

ILC – LCWS 11

Conventional Electrical System Design Summary

Randy Wielgos

September 29, 2011

Conventional Electrical Updates

- Scope
- Load Basis
 - Development
 - KCS
 - DRFS
- WBS
- Over all Electrical System Design
- Status of Design
 - Parsons Line Dwgs
 - KCS
 - DRFS

SCOPE:

- Conventional Electrical scope includes High Voltage and Low Voltage Electrical Transmission and Distribution on the surface and in the tunnel
- Estimating and Costing Follows the RDR WBS system

| | | |
|-------|---------|---|
| 1.7.2 | | ELECTRICAL |
| | 1.7.2.1 | Engineering, study work and documentation |
| | | 1.7.2.1.1 In-house Engineering |
| | | 1.7.2.1.2 Outsourced Consultancy Services |
| | 1.7.2.2 | High Voltage Equipment, Power Distribution |
| | | 1.7.2.2.1 Main Substation |
| | | 1.7.2.2.2 Distribution Substations |
| | | 1.7.2.2.3 Medium Voltage Distribution & Transforming |
| | | 1.7.2.2.4 H.V. cable links from central area |
| | 1.7.2.3 | Low Voltage Equipment, Power Distribution |
| | | 1.7.2.3.1 Surface buildings (transferred to civil engineer) |
| | | 1.7.2.3.2 Shafts and shaft base caverns |
| | | 1.7.2.3.3 Tunnel |
| | 1.7.2.4 | Emergency Power Sources |
| | 1.7.2.5 | Power Network monitoring |
| | 1.7.2.6 | Communication equipment |
| | | 1.7.2.6.1 Telephone equipment |
| | | 1.7.2.6.2 Public address and other communication equipment |

Load Table progress – Basis for current Concept design

| | | Load Tables | |
|-------------------|---------------------------|---------------------------|--------------------|
| | starting point | use | current Changes |
| Main Linac - KCS | Dec 8 2010 | Mar 23 2011 | none expected |
| Main Linac - DRFS | | email Aug 8 2011 | |
| RTML | Sep 7 2010 | Sep 7 2010 | Sep 13 2011 |
| Positron Source | Aug 27 2010 | Aug 27 2010 | Aug 18 2011 |
| Damping Ring | Aug 2 2010 | Jun 17 2011 | expecting Jan 2012 |
| BDS | Sep 7 2010 | Sep 27 2010 | |
| IR | Jun 30 2010 & Sep 20 2007 | Jun 30 2010 & Sep 20 2007 | Loads very minor |
| Electron Source | totals only | totals only | Loads very minor |

LOAD TABLES - Electrical

Electrical Power in MW DRAFT UPDATED JUL 22 2011

| RDR (w adjusted cryo Jan 27 2011) | | | | | | |
|-----------------------------------|--------------|--------------------------------------|-------------|-------------|-------------|--------------|
| Area System | RF Power | Conventional Power (operating power) | | | Emerg Power | Total |
| | | Conv (incl racks) | NC Magnets | Cryo | | |
| e-sources | 1.05 | 2.46 | 0.73 | 0.59 | 0.06 | 4.89 |
| e+sources | 4.11 | 8.59 | 8.9 | 0.59 | 0.21 | 22.4 |
| DR | 14 | 2.38 | 7.92 | 2.52 | 0.23 | 27.05 |
| RTML | 7.14 | 5.12 | 4.74 | 0 | 0.15 | 17.15 |
| Main Linac | 75.72 | 23.40 | 0.78 | 42.9 | 0.404 | 143.20 |
| BDS | 0 | 4.62 | 2.57 | 0.41 | 0.2 | 7.8 |
| Dumps | 0 | 3.83 | 0 | 0 | 0.12 | 3.95 |
| IR | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 102.0 | 50.4 | 25.6 | 47.0 | 1.4 | 226.4 |

| SB2009 w KlyCluster 5Hz Full Power (w/ 3.2Km DR, 3 ring, 5Hz) | | | | | | | | |
|---|--------------|--------------------------------------|-------------|-------------|-------------|------------|-------------|-------|
| Area System | RF Power | Conventional Power (operating power) | | | | | Emerg Power | Total |
| | | Conv (incl racks) | Conv/other | Racks | NC Magnets | Cryo | | |
| e-sources | 1.05 | 1.27 | 1.19 | 0.73 | 0.59 | 0.06 | 4.89 | |
| e+sources | 1.20 | 1.27 | 7.32 | 5.04 | 0.59 | 0.21 | 15.63 | |
| DR | 12.74 | 0.92 | 1.46 | 0 | 2.07 | 2.52 | 19.94 | |
| RTML | 3.57 | 1.85 | 1.27 | 0.55 | 4.49 | 0 | 11.88 | |
| Main Linac | 95.344 | 12.2 | 2.8 | 5 | 0.914 | 44.2 | 160.86 | |
| BDS | 0 | 4.62 | 0 | 0 | 10.43 | 0.41 | 15.66 | |
| Dumps | 0 | 3.2 | 0.63 | 0 | 0 | 0 | 3.95 | |
| IR | 0 | 0 | 0 | 0 | 0.456 | 1.324 | 1.78 | |
| TOTALS | 113.9 | 25.3 | 20.2 | 24.1 | 49.6 | 1.4 | 235 | |

| SB2009 w DRFS Full Power | | | | | | | | |
|--------------------------|--------------|--------------------------------------|-------------|-------------|-------------|------------|-------------|-------|
| Area System | RF Power | Conventional Power (operating power) | | | | | Emerg Power | Total |
| | | Conv (incl racks) | Conv/other | Racks | NC Magnets | Cryo | | |
| e-sources | 1.05 | 1.27 | 1.19 | 0.73 | 0.59 | 0.06 | 4.9 | |
| e+sources | 1.20 | 1.27 | 7.32 | 5.04 | 0.59 | 0.21 | 15.63 | |
| DR | 12.74 | 0.92 | 1.46 | 0 | 2.07 | 2.52 | 19.94 | |
| RTML | 3.57 | 1.85 | 1.27 | 0.55 | 4.49 | 0 | 11.88 | |
| Main Linac | 128.35 | 12.2 | 2.8 | 6.8 | 0.914 | 44.2 | 195.67 | |
| BDS | 0 | 0.00 | 0 | 0 | 10.43 | 0.41 | 11.04 | |
| Dumps | 0 | 3.2 | 0.63 | 0 | 0 | 0 | 3.95 | |
| IR | 0 | 0 | 0 | 0 | 0.456 | 1.324 | 1.78 | |
| TOTALS | 146.9 | 20.7 | 22.0 | 24.1 | 49.6 | 1.4 | 265 | |

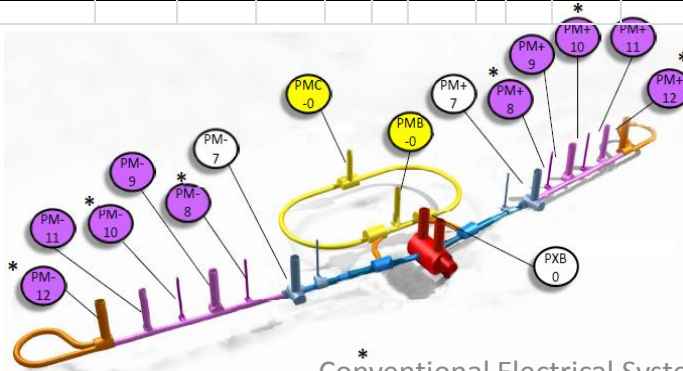
Items in 'Conv' column will be further updated by CFS (Parsons) !!!
 New numbers given so far (2010)
 placeholder (no info)
 DRFS Info JUL 21 2011

KCS POWER LOAD TABLE (Technical Equipment only)

