

Presentation to CTA

1st draft design of electrical system for CTA power supply

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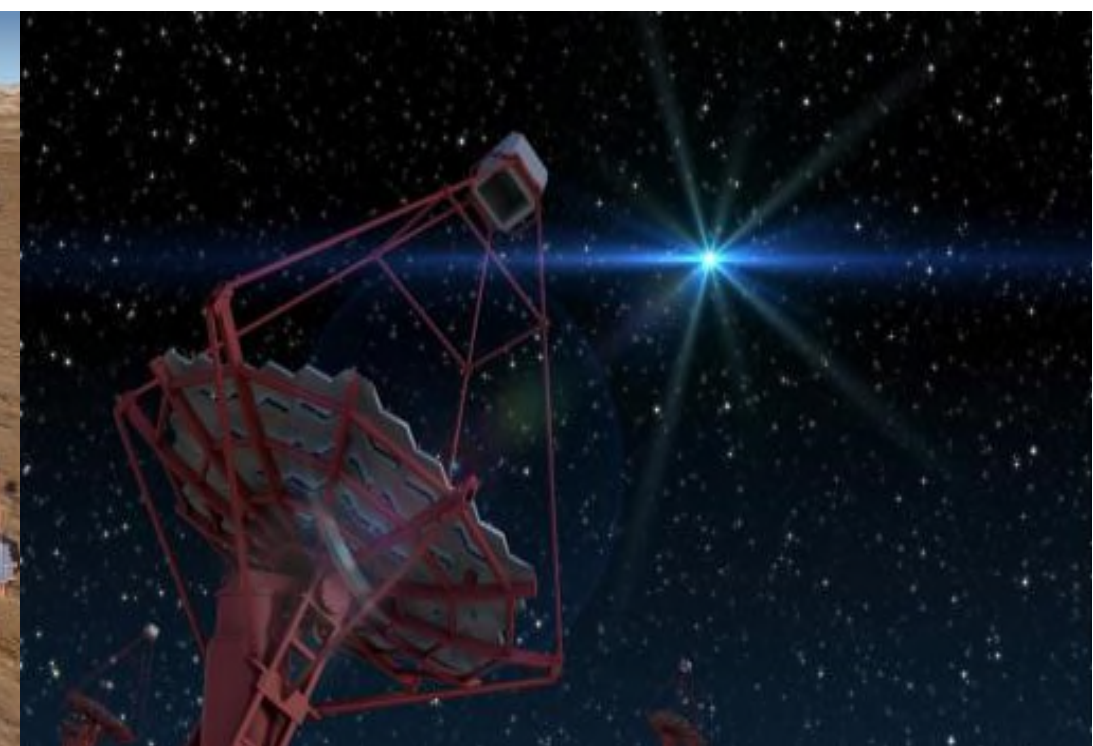
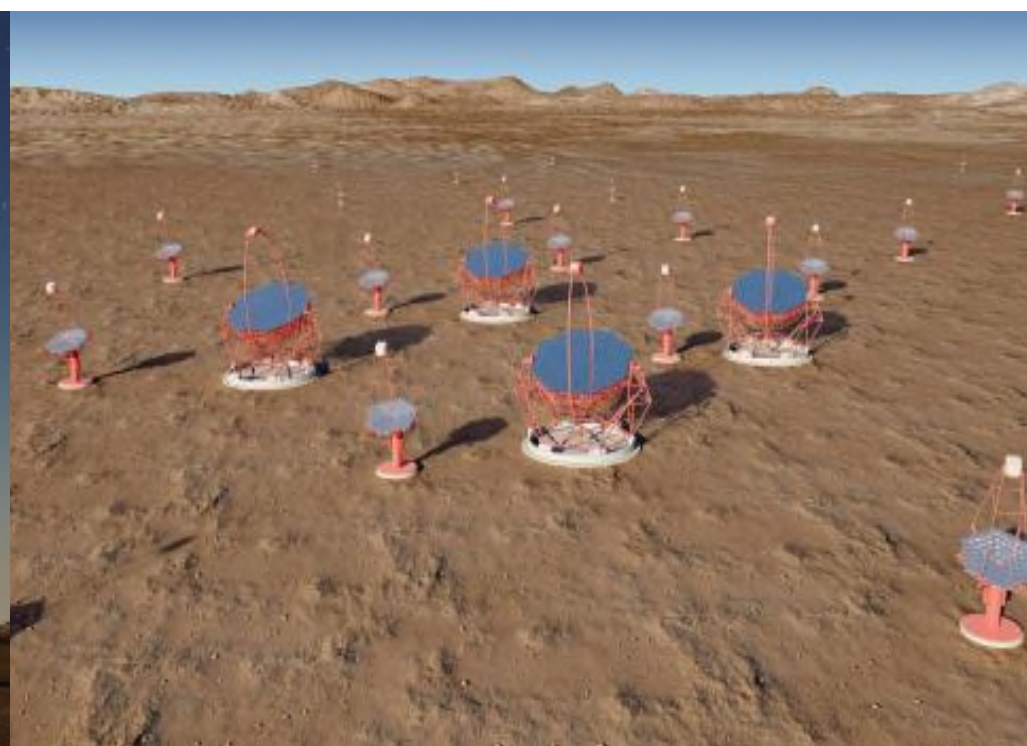
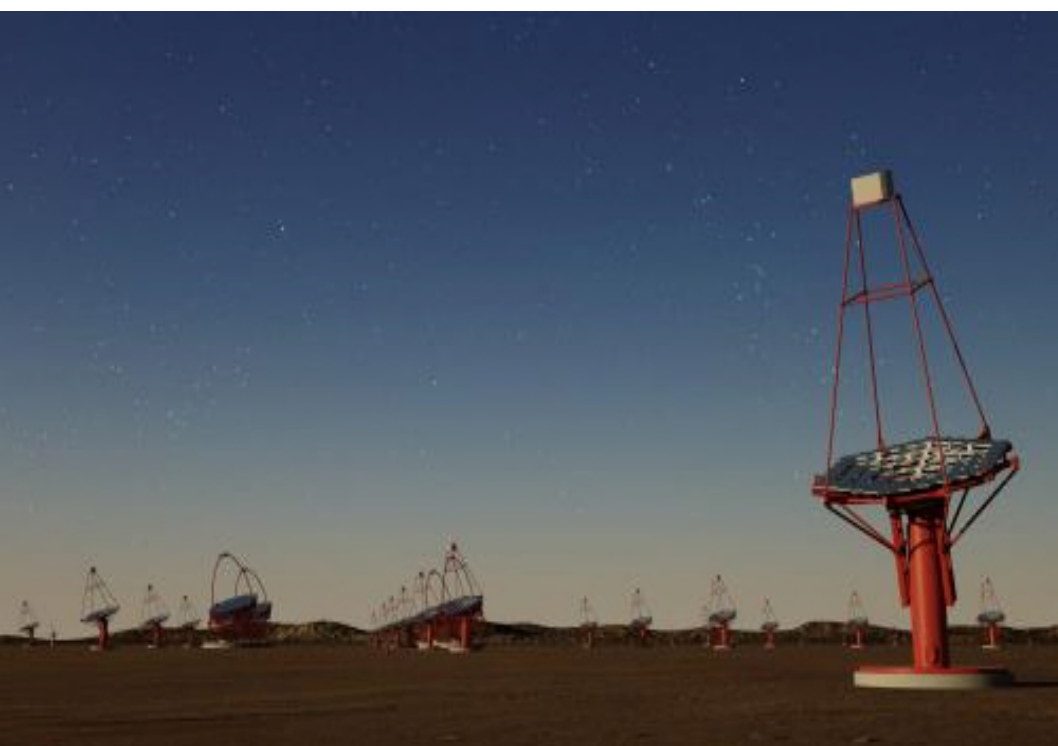
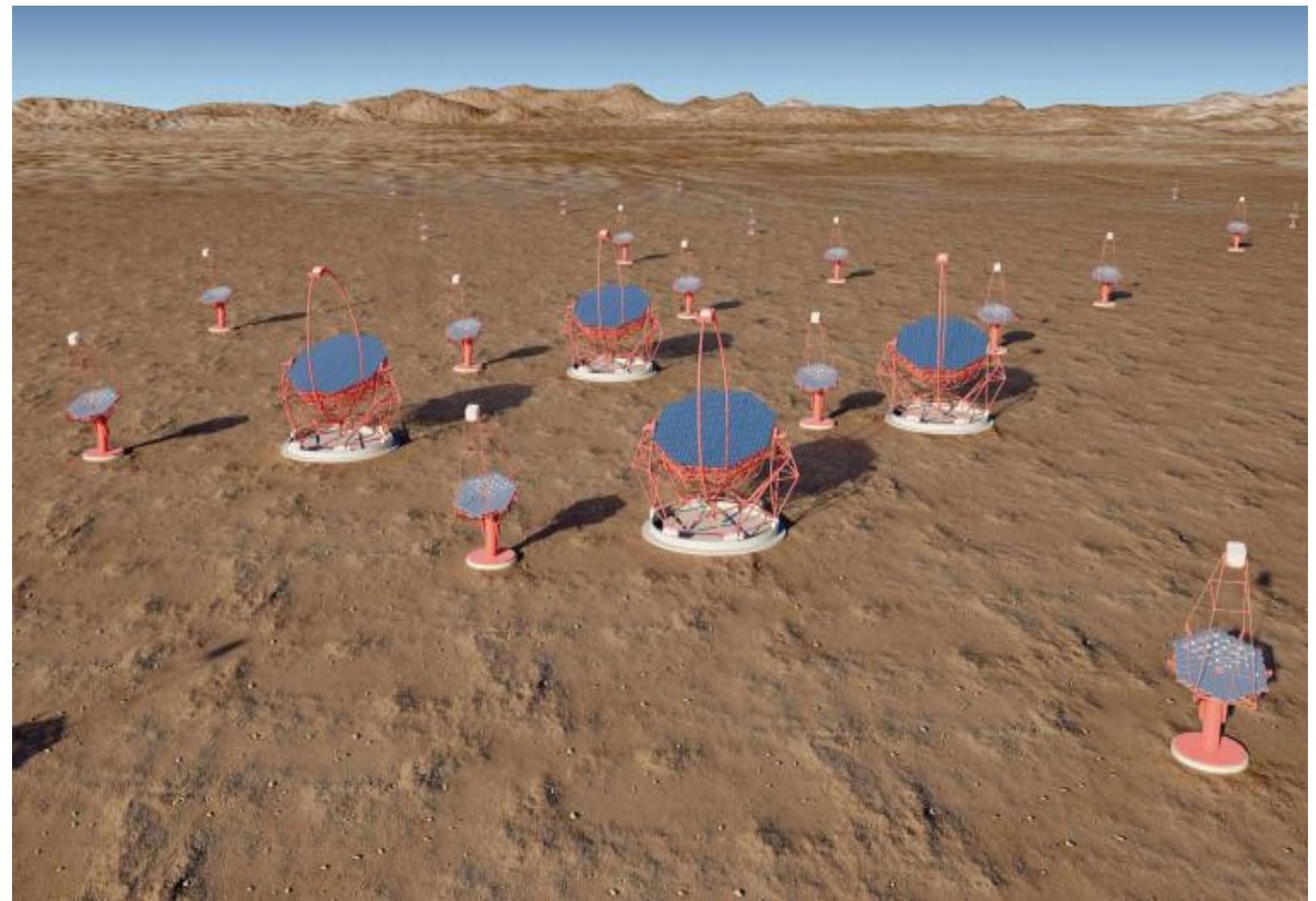


