Power Quality Solutions, PPHVC-LV

# PQC-STATCON CASE STUDIES
## Success Stories & Highlights

Power and productivity
for a better world™

# PQC-STATCON

# Case Study – I
# M/s TATA MOTORS LTD

# Case Study - I
## M/s TATA MOTORS LTD

**PQC-STATCON Installation in M/s TATA MOTORS LTD.**

- **PQC-STATCON** commissioned successfully  Iin N1, N2 and N3 sub-stations each rated 0-600 to improve the power quality.

# Performance Chart
## With & without instantaneous stepless compensator

### Transformer 1

| Sl. No. | Power Quality Parameters | Ph | Without DRPC System | | | With DRPC System | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Avg | Min | Max | Avg | Min | Max | |
| 1 | Voltage | R | 413.1 | 403.7 | 417.7 | 415.4 | 409.3 | 419.4 | V |
| | | Y | 411.4 | 404.4 | 415.6 | 413.0 | 408.3 | 416.9 | |
| | | B | 412.5 | 406.3 | 416.4 | 413.7 | 410.5 | 419.3 | |
| 2 | Load Current | R | 596.0 | 280.0 | 1477.0 | 459.0 | 246.0 | 1400.0 | A |
| | | Y | 583.0 | 281.0 | 1493.0 | 464.0 | 277.0 | 1019.0 | |
| | | B | 496.1 | 262.2 | 905.0 | 455.0 | 267.5 | 819.4 | |
| 5 | Active Power | 3ph | 291.8 | 181.4 | 553.9 | 299.7 | 186.4 | 590.7 | kW |
| 6 | Reactive Power | 3ph | 265.5 | 92.0 | 641.3 | -35.2 | -177.8 | 276.8 | kVAr |
| 7 | Apparent Power | 3ph | 398.4 | 208.6 | 835.7 | 329.4 | 188.8 | 751.4 | kVA |
| 8 | Power factor | 3ph | 0.732 | | | 0.999 | | | Avg. |

### Transformer 2

| Sl. No. | Power Quality Parameters | Ph | Without DRPC System | | | With DRPC System | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Avg | Min | Max | Avg | Min | Max | |
| 1 | Voltage | R | 409.6 | 399.1 | 414.2 | 423.0 | 418.1 | 428.3 | V |
| | | Y | 406.4 | 395.6 | 411.5 | 421.5 | 415.9 | 427.1 | |
| | | B | 407.7 | 401.4 | 411.3 | 421.3 | 417.0 | 426.6 | |
| 2 | Load Current | R | 775.0 | 429.0 | 1804.0 | 406.8 | 219.3 | 882.7 | A |
| | | Y | 918.0 | 408.0 | 2074.0 | 447.0 | 225.0 | 1193.0 | |
| | | B | 792.0 | 433.0 | 1567.0 | 428.1 | 226.3 | 839.2 | |
| 5 | Active Power | 3ph | 362.7 | 187.8 | 725.2 | 276.7 | 161.1 | 534.0 | kW |
| 6 | Reactive Power | 3ph | 451.3 | 235.7 | 916.4 | -25.6 | -205.3 | 233.0 | kVAr |
| 7 | Apparent Power | 3ph | 585.0 | 302.0 | 1156.0 | 312.0 | 164.5 | 657.7 | kVA |
| 8 | Power factor | 3ph | 0.621 | | | 0.999 | | | Avg. |

### Transformer 3

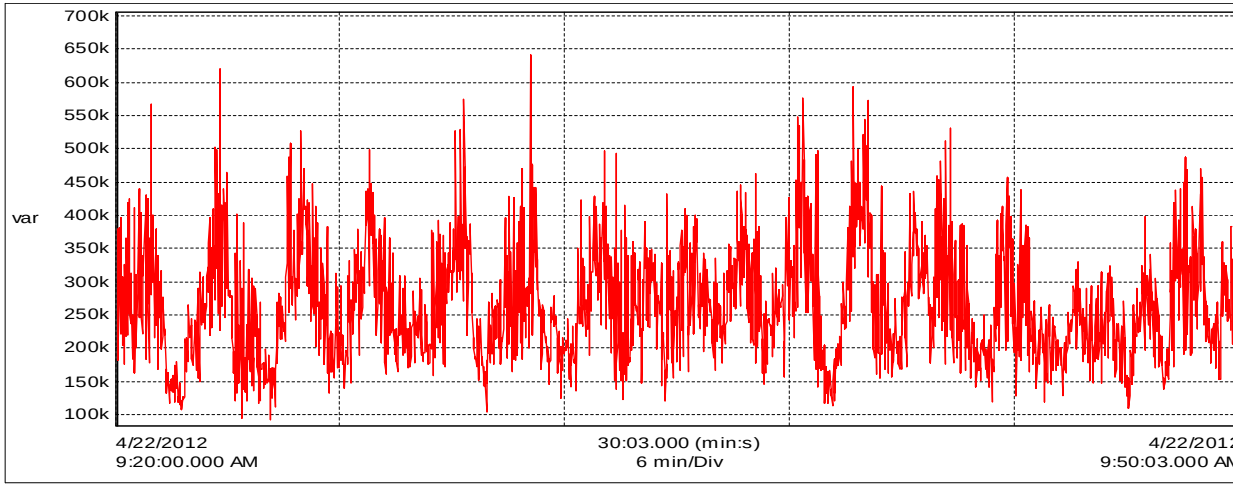
| Sl. No. | Power Quality Parameters | Ph | Without DRPC System | | | With DRPC System | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Avg | Min | Max | Avg | Min | Max | |
| 1 | Voltage | R | 417.3 | 410.0 | 422.9 | 425.8 | 418.1 | 430.6 | V |
| | | Y | 415.8 | 407.4 | 420.8 | 422.4 | 417.0 | 426.7 | |
| | | B | 414.9 | 408.0 | 419.9 | 423.0 | 418.2 | 427.1 | |
| 2 | Load Current | R | 115.2 | 26.6 | 238.7 | 83.9 | 19.1 | 222.3 | A |
| | | Y | 95.5 | 26.6 | 279.4 | 88.0 | 36.2 | 207.2 | |
| | | B | 105.1 | 31.5 | 220.3 | 80.0 | 29.4 | 170.8 | |
| 5 | Active Power | 3ph | 43.7 | 16.9 | 104.3 | 47.4 | 18.4 | 100.7 | kW |
| 6 | Reactive Power | 3ph | 61.2 | 17.0 | 133.0 | -11.8 | -66.7 | 73.4 | kVAr |
| 7 | Apparent Power | 3ph | 75.8 | 24.2 | 170.0 | 61.6 | 20.7 | 128.4 | kVA |
| 8 | Power factor | 3ph | 0.576 | | | 0.999 | | | Avg. |