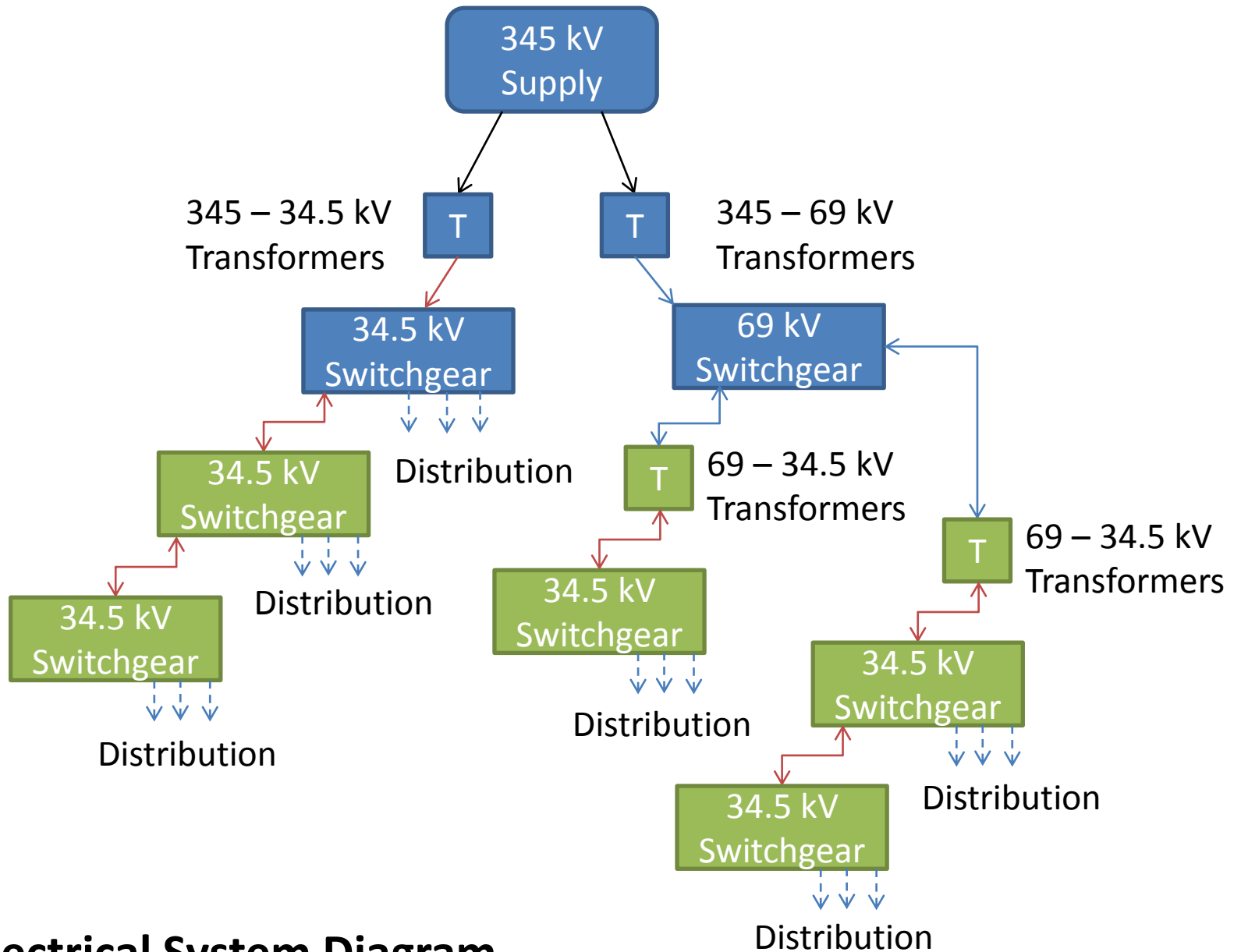
(sample load distribution) *EXCLUDING non-technical components * Conventional Nos by PARSONS

| New Shaft Nos | PM-12 | PM-11 | PM-10 | PM-9 | PM-8 | PM-7 | PMB-0 | PMC-0 | PXA-0 | PM+7 | PM+8 | PM+9 | PM+10 | PM+11 | PM+12 | |
|------------------------------|------------------|----------------|----------------|----------------|----------------|----------------|--------------|-------------|-----------|---------------|---------------|----------------|----------------|----------------|------------------|------------|
| Old Shaft Nos | Shaft 11 | Shaft 7 | Shaft 14 | Shaft 5 | Shaft 15 | Shaft 3 | Shaft 12 | Shaft 13 | Shaft 1.0 | Shaft 2 | Shaft 16 | Shaft 4 | Shaft 17 | Shaft 6 | Shaft 10 | TOTAL MW * |
| Total | 8.3 | 18.1 | 10.1 | 18.1 | 10.1 | 24.8 | 3.8 | 14.4 | 16.7 | 22.9 | 10.1 | 18.1 | 10.1 | 18.1 | 7.8 | 212 |
| SURFACE | | | | | | | | | | | | | | | | |
| e - (surface) | | 0.00 | | | | 0.00 | | 0 | | 0.30 | | | | 0.00 | | 0.30 |
| ML RF installed (surface) | 29 RF 4.342 | 66 RF 9.882 | 66 RF 9.882 | 66 RF 9.882 | 66 RF 9.882 | 66 RF 9.882 | | 0 | | 66RF 9.882 | 66RF 9.882 | 66RF 9.882 | 66 RF 9.882 | 66 RF 9.882 | 26 RF 3.893 | 109.20 |
| ML Racks installed (surface) | 29 RF 0.087 | 66 RF 0.198 | 66 RF 0.198 | 66 RF 0.198 | 66 RF 0.198 | 66 RF 0.198 | | 0 | | 66RF 0.198 | 66RF 0.198 | 66RF 0.198 | 66 RF 0.198 | 66 RF 0.198 | 26 RF 0.078 | |
| CRYO (surface) | | 7.37 | | 7.37 | | 7.96 | | 2.52 | 1.73 | 7.96 | | 7.37 | | 7.37 | | 49.63 |
| TUNNEL | | | | | | | | | | | | | | | | |
| RTML Total (in tunnels) | 45% rtml 3.87 | | | | | 0.00 | 10% 0.861 | | | 0.00 | | | | | 45% rtml 3.87 | 8.61 |
| ML Racks (tunnel) | | 105 RF 0.53 | | 108 RF 0.54 | | 81 RF 0.41 | | | | 81 RF 0.41 | | 108 RF 0.54 | | 101 RF 0.51 | | 3.83 |
| ML conv magnets? (tunnel) | | 0.15 | | 0.15 | | 0.15 | | | | 0.15 | | 0.15 | | 0.15 | | |
| DR (in tunnel) | | | | | | | 20% 2.962 | 80% 11.8 | | | | | | | | 14.81 |
| e+ TOTAL (in tunnel) | | | | | | 100% 6.25 | | | | | | | | | | 6.25 |
| e- (in tunnel) | | | | | | | | | | 4 | | | | | | 4.00 |
| BDS (in tunnel) | | | | | | 0.00 | | | 10.578 | 0.00 | | | | | | 10.58 |
| Dumps (in tunnel) | | | | | | | | | 3.95 | | | | | | | 3.95 |
| IR (tunnel) | | | | | | | | | 0.456 | | | | | | | 0.456 |
| | | | | | | | | | | | | | | | | 212 |

