

one observatory
two telescopes
three continents

SKA Power Procurement Programme

MASUM 2022-05-10

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SKA Power Engineer

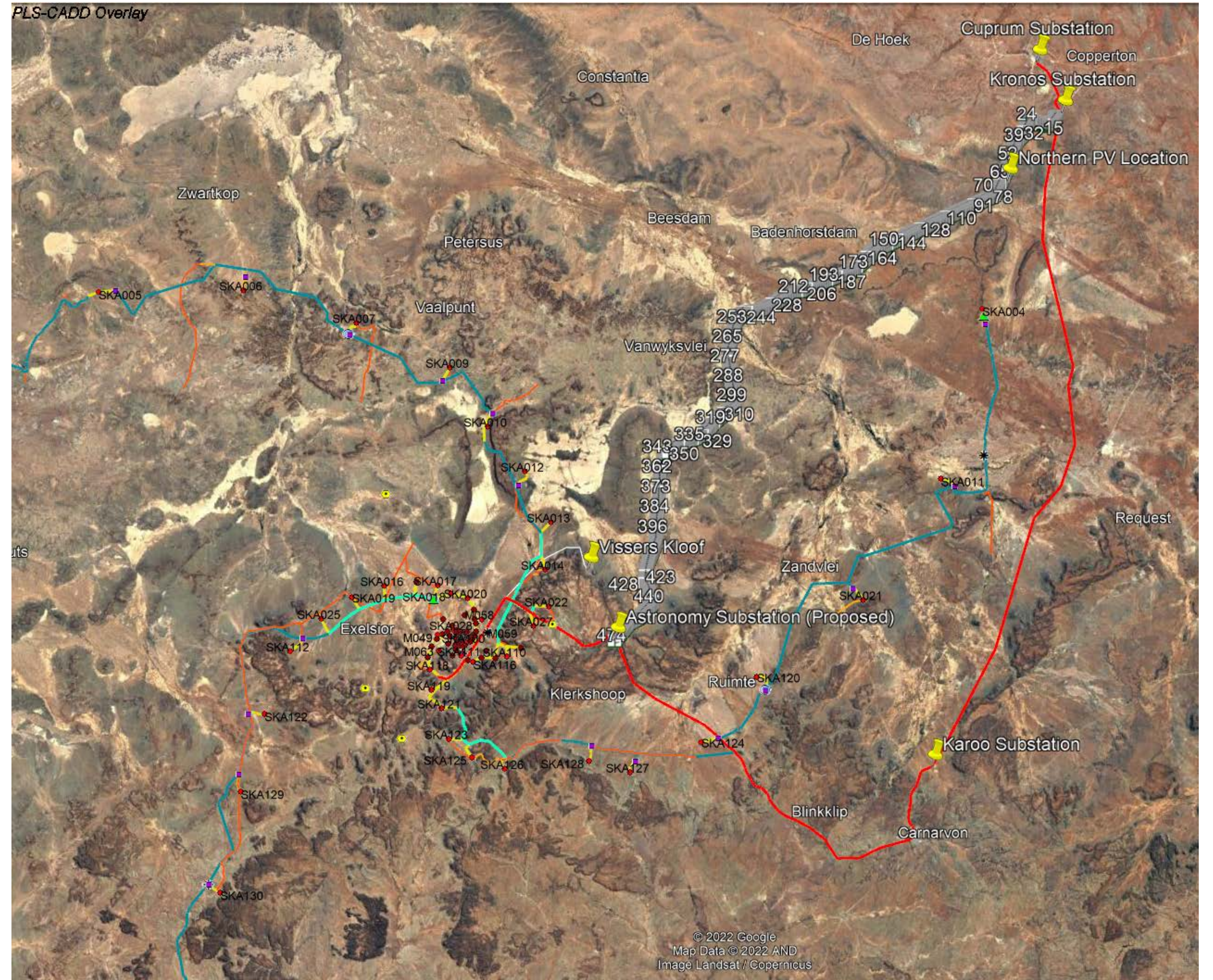


SKA Power Procurement Program (PPP)

- SKA Energy requirements are significant
 - ~13 MW total continuously (24/7/365 @ >95% availability)
 - > 98% of Observatory CO₂ emissions
 - Contracts worth Eur 100's of millions
- SKA-Low Murchison
 - 9 Remote stations: +/-25kW ea
 - Central Power Station (CPS): +/-3300kW
- SKA-Low Perth
 - SPC Requirements (Pawsey): +/-3000kW
- **SKA-Mid Karoo**
 - **21 Remote stations: 8 – 12 kW ea**
 - **New 132kV transmission line*: +/-3400kW**
- **SKA-Mid Cape Town**
 - **SPC Requirements + Ref Design (SARAO/iThemba): +/-3500kW**
 - **On-site PV (2200kW) + Battery + Backup Generators**



Power Locations



SKA Power Procurement Program (PPP)

- SKA Capital funding does not include power supply infrastructure!
- SKAO intends to issue tenders to Independent Power Producers (IPPS)
 - Enter into Power Purchase Agreements (PPAs)
 - Power stations and supporting infrastructure to be constructed, owned and operated by IPPs
- Electromagnetic Interference (EMI) is a major, major concern
 - Strictest EMC standards in the world
 - Overriding consideration for SKAO, but...
 - Something virtually no IPPs have experience with
 - Previous attempts to shift risk to IPPs failed completely



