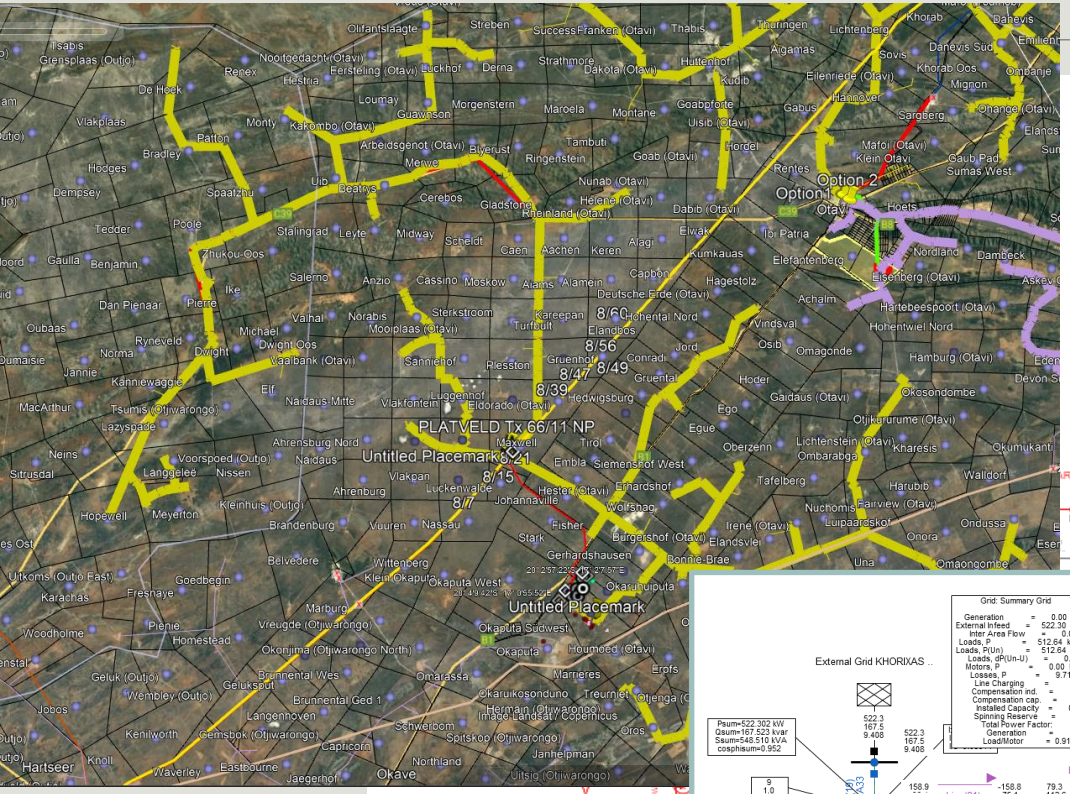
Shunts (typically sized 300kVAR and 600kVAr are installed at optimal locations – enclosed the impact of 2x 600kVAr Shunts, designed for 36kV