*does n't include conventional



* Conventional Electrical System Design Summary



Electrical System Diagram

Parsons Electrical Design and Cost Estimating

Basis of Design – Full Power Option

Conventional Facilities Development of Loads

Mechanical & Electrical Coordination

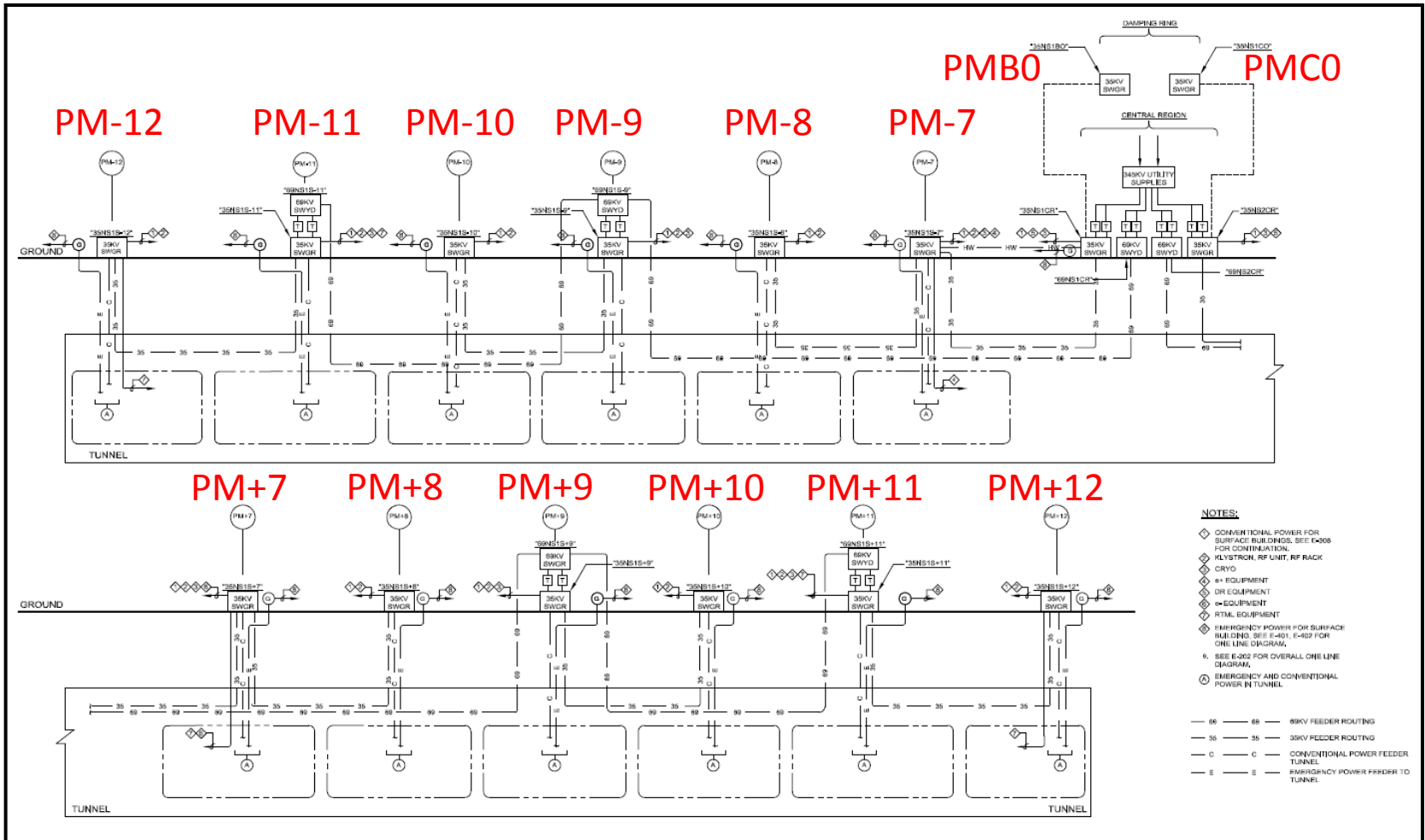
Determination of Load Characteristics