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Main input data for design – Infrastructure requirements

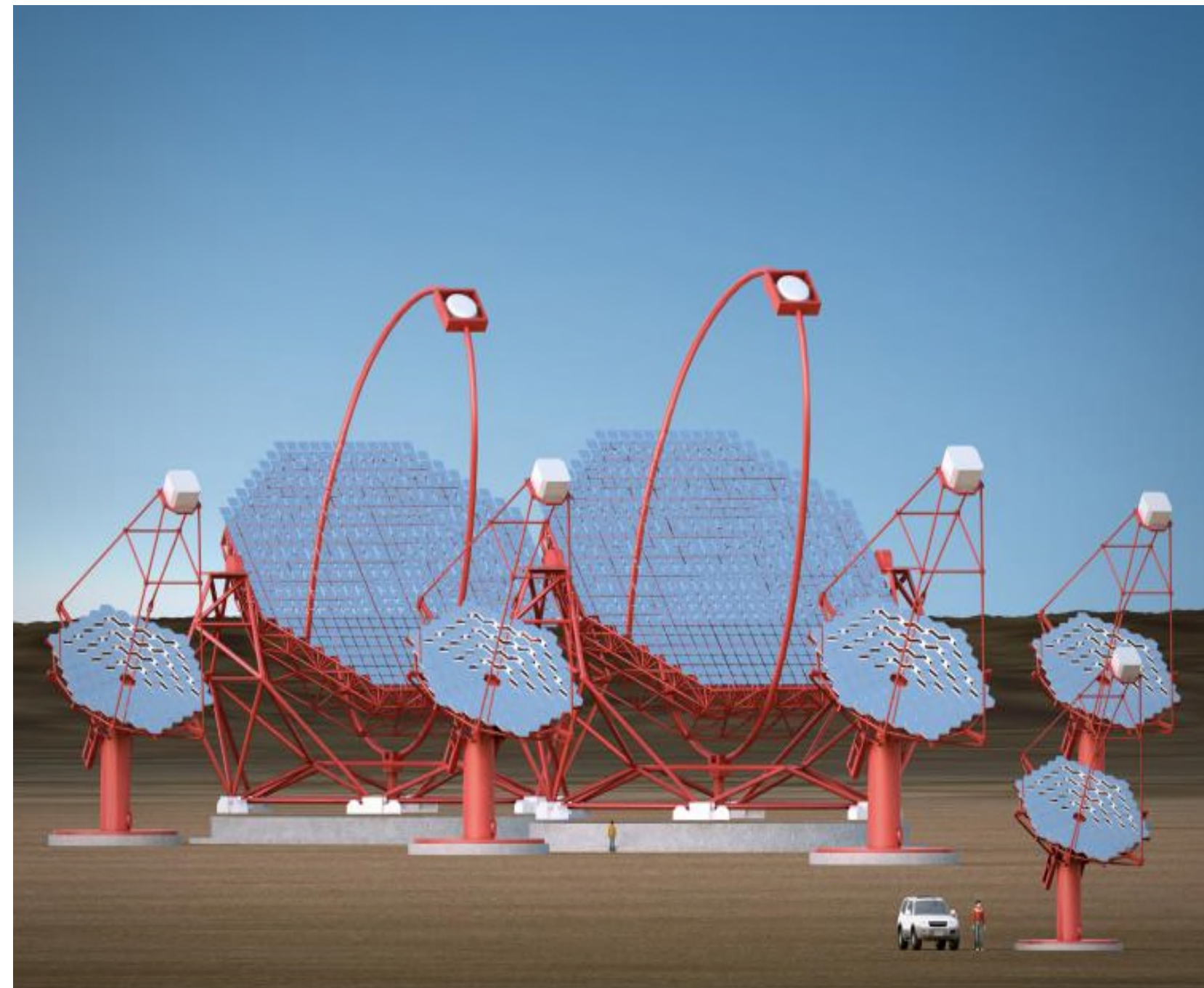
- Altitude of the site: approximately 2000m above sea level
- Site diameter: approximately 3000m
- Desert area / mountain area
- Wind: <90km/h
- Temperature: -20 to +40°C
- Humidity: 2-100%
- Sand and dust to be considered
- Special earthquakes requirements
- Power system availability >99,5%
- (power requirements may have to be updated)



Overview of electrical load

- Antenna:

	min	peak
• LST -?	120kW	515kW
• MST -?	xxxkW	xxxkW
• SST 1M -?	xxxkW	40kW
• SST 2M -?	xxxkW	40kW
• SCT -?	xxxkW	40kW
- Residence / Hotel 200kW ?
- Offices, workshop 100kW ?
- Data centre xxxkW ???
- Heating and cooling load ???



Power supply alternatives



- Grid connection, HV network or MV network
 - High Voltage or Medium Voltage network (distances ???)
 - Single circuit or double circuit line
 - Availability ??? (name of power utility?)
- Island power plant, Diesel generators or Gas turbines (fuel)
- Grid connection and diesel as back-up power supply
- Grid connection and diesel as back-up power supply combined with flywheel
- Renewable energy as supplementary power (solar and wind)
- Interconnection to other island power plants (Chile – Paranal Observatory)