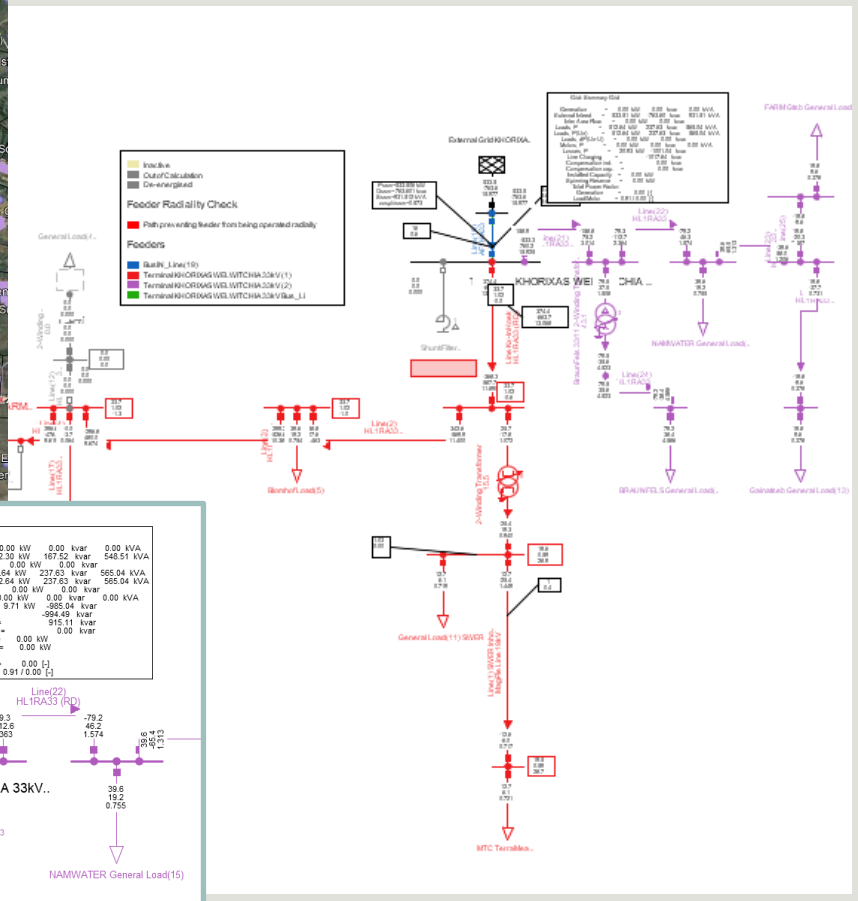


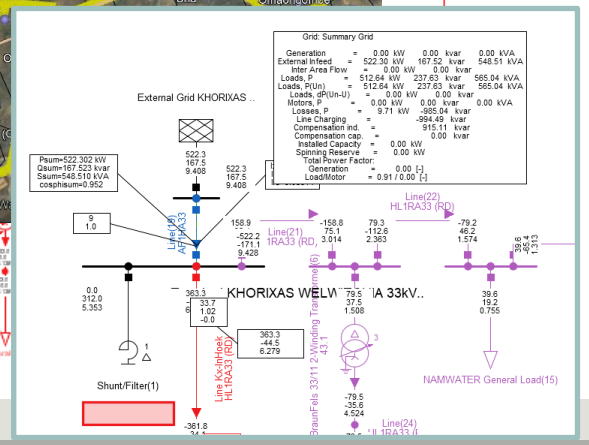


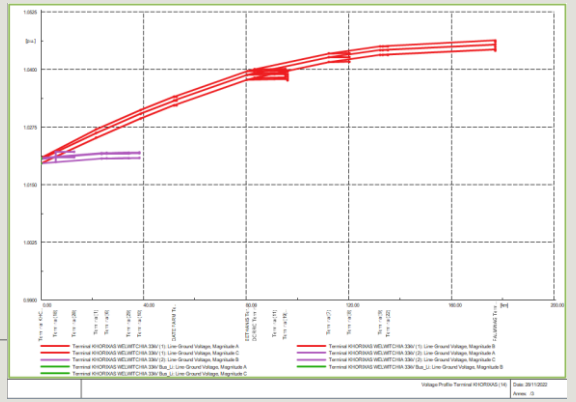
Modelling of Networks – Profile, P.Q.S – Load Scaling SHUNT placement

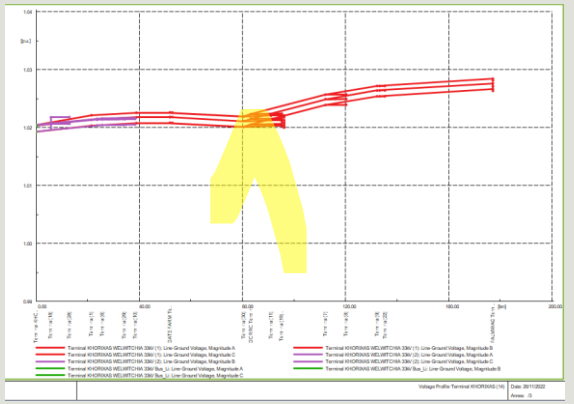
Shunt placement modeled – Retic WITHOUT, WITH at 50% and END of LINE –
Conclude – not extremely critical – select for best access and operation (preferred > 50%)

