

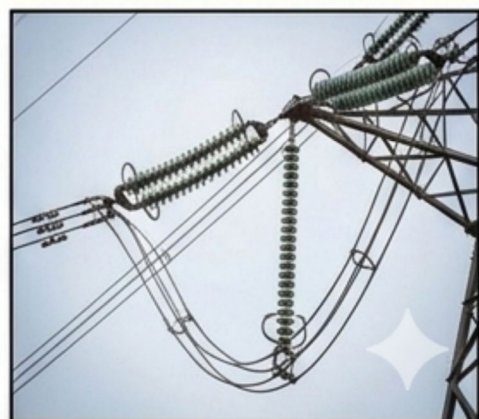


# **Resource Adequacy Plan for Transmission System of Goa up to the year 2034-35**

**Government of India**

**Ministry of Power**

**Central Electricity Authority**



| <b>Table of Content</b> |                                                                                                                      |                 |
|-------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Sl. No.</b>          | <b>Chapter</b>                                                                                                       | <b>Page No.</b> |
|                         | <b>Executive Summary</b>                                                                                             | <b>i-ii</b>     |
| <b>Chapter-1</b>        | <b>Power supply scenario in Goa and projected electricity demand</b>                                                 | <b>1-6</b>      |
| <b>1.1</b>              | Background                                                                                                           | 1               |
| <b>1.2</b>              | Present Power Scenario in Goa                                                                                        | 1-3             |
|                         | <b>1.2.1</b> Installed Generation Capacity (Intra-State) (as on 31.03.2026)                                          | 1-2             |
|                         | <b>1.2.2</b> Electricity Demand of Goa                                                                               | 2-3             |
| <b>1.3</b>              | Projected Electricity Demand                                                                                         | 3-4             |
| <b>1.4</b>              | Existing Transmission Network in Goa (as on 31.03.2026)                                                              | 4-5             |
|                         | <b>1.4.1</b> Intra-State Transmission System in Goa                                                                  | 4-5             |
|                         | <b>1.4.2</b> Inter-State Transmission System in Goa                                                                  | 5               |
| <b>1.5</b>              | Constraints in Transmission Network in Goa                                                                           | 5-6             |
| <b>Chapter-2</b>        | <b>Transmission System Requirement by 2034-35</b>                                                                    | <b>7-10</b>     |
| <b>2.1</b>              | Load flow studies for preparation of Resource Adequacy of transmission system in Goa                                 | 7               |
| <b>2.2</b>              | The transmission constraints observed as per load flow studies and suggested remedial measures                       | 7-8             |
| <b>2.3</b>              | Details of the transmission schemes to be added under Intra-State during 2026-2035 is given below (110 kV and above) | 8-9             |
|                         | <b>2.3.1</b> Summary of Transformation capacity (MVA) to be added under intra-state during 2026-2035                 | 9               |
|                         | <b>2.3.2</b> Summary of Transmission lines (ckm) to be added under intra-state during 2026-2035                      | 9               |
|                         | <b>2.3.3</b> Substations to be added under intra-state during                                                        | 9               |

|                  |                                                                                   |           |
|------------------|-----------------------------------------------------------------------------------|-----------|
|                  | 2026-2035                                                                         |           |
|                  | <b>2.3.4</b> Reactive compensation requirement under intra-state during 2026-2035 | 9         |
| <b>2.4</b>       | Transmission elements to be added in Goa under ISTS during 2026-30                | 9-10      |
| <b>2.5</b>       | Transmission elements to be added in Goa under ISTS during 2030-35                | 10        |
| <b>Chapter-3</b> | <b>Recommendations</b>                                                            | <b>11</b> |

## EXECUTIVE SUMMARY

Goa, India's smallest state by area, is a vibrant coastal paradise nestled along the Arabian Sea within the Konkan region. Renowned globally for its striking contrast of golden-sand beaches, continuous serene stretches of coconut groves, lush biodiversity of the Western Ghats, cascading waterfalls and sprawling spice plantations, making it one of the most celebrated and dynamic travel destinations in the world.

The electricity demand in Goa is predominantly driven by domestic, commercial (tourism-related), and moderate industrial consumption. The state does not have significant conventional generation capacity within its boundary and is largely dependent on power allocation from central generating stations and bilateral/interstate power procurement through the national grid. Due to land constraints and environmental considerations, the scope for large-scale conventional generation within the state is limited.

A robust power transmission system is crucial for Goa to sustain its vibrant, tourism-driven economy while transitioning toward long-term energy security. As a state that relies heavily on importing electricity from the national grid, Goa's economic stability depends entirely on a high-capacity, reliable transmission network to deliver power efficiently from external generation hubs to local substations, to provide the flexible capacity needed to handle load variations and to ensure an uninterrupted and stable power supply for both residents and commercial enterprises.

With respect to electricity demand, Goa has witnessed an all-time high peak demand of 891 MW in April 2026. From the analysis of peak demand of Goa for past 12 years, it has been observed that peak electricity demand in Goa is generally experienced in the months of March/ April during evening time and has grown @ 4% per year. As per the revised 20<sup>th</sup> Electric Power Survey (EPS) Report, peak electricity demand is projected to increase to 1.048 GW by 2029-30 and 1.258 GW by 2034-35.

Summary of existing transmission system under ISTS and InSTS in Goa is given below:

### Existing transmission system in Goa as on 31.03.2026:

|                                                | 400 kV | 220 kV | 110 kV | Total |
|------------------------------------------------|--------|--------|--------|-------|
| <b>Inter-State Transmission System (ISTS)</b>  |        |        |        |       |
| <b>Transformation Capacity (MVA)</b>           | 1945   | 0      | 0      | 1945  |
| <b>Transmission Line (ckm)</b>                 | 456    | 87     | 0      | 543   |
| <b>Intra-State Transmission System (InSTS)</b> |        |        |        |       |
| <b>Transformation Capacity (MVA)</b>           | 0      | 1402   | 760    | 2162  |
| <b>Transmission line (ckm)</b>                 | 0      | 458.9  | 205.9  | 664.8 |

A comprehensive system study for strengthening of the transmission network, both ISTS and Intra-State, in Goa has been carried out by CEA in association with CTUIL, Grid-India and GED, and Resource Adequacy plan has been prepared indicating the transmission capacity to be added in Goa till the year 2034-35.

Summary of planned transmission system under ISTS and InSTS in Goa is given below:

**Transmission System addition planned/ under planning by 2035:**

|                                                | 400 kV | 220 kV | 110 kV | Total |
|------------------------------------------------|--------|--------|--------|-------|
| <b>Inter-State Transmission System (ISTS)</b>  |        |        |        |       |
| <b>Transformation Capacity (MVA)</b>           | 0      | 0      | 0      | 0     |
| <b>Transmission Line (ckm)</b>                 | 210    | 0      | 0      | 210   |
| <b>Intra-State Transmission System (InSTS)</b> |        |        |        |       |
| <b>Transformation Capacity (MVA)</b>           | 0      | 1330   | 126    | 1456  |
| <b>Transmission line (ckm)</b>                 | 0      | 134    | 0      | 134   |

## **Chapter-1**

### **Power supply scenario in Goa and projected electricity demand**

#### **1.1 Background**

Goa is located along the western coast of India, has a geographical area of about 3,702 sq km and is bounded by Maharashtra to the north and Karnataka to the east and south, with the Arabian Sea forming its western boundary. The state's terrain comprises coastal plains, river basins, and hilly regions of the Western Ghats. It experiences a tropical monsoon climate with high humidity, moderate temperature variation, and substantial seasonal rainfall, which influences load patterns, particularly in the tourism and domestic sectors.

The electricity demand in Goa is predominantly driven by domestic, commercial (tourism-related), and moderate industrial consumption. The state does not have significant conventional generation capacity within its boundary and is largely dependent on power allocation from central generating stations and bilateral/interstate power procurement through the national grid. Seasonal variations in demand are observed, with higher consumption during peak tourist periods and summer months.

Due to land constraints and environmental considerations, the scope for large-scale conventional generation within the state is limited. However, there exists potential for distributed renewable energy, particularly rooftop solar installations, which can contribute to meeting peak demand and reducing dependence on external sources.

The transmission system in Goa is critical for ensuring reliable power supply, as the state relies heavily on interstate power inflows. The network facilitates bulk power transfer from the grid and ensures its distribution across load centres while maintaining voltage profile and system stability. With anticipated growth in electricity demand driven by urbanisation, economic activity, and expansion in the services sector, augmentation and strengthening of the transmission network is essential.

In this context, a detailed assessment of the existing power supply scenario and future demand projections has been carried out by Central Electricity Authority in coordination with CTUIL, Grid-India and Goa STU. Based on the analysis, a Resource Adequacy Plan has been formulated indicating the requirement of transmission system strengthening and capacity additions to reliably meet the projected demand of Goa up to the year 2034–35.

#### **1.2 Present Power Scenario in Goa**

##### **1.2.1 Installed Generation Capacity (Intra-State) (as on 31/03/2026)**

The state does not have significant conventional generation capacity within its boundary and is largely dependent on power allocation from central generating stations and bilateral/interstate power procurement through the national grid as given below:

**Table 1.1:** Installed Capacity (in MW) of Power Utilities in Goa, as per Allocated Shares in Joint and Central Sector Utilities. (As on 31/03/2026)

| Ownership/ Sector | Mode Wise Breakup |         |       |        |        |                    |                   |               |                 |                        |
|-------------------|-------------------|---------|-------|--------|--------|--------------------|-------------------|---------------|-----------------|------------------------|
|                   | Thermal (in MW)   |         |       |        |        | Nuclear<br>(in MW) | Renewable (in MW) |               |                 | Grand Total<br>(in MW) |
|                   | Coal              | Lignite | Gas   | Diesel | Total  |                    | Hydro             | RES<br>(MNRE) | Renewable Total |                        |
| State             | 0.00              | 0.00    | 0.00  | 0.00   | 0.00   | 0.00               | 0.00              | 0.00          | 0.00            | 0.00                   |
| Private           | 0.00              | 0.00    | 0.00  | 0.00   | 0.00   | 0.00               | 0.00              | 82.49         | 82.49           | 82.49                  |
| Central           | 492.27            | 0.00    | 19.67 | 0.00   | 511.94 | 41.68              | 5.00              | 1.00          | 6.00            | 559.62                 |
| Total             | 492.27            | 0.00    | 19.67 | 0.00   | 511.94 | 41.68              | 5.00              | 83.49         | 88.49           | 642.11                 |