Engineering Drawings & Specifications for Estimating

Under Review and Comment

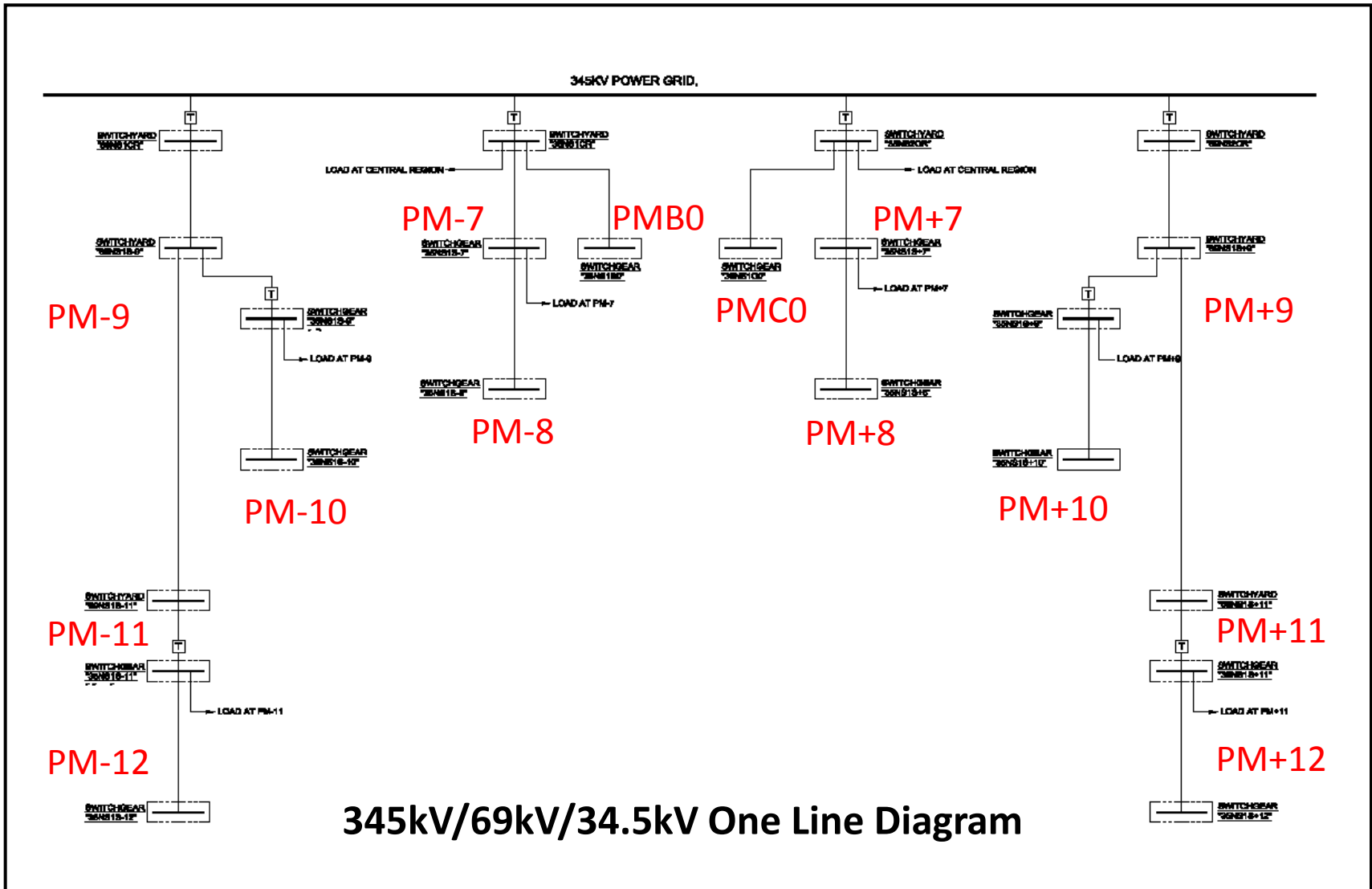
Cost Information in Development

Electrical Design Status

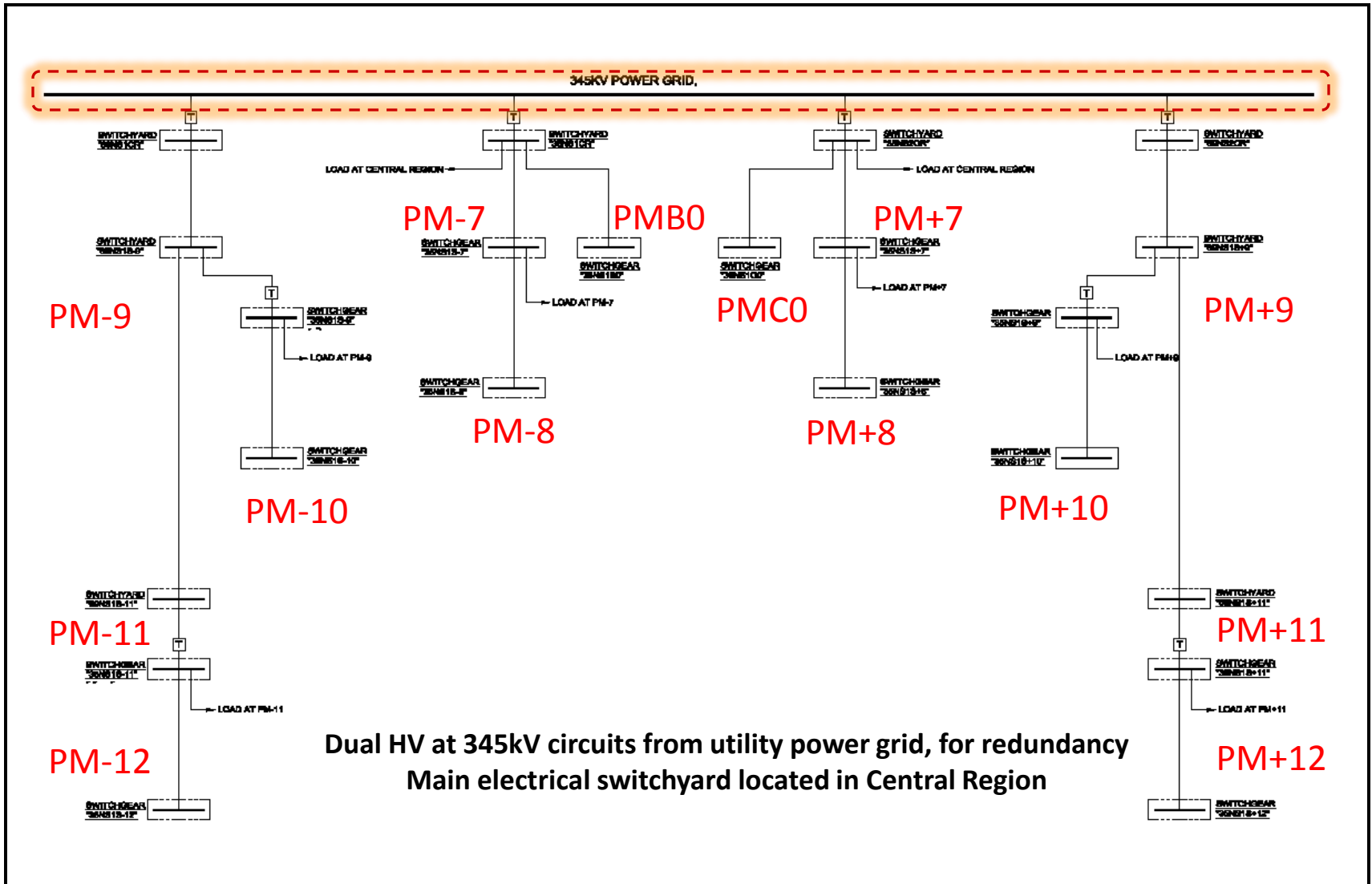


Power System Configuration

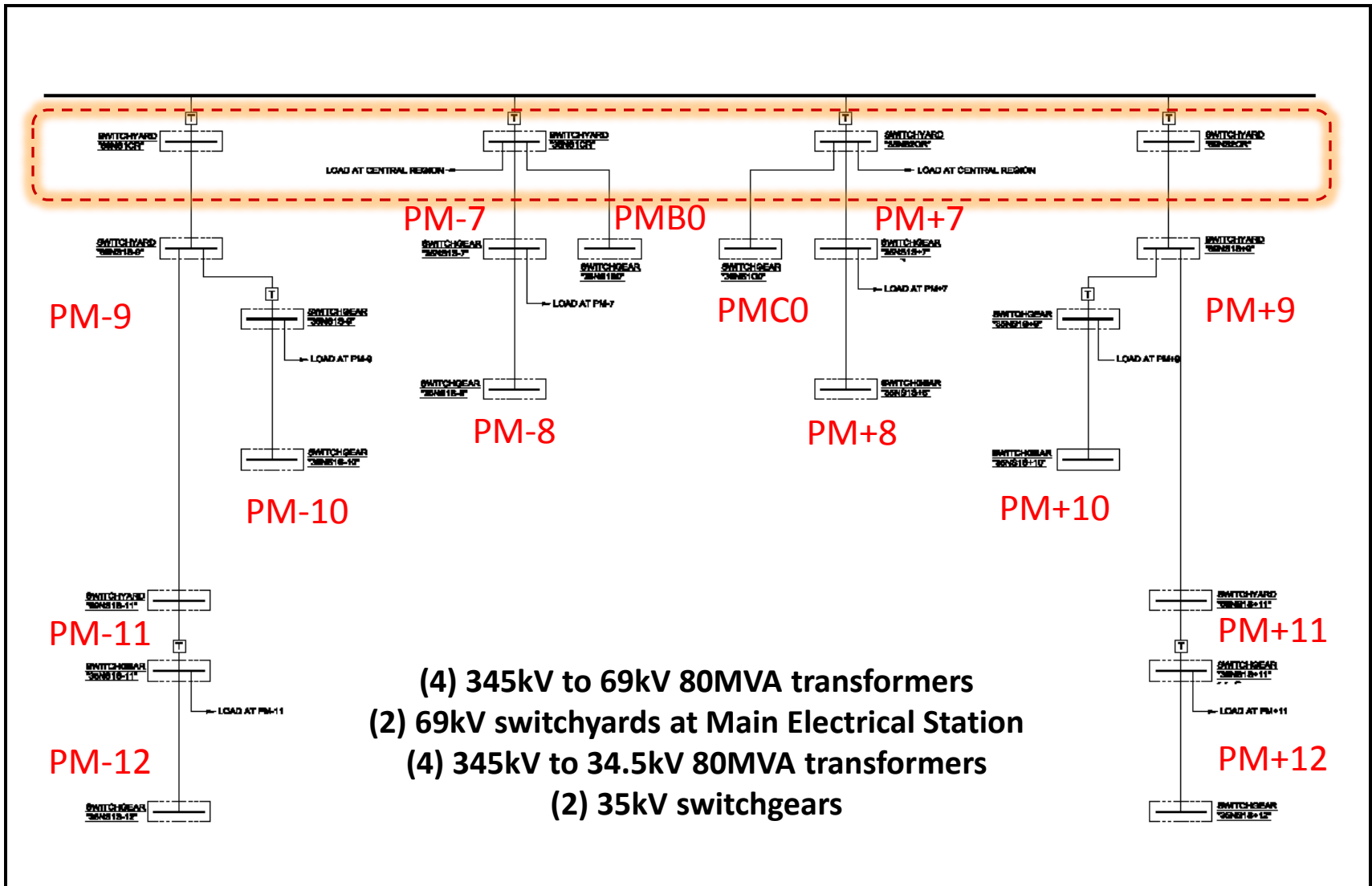
Conventional Electrical System Design
 Summary