### Transformer 4

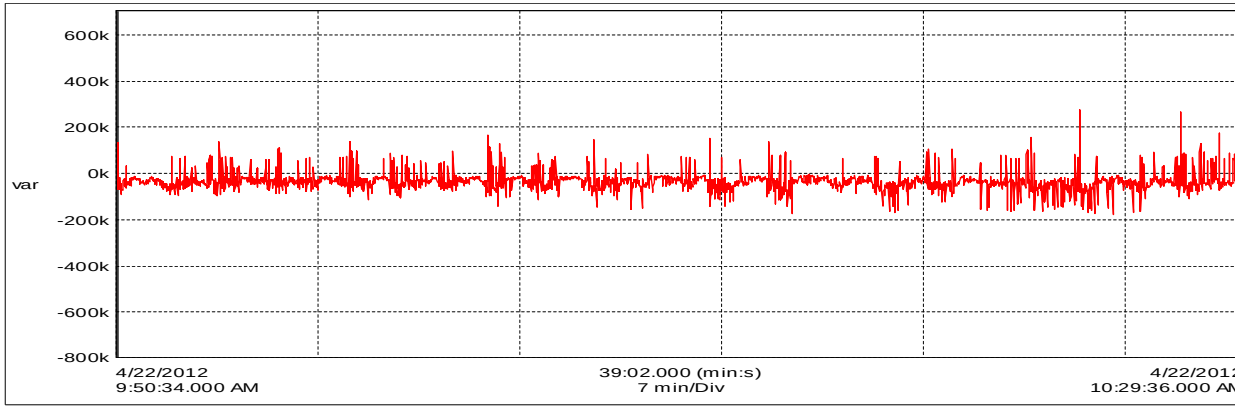
| Sl. No. | Power Quality Parameters | Ph | Without DRPC System | | | With DRPC System | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Avg | Min | Max | Avg | Min | Max | |
| 1 | Voltage | R | 401.0 | 391.6 | 407.1 | 400.3 | 398.1 | 402.4 | V |
| | | Y | 399.4 | 390.1 | 404.7 | 398.4 | 395.9 | 400.5 | |
| | | B | 399.3 | 389.6 | 404.8 | 398.4 | 396.2 | 400.5 | |
| 2 | Load Current | R | 497.0 | 164.0 | 1133.0 | 343.0 | 165.6 | 716.2 | A |
| | | Y | 497.0 | 157.0 | 1115.0 | 348.1 | 158.0 | 724.4 | |
| | | B | 468.0 | 148.0 | 1111.0 | 345.0 | 152.1 | 688.3 | |
| 5 | Active Power | 3ph | 248.5 | 107.8 | 501.4 | 222.1 | 106.9 | 437.6 | kW |
| 6 | Reactive Power | 3ph | 223.3 | -41.4 | 549.7 | -42.9 | -160.4 | 82.6 | kVAr |
| 7 | Apparent Power | 3ph | 337.4 | 116.2 | 729.6 | 238.7 | 111.9 | 468.9 | kVA |
| 8 | Power factor | 3ph | 0.737 | | | 0.995 | | | Avg. |