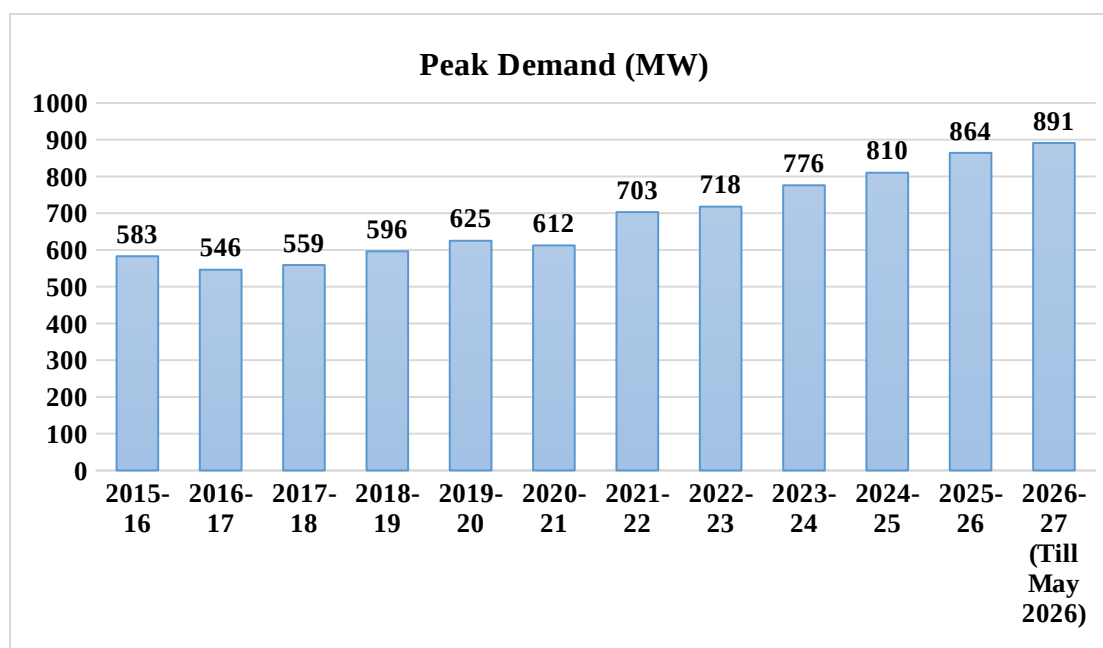
### 1.2.2 Electricity Demand of Goa

Till date, Goa has witnessed an all-time high peak demand of 891 MW in April 2026. From the analysis of peak demand of Goa for past 12 years, it has been observed that peak demand of Goa has grown @ 4 % per year.

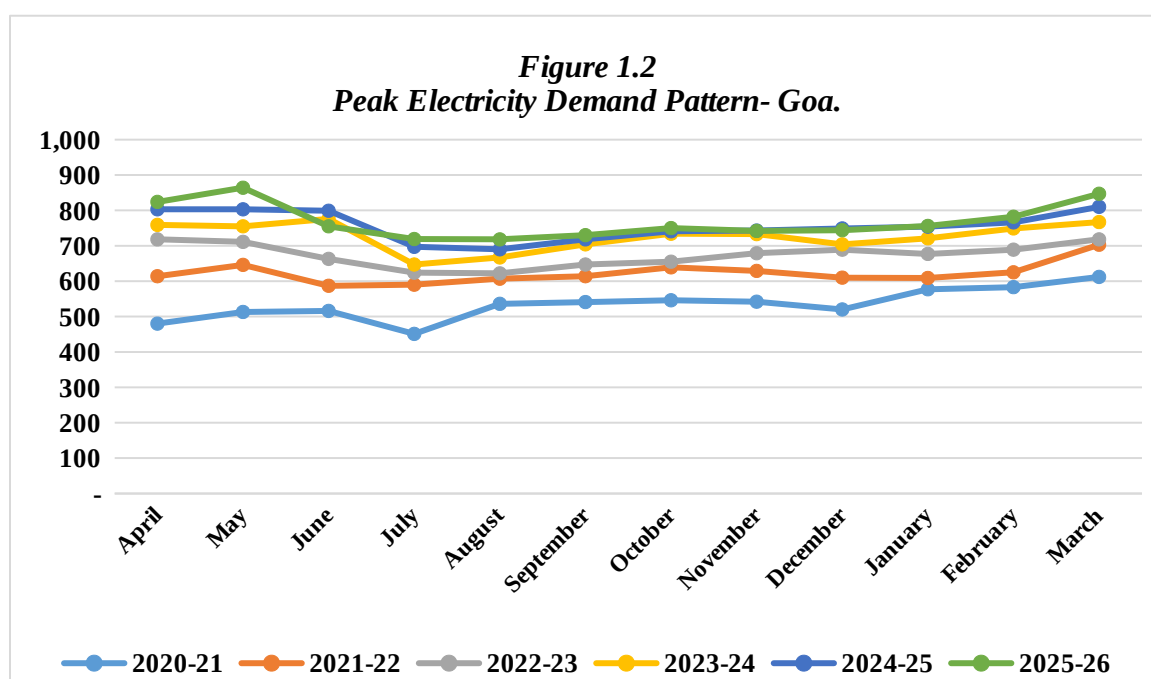
The recorded peak demand of Goa (as per Power Supply Position report of CEA) for twelve years starting from FY 2015-16 to FY 2026-27 (Till May 2026) is given in the Table 1.2.

**Table 1.2:** Recorded Peak Demand of Goa

| Sr. No. | Year                    | Peak Demand (MW) |
|---------|-------------------------|------------------|
| 1       | 2015-16                 | 583              |
| 2       | 2016-17                 | 546              |
| 3       | 2017-18                 | 559              |
| 4       | 2018-19                 | 596              |
| 5       | 2019-20                 | 625              |
| 6       | 2020-21                 | 612              |
| 7       | 2021-22                 | 703              |
| 8       | 2022-23                 | 718              |
| 9       | 2023-24                 | 776              |
| 10      | 2024-25                 | 810              |
| 11      | 2025-26                 | 864              |
| 12      | 2026-27 (Till May 2026) | 891              |



Peak electricity demand in Goa is generally experienced in the months of March/ April, during evening time. Monthly variation of Maximum Demand pattern of Goa for past 6 years is shown in Fig. 1.1



### 1.3 Projected Electricity Demand:

As per the revised 20<sup>th</sup> Electric Power Survey (EPS) Report, peak electricity demand is projected to increase to 1.258 GW by 2034-35. Yearwise projected electricity demand of Goa is given in the Table 1.3 below:

**Table 1.3:** Projected electricity demand in Goa

| Sl. No. | Year                 | Peak electricity demand in Goa (MW) |
|---------|----------------------|-------------------------------------|
| 1.      | 2025-26 (Actual)     | 864                                 |
| 2.      | 2026-27 (Projection) | 914                                 |
| 3.      | 2027-28 (Projection) | 951                                 |
| 4.      | 2028-29 (Projection) | 1000                                |
| 5.      | 2029-30 (Projection) | 1048                                |
| 6.      | 2030-31 (Projection) | 1089                                |
| 7.      | 2031-32 (Projection) | 1127                                |
| 8.      | 2032-33 (Projection) | 1175                                |
| 9.      | 2033-34 (Projection) | 1217                                |
| 10.     | 2034-35 (Projection) | 1258                                |

#### 1.4 Existing Transmission Network in Goa (as on 31.03.2026)

##### 1.4.1 Intra-State Transmission System in Goa

The details of existing intra-state transmission network in Goa is given in Table 1.4 and Table 1.5.

**Table 1.4:** Existing Intra-State Transmission system (Substations)

| S.No         | Voltage level | Existing Intra- State transmission system (Substations) |            |             |
|--------------|---------------|---------------------------------------------------------|------------|-------------|
|              |               | No of Substations                                       | MVA        |             |
| 1            | 220 kV        | 5                                                       | 220/110 kV | 800         |
|              |               |                                                         | 220/33 kV  | 602         |
|              |               |                                                         | 110/33 kV  | 420         |
| 2            | 110 kV        | 2                                                       | 110/33 kV  | 340         |
| <b>Total</b> |               | <b>7</b>                                                |            | <b>2162</b> |

**Table 1.5:** Existing Intra-State Transmission system (Transmission Lines)

| S.No | Voltage level | Existing Intra- State transmission system (Transmission Lines) |
|------|---------------|----------------------------------------------------------------|
|      |               | Ckm.                                                           |
| 1    | 220 kV        | 458.9 ckm.                                                     |
| 2    | 110 kV        | 205.9 ckm.                                                     |
|      | Total         | 664.8 ckm.                                                     |

**List of 220 kV substations:**

- (1) 220/33 kV, 2x50 MVA, Amona S/s.
- (2) 220/110/33 kV, 3x100 MVA + (2x63+1x50) MVA + 3x50 MVA, Ponda S/s.
- (3) 220/110/33 kV, 3x100 MVA + 2x63 MVA + (3x50+1x40) MVA, Tivim S/s.
- (4) 220/110/33 kV, 2x100 MVA + 1x50 MVA + 2x40 MVA, Xeldem S/s.
- (5) 220/33 kV, 3x50 MVA, Cuncoim S/s.

**List of 110 kV substations:**

- (1) 110/33 kV, 2x50 +2x40 MVA, Verna S/s.
- (2) 110/33 kV, 4x40 MVA, Kadamba S/s.

**1.4.2 Inter-State Transmission System in Goa**

The details of existing inter-state transmission network in Goa is given in Table 1.6, Table 1.7, and Table 1.8.

**Table 1.6:** Existing Inter-State Transmission system (Substations)

| Voltage level | Existing Inter- State transmission system (Substations) |            |      |
|---------------|---------------------------------------------------------|------------|------|
|               | No of Substations                                       | MVA        |      |
| 400 kV        | 2                                                       | 400/220 kV | 1945 |

**Table 1.7:** Existing Inter-State Transmission system (Transmission Lines)

| S.No | Voltage level | Existing Inter- State transmission system (Transmission Lines) |
|------|---------------|----------------------------------------------------------------|
|      |               | (ckm)                                                          |
| 1    | 400 kV        | 456                                                            |
| 2    | 220 kV        | 87                                                             |
|      | <b>Total</b>  | <b>543</b>                                                     |

**List of 400 kV Substations:**

- (i) 3x315 MVA, 400/220 kV Mapusa S/s.
- (ii) 2x500 MVA, 400/220 kV Xeldem S/s.