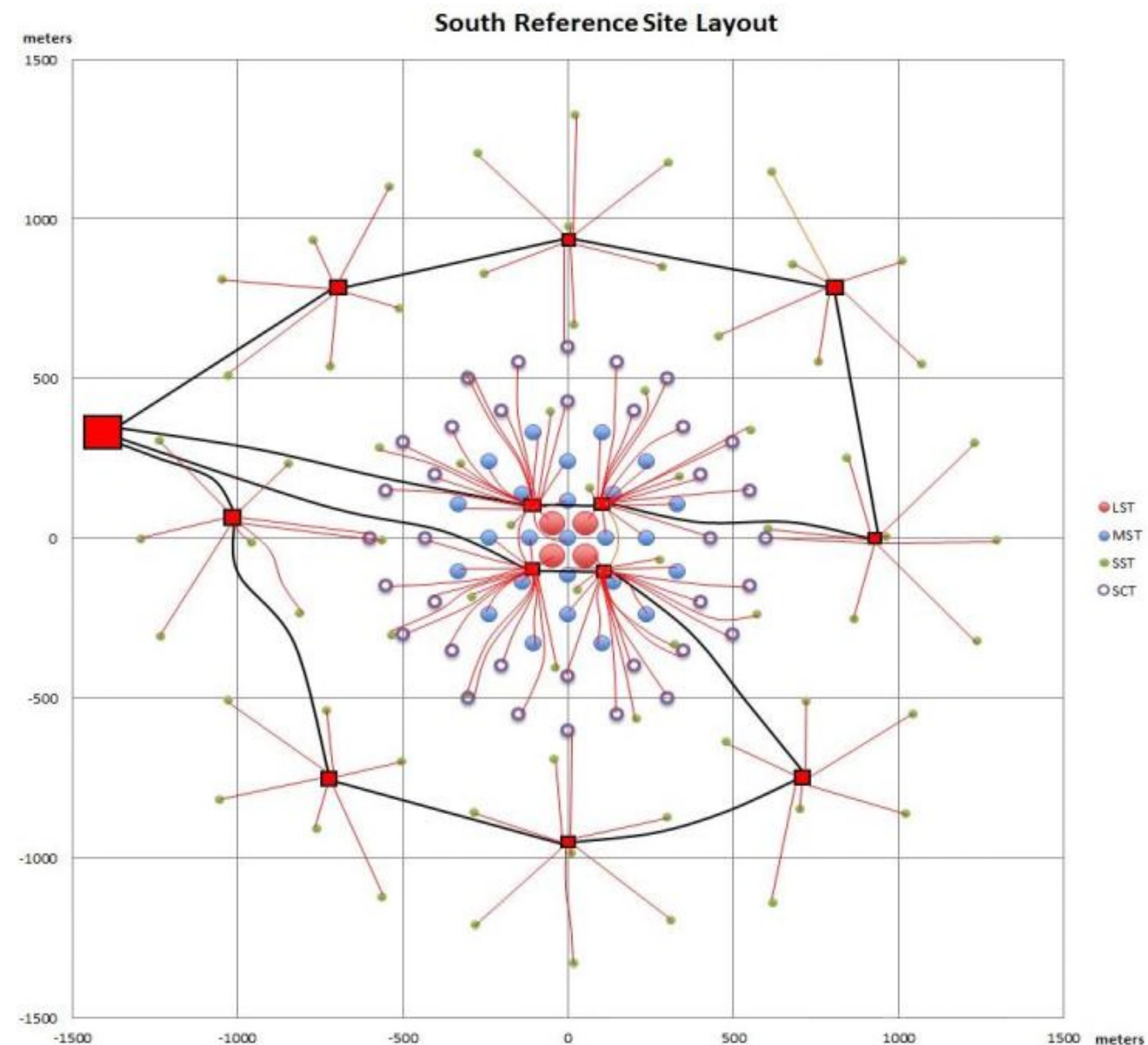
Specific layout and possible grid connection - Chile

- Site near Paranal Observatory
- 66kV over head line in preparation (mid 2018)
- 66kV line crossing the site or passing nearby
- Co-operation with Paranal and TL-Contractor
- Connection on 66kV or 23kV ???
- Renewable energy as supplementary power (solar and wind)
- 66kV single circuit or double circuit line
- Location of CTA substation according to line routing (Is change of routing still possible?)
- Location of CTA SS and PP

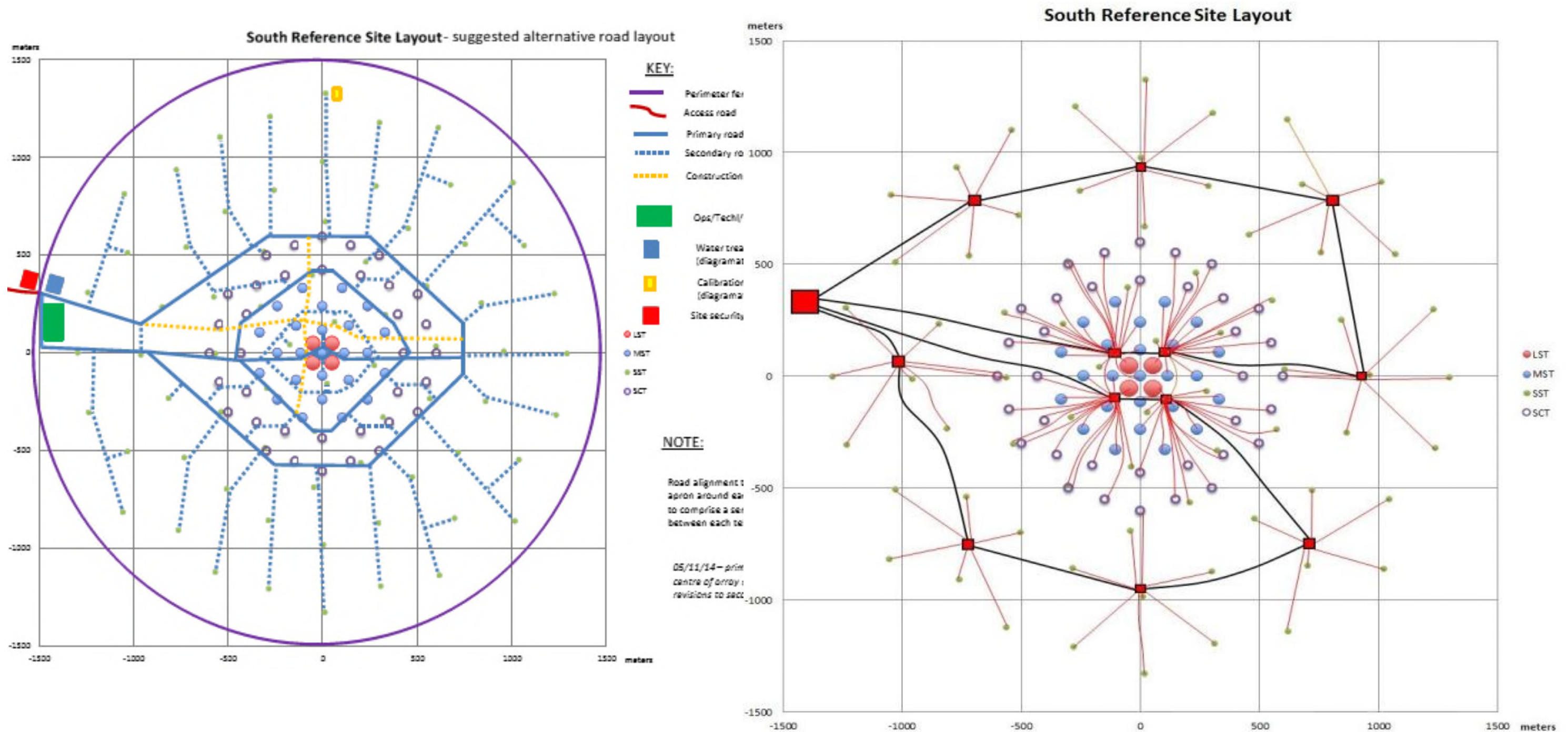


Power distribution layout

- Main HV/MV SS (and island PP) near main buildings
- 2 cable ring systems, length max. 7km each, MV level could be 10kV (network calculation required)
- LV (400V) star connection from D-SS to antennas
- 4 inner MV-SS, 8 outside MV-SS
- Use of max. 3 types of standard distribution transformers
- LV cable length would be max. 400m
- Optical fibre cable could follow MV rings
- Two pair of inner MV/LV SS could be interconnected on LV level
- Location of D-SS near planned roads