# Case Study – I: REACTIVE POWER
## Feeder - N1

**Without RTPFC – Reactive Power (kVAr) Vs Time**

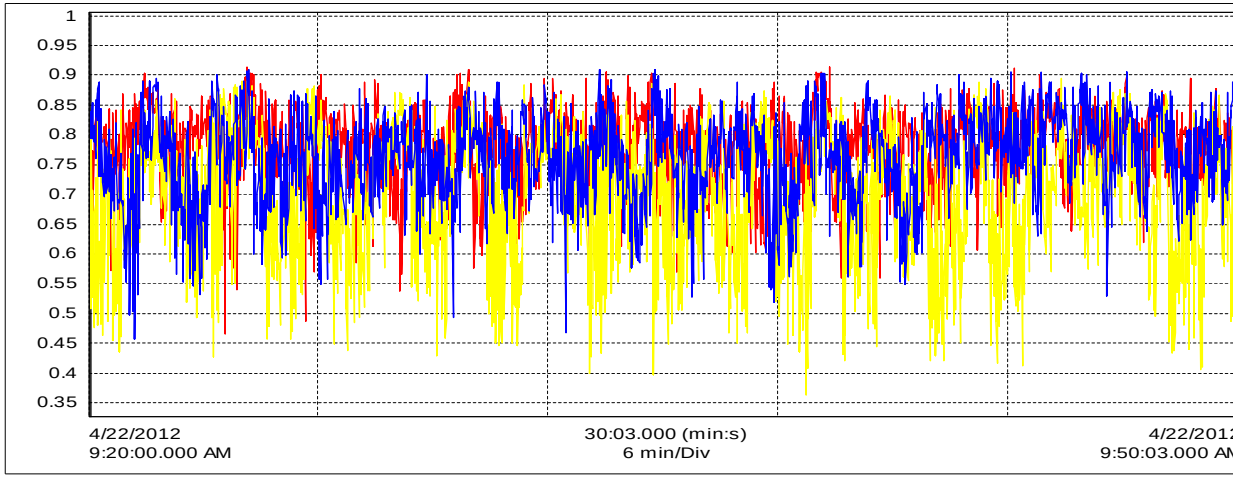



**With RTPFC – Reactive Power (kVAr) Vs Time**

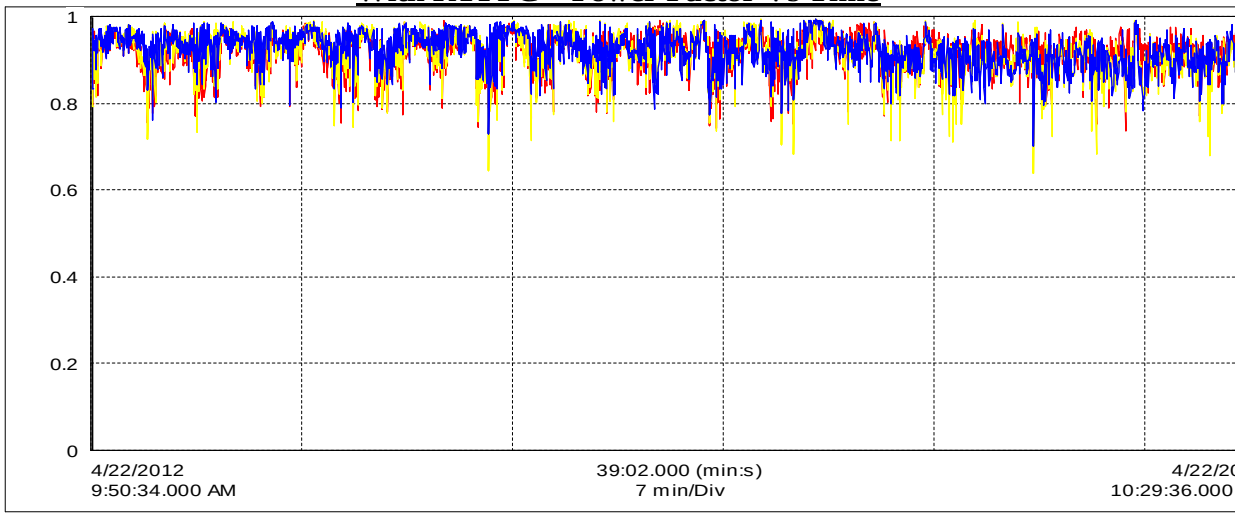


# Case Study – I: POWER FACTOR
## Feeder - N1

**Without RTPFC – Power Factor Vs Time**

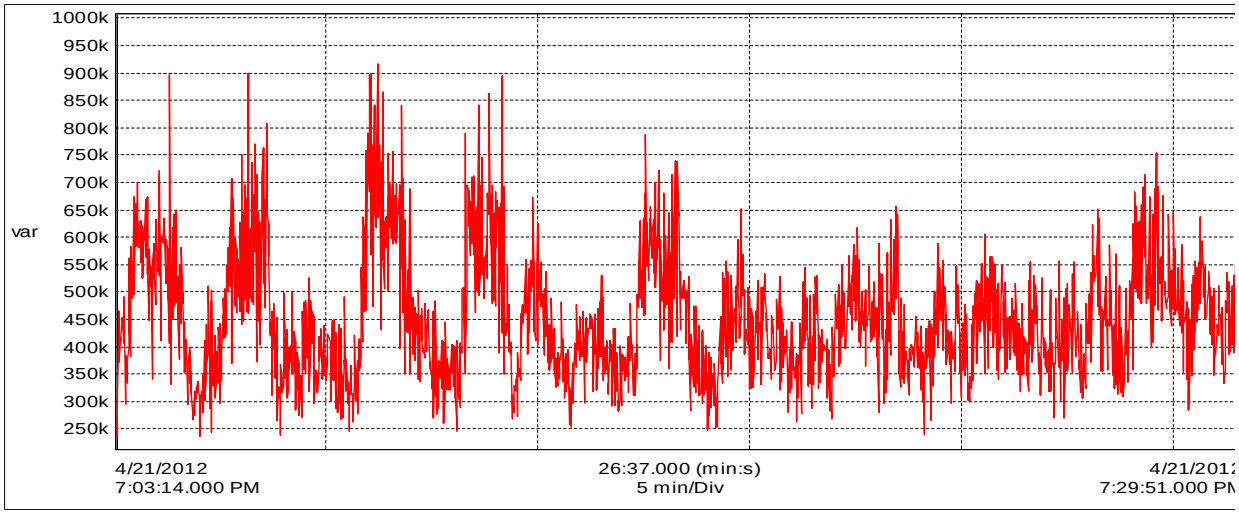


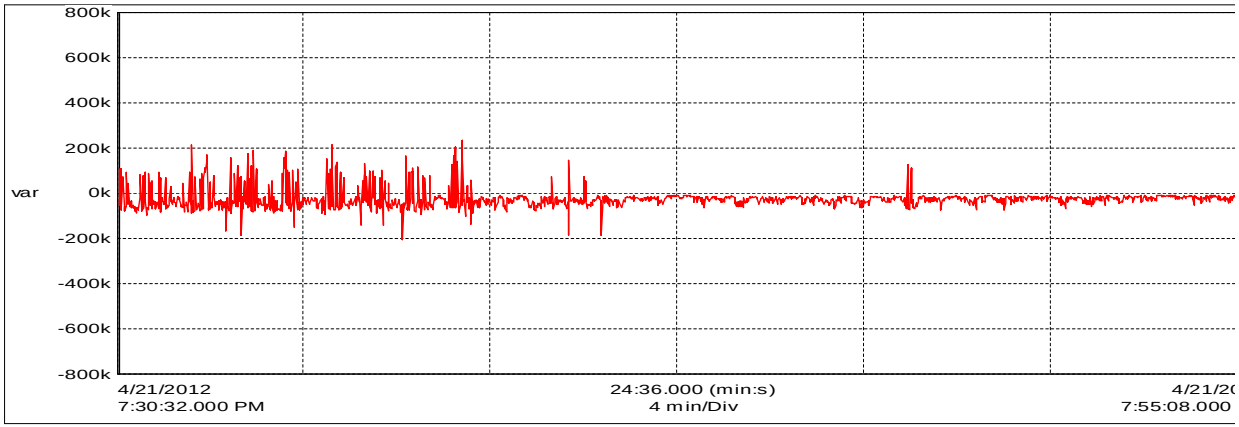

**With RTPFC – Power Factor Vs Time**



# Case Study – I: REACTIVE POWER
## Feeder - N2

**Without RTPFC System – Reactive Power (kVAr) Vs Time**

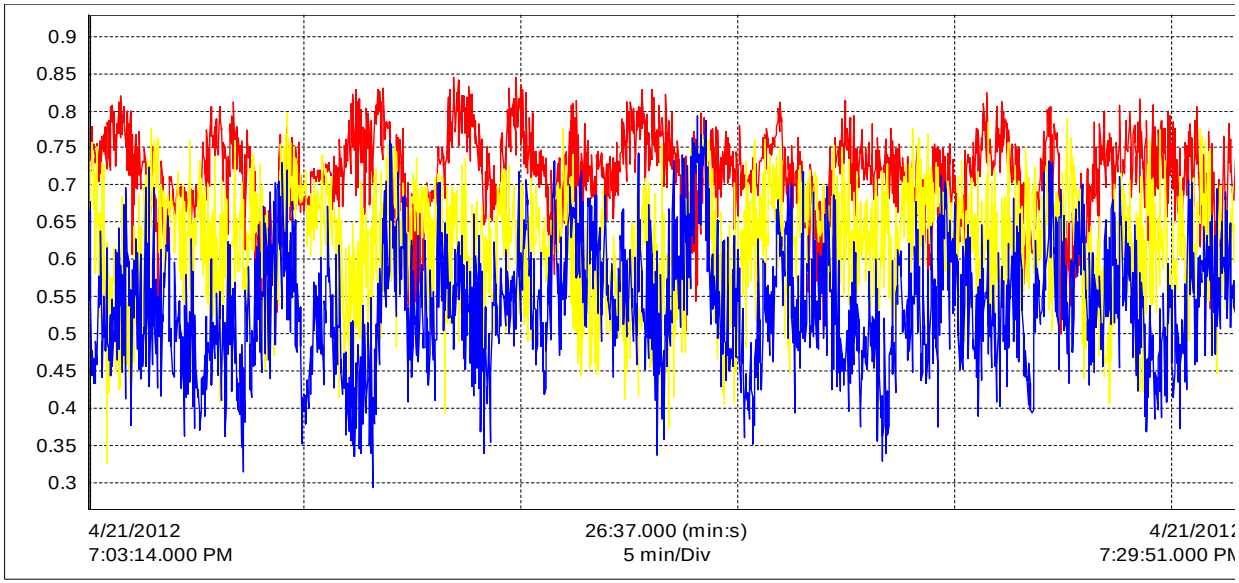