**Table 1.8:** Reactors in Goa under ISTS

| Voltage level (kV) | Bus Reactors (Nos.) | Bus Reactors (MVAR) |
|--------------------|---------------------|---------------------|
| 400 kV             | 2                   | 175                 |

## 1.5 Constraints in Transmission Network in Goa:

### (i) Low voltage at various substations in Goa:

Low voltage operation in Goa is one of the limiting constraint for enhancing the import capability of Goa.

#### Remedial Measures:

To address the low voltage issue in Goa, a study has been carried out by Grid-India for reactive compensation study for the current scenario. Based on the study results, Grid- India has suggested a **211 MVAR** of capacitor bank requirement at various sub-stations as given below:

| S.No. | Substation   | Capacitor bank requirement (MVAR) |
|-------|--------------|-----------------------------------|
| 1     | Kadamba      | 132                               |
| 2     | Verna        | 42                                |
| 3     | Saligao      | 18                                |
| 4     | Ponda        | 6                                 |
| 5     | Binani       | 10                                |
| 6     | KRC          | 3                                 |
|       | <b>Total</b> | <b>211</b>                        |

Detailed report is attached as **Annexure**.

## Chapter-2

### Transmission System Requirement by 2034-35

#### 2.1 Load flow studies for preparation of Resource Adequacy of transmission system in Goa

System studies for the resource adequacy plan for Goa's Intra-State transmission system have been carried out using PSSE Software. The studies that have been carried out include the following:

- (i) Steady state load flow studies
- (ii) Contingency Analysis
- (iii) Short Circuit Studies

The load flow studies have been carried out for the year 2034-35 with following considerations:

- (i) GED's transmission network has been represented at 110 kV and above voltage levels, where loads have been considered incidental on 110 kV buses.
- (ii) Load power factor has been considered within  $\pm 0.95$  as per the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2019.
- (iii) 'N-1' criterion has been considered as recommended in the Manual on Transmission Planning Criteria of CEA (2025).
- (iv) Transformation capacity of the substations and system voltage limits have been considered as per the Manual on Transmission Planning Criteria of CEA (2025).
- (v) **Generation to be added under Intra-state during 2026-2035 and the projected Electricity Demand:**

As per the revised 20<sup>th</sup> Electric Power Survey (EPS) Report, peak electricity demand is projected to increase to 1.258 GW by 2034-35. However, Goa has projected the demand of 1.28 GW by 2034-35. The same has been considered in the load flow studies.

The state does not have any upcoming generation plant within its boundary by 2034-35, except distributed renewable energy such as rooftop solar installations, and is largely dependent on power allocation from central generating stations and bilateral/interstate power procurement through the national grid,

#### 2.2 The transmission constraints observed as per load flow studies and suggested remedial measures are as given below:

| S.No . | Transmission Constraints                                                   | Remedial Measures                                                                                                                                                                                                                                                                                                                      |
|--------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.     | High loading on 2x500 MVA 400/220 kV ICTs at Xeldem S/s (517 MW under N-1) | 1x500 MVA, 400/220 kV ICT augmentation (3 <sup>rd</sup> ) at Xeldem*<br>* As the ICT loadings are marginally higher under N-1 condition in 2034-35 time frame, real time loading may be monitored and ICT implementation may be taken based on the same under ISTS.                                                                    |
| 2.     | Tapping arrangement at Kadamba S/s                                         | As per Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023, there shall not be tapping of another transmission line from the main line for 66 kV and above class of lines. Some lines of Goa are tapped at Kadamba. Additional line/ switching station to be planned for removal of tap. |

**2.3 Details of the transmission schemes to be added under Intra-State during 2026-2035 is given below (110 kV and above):**

| S.No .     | Scheme/Details                                      | Voltage (kV) | Line Length (in ckm) | Total MVA | Status (Under Construction / Planned)    | Anticipated SCoD |
|------------|-----------------------------------------------------|--------------|----------------------|-----------|------------------------------------------|------------------|
| <b>(A)</b> | <b>New Substations alongwith transmission lines</b> |              |                      |           |                                          |                  |
| <b>1</b>   | <b>220/33 kV, 3x63 MVA, Saligao S/s.</b>            | 220/33       | 0                    | 189       | Under Construction                       | 2026-27          |
|            | Mapusa to Saligao 220 kV D/c line.                  | 220          | 35.96                | 0         | Under Construction                       | 2026-27          |
| <b>2</b>   | <b>220/33 kV, 3x100 MVA, Verna S/s.</b>             | 220/33       | 0                    | 300       | Planned                                  | 2028-29          |
|            | Xeldem (GTTPL) to Verna 220 kV D/c line.            | 220          | 44                   | 0         | Planned                                  | 2028-29          |
| <b>3</b>   | <b>220/33 kV, 3x63 MVA, Tuem S/s.</b>               | 220/33       | 0                    | 189       | Planned                                  | 2031-32          |
|            | Mapusa to Tuem 220 kV D/c line.                     | 220          | 34                   | 0         | Planned                                  | 2031-32          |
| <b>4</b>   | <b>220/33 kV, 3x100 MVA, Kundaim S/s.</b>           | 220/33       | 0                    | 300       | Planned                                  | 2034-35          |
|            | Amona to Kundain 220 kV D/c line.                   | 220          | 20                   | 0         | Planned                                  | 2034-35          |
| <b>(B)</b> | <b>ICT Augmentations</b>                            |              |                      |           |                                          |                  |
| <b>1</b>   | Verna                                               | 110/33       |                      | 126       | Idle charged, GIS testing is in progress | 2026-27          |
| <b>2</b>   | Amona                                               | 220/33       |                      | 63        | Planned                                  | 2027-28          |
| <b>3</b>   | Xeldem                                              | 220/33       |                      | 63        | Planned                                  | 2027-28          |
| <b>4</b>   | Ponda                                               | 220/110      |                      | 100       | Planned                                  | 2028-29          |

|   |          |        |  |    |         |         |
|---|----------|--------|--|----|---------|---------|
| 5 | Xeldem   | 220/33 |  | 63 | Planned | 2028-29 |
| 6 | Cuncalim | 220/33 |  | 63 | Planned | 2028-29 |

### 2.3.1 Summary of Transformation capacity (MVA) to be added under intra-state during 2026-2035:

**Table 2.1:** Transformation capacity (MVA) to be added under Intra-state during 2026-2035

| Transformation Capacity (MVA) |                          |                    |             |             |
|-------------------------------|--------------------------|--------------------|-------------|-------------|
| S.No.                         | Voltage level            | Under Construction | Planned     | Total       |
| 1                             | 220/110 kV,<br>220/33 kV | 189                | 1141        | 1330        |
| 2                             | 110/33 kV                | 126                | 0           | 126         |
|                               | <b>Total</b>             | <b>315</b>         | <b>1141</b> | <b>1456</b> |

### 2.3.2 Summary of Transmission lines (ckm) to be added under intra-state during 2026-2035

**Table 2.2:** Transmission lines (ckm) to be added under Intra-state during 2026-2035

| Transmission Lines (ckm) |               |                    |         |       |
|--------------------------|---------------|--------------------|---------|-------|
| S.No.                    | Voltage level | Under Construction | Planned | Total |
| 1                        | 220 kV        | 36                 | 98      | 134   |

### 2.3.3 Substations to be added under intra-state during 2026-2035

**Table 2.3:** No of substations to be added to be added during 2026-30

| Voltage level | No of substations |
|---------------|-------------------|
| 220 kV        | 4                 |

### 2.3.4 Reactive compensation requirement under intra-state during 2026-2035:

| S.No. | Substation   | Capacitor bank requirement (MVAR) |
|-------|--------------|-----------------------------------|
| 1     | Kadamba      | 132                               |
| 2     | Verna        | 42                                |
| 3     | Saligao      | 18                                |
| 4     | Ponda        | 6                                 |
| 5     | Binani       | 10                                |
| 6     | KRC          | 3                                 |
|       | <b>Total</b> | <b>211</b>                        |

### 2.4 Transmission elements to be added in Goa under ISTS during 2026-30 is given below:

| Scheme /details                                                                                                                                                                    | Voltage level | Total ckm | Total MVA | Status             | Anticipated ScoD |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------|-----------|--------------------|------------------|
| <b>Additional 400 kV feed to Goa and additional system for power evacuation from generation projects pooled at Raigarh (Tamnar) Pool – Goa Tamnar Transmission Project (GTTPL)</b> |               |           |           |                    |                  |
| LILO of one ckt. Of Narendra (existing) – Narendra (New) 400kV D/c line at Xeldem                                                                                                  | 400 kV        | 210       |           | Under Construction | 2027-28          |

**2.5 Transmission elements to be added in Goa under ISTS during 2030-35 is given below:**

| Scheme /details                                                     | Voltage level | Total ckm | Total MVA | Status         | Anticipated ScoD                                 |
|---------------------------------------------------------------------|---------------|-----------|-----------|----------------|--------------------------------------------------|
| 1x500 MVA, 400/220 kV ICT augmentation (3 <sup>rd</sup> ) at Xeldem | 400/220 kV    | -         | 500       | Under Planning | During 2030-2035<br>(based on real time loading) |

## Chapter-3

### Recommendations

- 3.1** Intra-State Transmission system to be added by 2034-35 in Goa (110 kV and above) comprises of 134 ckm of transmission lines and 1456 MVA of transformation capacity as detailed below:

**Table 3.1:** Transformation capacity and transmission lines (MVA & ckm) to be added under Intra-state during 2026-2035

|                                      | 400 kV | 220 kV | 110 kV | Total |
|--------------------------------------|--------|--------|--------|-------|
| <b>Transformation Capacity (MVA)</b> | 0      | 1330   | 126    | 1456  |
| <b>Transmission line (ckm)</b>       | 0      | 134    | 0      | 134   |

- 3.2** All the planned transmission network should be timely implemented to avoid constraints in the transmission system. Tendering and award of the transmission elements should also be expedited.
- 3.3** In view of the low voltages already being experienced at various Intra-state/ ISTS substations in Goa and to reduce higher MVAR drawl from ISTS, Goa needs to implement capacitor banks of 211 MVAR as mentioned in the report at the earliest and also ensure the healthiness of available capacitor banks.
- 3.4** Goa should keep adequate space provision in the new substations for extension/augmentation to meet future load growth. Also, Goa should provide appropriate space provisions 33 kV bays in their 220/33 kV and 110/33 kV grid substations for supply of power to DISCOMs.
- 3.5** Transmission schemes which are not yet under implementation and are at planned stage for implementation by 2029-30 and 2034-35, may be taken up earlier or later as per requirement of Discom and actual load growth etc. Accordingly, the Resource Adequacy study for transmission system in the state may be reviewed in the coming years.

