## Electrical Transient Analyzer Program

## Load Flow Analysis

Loading Category (1): Design

Generation Category (1): Design

Load Diversity Factor: None

| | Swing | V-Control | Load | Total |
|---|---|---|---|---|
| Number of Buses: | 1 | 2 | 6 | 9 |

| | XFMR2 | XFMR3 | Reactor | Line/Cable/ Busway | Impedance | Tie PD | Total |
|---|---|---|---|---|---|---|---|
| Number of Branches: | 1 | 0 | 0 | 9 | 0 | 0 | 10 |

| | |
|---|---|
| Method of Solution: | Adaptive Newton-Raphson Method |
| Maximum No. of Iteration: | 99 |
| Precision of Solution: | 0.0001000 |
| System Frequency: | 60.00 Hz |
| Unit System: | English |
| Project Filename: | grid1 |
| Output Filename: | C:\Users\owner's\Desktop\PSA PBL\grid1\grid1\Untitled.lfr |

## Adjustments

| Tolerance | Apply Adjustments | Individual /Global | Percent |
|---|---|---|---|
| Transformer Impedance: | Yes | Individual | |
| Reactor Impedance: | Yes | Individual | |
| Overload Heater Resistance: | No | | |
| Transmission Line Length: | No | | |
| Cable / Busway Length: | No | | |

| Temperature Correction | Apply Adjustments | Individual /Global | Degree C |
|---|---|---|---|
| Transmission Line Resistance: | Yes | Individual | |
| Cable / Busway Resistance: | Yes | Individual | |

## Bus Input Data

| Bus | | | Initial Voltage | | Load | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Constant kVA | | Constant Z | | Constant I | | Generic | |
| ID | kV | Sub-sys | % Mag. | Ang. | MW | Mvar | MW | Mvar | MW | Mvar | MW | Mvar |
| Bus1 | 11.330 | 1 | 100.0 | 0.0 | | | | | | | | |
| Bus_2 | 11.330 | 1 | 97.6 | 12.6 | 0.204 | 0.126 | 0.065 | 0.041 | | | | |
| Bus_3 | 11.300 | 1 | 100.0 | 23.0 | 0.340 | 0.211 | 0.098 | 0.061 | | | | |
| Bus_4 | 11.330 | 1 | 98.1 | 4.7 | 0.204 | 0.126 | 0.055 | 0.034 | | | | |
| Bus_5 | 11.220 | 1 | 98.2 | 15.0 | 0.820 | 0.508 | 0.230 | 0.142 | | | | |
| Bus_6 | 11.300 | 1 | 100.3 | 32.0 | 0.204 | 0.126 | 0.059 | 0.037 | | | | |
| Bus_7 | 11.132 | 1 | 98.8 | 9.7 | 0.544 | 0.337 | 0.144 | 0.090 | | | | |
| Bus_8 | 11.176 | 1 | 98.5 | 14.9 | 0.666 | 0.413 | 0.189 | 0.117 | | | | |
| Bus_9 | 10.000 | 1 | 100.0 | 33.3 | 1.972 | 1.222 | 0.493 | 0.306 | | | | |
| Total Number of Buses: 9 | | | | | 4.954 | 3.071 | 1.334 | 0.827 | 0.000 | 0.000 | 0.000 | 0.000 |

| Generation Bus | | | | Voltage | | Generation | | | Mvar Limits | |
|---|---|---|---|---|---|---|---|---|---|---|
| ID | kV | Type | Sub-sys | % Mag. | Angle | MW | Mvar | % PF | Max | Min |
| Bus1 | 11.330 | Swing | 1 | 100.0 | 0.0 | | | | | |
| Bus_3 | 11.300 | Voltage Control | 1 | 100.0 | 23.0 | 25.000 | | | 30.000 | 0.000 |
| Bus_9 | 10.000 | Voltage Control | 1 | 100.0 | 33.3 | 25.000 | | | 70.000 | -40.000 |
| | | | | | | 50.000 | 0.000 | | | |