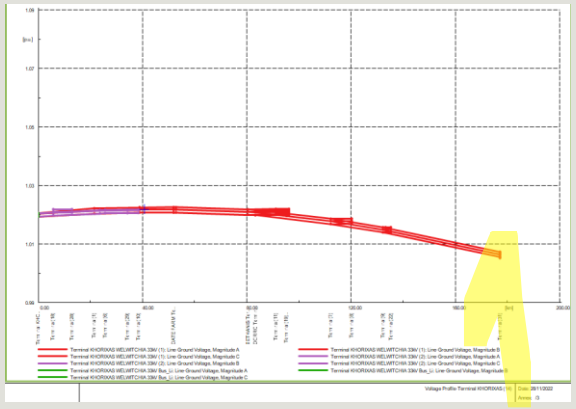




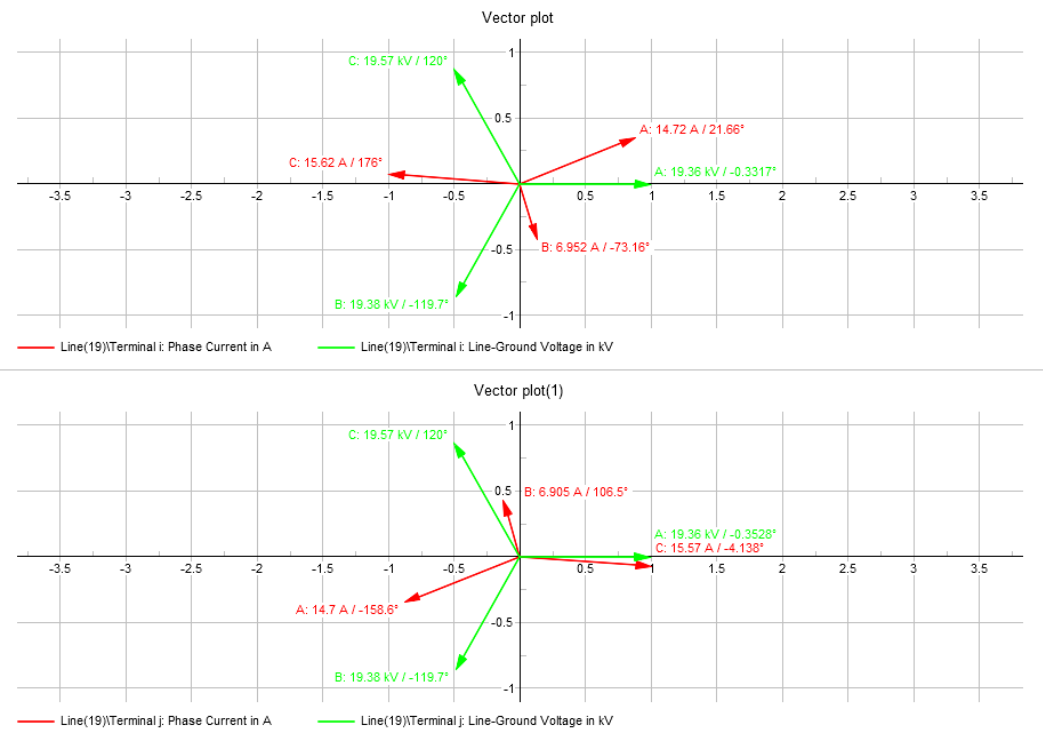




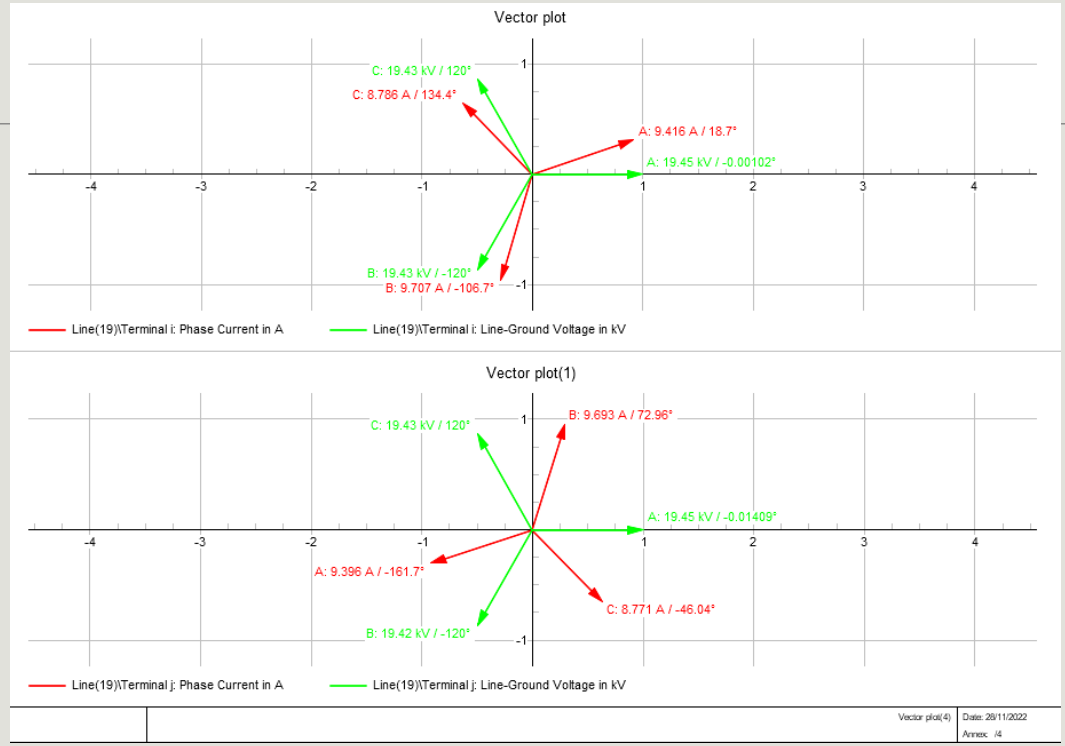




Modelling of Networks – Operational issue considered



Imbalance 6A / 14A / 15A

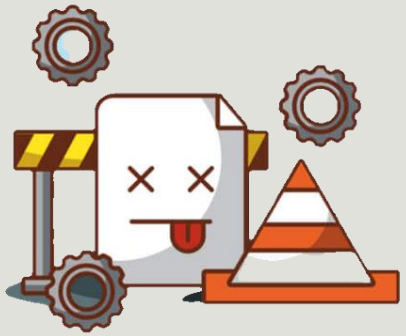


NORMAL OPERATION

If a shunt phase fails … significant imbalance can trip the protection

FINANCIAL ASSESSMENT AND FIXES

2_174 Kamanjab - Anker	no shunt - ADD 1 Shunt	N$	258,048.00
3_238 Tschudi - Guinas	no shunt - ADD 4 Shunts	N$	875,520.00
4_167 Platveld – Aims	AS PER OD 5 SHUNTS Installed- CHECK- FIX- REPAIR-RECOMMISSION defective	N$	642,240.00
5_179 Omatako Base – Mt Etjo	no shunts? ONE INSTALLED_ ADD 1.	N$	316,800.00



N$ 2 Million SAVING – per annum

SUMMARYACTION

1. CENORED implements stringent measures to ensure that ALL **shunts** are **operational**.
2. CENORED will further **interrogate** the **data** retrieved from its meters (**pre month end / monthly**)- as this would allow the technicians and engineers to identify non-operational shunts – hence avoid future high (DEMAND) bills.
3. **accountability / system ownership among CENORED** electricians and technicians will be emphasized on – to ensure SHUNT OPERATION , FLAGGING (by QoS) –
4. All **protection Coordination** will be revised and assessed, to ensure shunts do not trip on single phasing / energizing / operation.
5. **ROLL-OUT / REVIEW of Shunt installations as required will be undertaken**.
6. **QoS Project** to automatically notify on Power Factor setpoint violation.

END

QUESTIONS