\*\*\*\*\*

Annexure

**WRLDC STUDY\_14**  
**REACTIVE POWER STUDY IN GOA NETWORK**

## **Background :**

- Low voltage operation in Goa is one of the limiting constraint for enhancing the import capability of Goa.
- Meeting was held between WRLDC and SLDC Goa 04-May'26 to deliberate on the measures required for addressing low voltages wherein WRLDC agreed to help Goa for reactive compensation study for the current scenario.
- On 07-May'26, SLDC Goa shared the necessary details to WRLDC. Subsequently WRLDC has carried out the assessment & the results are provided below in this presentation.

## **Assumptions consider in Base case:**

- Goa demand: 740 MW
- Goa MW Drawal: 750 MW
- Goa MVAR Drawal from ISTS: 260 MVAR
- Latest Goa network considered with bus split done at 110 kV Ponda S/s, 110 kV Kadamba S/s and 110 kV Verna S/s
- Under N-1 contingency of 400 kV Kolhapur-Mapusa D/c low voltages were observed in Goa network.

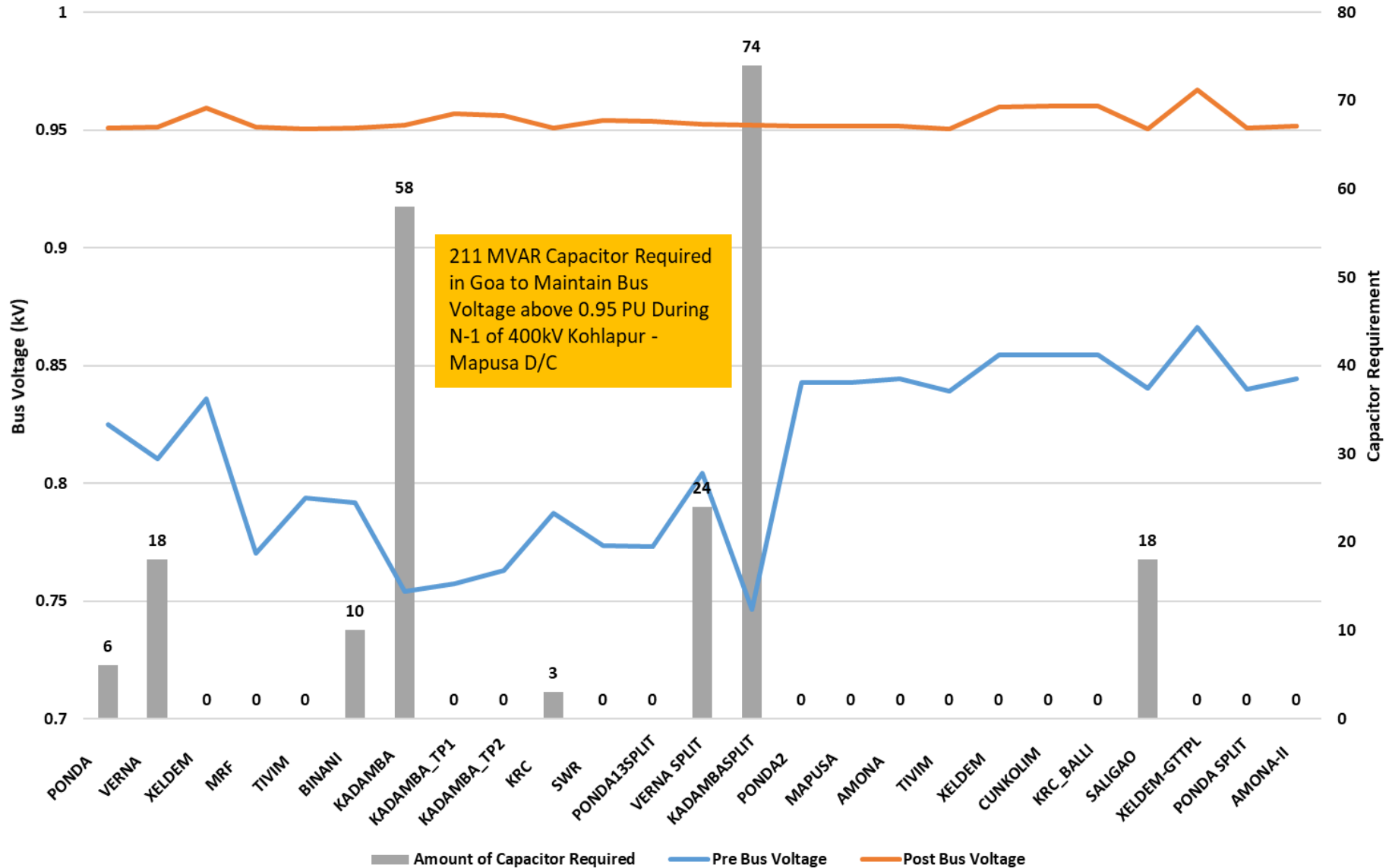
## **Inferences :**

- Total **211 MVAR** of capacitor bank requirement is observed at various sub-stations.
- Capacitor Installation can be redistributed based on capacitor bank sizing and feasibility at site.

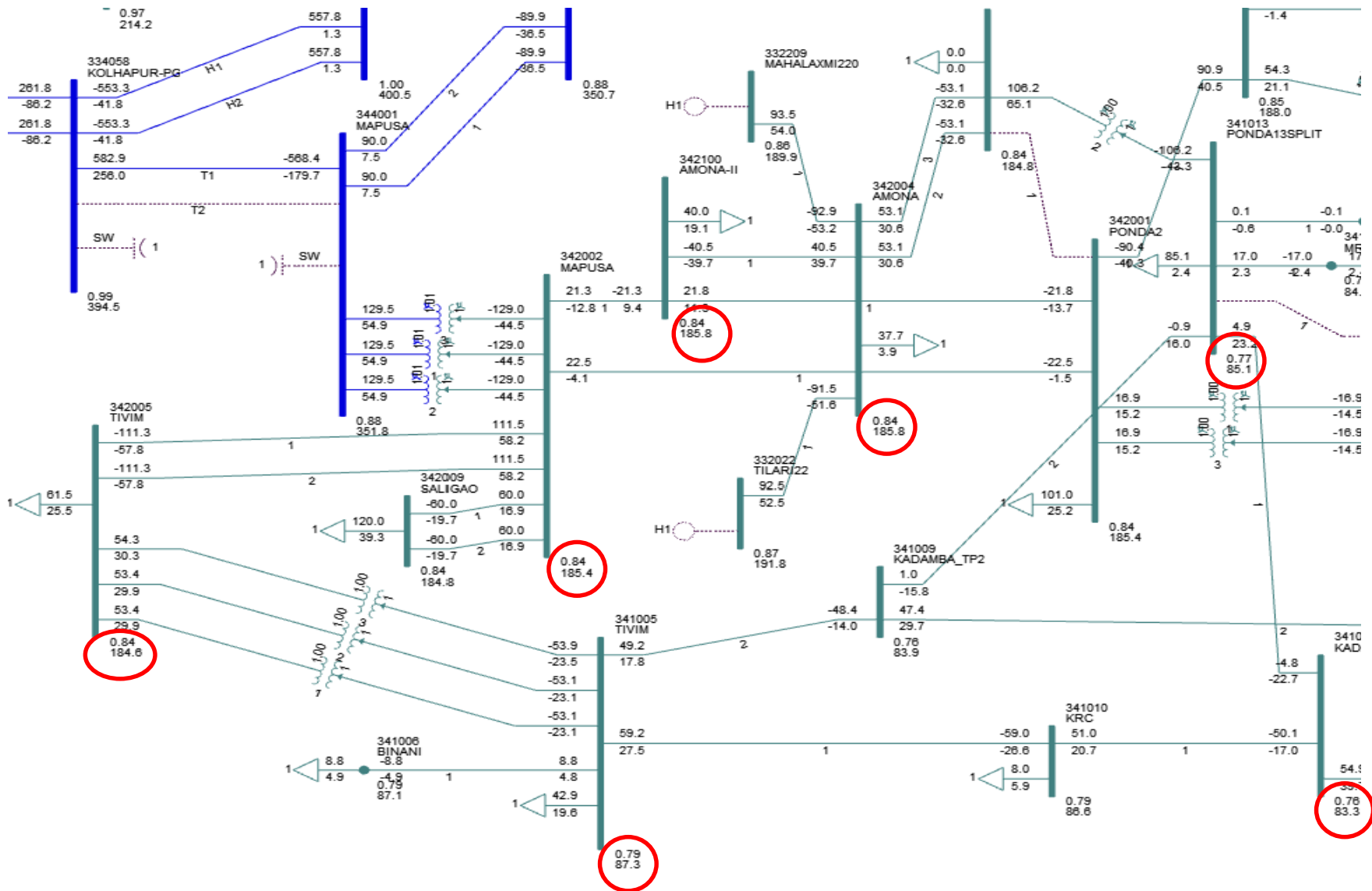
# Capacitor compensation requirement

➤ On the basis of the study, capacitor compensation requirement was assessed as follows:

## Goa Capacitor Bank Requirement for Low Voltage Scannerio



# Goa SLD with low voltage observed at 220kV & 110kV network.

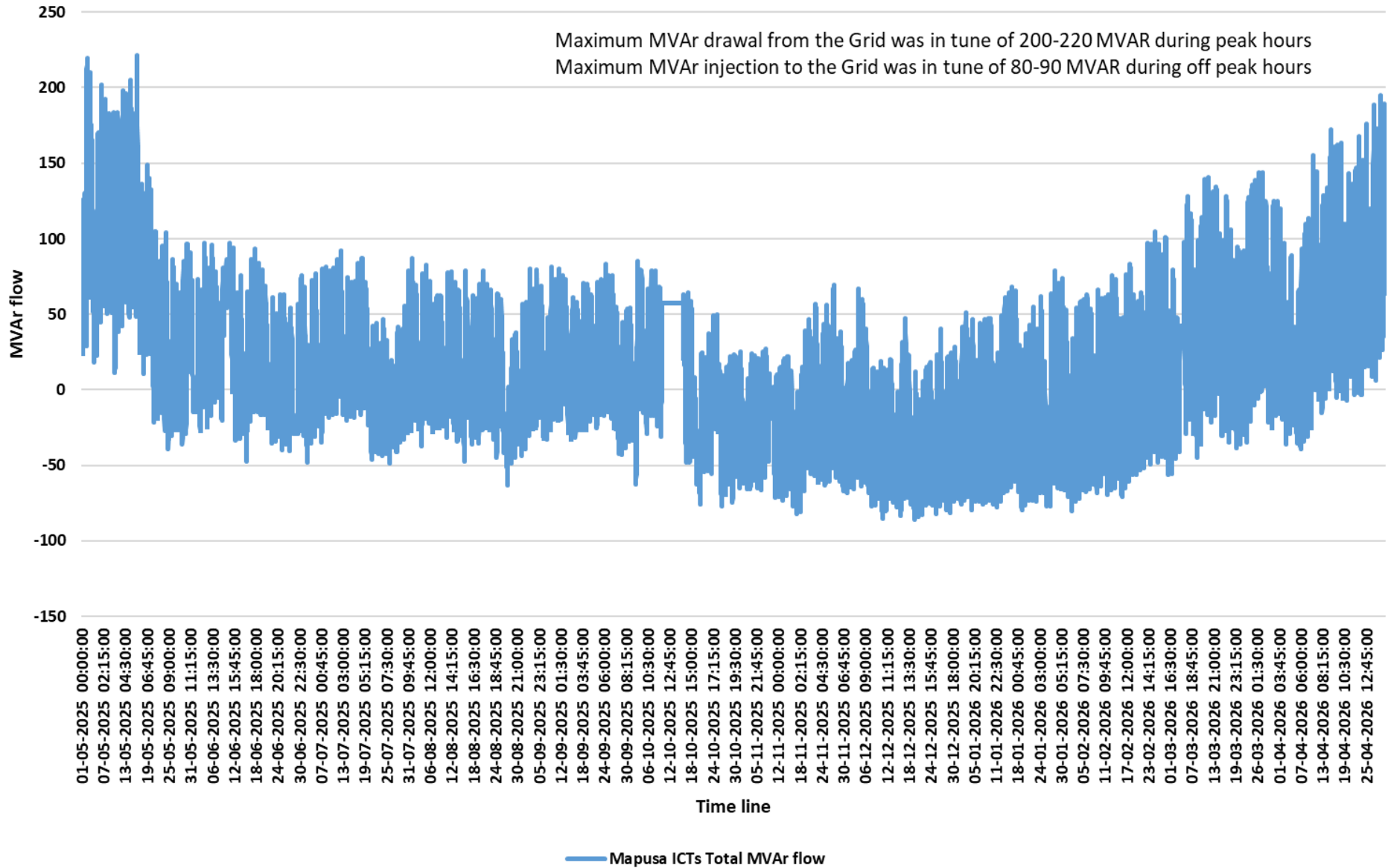




# Results

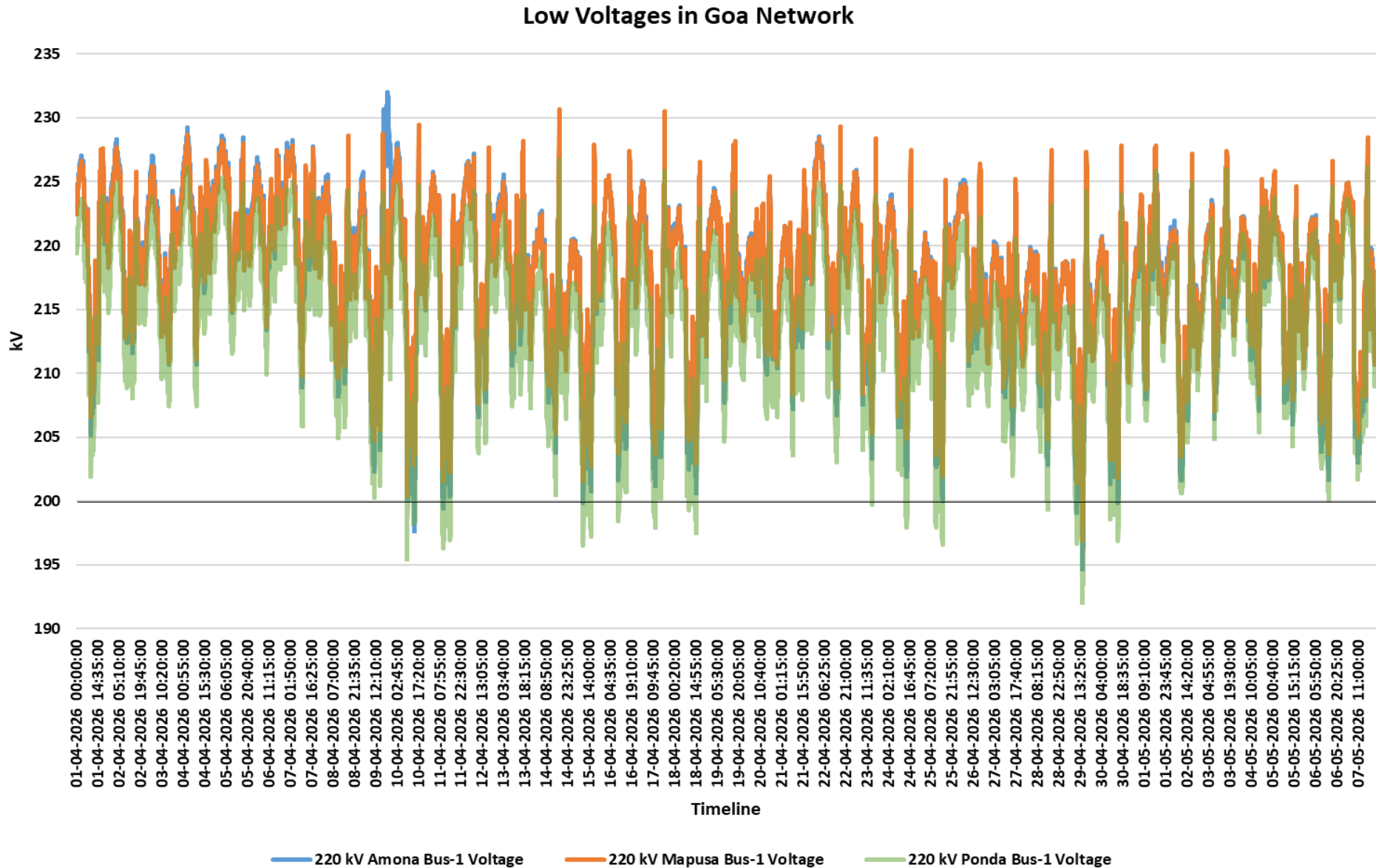
| S. no. | Bus No. | Station      | Pre Bus Voltage | Post Bus Voltage | Amount of Capacitor Required |
|--------|---------|--------------|-----------------|------------------|------------------------------|
| 1      | 341001  | PONDA        | 0.825031161     | 0.950815916      | <b>6</b>                     |
| 2      | 341002  | VERNA        | 0.810215056     | 0.951373637      | <b>18</b>                    |
| 3      | 341003  | XELDEM       | 0.835709155     | 0.959598899      | 0                            |
| 4      | 341004  | MRF          | 0.770460665     | 0.951371372      | 0                            |
| 5      | 341005  | TIVIM        | 0.793634236     | 0.950665116      | 0                            |
| 6      | 341006  | BINANI       | 0.79169184      | 0.950890958      | <b>10</b>                    |
| 7      | 341007  | KADAMBA      | 0.753963351     | 0.951951742      | <b>58</b>                    |
| 8      | 341008  | KADAMBA_TP1  | 0.757307172     | 0.957000613      | 0                            |
| 9      | 341009  | KADAMBA_TP2  | 0.762901843     | 0.956284642      | 0                            |
| 10     | 341010  | KRC          | 0.787145376     | 0.950831354      | <b>3</b>                     |
| 11     | 341011  | SWR          | 0.773624241     | 0.954102039      | 0                            |
| 12     | 341013  | PONDA13SPLIT | 0.773259997     | 0.953621507      | 0                            |
| 13     | 341014  | VERNA SPLIT  | 0.804168284     | 0.952384114      | <b>24</b>                    |
| 14     | 341015  | KADAMBASPLIT | 0.746534467     | 0.952057898      | <b>74</b>                    |
| 15     | 342001  | PONDA2       | 0.842701852     | 0.951756477      | 0                            |
| 16     | 342002  | MAPUSA       | 0.842815638     | 0.951860607      | 0                            |
| 17     | 342004  | AMONA        | 0.844452322     | 0.951547205      | 0                            |
| 18     | 342005  | TIVIM        | 0.838912845     | 0.950439811      | 0                            |
| 19     | 342006  | XELDEM       | 0.854608595     | 0.959942341      | 0                            |
| 20     | 342007  | CUNKOLIM     | 0.854682326     | 0.960030735      | 0                            |
| 21     | 342008  | KRC_BALLI    | 0.854675353     | 0.960026681      | 0                            |
| 22     | 342009  | SALIGAO      | 0.840195119     | 0.95039326       | <b>18</b>                    |
| 23     | 342010  | XELDEM-GTTPL | 0.866314054     | 0.966920435      | 0                            |
| 24     | 342055  | PONDA SPLIT  | 0.840037942     | 0.951060116      | 0                            |
| 25     | 342100  | AMONA-II     | 0.844452322     | 0.951547205      | 0                            |
| Total= |         |              |                 |                  | <b>211</b>                   |