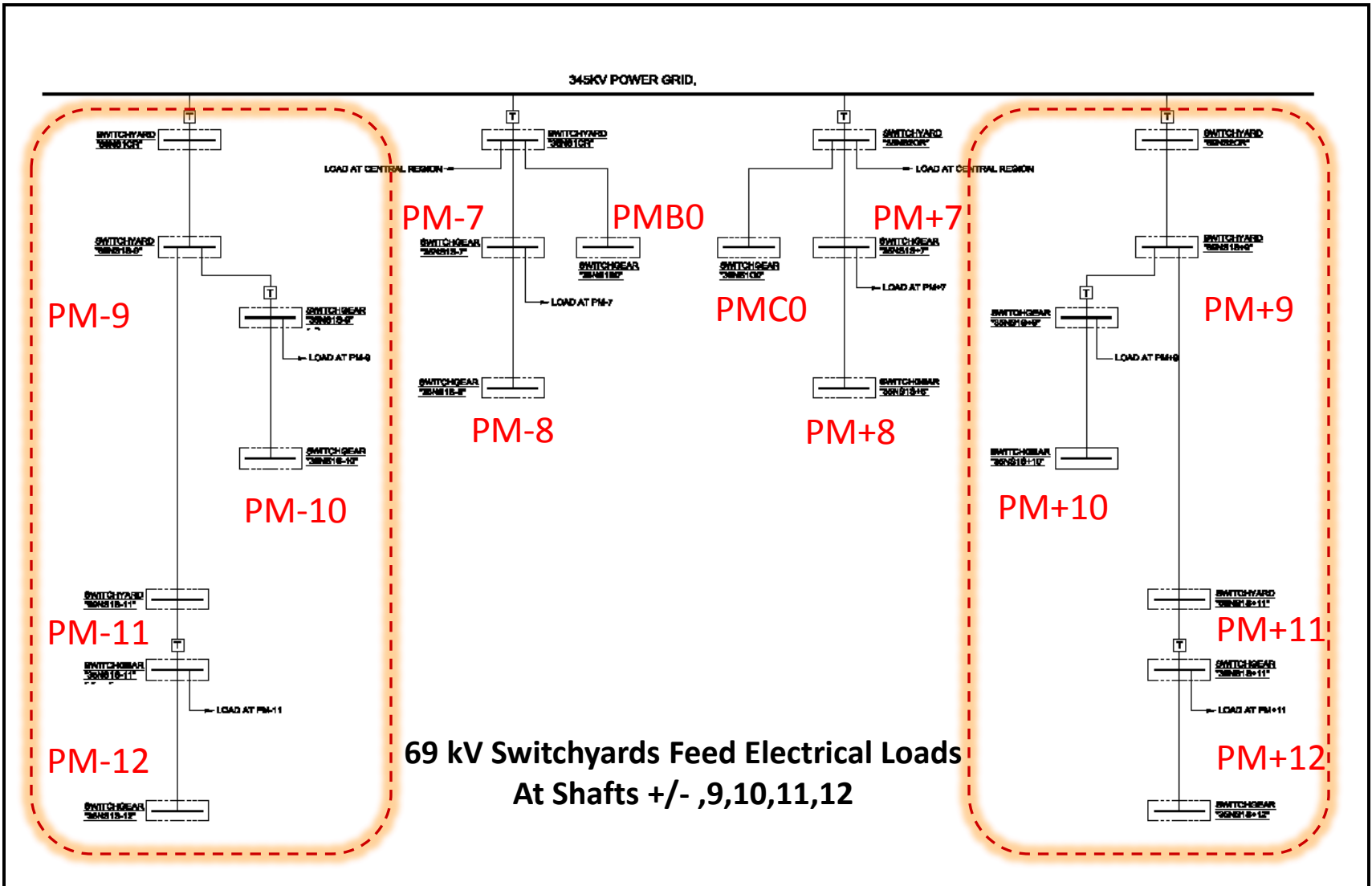
Power System Configuration - KCS



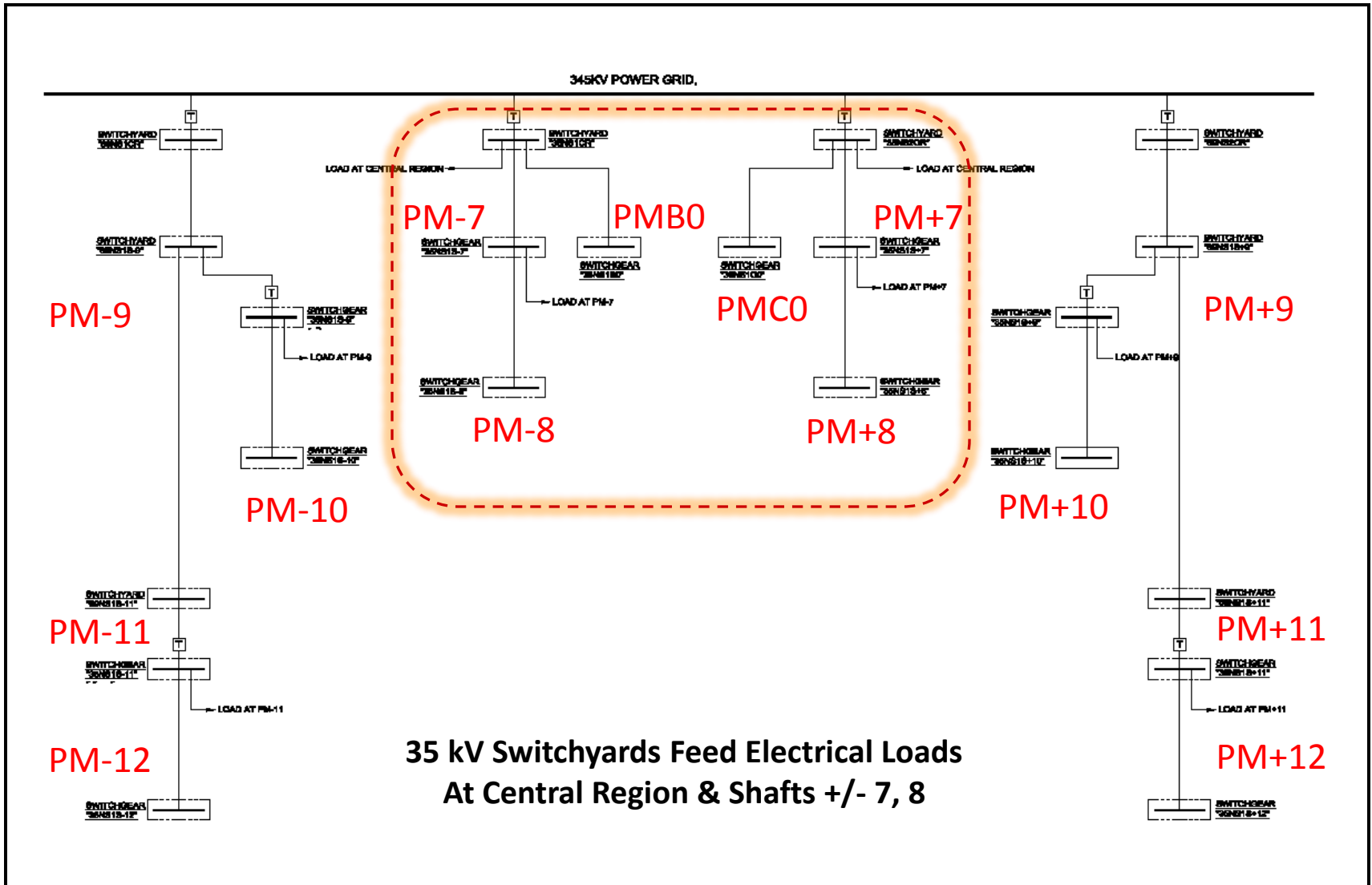
High Voltage Power Distribution



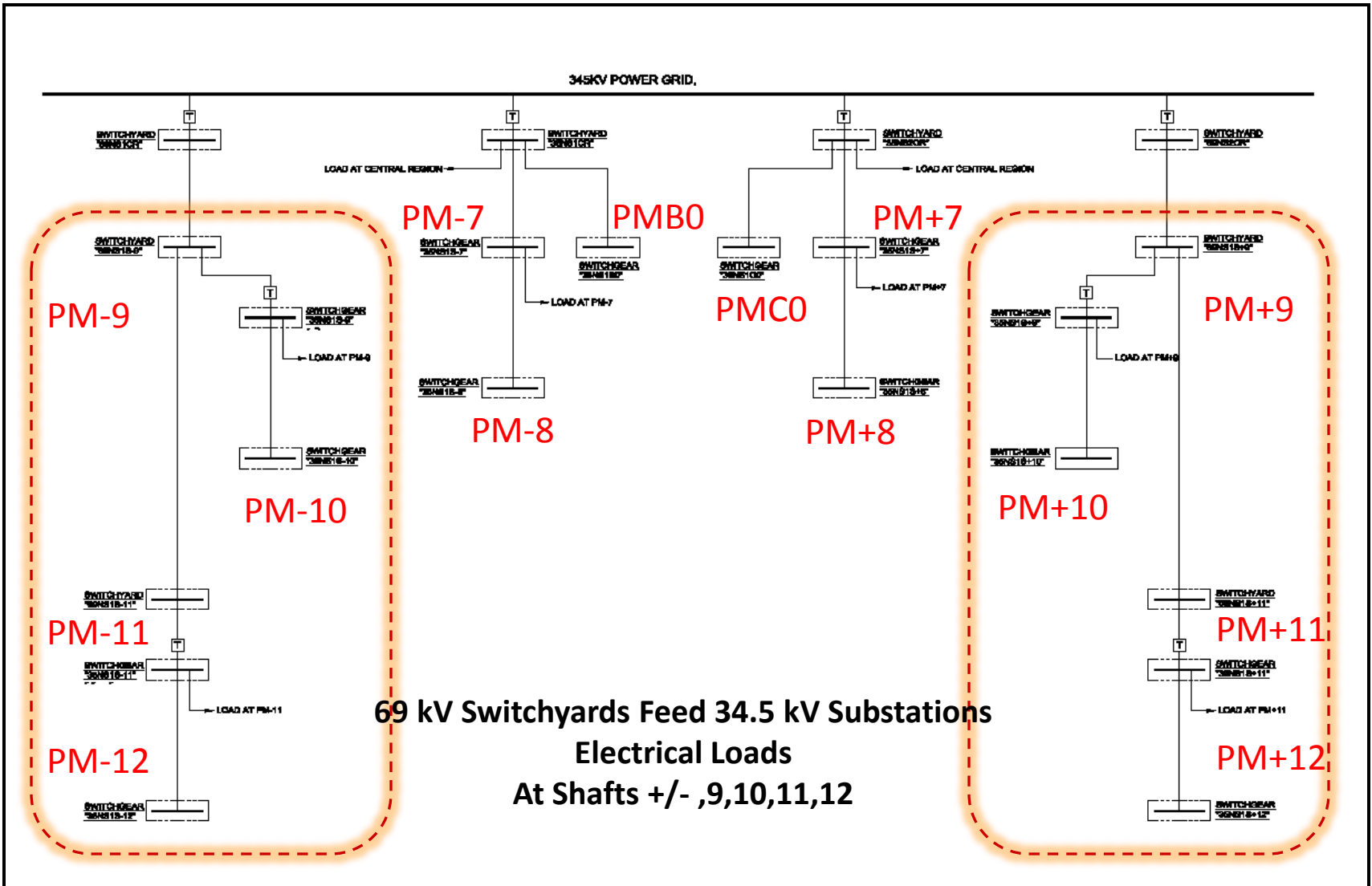
High Voltage Power Distribution



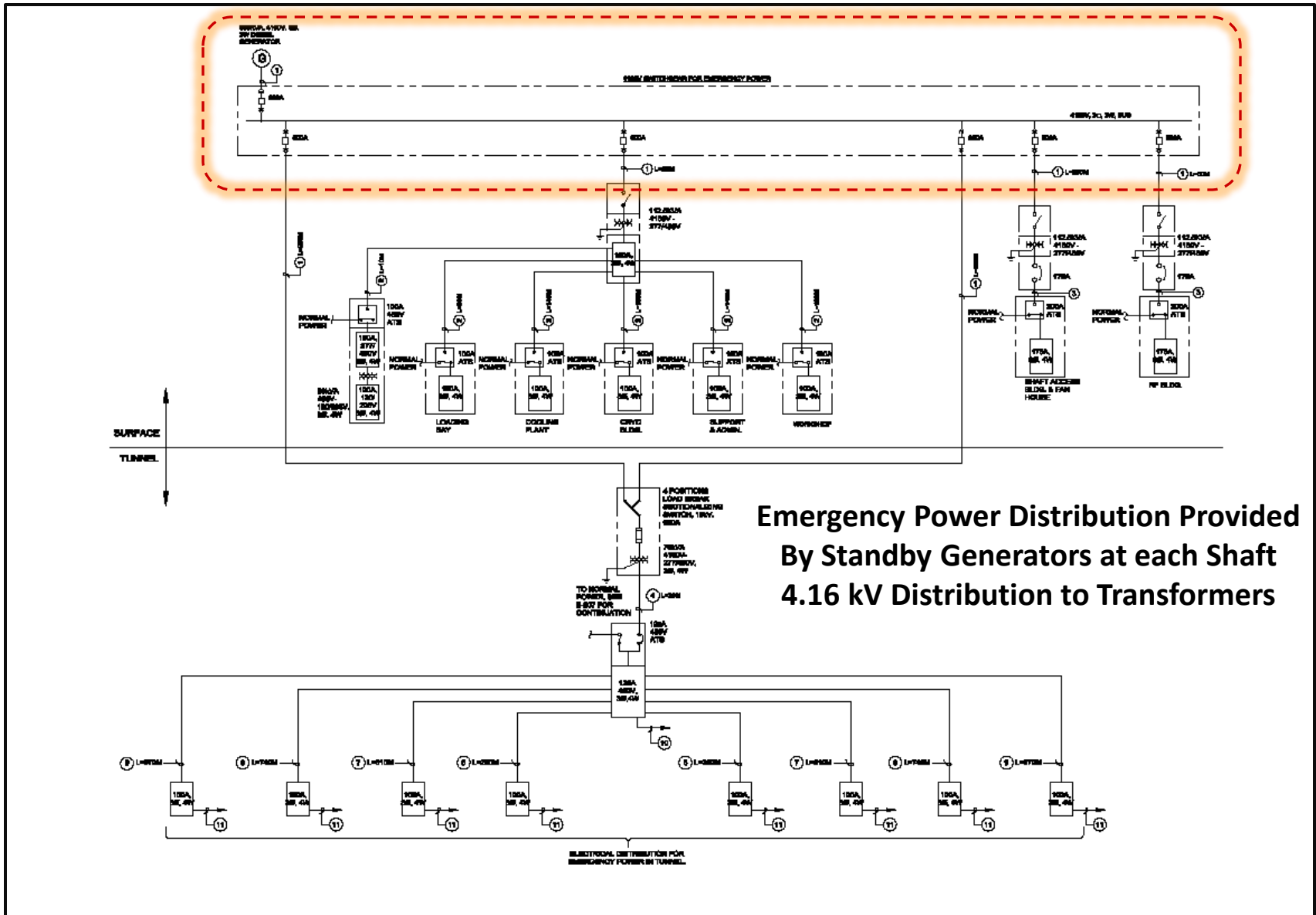
Medium Voltage Power Distribution