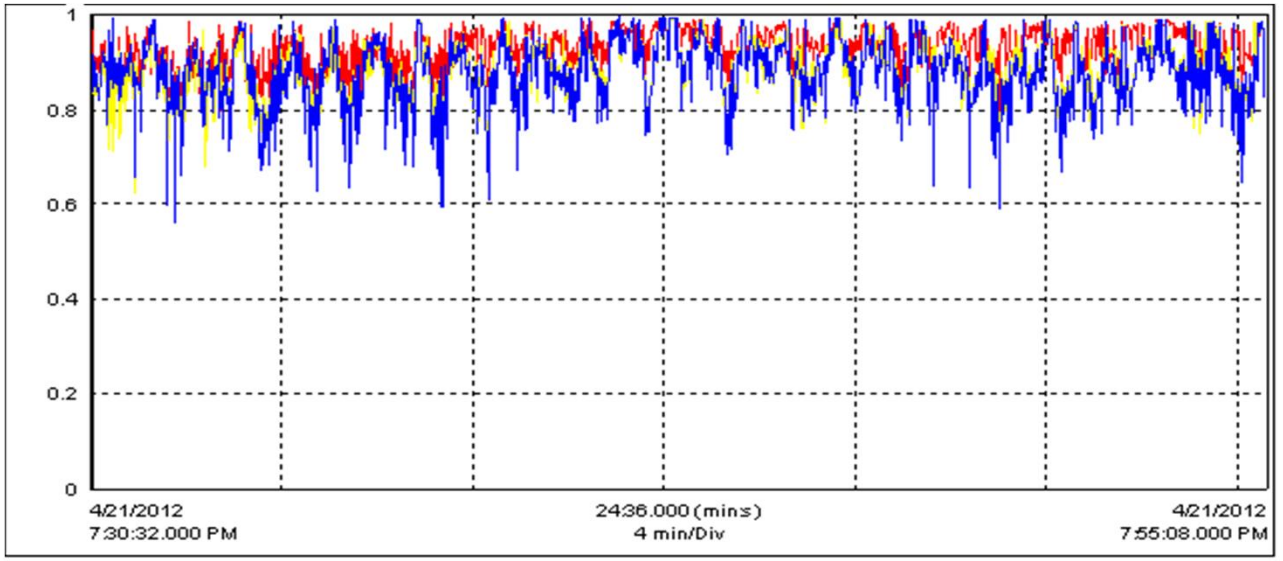
# Case Study – I: POWER FACTOR

## Feeder - N2

**Without RTPFC – Power Factor Vs Time**

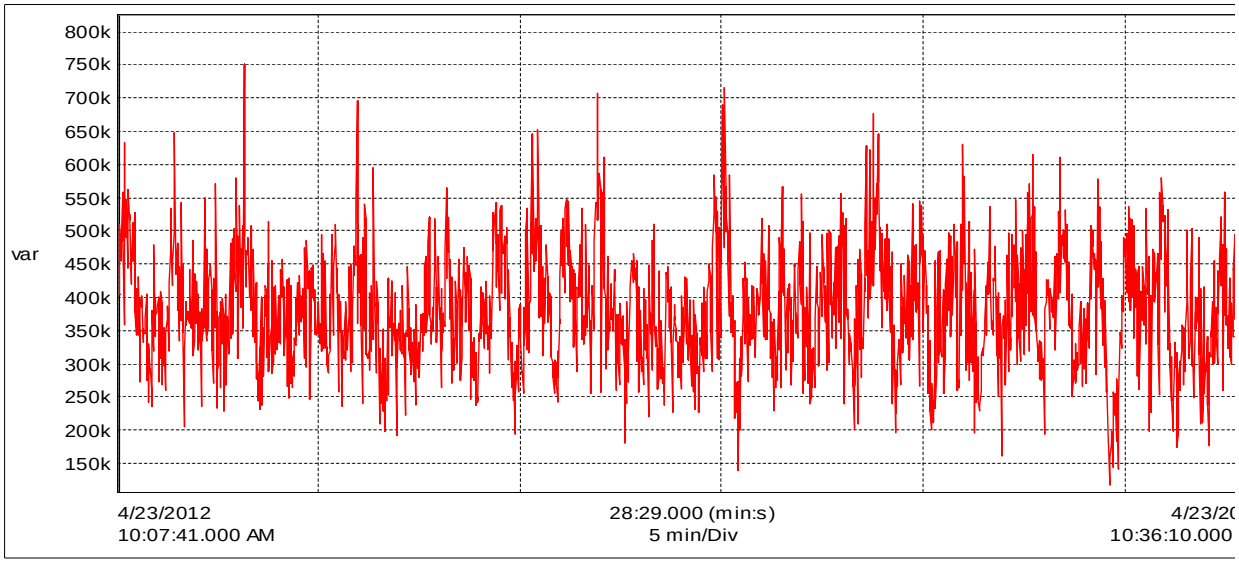



**With RTPFC – Power Factor Vs Time**

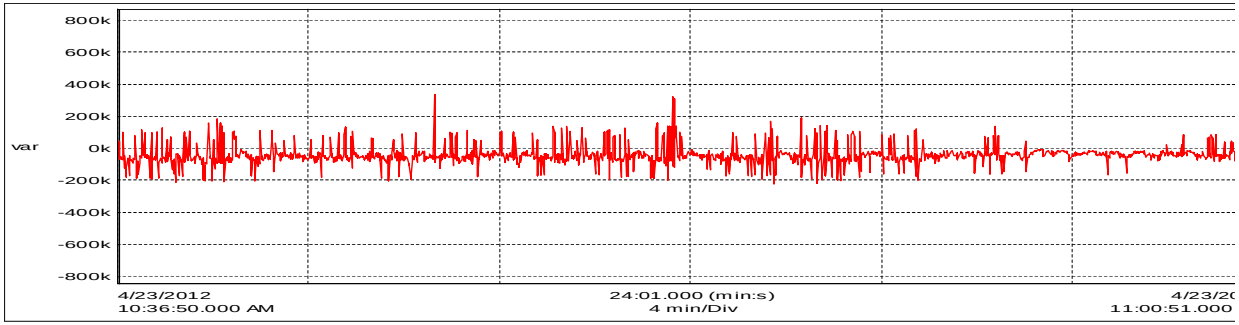


# Case Study – I: REACTIVE POWER
## Feeder - N3

**Without RTPFC – Reactive Power (kVAr) Vs Time**



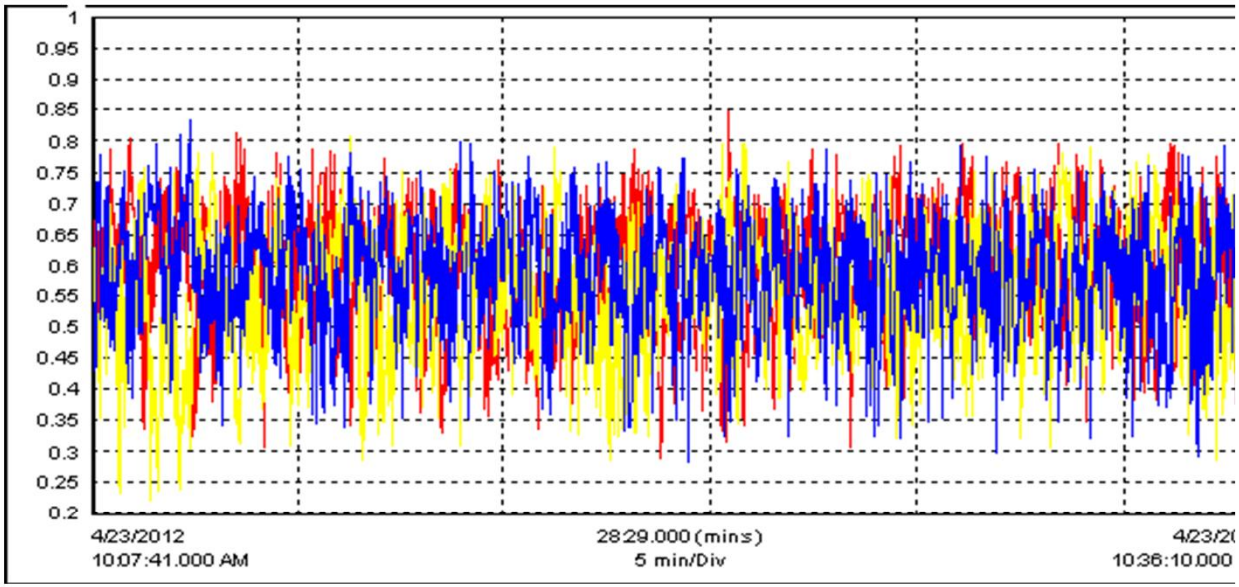

**With RTPFC – Reactive Power (kVAr) Vs Time**



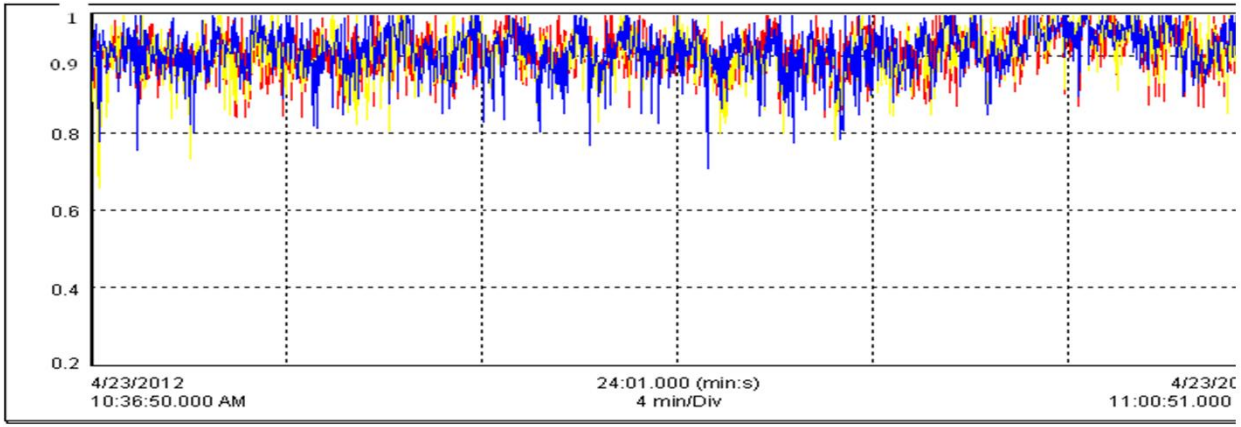
# Case Study – I: POWER FACTOR

## Feeder - N3

**Without RTPFC – Power Factor Vs Time**



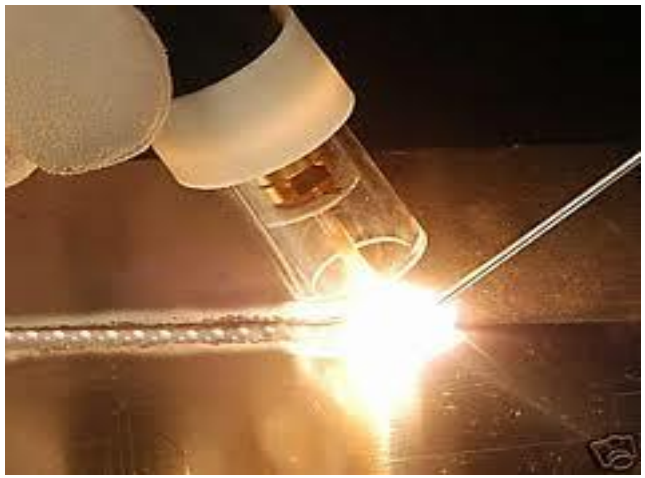