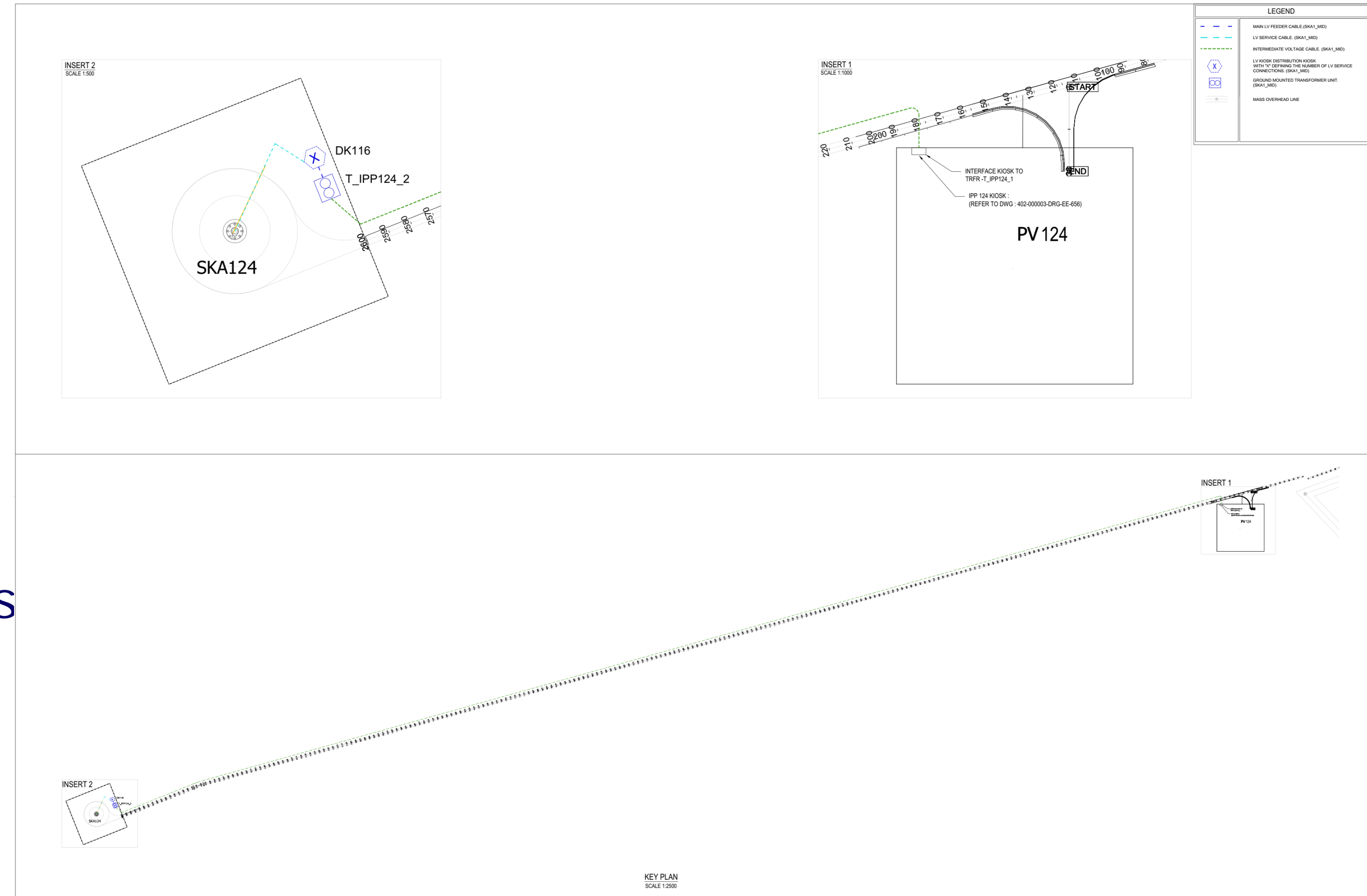
SKA Power Procurement Program (PPP)

- PPP adopted several risk mitigation strategies:
 - Multi-stage process: RfI (completed), RfP and RfT
 - Sharing of risk between SKAO and IPP
 - **Allocating risk to the party most able to handle it**, SKAO handles:
 - The overall risk on tariff due to the EMI mitigation measurements
 - CO2 emissions (by means of tender scoring criteria)
 - Demand & sizing, locations, etc.
- Only realistic means to limit SKAO risk:
 - Create detailed, qualified reference designs
 - Create detailed guidance material (Basis of Design, Design Reports, EMC Control Plans, etc.)
- Please refer to Power Procurement Plan for details