Medium Voltage Power Distribution

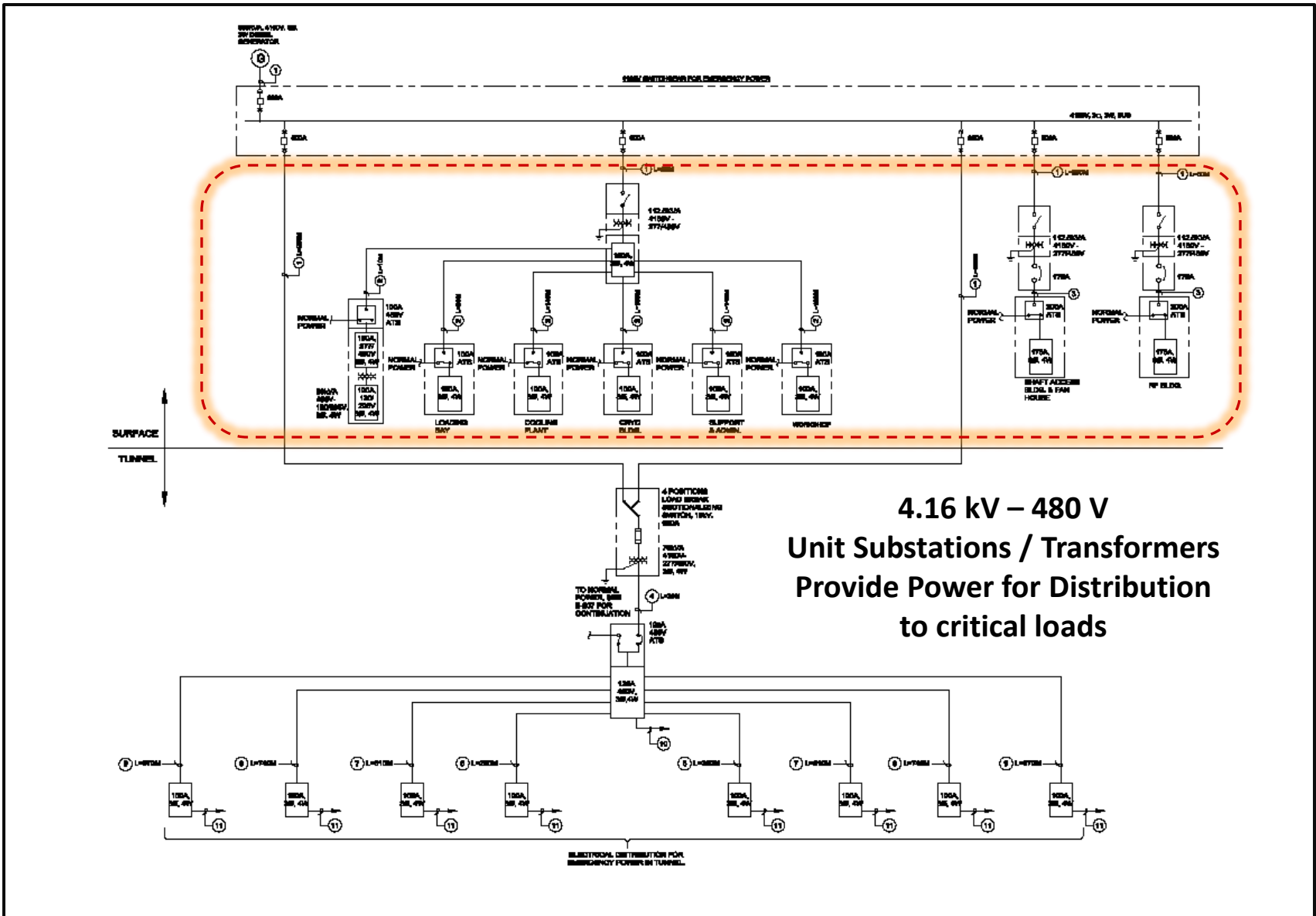


Medium Voltage Power Distribution

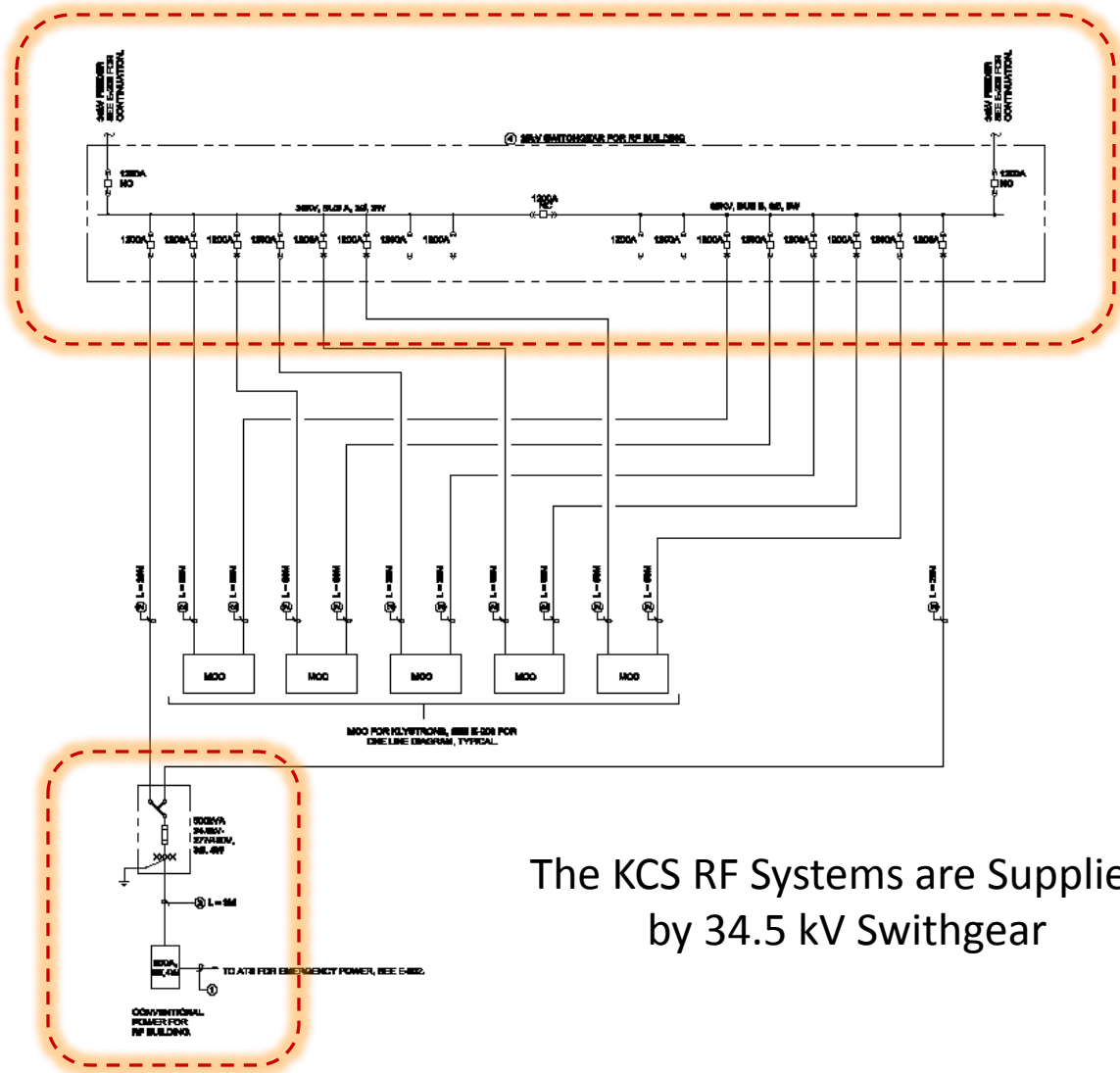


**Emergency Power Distribution Provided
By Standby Generators at each Shaft
4.16 kV Distribution to Transformers**