**With RTPFC – Power Factor Vs Time**



# PQC STATCON

# Case Study – II
# M/s Denso Kirloskar

# Case Study - II
## M/s Denso Kirloskar, Bangalore



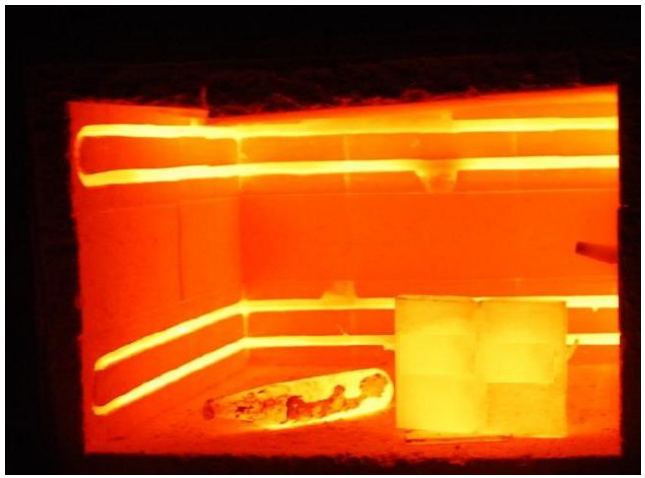


**Figure 15 : Typical Loads – M/s Denso Kirloskar**

- Feeder factory, radiators/spare parts for Toyota cars all over the world
- Welding, furnace and oven loads
- Power cuts are very normal during the peak hours of operation
- Equipped with 4.5MVA captive plant, along with the EB line
- DGs running at, as low as 0.4 pf.