## 400/220 kV ICTs MVar flow at Mapusa



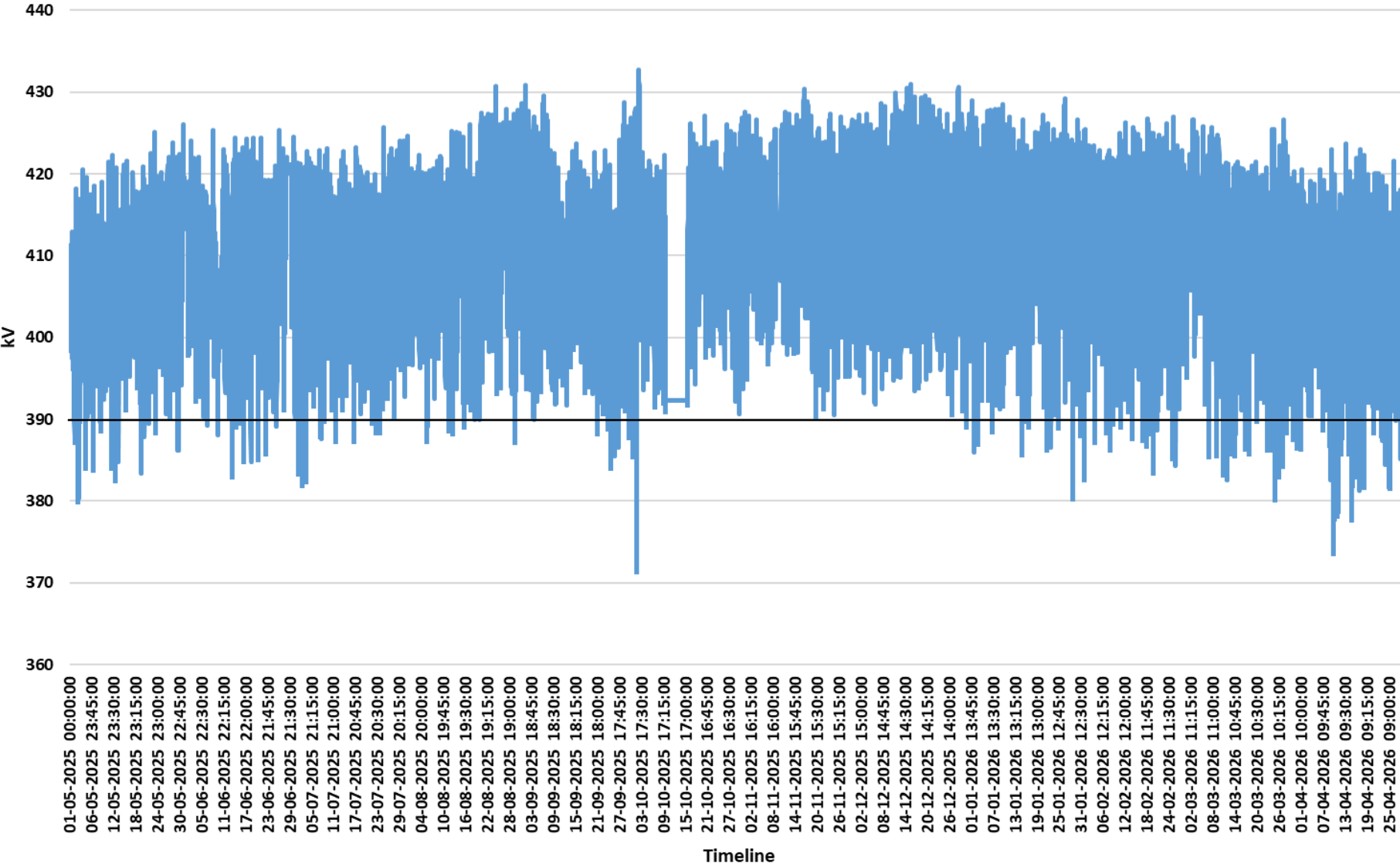
## Low Voltage issues in Goa

➤ During afternoon peak low voltages were observed in Goa network at 220 kV Mapusa, 220 kV Ponda, 220 kV Amona S/s.

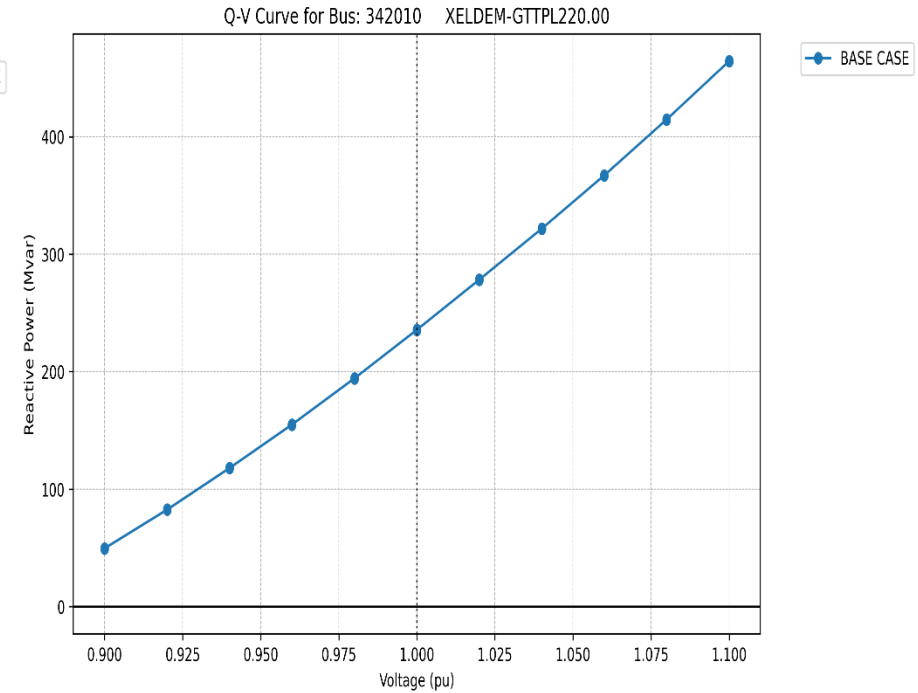
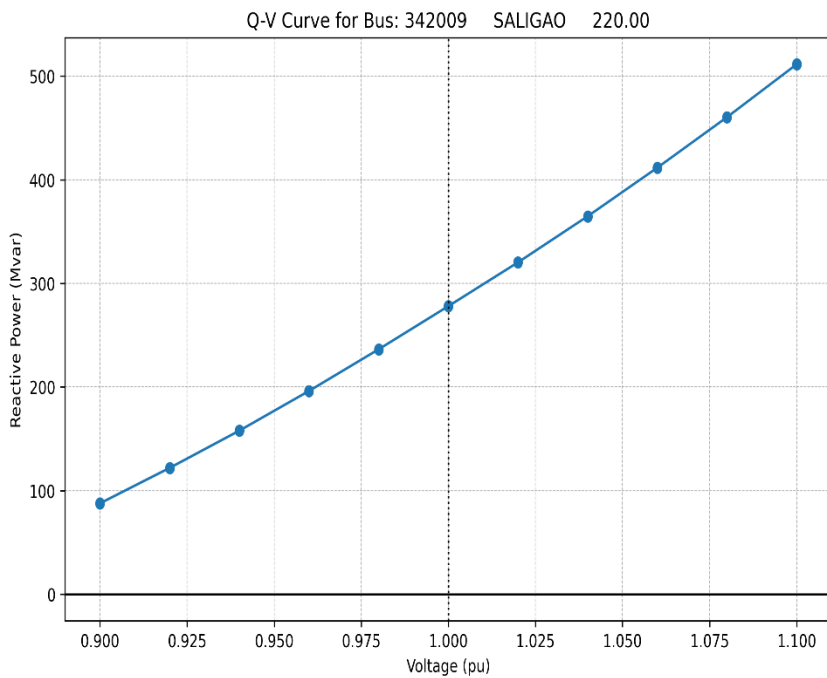
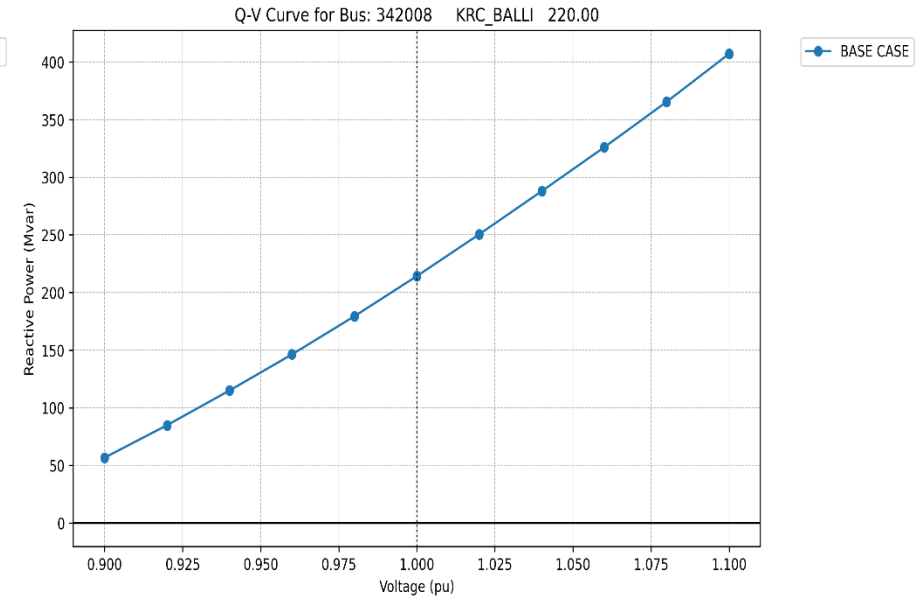
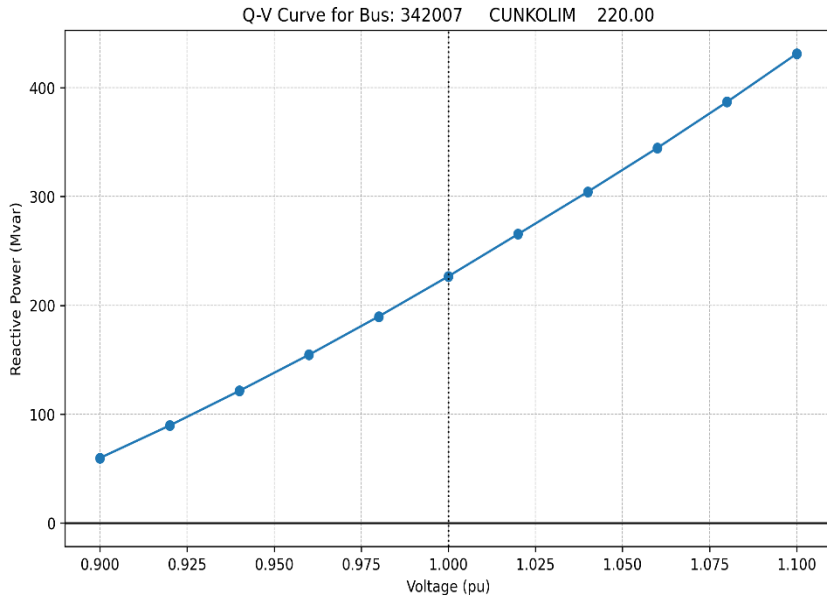