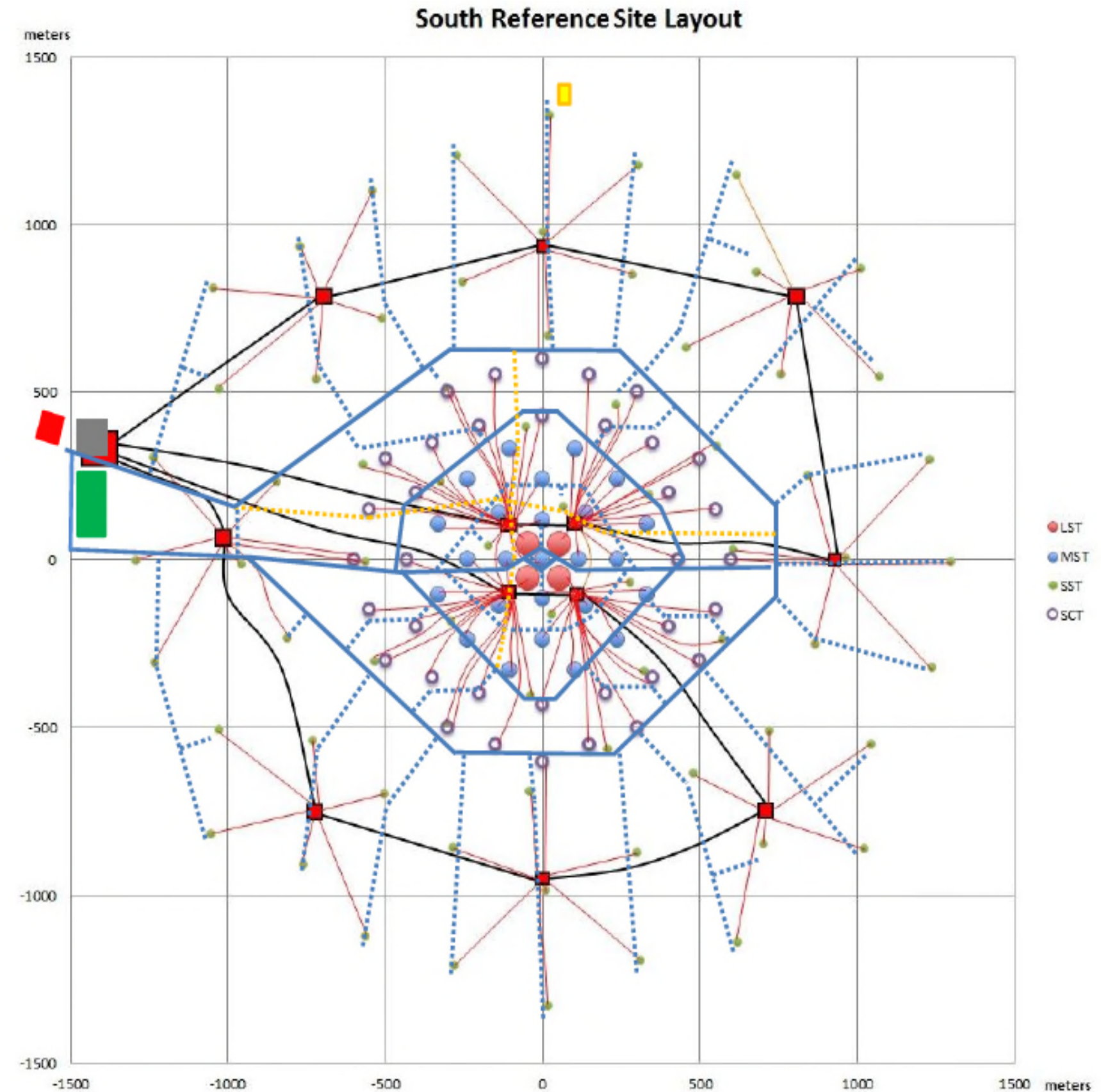


Distribution SS and roads (1st planning status)



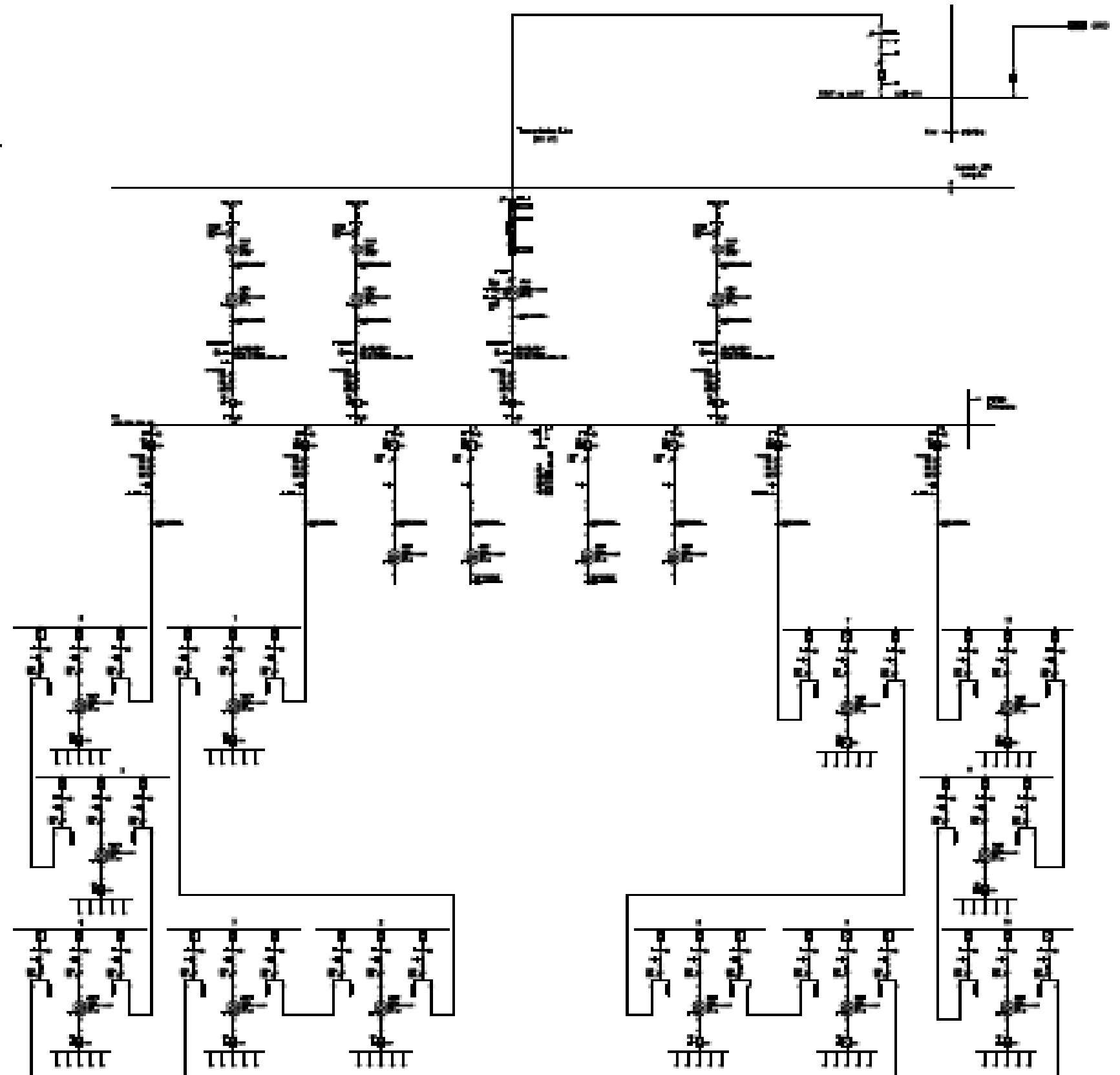
Distribution SS and Road System

- Distribution Substations position near roads
- Position of HV-SS and backup power plant to be defined
- Residence area vs noise level of diesel power plant
- HV transmission line routing to be considered as well



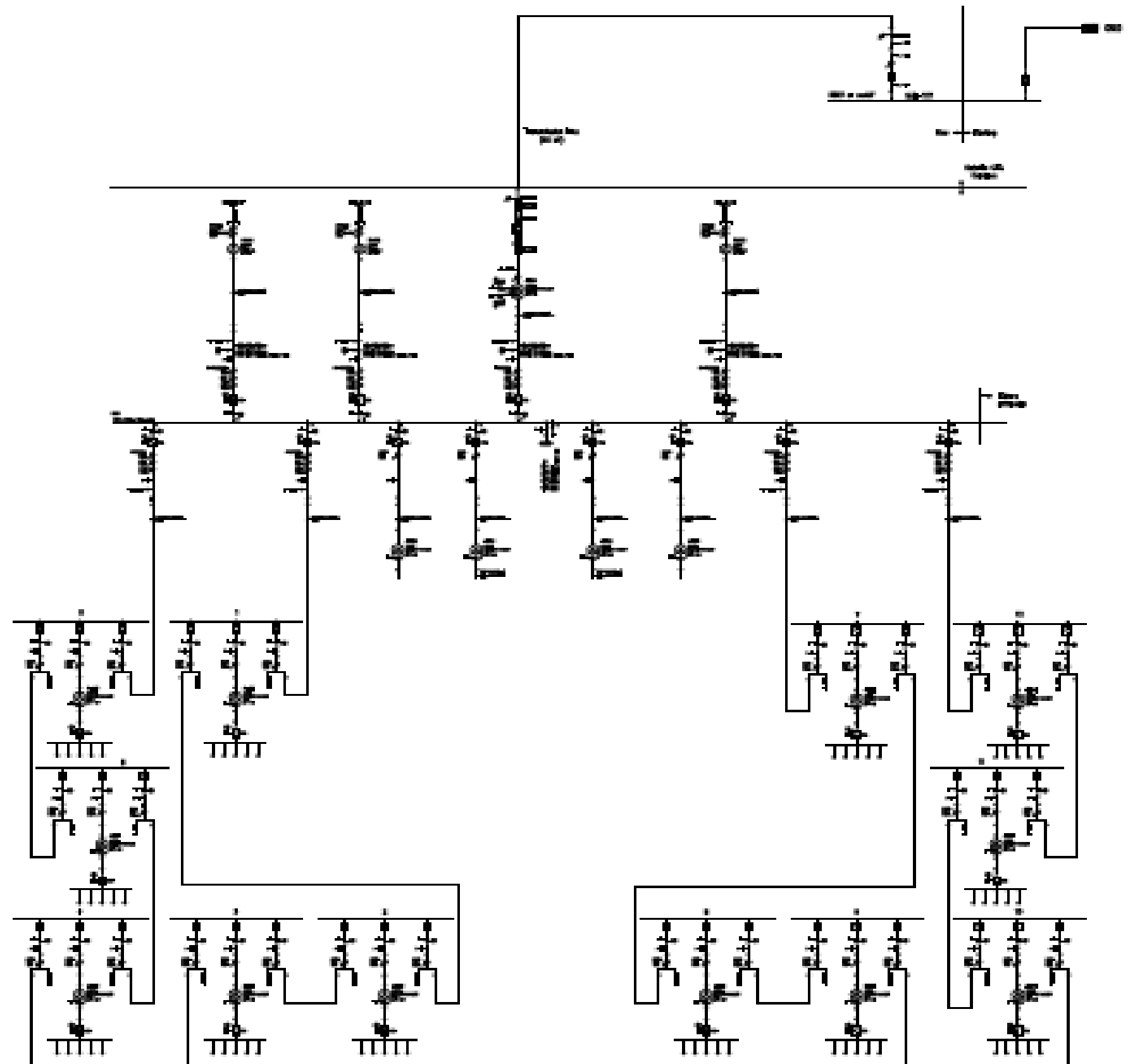
SLD – Version 1

- Single HV Interconnection (Transmission line)
- HV substation
 - - 1 HV field (gas insulated or air insulated)
 - 1 main HV/MV transformer
- Single busbar MV Switchgear (10kV)
- 3 Generators connected via transformers
- 4 distribution transformers (Res/Hotel + Buildings)
- 2 MV ring systems, 6 distribution SS each
- 12 Distribution SS transformers
- Load (antennas) connected as cable connection (black box)