# Case Study – II
## Single Line Diagram

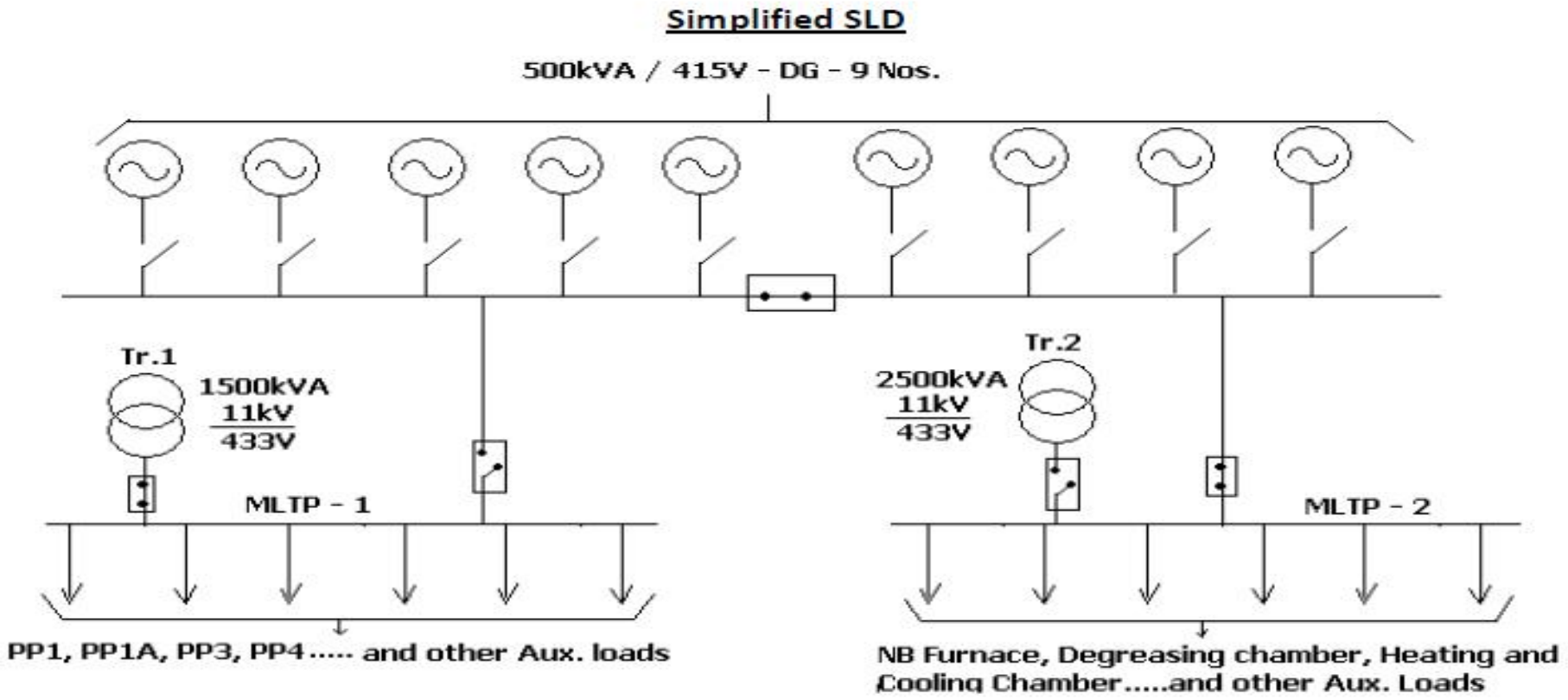



**Figure 16 : Typical SLD – M/s Denso Kirloskar**

# Case Study – II
## Problems in the system

- Mostly running on DGs
- DGs operating at very low pf
- DGs tripping due to unbalance
- Flicker  due to the welding loads, dynamic  reactive power
- Low PF - Electricity Bill

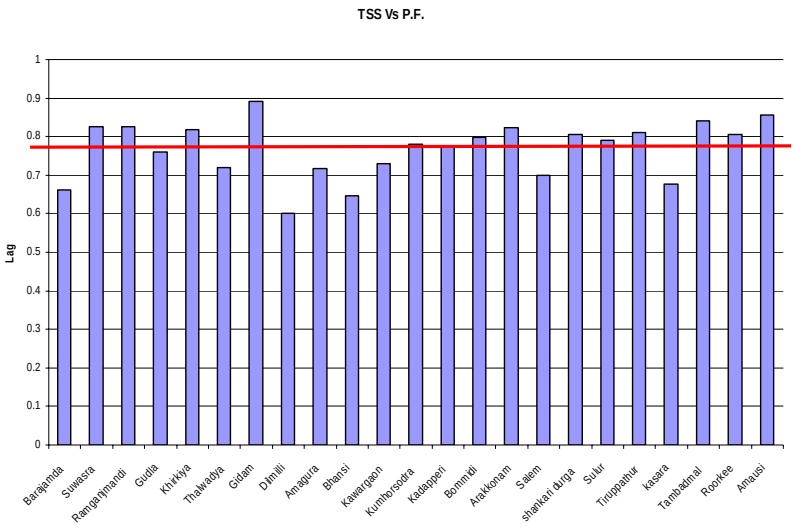
# Case Study – II
## Performance after ABB solution

- The plant operates at **unity PF on utility** supply, 0.85PF on generator supply as per configuration.
- During power failure, the generators could take up more welding .
- Flickering of Illumination lamps reduced substantially
- 5 generators could feed the whole plant, instead of 9 generators, lower fuel consumption