Low Voltage issues at 400 kV Mapusa S/s

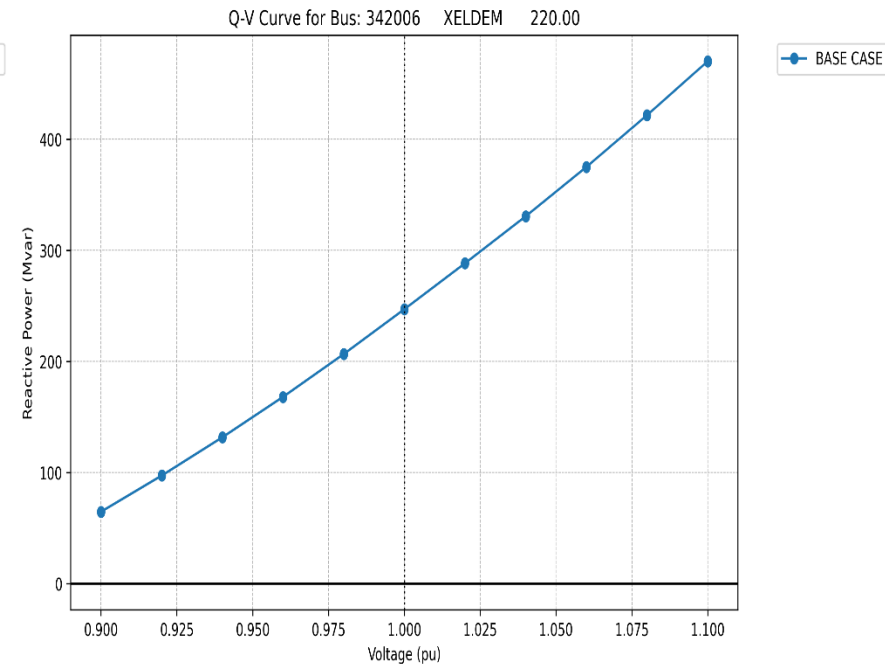
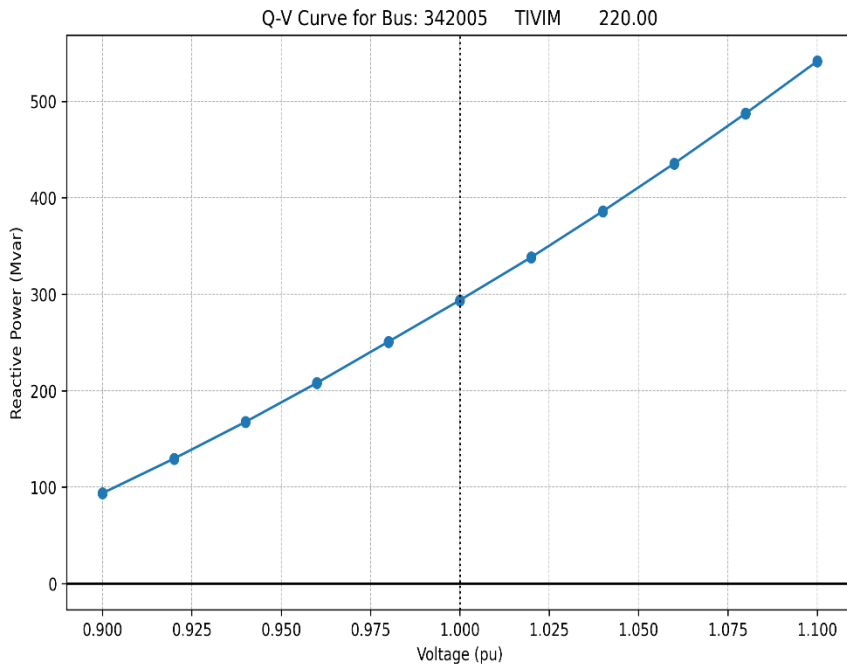
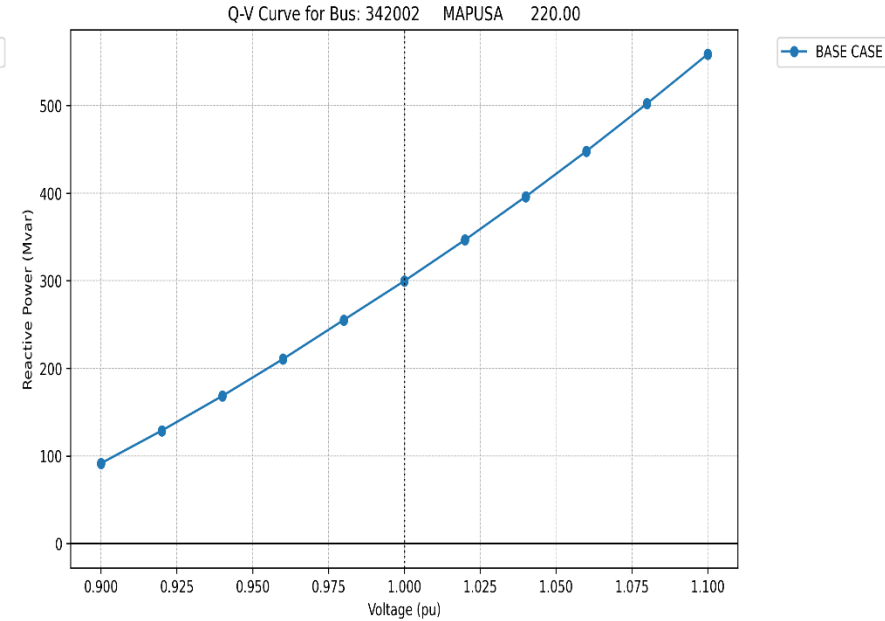
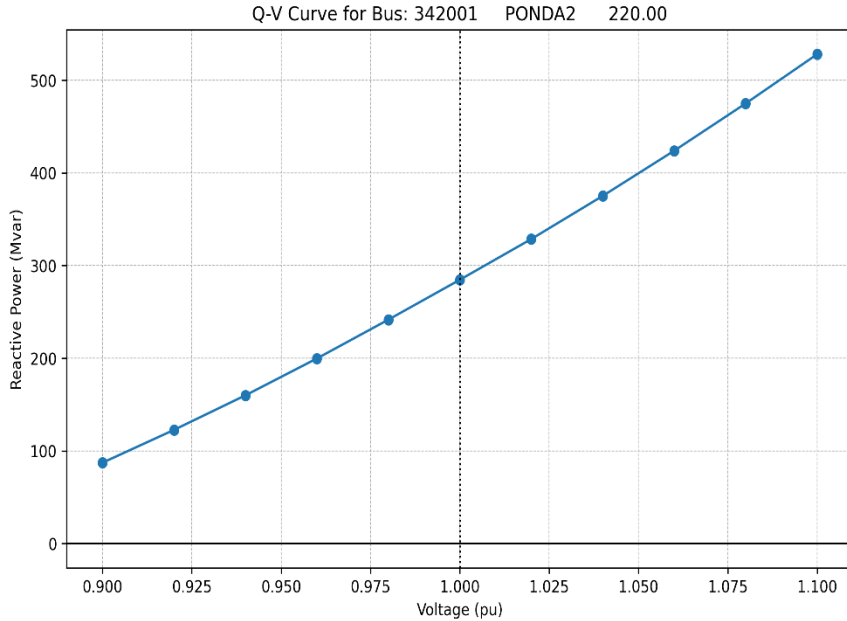
400 kV Mapusa Bus Voltage