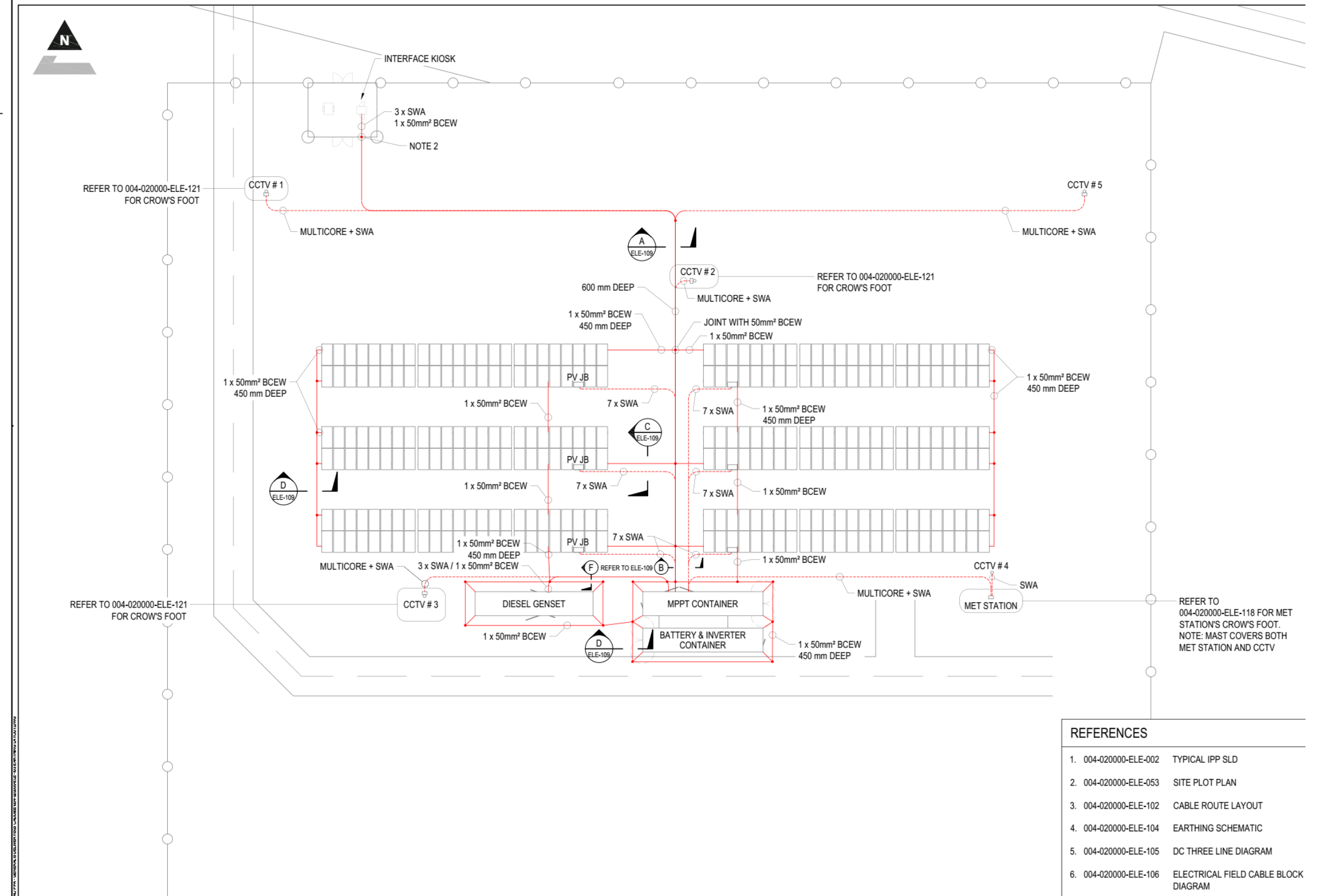
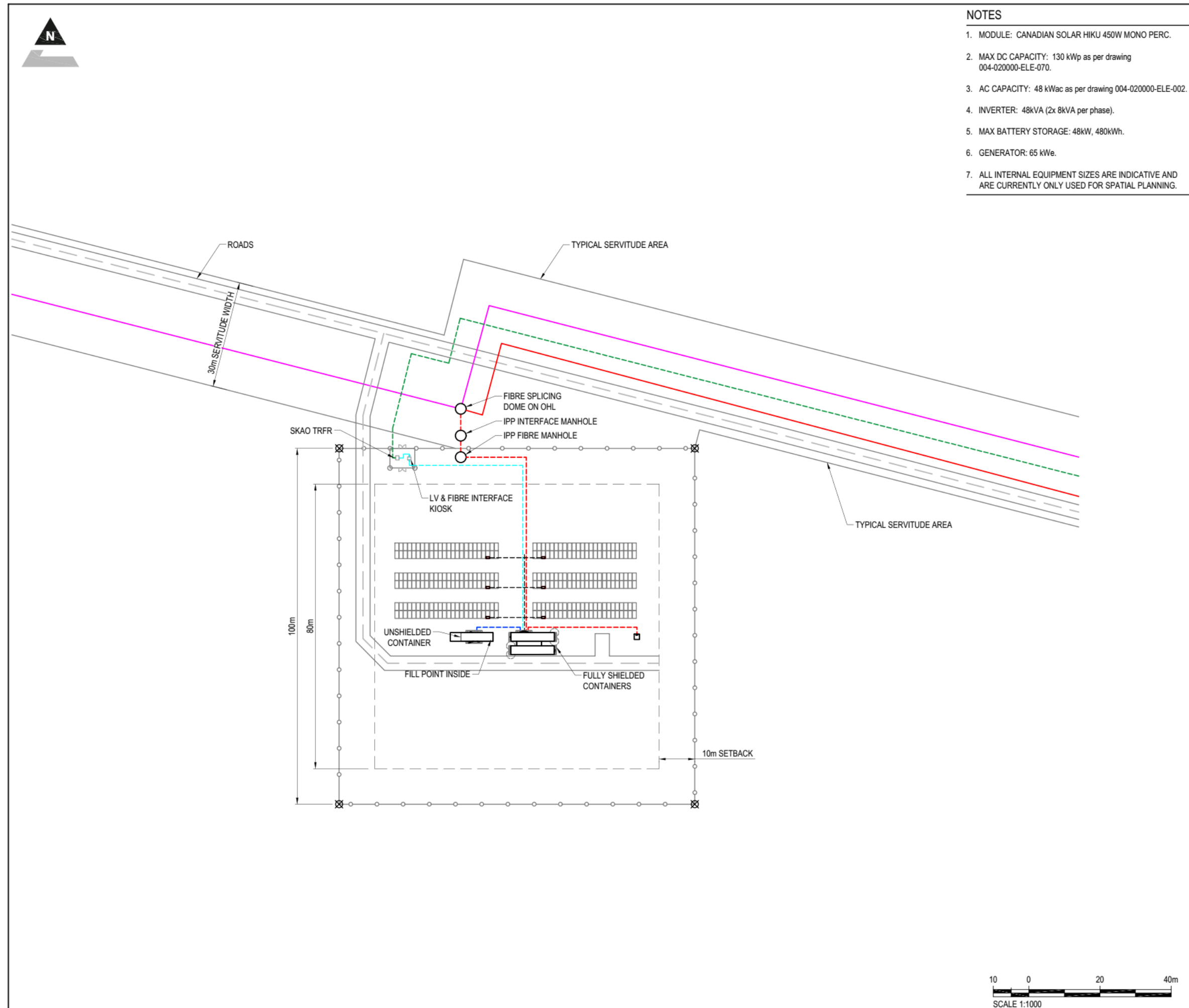