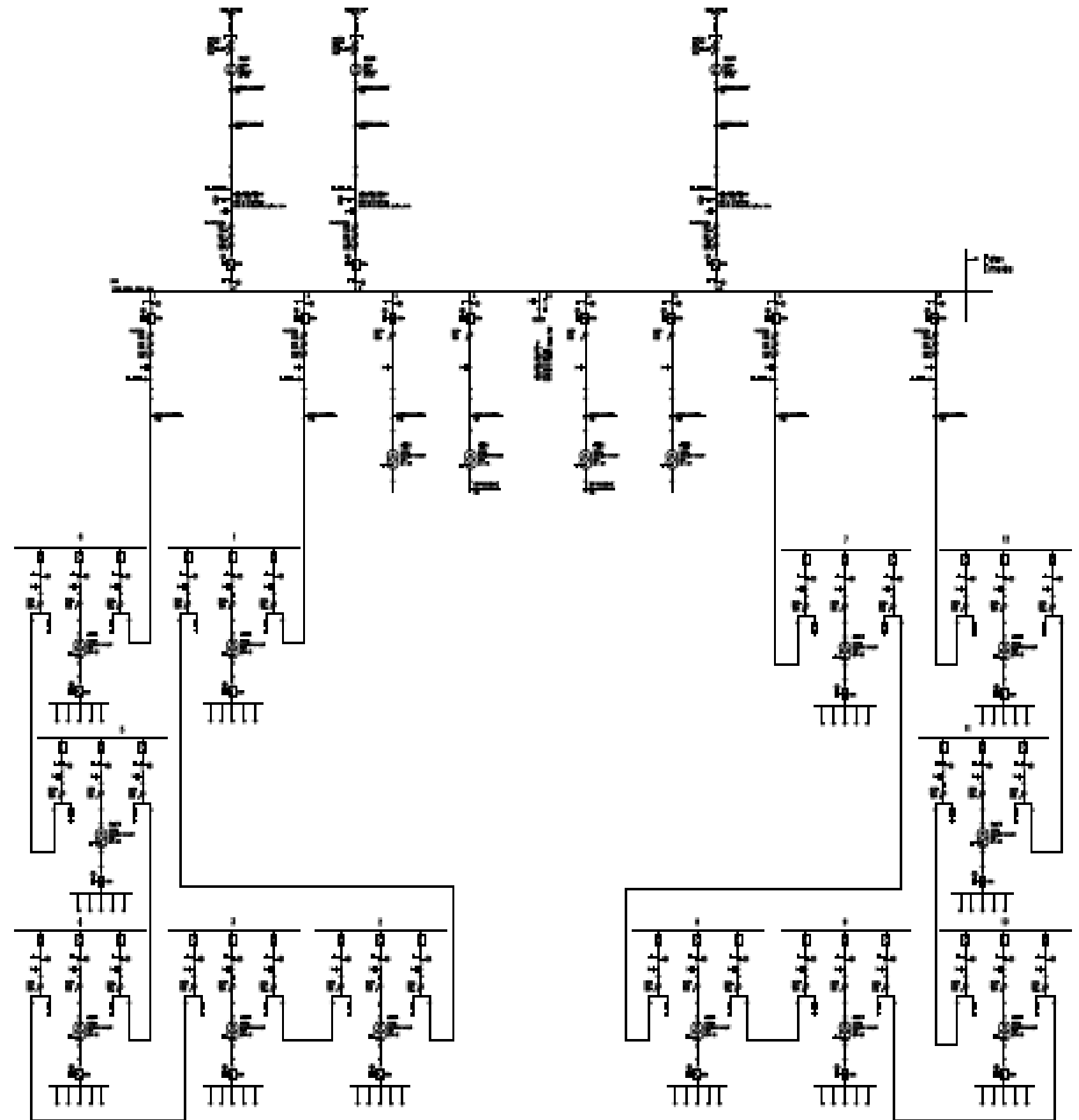
SLD – Version 2

- Single HV Interconnection (Transmission line)
- HV substation
 - - 1 HV field (gas insulated or air insulated)
 - 1 main HV/MV transformer
- Single busbar MV Switchgear (10kV)
- 3 Generators - **(10kV) no transformers**
- 4 distribution transformers (Res/Hotel + Buildings)
- 2 MV ring systems, 6 distribution SS each
- 12 Distribution SS transformers
- Load (antennas) connected as cable connection (black box)



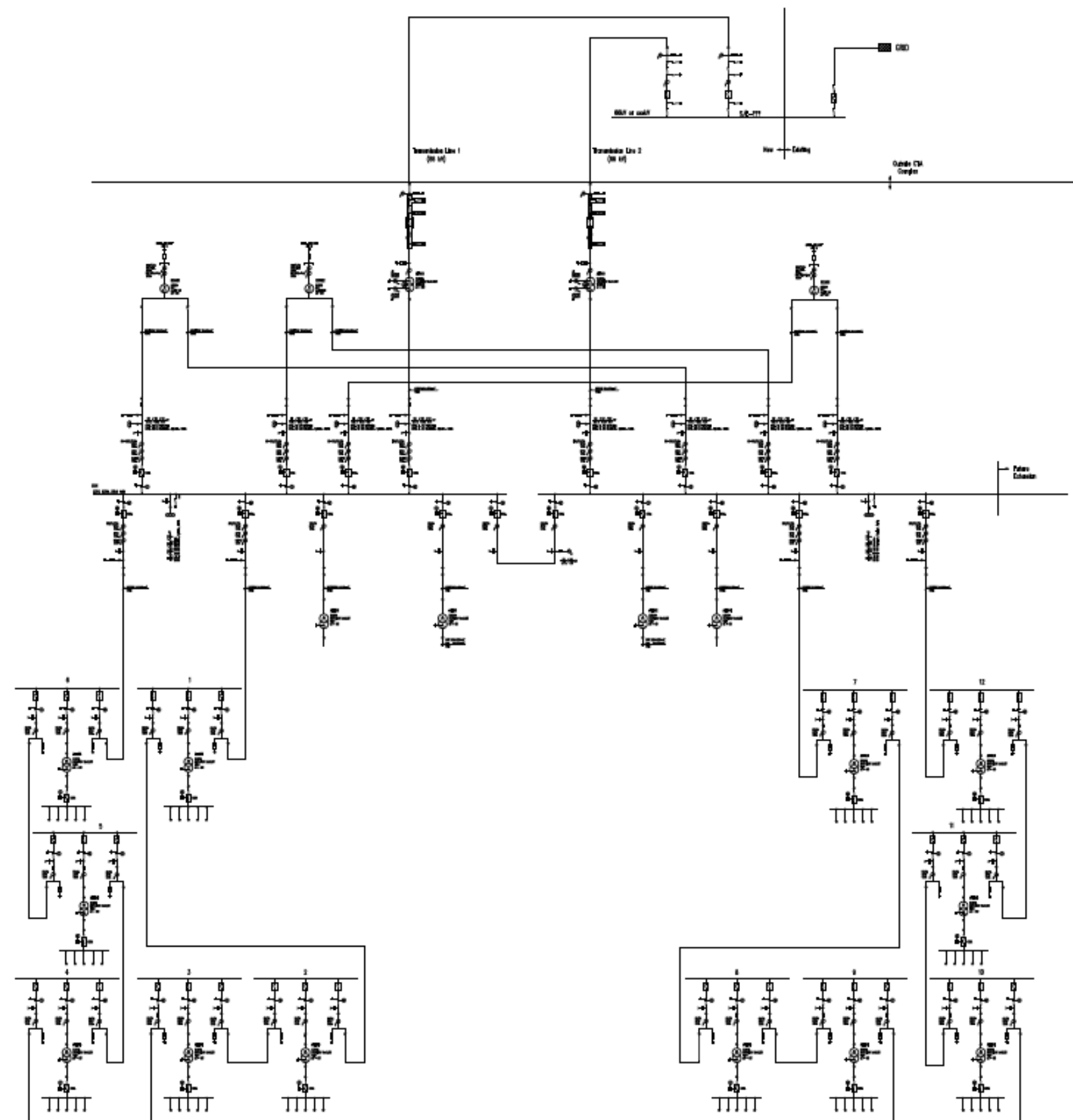
SLD – Version 3

- **No HV Interconnection (Transmission line)**
- **Island Power Plant with Gas Turbines or Diesel Units**
- Single busbar MV Switchgear (10kV)
- 3 Generators - **(10kV) no transformers**
- 4 distribution transformers (Res./Hotel + Buildings)
- 2 MV ring systems, 6 distribution SS each
- 12 Distribution SS transformers
- Load (antennas) connected as cable connection (black box)