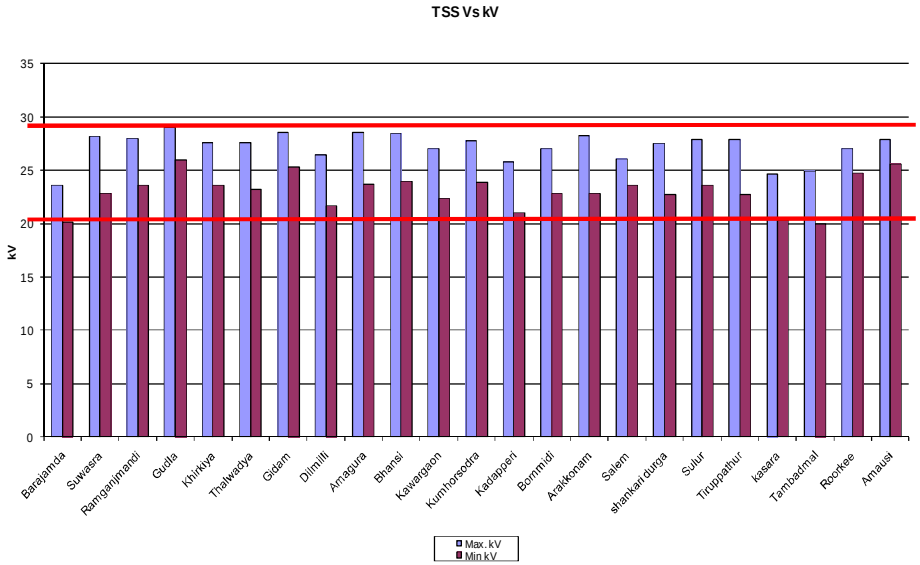
# PQC-STATCON

# Case Study – III
# Power Quality for the Indian Railway Network

# Case Study – III (TSS, Indian Railways)
## Problems in Railways Network (1)




**TSS vs Power Factor (PF)**

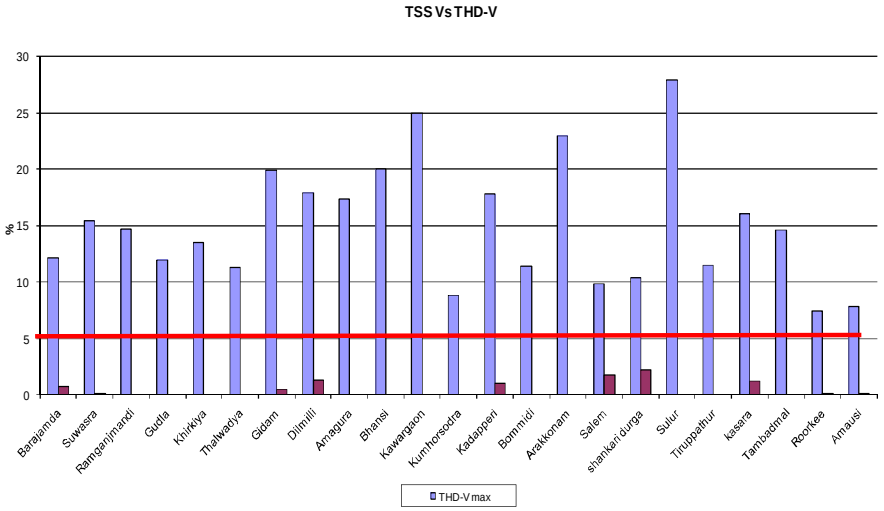


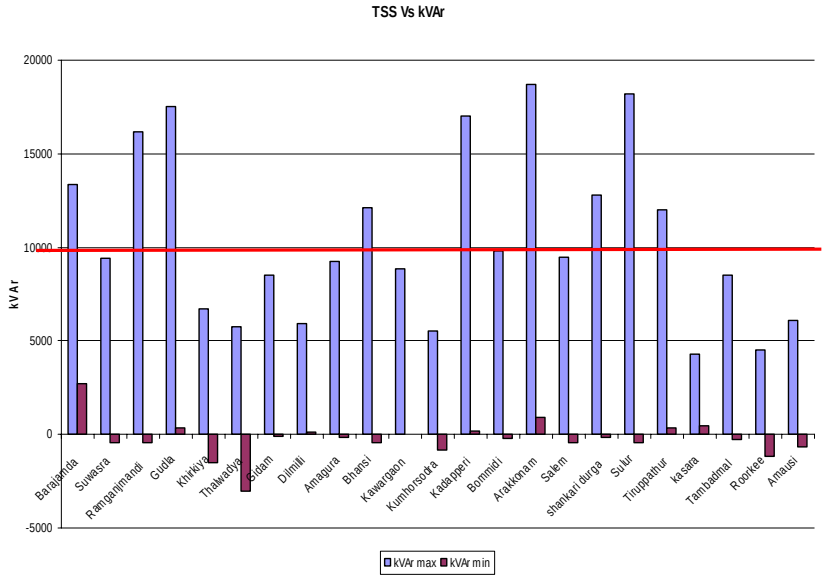

**TSS vs Supply Voltage**

**Figure 17 : Typical Railway PF and Voltage pattern**

- Low power factor, < 0.8 Lag
- Large supply voltage fluctuations, 20kV – 28kV
- High penalty, due to poor power factor

# Case Study – III
## Problems in Railways Network (2)




**TSS vs Voltage THD**

**TSS vs Current THD**

**Figure 18 : Typical Railway Voltage and Current THD**

- Unacceptable voltage THDV > 10% & Current THDI > 30%
- Typically Dynamic Reactive Power varies > 0-10 MVAr