Emergency Power Distribution

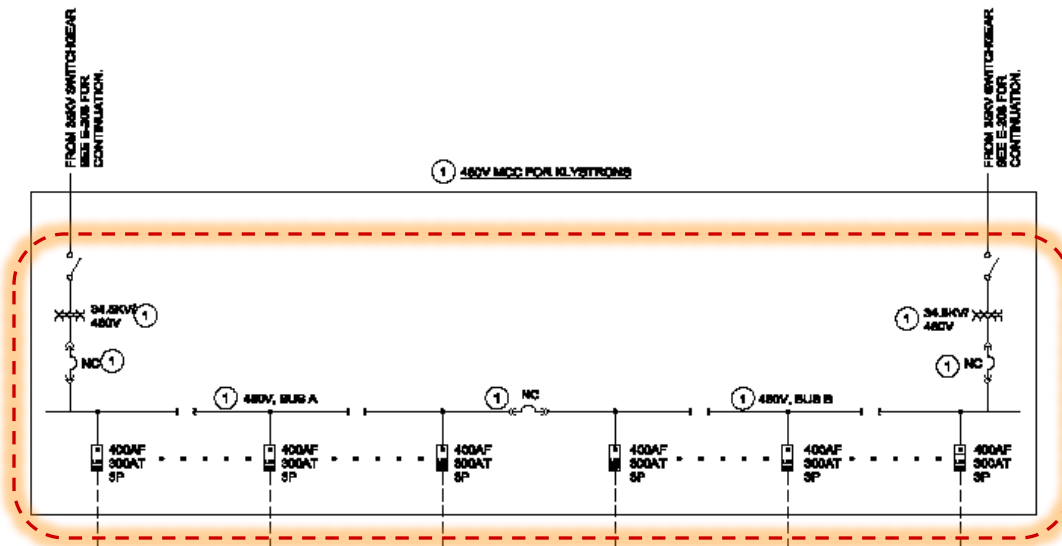


Emergency Power Distribution

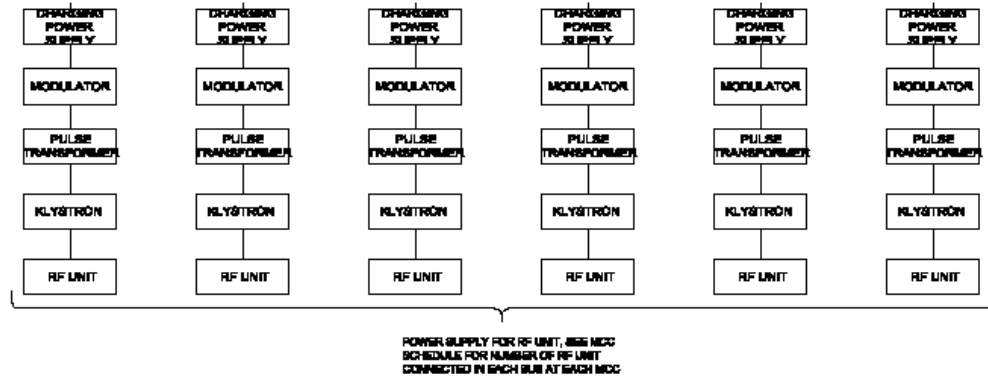


The KCS RF Systems are Supplied by 34.5 kV Switchgear

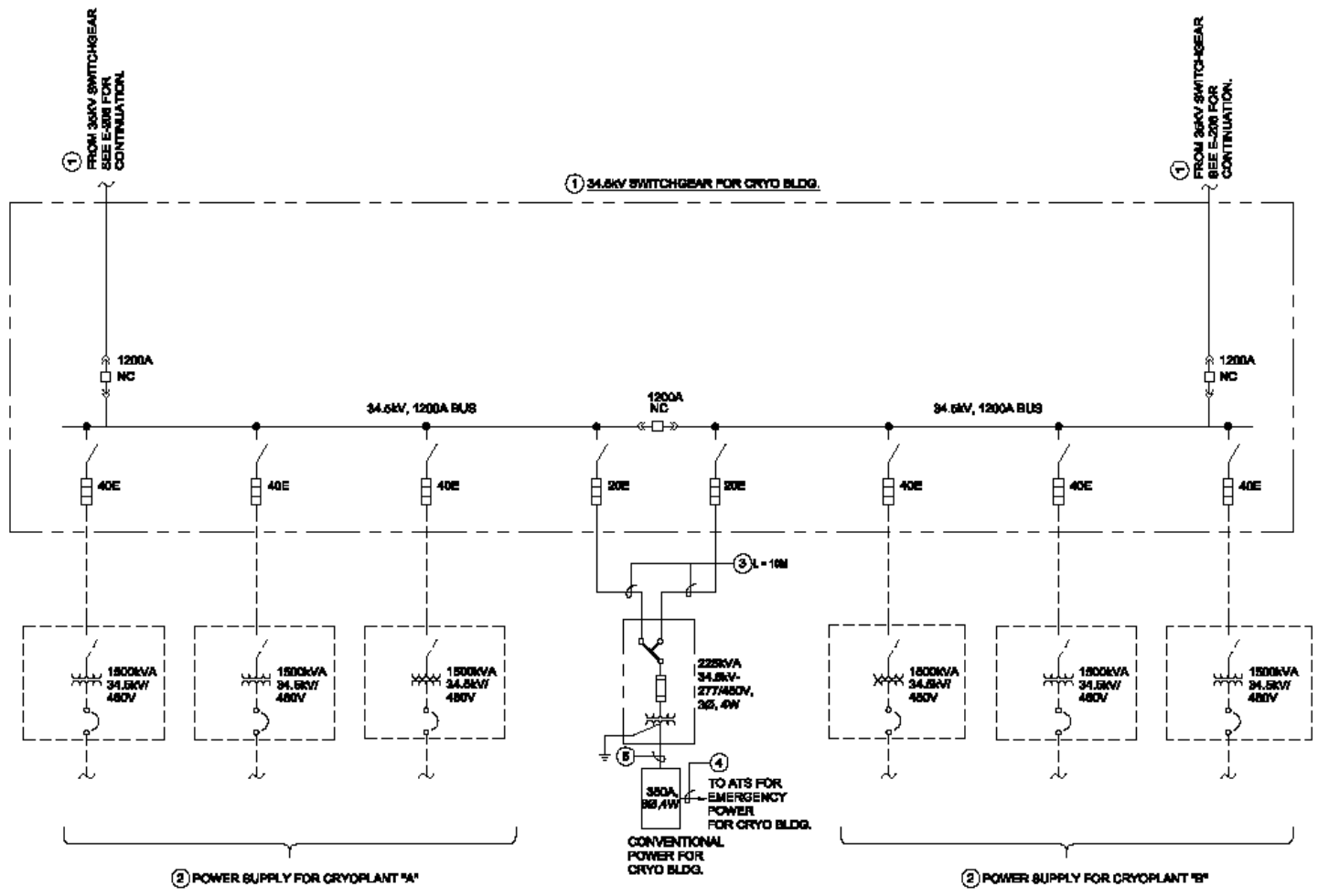
Power Distribution for RF



The KCS RF Systems are Supplied by 480V Transformers & MCC's