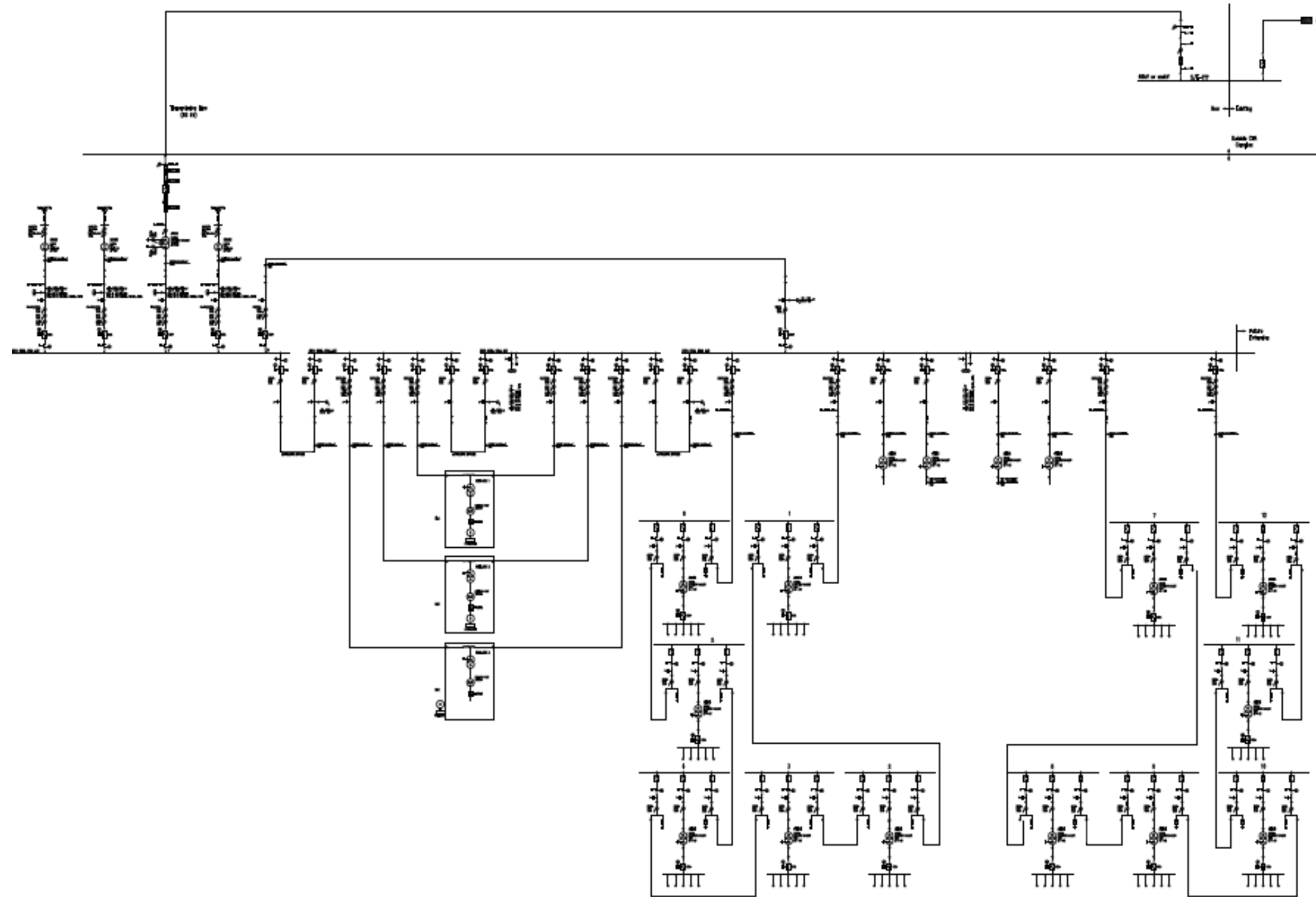
SLD – Version 2a

- **Double** HV Interconnection (2 Transmission lines)
- HV substation
 - **2 HV field (gas insulated or air insulated)**
 - **2 main HV/MV transformer**
- Single busbar MV Switchgear (10kV) – **2 sections**
- **Coupling field between 2 sections**
- 3 Generators - **cross connections to 2 sections**
- 4 distribution transformers (Res./Hotel + Buildings)
- 2 MV ring systems, 6 distribution SS each
- 12 Distribution SS transformers
- Load (antennas) connected as cable connection (black box)



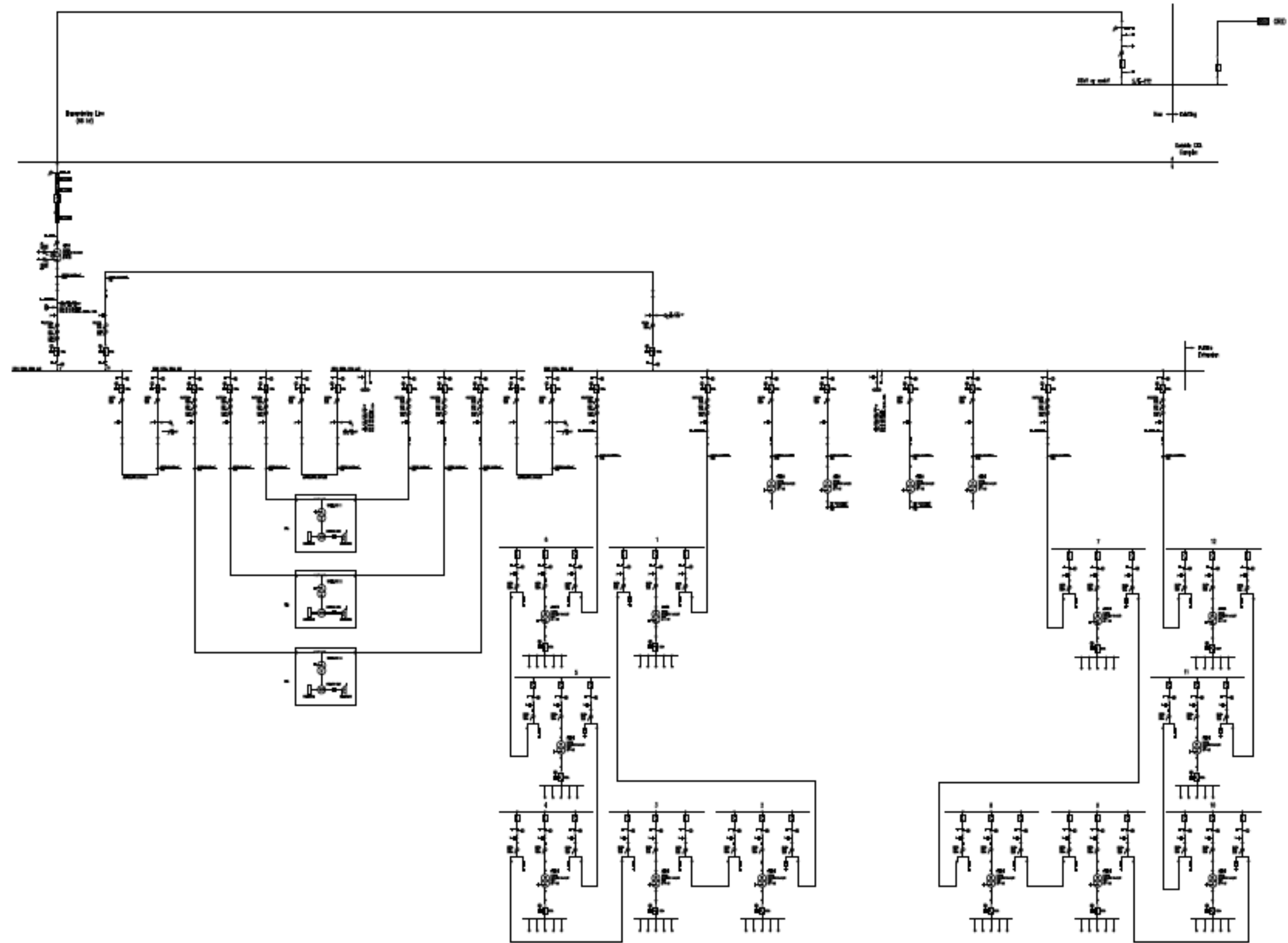
SLD – Version 4

- HV Interconnection (1 TL)
- HV substation (1 HV field 1 main HV/MV transformer)
- Single busbar MV Switchgear (10kV), 4 sections
- 3 Generators – (10kV) no transformers
- Flywheel system
- 4 distribution transformers (Res/Hotel + Buildings)
- 2 MV ring systems, 6 distribution SS each
- 12 Distribution SS transformers
- Load (antennas) connected as cable connection (black box)