# Case Study – III
## 4.8 MVAr Compensator System

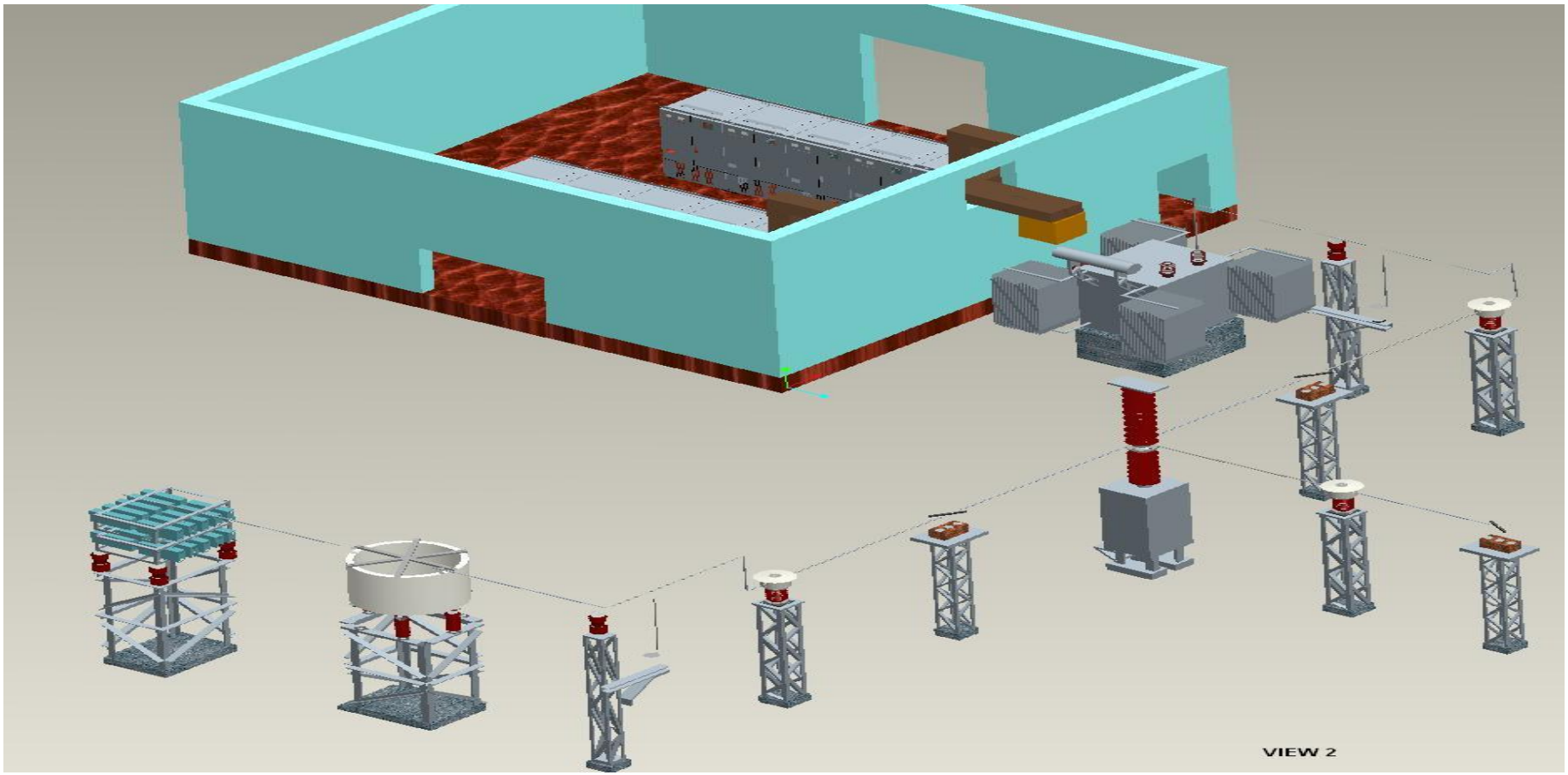



**Figure 19 : Typical Railway TSS Scheme ( STATCON + MV Capacitor Bank )**

# Case Study – III (TSS, Indian Railways)
## 4.8 MVAr Compensator

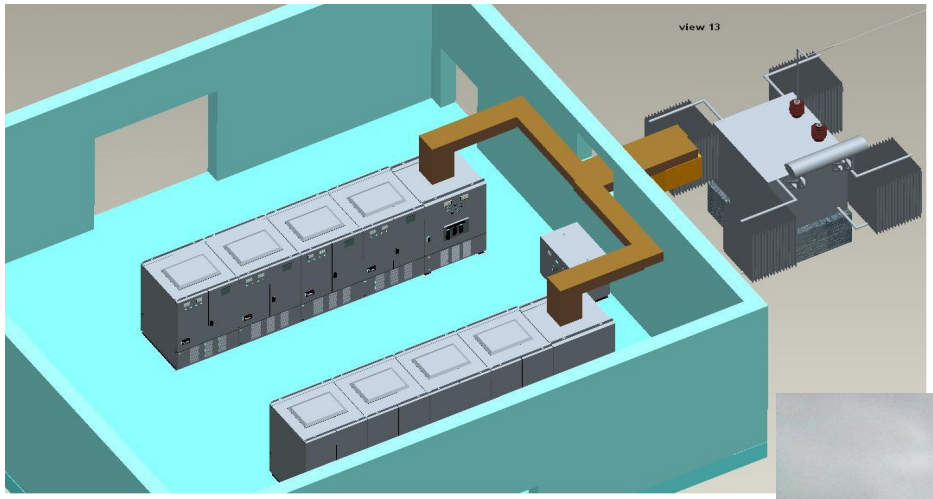



**Figure 20 : Typical Railway STATCON + MV Capacitor Bank Installation**

# Case Study – III
## Performance after ABB Solution

- PF more than 0.95 to Unity as per the Tender requirement.
- Railways get rebate from electricity boards, for high PF
- Improved voltage profile
- Lower current and voltage THD
- Longer lifetime of equipment and less maintenance
- So far 18 Indian traction substation uses ABB STATCON solutions

# PQC-STATCON

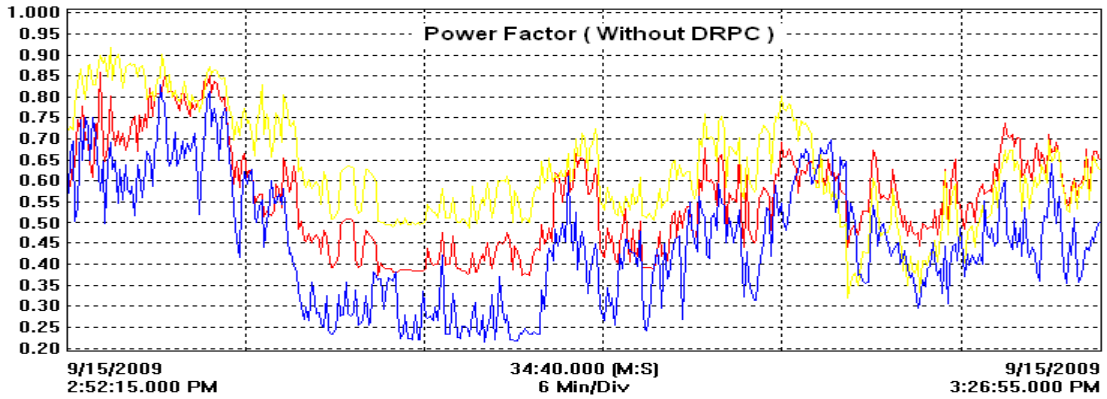
# Case Study – IV
# FIAT India Automobiles Ltd

# Case Study - IV
## M/s FIAT India Automobiles

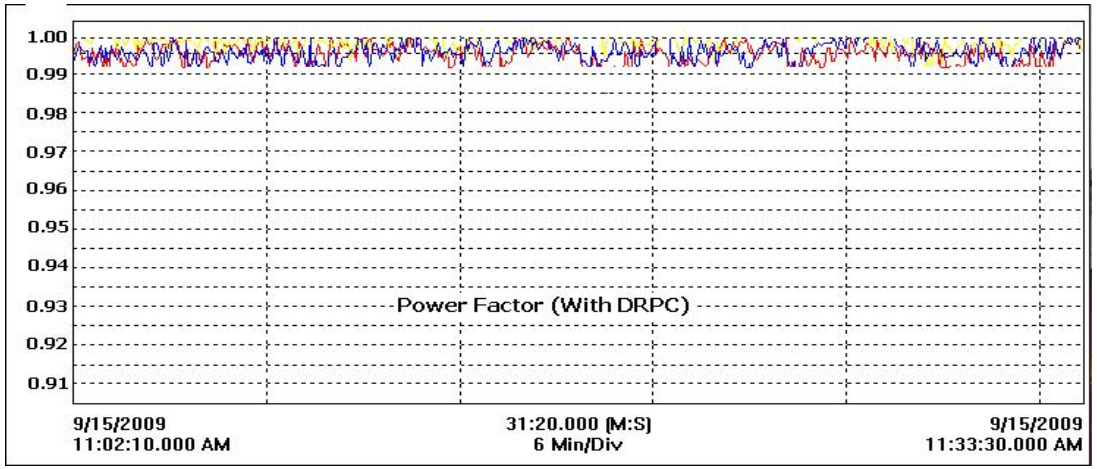
- M/s FIAT, Pune manufactures ‘Punto’ and ‘Linea’ cars
- ABB provided PQC STATCON solutions for the welding plant.
- **PQC STATCON** commissioned successfully 1200kVAr for 2.5 MVA and 600kVAr Transformer .

# Case Study - IV
## M/s FIAT India Automobiles

**Source PF of 2.5 MVA transformer (PQC Off)**




**Source PF of 2.5 MVA transformer (PQC STATCON on)**



# Other installations of PQC-STATCON !
## M/s JSW SALEM (+/- 5000 kvar)



- Mixed Mill loads with EAF.
- Penalty due to low PF
- PF improved from 0.8 to unity in import mode.
- Avoid penalty.

# Other installations of PQC-STATCON !
## M/s KALYANI CARPENTER (0-9000 kvar)

- 80% load is EAF.
- Target PF = 0.98
- PF imporved from 0.92 0.99
- PF rebate close to 50 lacs / month.

# MAJOR CLIENTS OF PQC STATCON – AUTOMOBILE SECTOR








# MAJOR CLIENTS OF POC STATCON – STEEL SECTOR

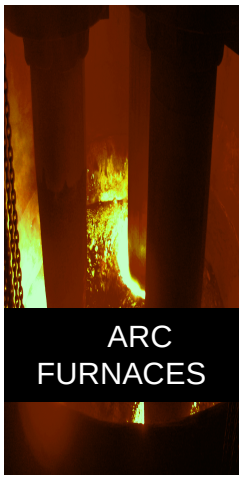


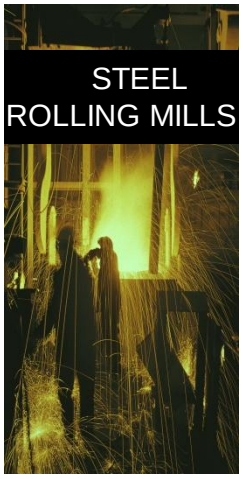





# MAJOR CLIENTS OF PQC STATCON – STEEL SECTOR & Many More ☺

# Applications of PQC – STATCON


ARC FURNACES


STEEL ROLLING MILLS

- Railway/ Traction Sub Stations
- Arc Furnaces
- Automotive / Welding Plant
- Steel Plants / Rolling Mills
- Airports / Shipyards / Ships
- Off-shore Drilling
- Process Industries
- Sky lifts / Compressor loads
- Pulp & Paper Industries
- Chemical Plants
- Hydro Plants
- Cement Factories
- Water treatment Plants
- Wind Mills


TRACTION SUB-STATIONS


WELDING LOADS

Power and productivity
for a better world™