Status: Mid Remote Power Stations

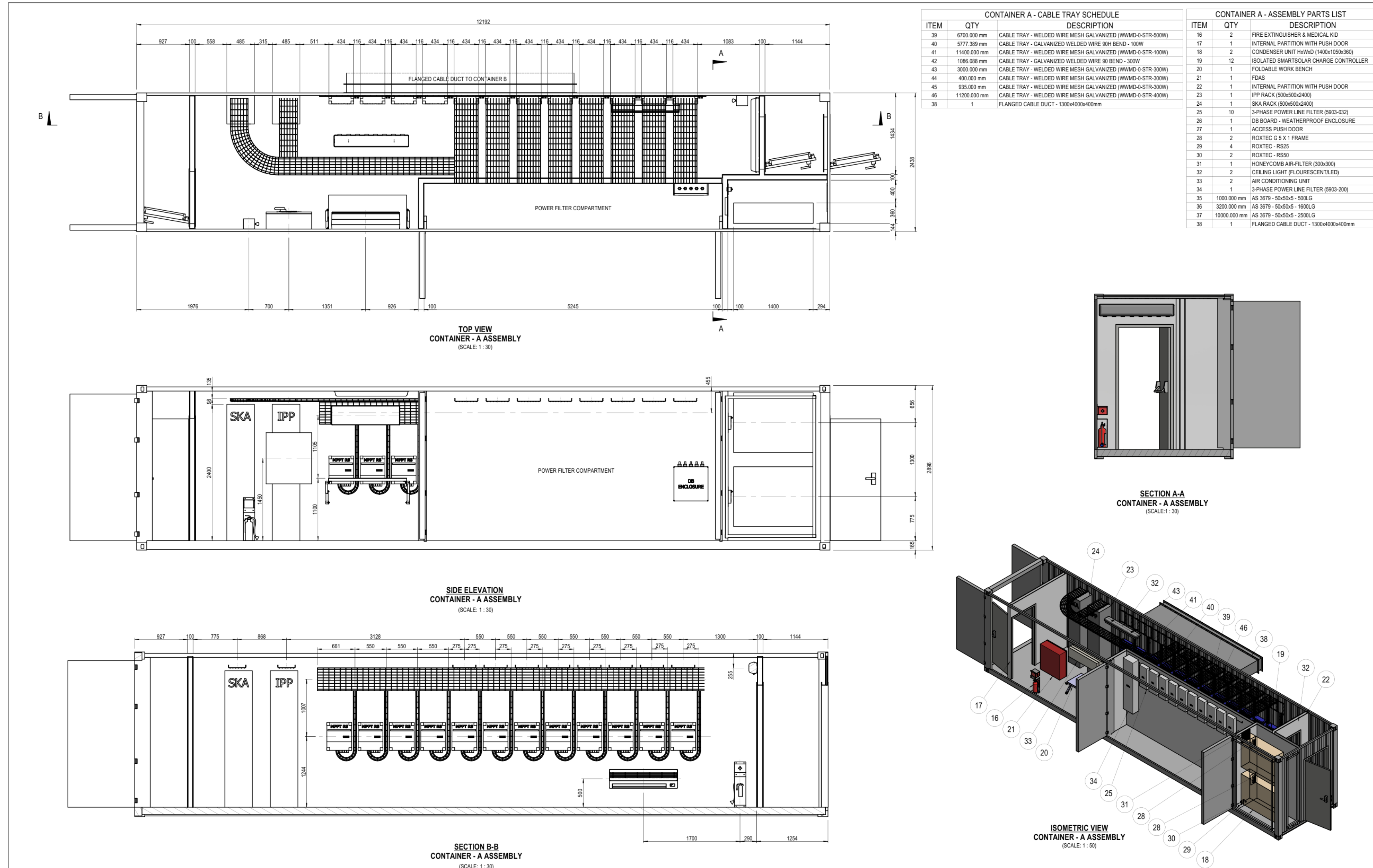
- Spatial, electrical and control system design mostly complete
- Major review in Jan / Feb 2022
 - 107 documents
 - 49 reviewers
 - 500 observations!
- Currently performing detailed EMC design and investigations
- Started developing commercial documents
- Target Q3 issue of Request For Proposal