SLD – Version 5

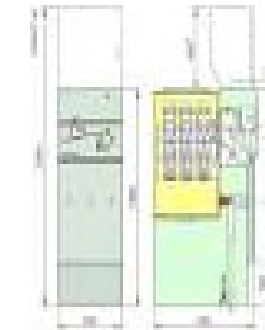
- HV Interconnection (1 TL)
- HV substation (1 HV field, main HV/MV transformer)
- Single busbar MV SWG (10kV), 4 sections
- 3 Generators – (10kV) no transformers
- Flywheel system with attached Diesel Generator
- 4 distribution transformer (Res./Hotel + Buildings)
- 2 MV ring systems, 6 distribution SS each
- 12 Distribution SS transformers
- Load (antennas) connected as cable connection



High Voltage - Medium Voltage and Low Voltage Switchgear

HV gas isolated (GIS) or air isolated (AIS) or hybrid isolated (HIS)

MV Switchgear



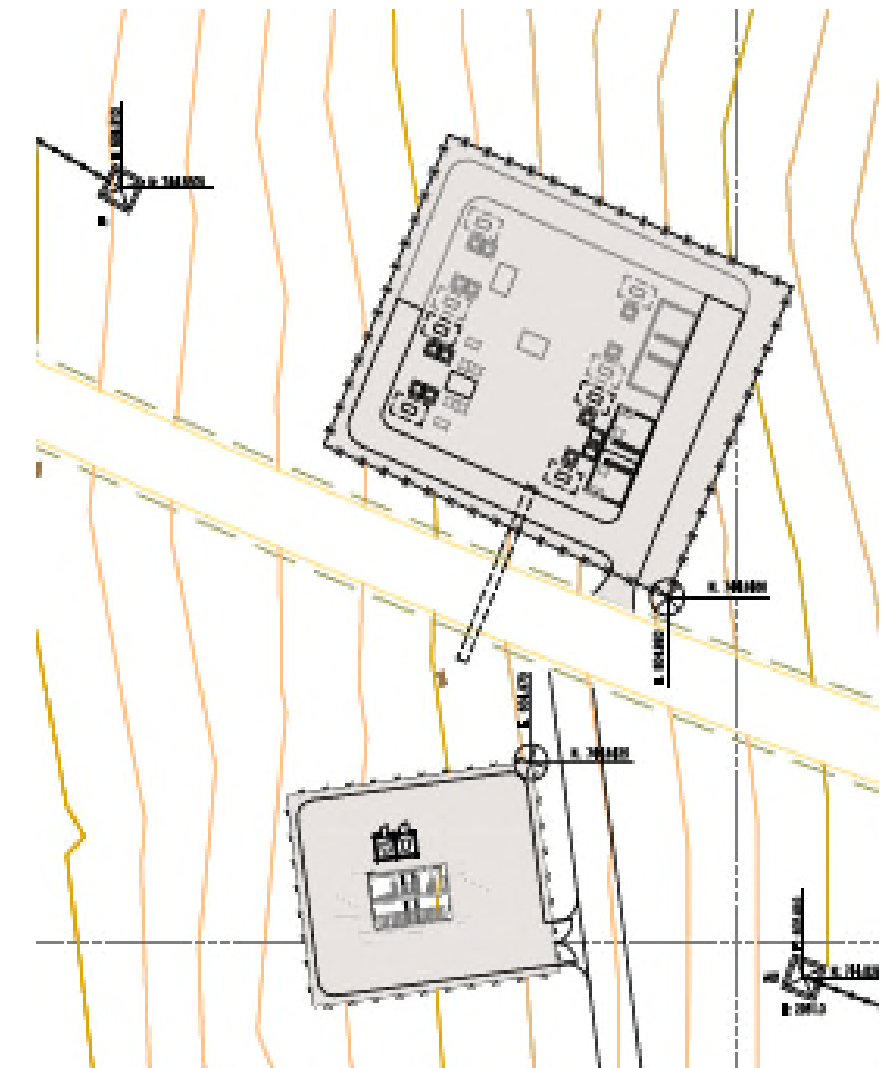
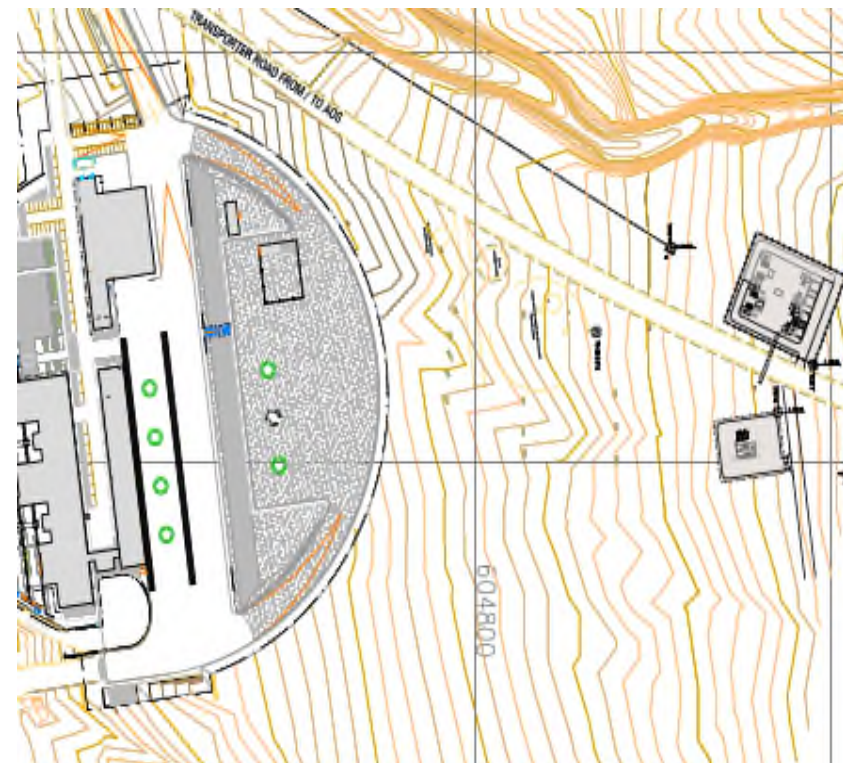
Transformers

LV Switchgear



Responsibility of civil design for electrical equipment ?