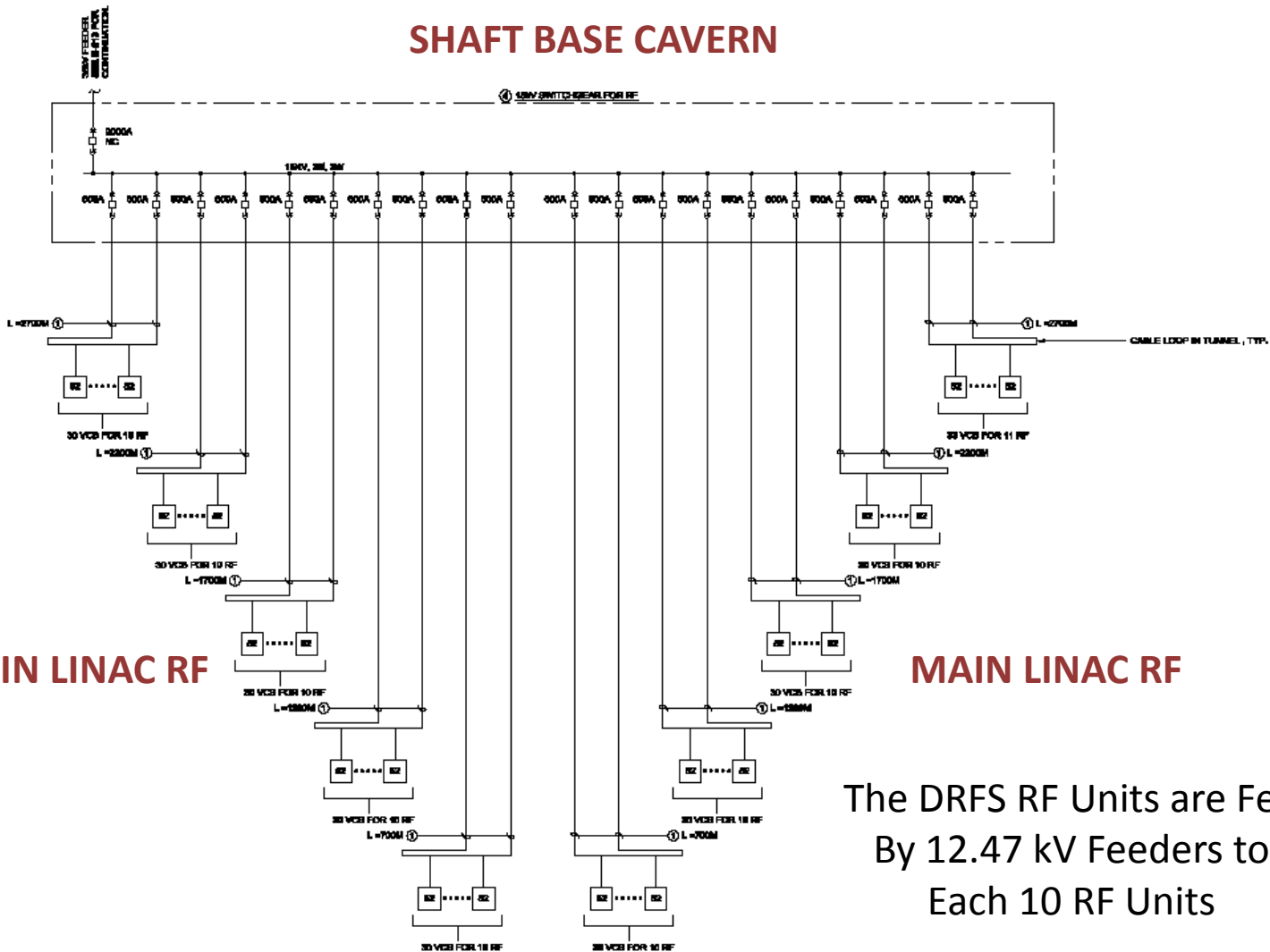
Power Distribution for RF



The Cryo Plants are Supplied
by 34.5 kV Swithgear and Transformers

Power Distribution for Cryo

SHAFT BASE CAVERN



Power Distribution for RF - DRFS

Conventional Electrical System Design
Summary