Status: Mid Remote Power Stations

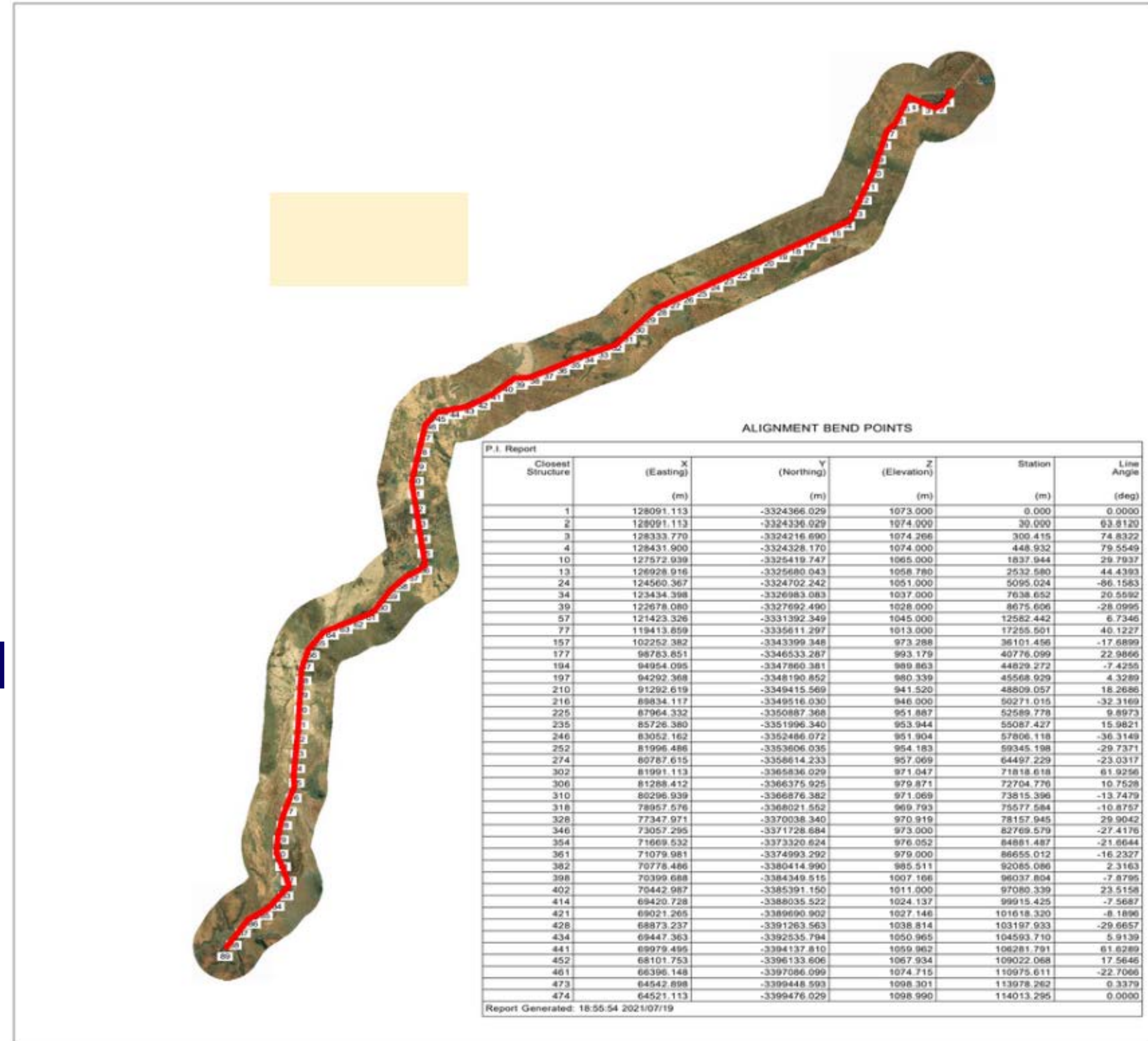


Status: Mid Remote Power Stations