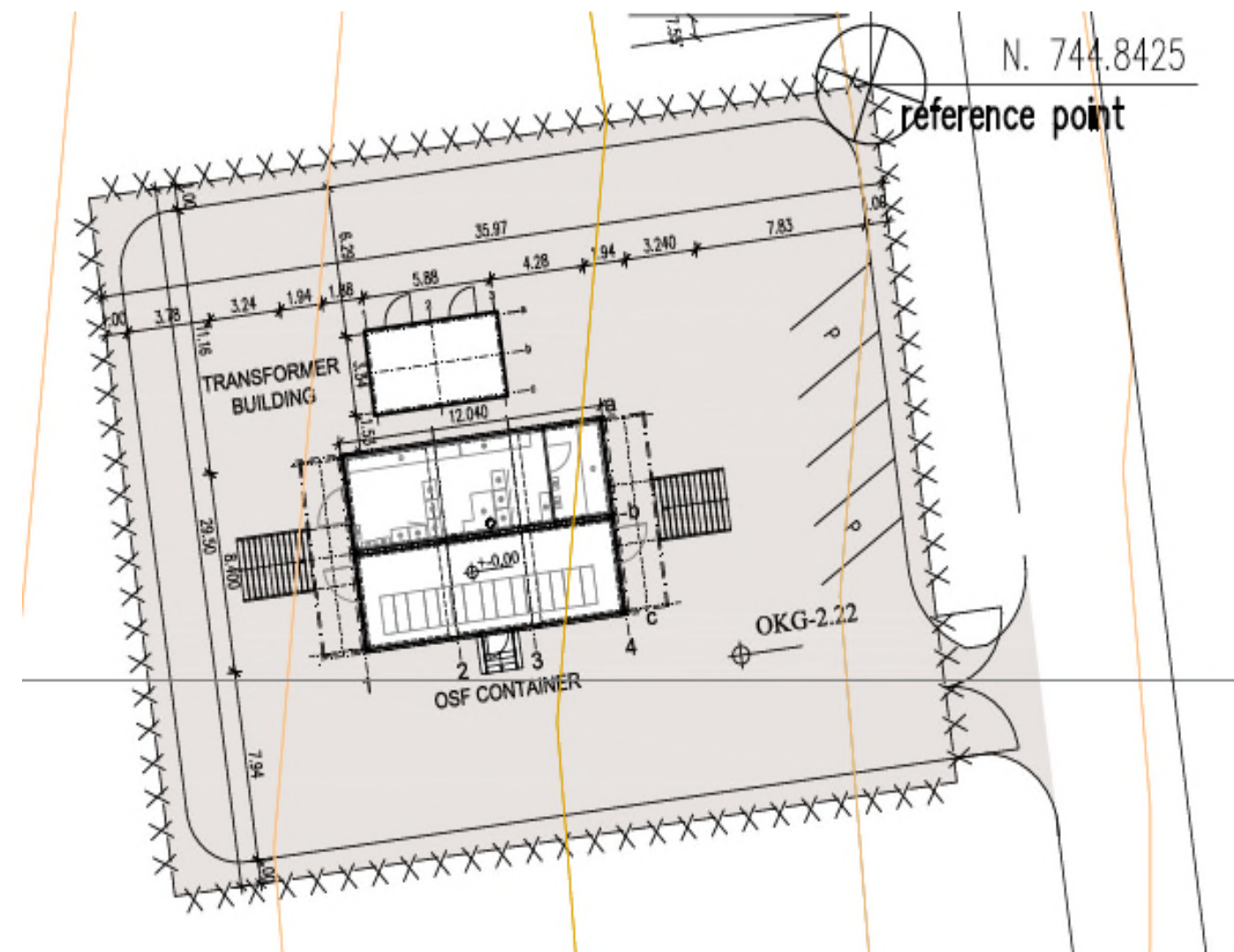
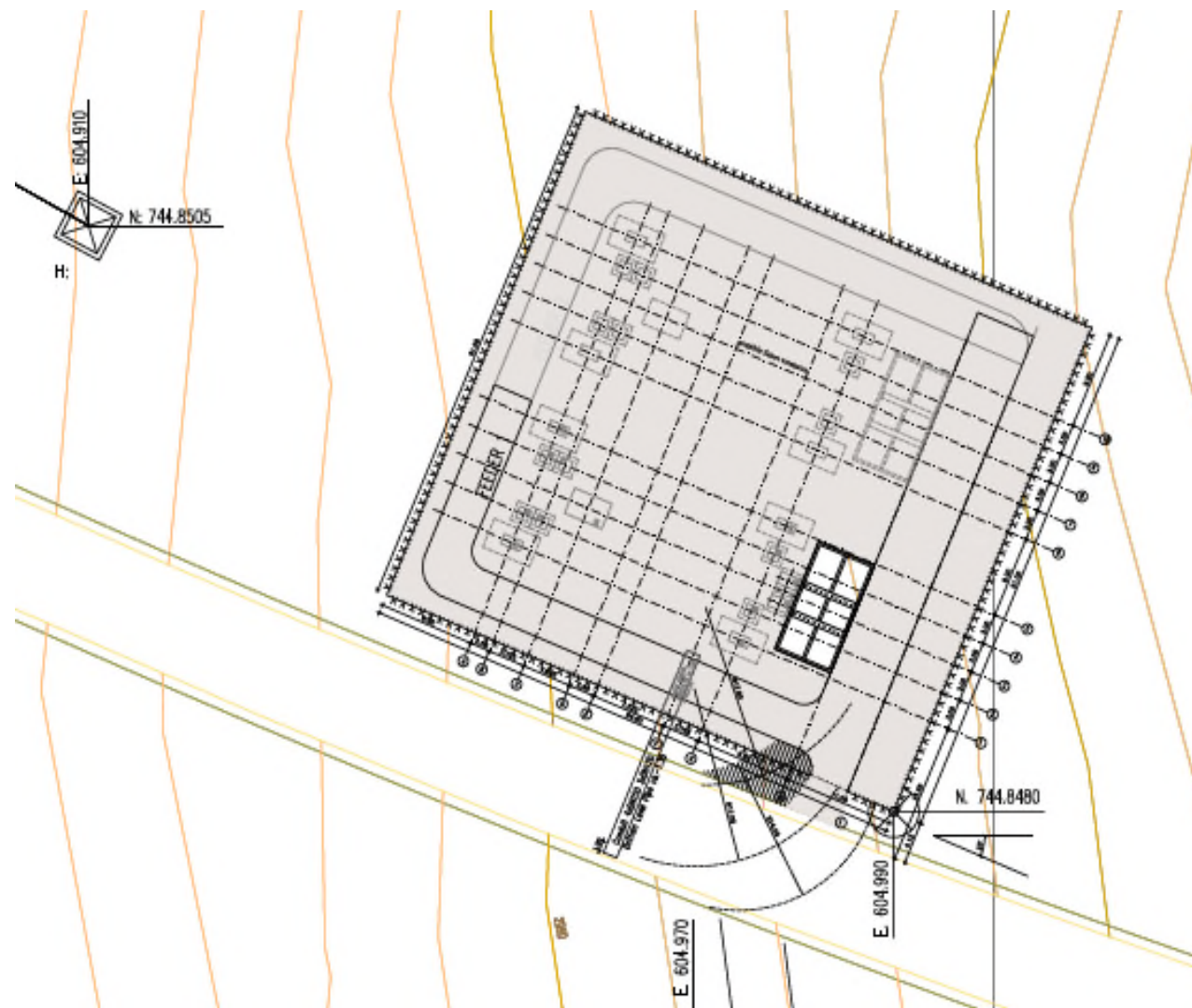
- Layout outside buildings
 - HV SS and MV SS
- Layouts inside buildings
 - Electrical distribution room
 - Battery rooms
 - Transformer rooms
 - El. installation (light, switches, sockets, etc.) in all buildings
 - Power supply and el. installation for data centre
- Layout of 12 distribution SS - containers
- Cable connections, trenches and road crossings and other details



Examples HV and MV Layouts

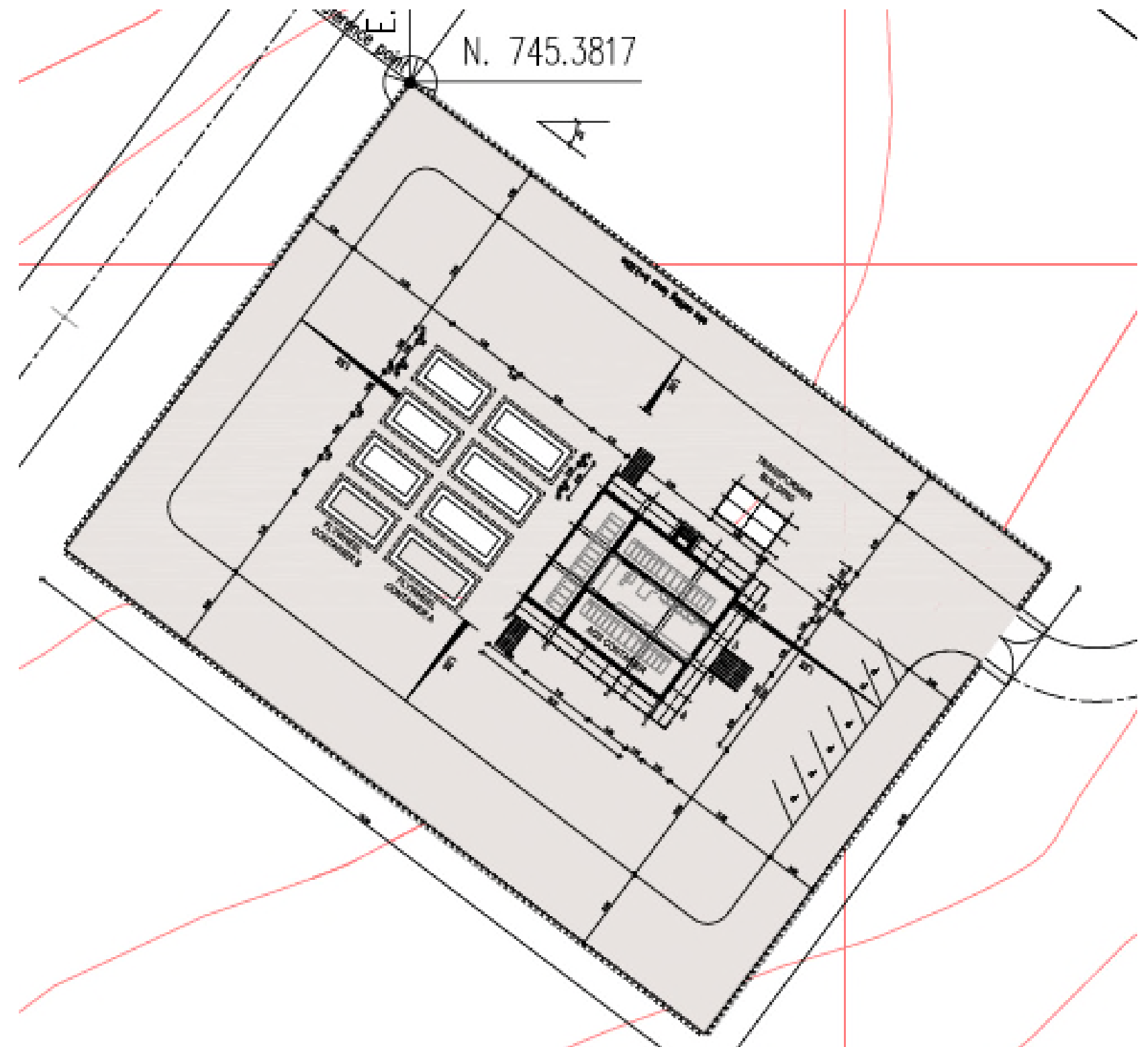
HV outdoor SS - gas isolated (GIS) or air isolated (AIS) or hybrid isolated (HIS)

MV SS in prefabricated container or new building



Example

**MV SS layout
with diesel generators
and / or
with flywheel system**



Thank you for your attention!