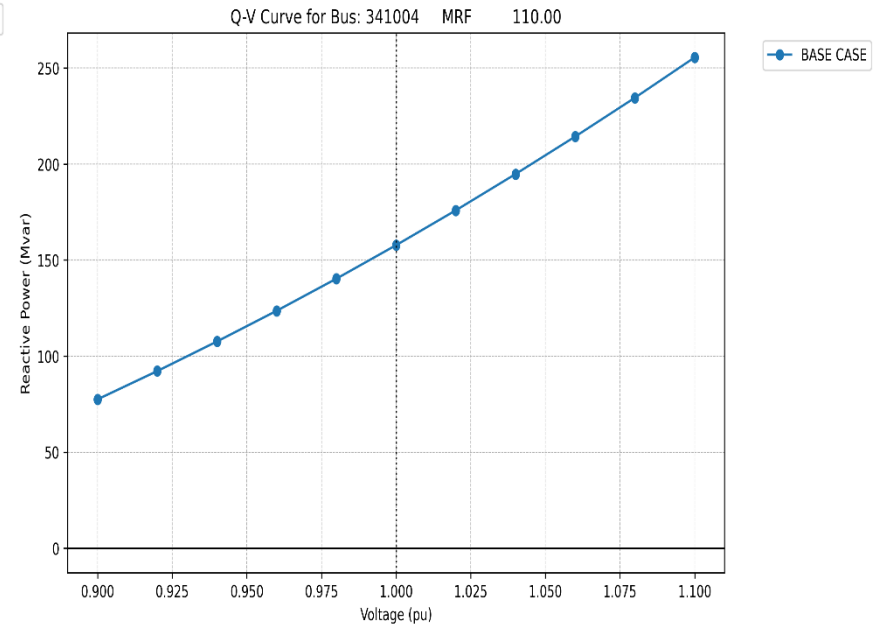
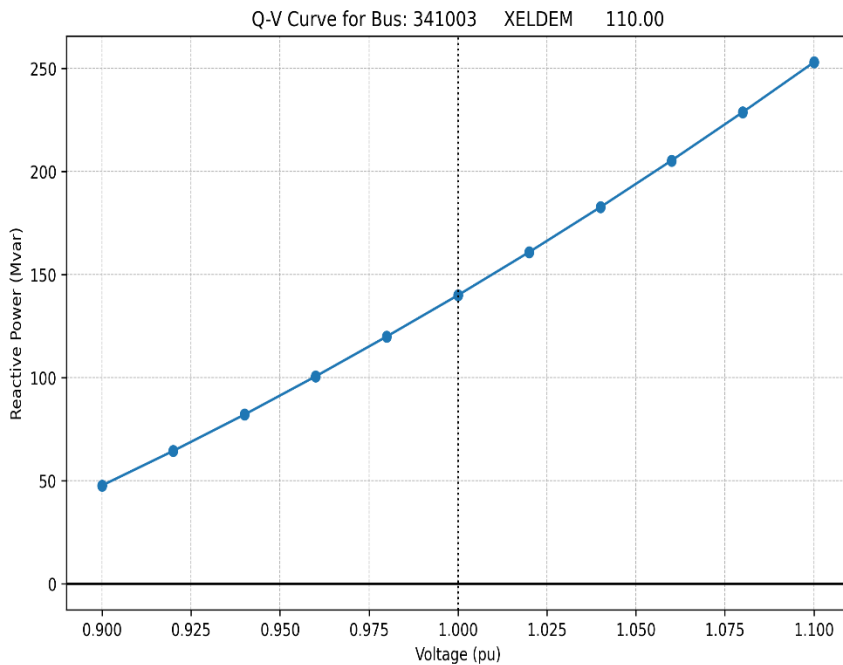
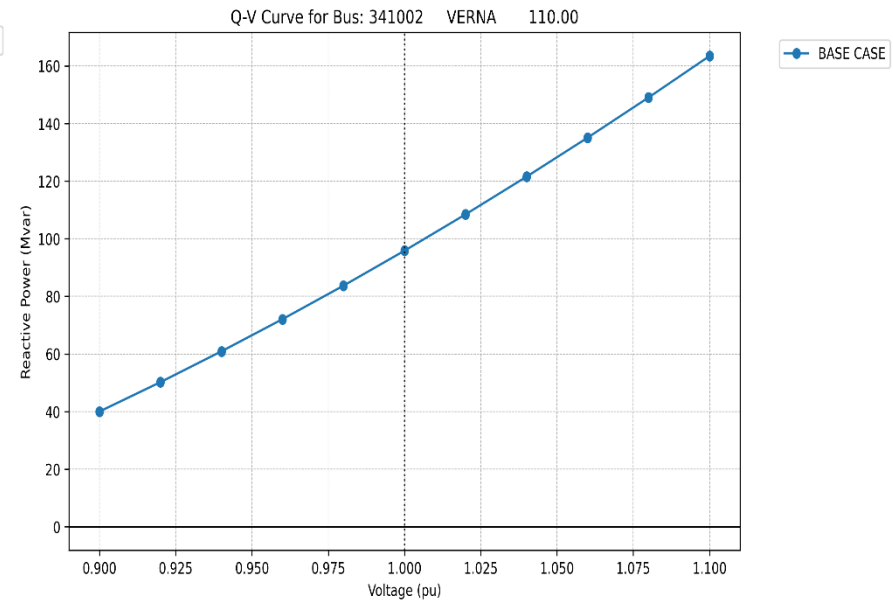
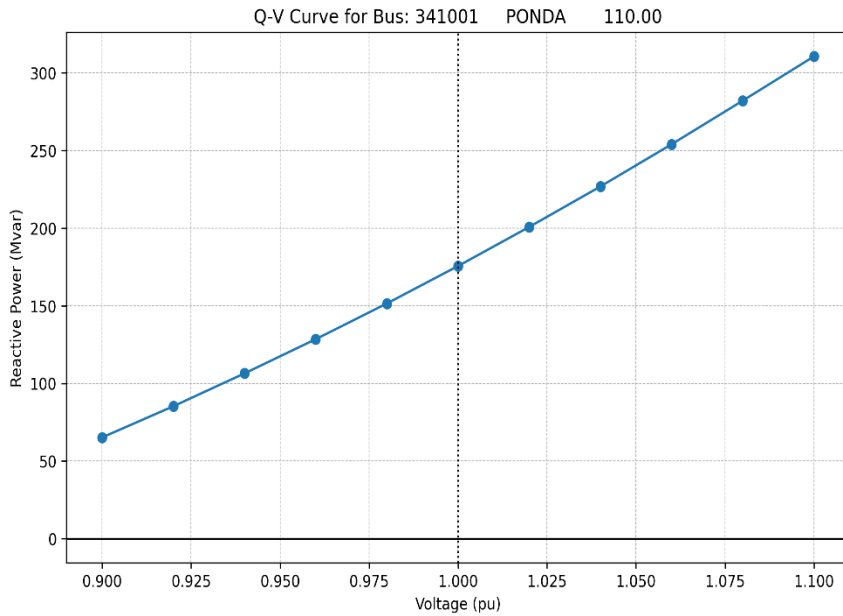
# Q-V analysis results



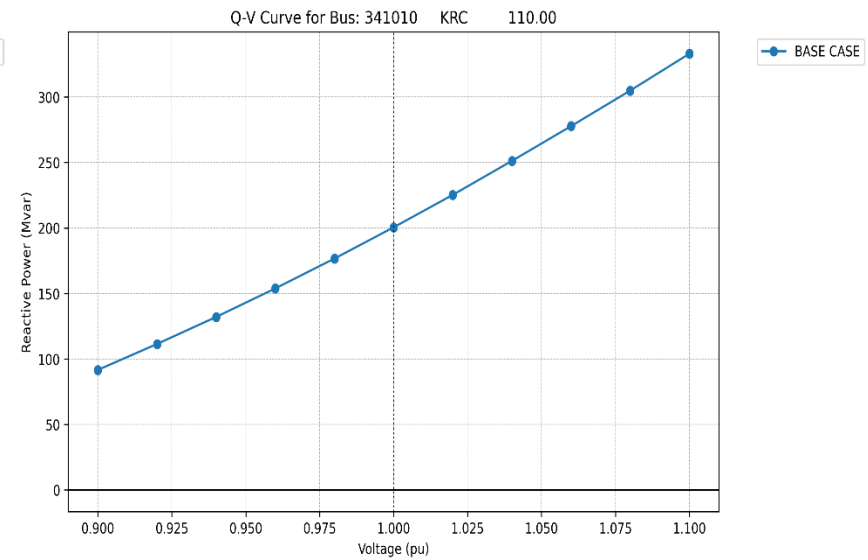
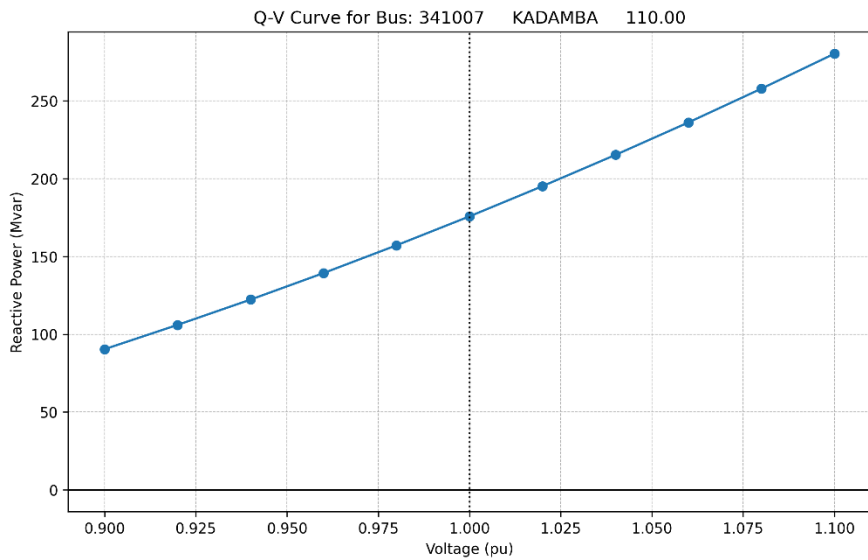
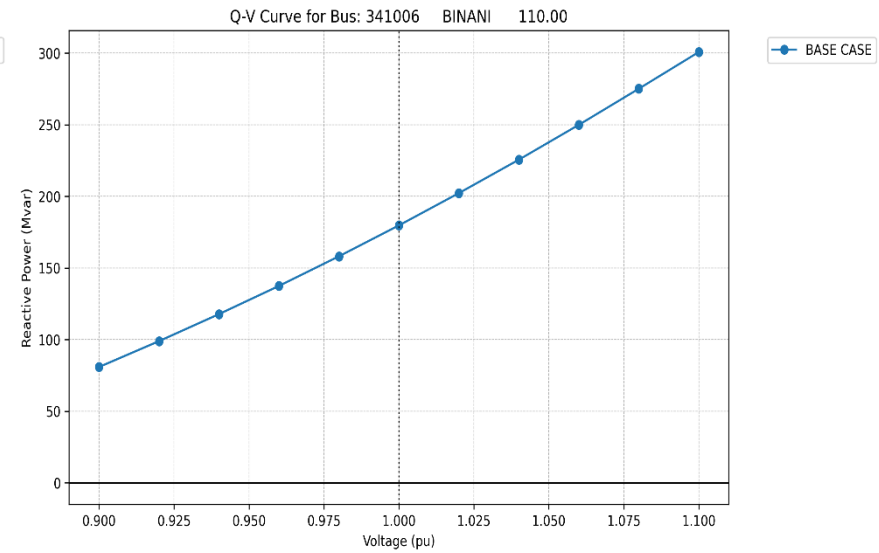
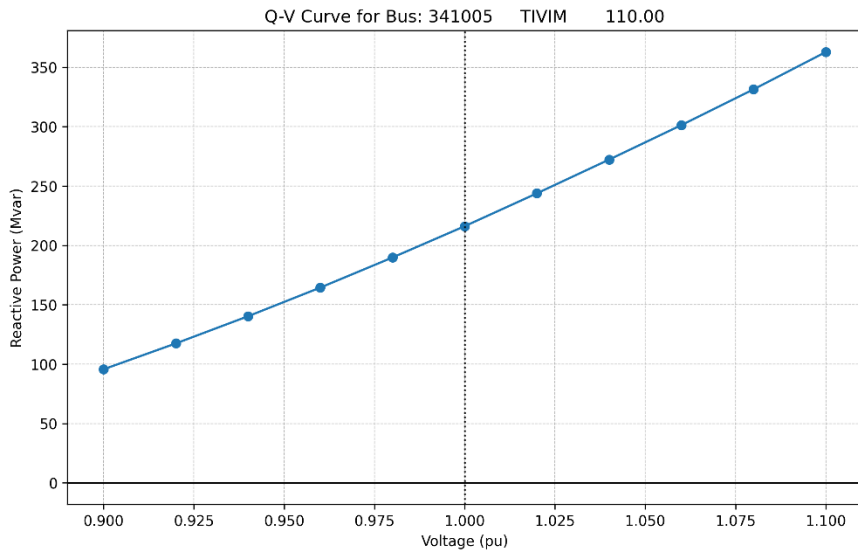
# Q-V analysis results



# Q-V analysis results



# Q-V analysis results



# Q-V analysis results