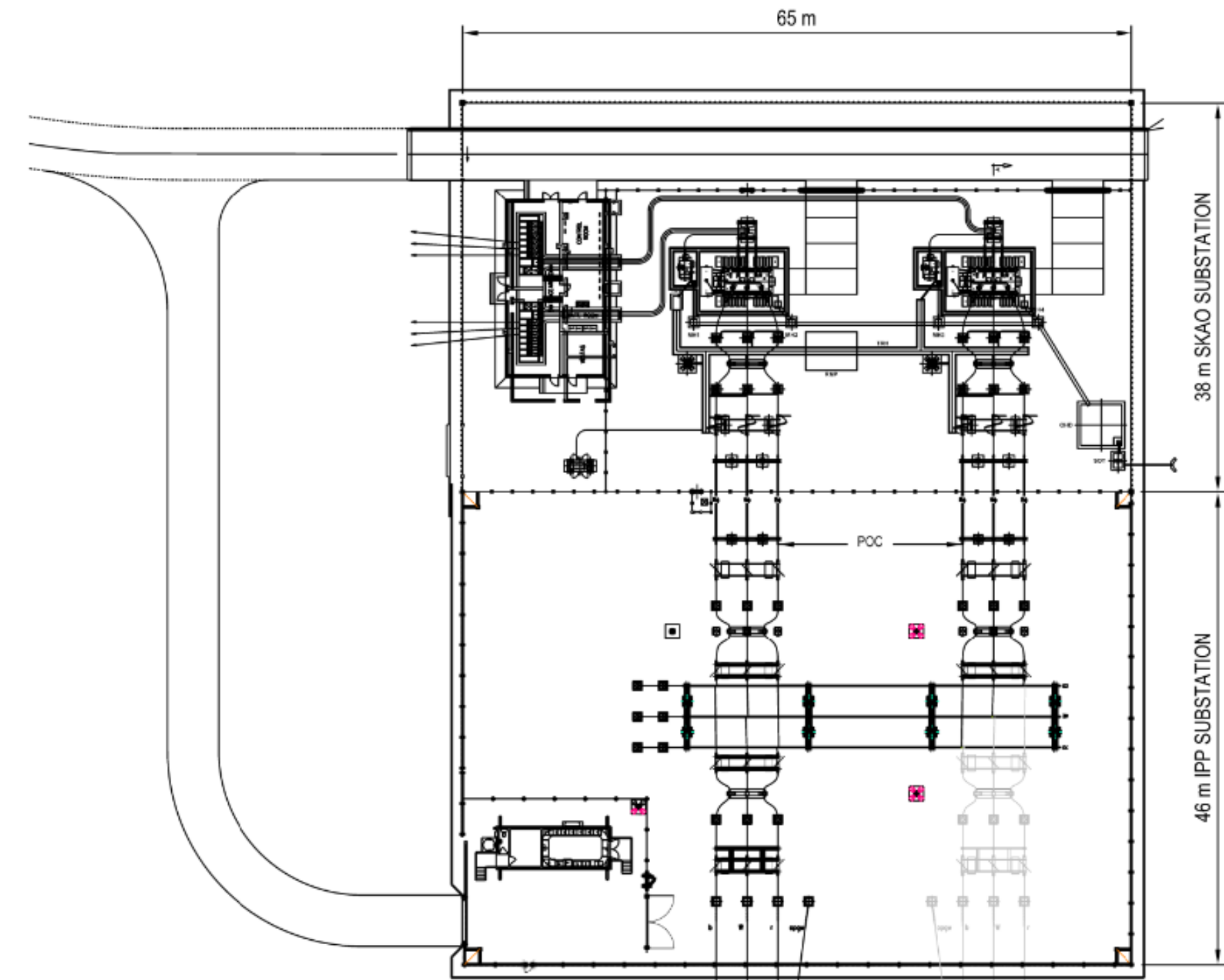
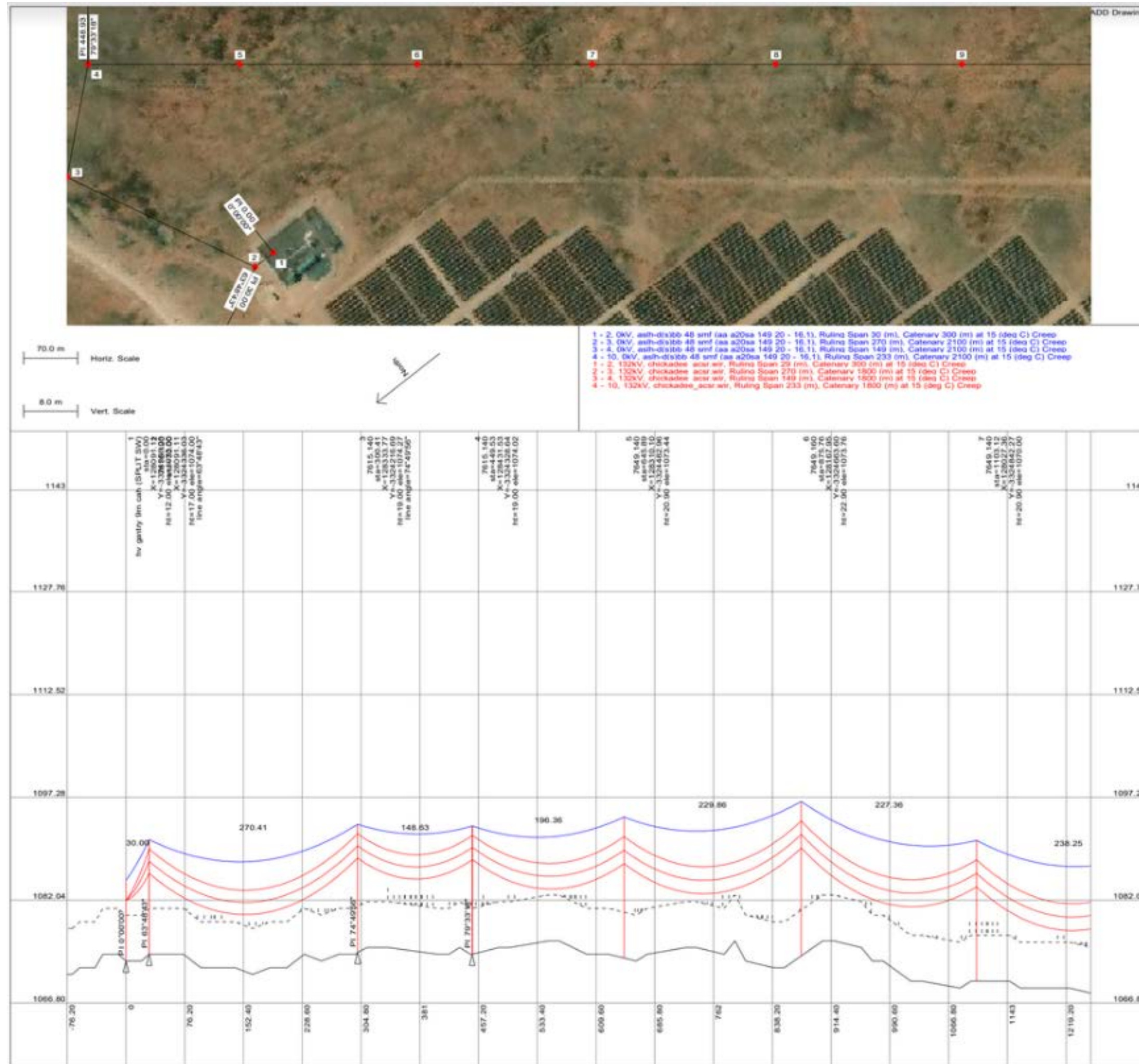


Status: Mid Central Power Station

- Upcoming trade-off:
 - On-site shielded vs
 - Off-site + 132kV transmission line
- On-site re-use Low CPS reference design
- Off-site completed costed substation and line reference design

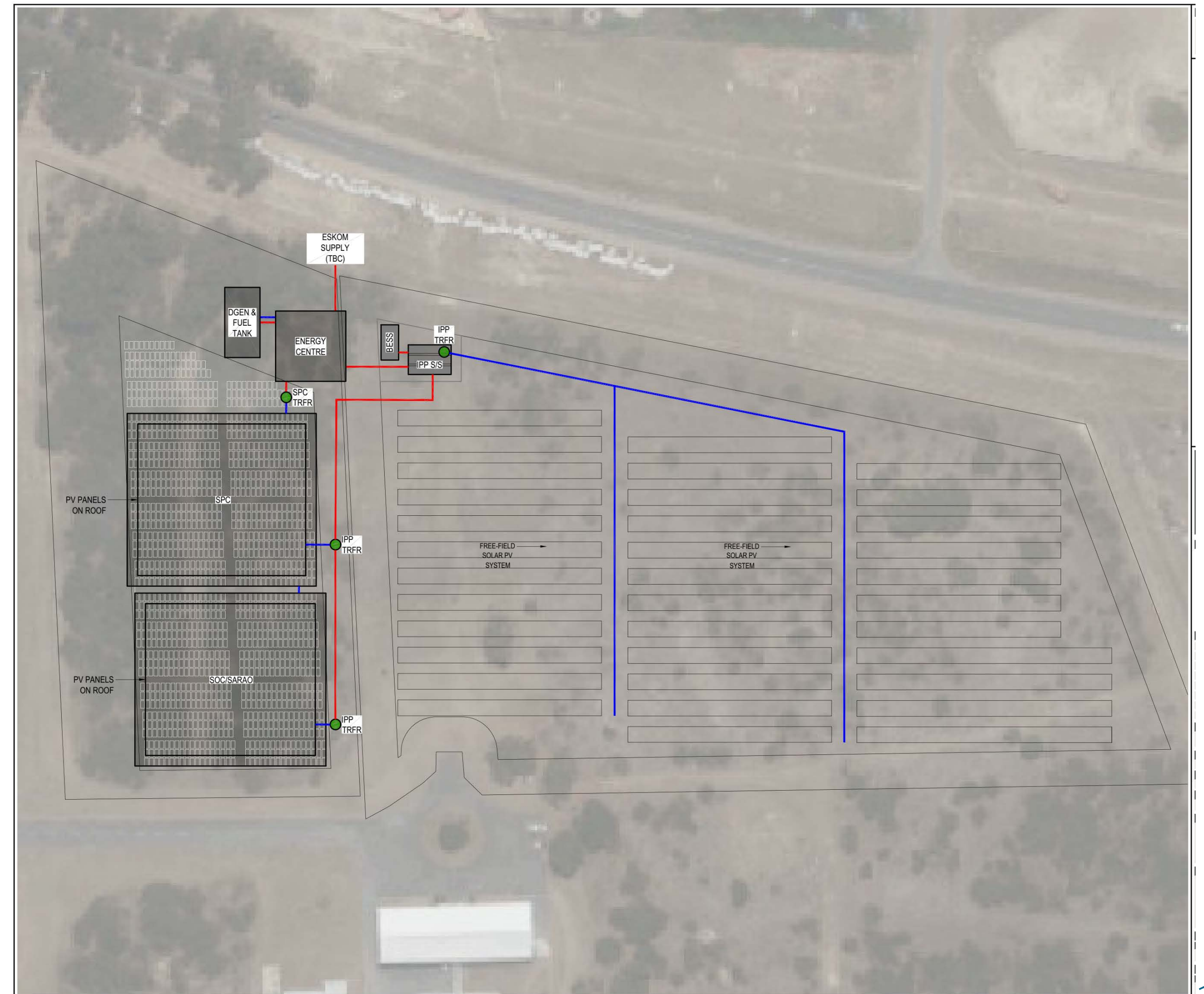


Status: Mid Central Power Station



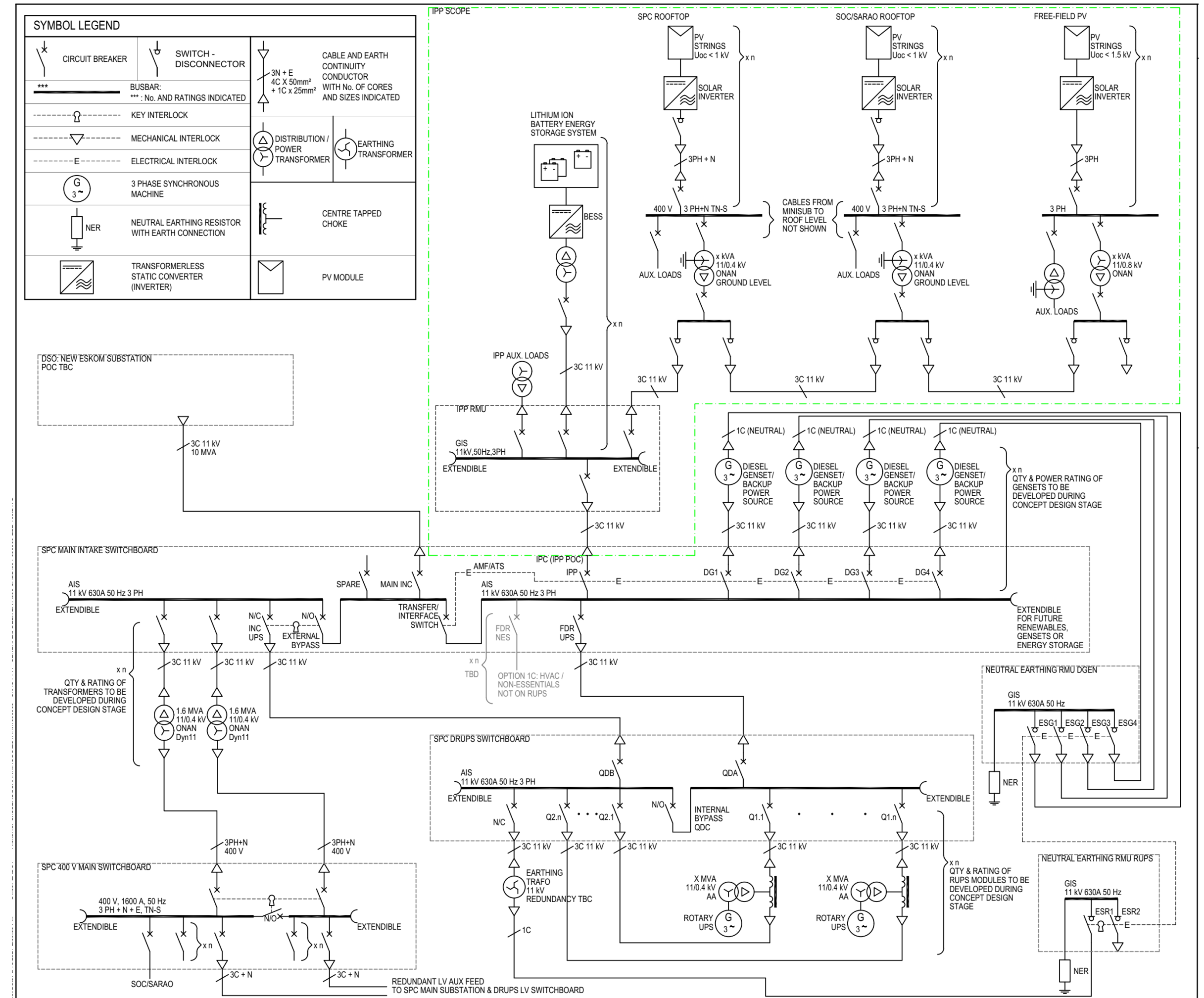
Status: Mid Science Processing Centre Power

- SPC site shared with iThemba labs
- Subject to load shedding from Eskom
- SKAO & iThemba differing load shedding approaches
- Completed and costed reference design:
 - 2.2MW PV
 - 6 MWh Battery
 - RUPS
 - Diesel generators



Status: Mid Science Processing Centre Power

- Reference design (continued):
- Successfully mitigate load shedding
- Combination of capital and IPP contracts
- Alternative option: shared UPS system with iThemba
- Handed over to SARAQ & NRF, expert consultant appointed
- Supplemented by “wheeled” energy



Status: Issues

- Critical issues identified and being studied / prototyped:
 - DC filter influence on MPPT operation
 - Large number of DC filters (>800 on RPSs), use attenuation of cable in soil as alternative?
 - Generator EMI measurement campaign & EMI-quiet design
 - Hydrogen fuel cells as alternative backup source
 - Trade-off on-site / distant CPS (based on Low design)
 - SPC UPS option selection (shared / separate)
- Other issues:
 - Resourcing: limited number of EMI experts, availability of design consultants
 - Changes in power estimates (you know who you are!)
 - Uniqueness of reference designs and commercial model



Thanks to:

- SKAO:
 - Director of Operations: Lewis Ball
 - EMC Team: Braam, Treasure and Paul
- Design Consultants:
 - Mesa Solutions (EMC)
 - Zutari Pty Ltd (ZA)
 - Aurecon Pty Ltd (Aus)
- SARA0 & CSIRO for their participation & assistance
- Reviewers and other SKAO personnel
- Suppliers



Thank you!

We recognise and acknowledge the indigenous peoples and cultures that have traditionally lived on the lands on which our facilities are located.

The logo for SKAO, featuring the letters 'SKAO' in a bold, white, sans-serif font. The letter 'K' is stylized with a red starburst shape inside it, and there are small white dots scattered around the letters.

www.skao.int