## Line/Cable/Busway Input Data

ohms or siemens/1000 ft per Conductor (Cable) or per Phase (Line/Busway)

| Line/Cable/Busway ID | Library | Size | Length Adj. (ft) | % Tol. | #/Phase | T (°C) | R | X | Y |
|---|---|---|---|---|---|---|---|---|---|
| Cable3 | 15MALS1 | 750 | 2000.0 | 0.0 | 12 | 75 | 0.036570 | 0.049700 | |
| Line1 | | 319. | 5280.0 | 0.0 | 1 | 75 | 0.049510 | 0.161438 | 0.0000009 |
| Line4 | | 319. | 5280.0 | 0.0 | 1 | 75 | 0.049510 | 0.161438 | 0.0000009 |
| Line6 | | 319. | 5280.0 | 0.0 | 1 | 75 | 0.049510 | 0.161438 | 0.0000009 |
| Line8 | | 319. | 5280.0 | 0.0 | 1 | 75 | 0.049510 | 0.161438 | 0.0000009 |
| Line10 | | 319. | 5280.0 | 0.0 | 1 | 75 | 0.049510 | 0.161438 | 0.0000009 |
| Line12 | | 319. | 5280.0 | 0.0 | 1 | 75 | 0.049510 | 0.161438 | 0.0000009 |
| Line14 | | 319. | 5280.0 | 0.0 | 1 | 75 | 0.049510 | 0.161438 | 0.0000009 |
| Line16 | | 319. | 5280.0 | 0.0 | 1 | 75 | 0.049510 | 0.161438 | 0.0000009 |

Line / Cable / Busway resistances are listed at the specified temperatures.

## 2-Winding Transformer Input Data

| Transformer | | Rating | | | | | Z Variation | | | % Tap Setting | | Adjusted | Phase Shift | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | Phase | MVA | Prim. kV | Sec. kV | % Z1 | X1/R1 | + 5% | - 5% | % Tol. | Prim. | Sec. | % Z | Type | Angle |
| T1 | 3-Phase | 100.000 | 11.300 | 10.000 | 10.00 | 20.10 | 0 | 0 | 0 | 0 | 0 | 10.0000 | Dyn | 0.000 |

## Branch Connections

| CKT/Branch | | Connected Bus ID | | % Impedance, Pos. Seq., 100 MVA Base | | | |
|---|---|---|---|---|---|---|---|
| ID | Type | From Bus | To Bus | R | X | Z | Y |
| T1 | 2W XFMR | Bus_6 | Bus_9 | 0.49 | 9.93 | 9.95 | |
| Cable3 | Cable | Bus_5 | Bus_8 | 0.47 | 0.65 | 0.80 | |
| Line1 | Line | Bus_2 | Bus_3 | 20.36 | 66.40 | 69.45 | 0.0006382 |
| Line4 | Line | Bus1 | Bus_2 | 20.36 | 66.40 | 69.45 | 0.0006382 |
| Line6 | Line | Bus1 | Bus_4 | 20.36 | 66.40 | 69.45 | 0.0006382 |
| Line8 | Line | Bus_4 | Bus_7 | 20.36 | 66.40 | 69.45 | 0.0006382 |
| Line10 | Line | Bus_7 | Bus_8 | 20.36 | 66.40 | 69.45 | 0.0006382 |
| Line12 | Line | Bus_2 | Bus_5 | 20.36 | 66.40 | 69.45 | 0.0006382 |
| Line14 | Line | Bus_3 | Bus_5 | 20.36 | 66.40 | 69.45 | 0.0006382 |
| Line16 | Line | Bus_3 | Bus_6 | 20.36 | 66.40 | 69.45 | 0.0006382 |

## LOAD FLOW REPORT

| Bus | | Voltage | | Generation | | Load | | Load Flow | | | | | XFMR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | kV | % Mag. | Ang. | MW | Mvar | MW | Mvar | ID | MW | Mvar | Amp | %PF | %Tap |
| * Bus1 | 11.330 | 100.000 | 0.0 | -37.452 | 22.079 | 0.000 | 0.000 | Bus_2 | -27.276 | 15.575 | 1600.6 | -86.8 | |
| | | | | | | | | Bus_4 | -10.175 | 6.504 | 615.4 | -84.3 | |
| Bus_2 | 11.330 | 97.562 | 12.6 | 0.000 | 0.000 | 0.266 | 0.165 | Bus_3 | -24.340 | 6.666 | 1318.1 | -96.4 | |
| | | | | | | | | Bus1 | 29.286 | -9.025 | 1600.6 | -95.6 | |
| | | | | | | | | Bus_5 | -5.212 | 2.194 | 295.4 | -92.2 | |
| * Bus_3 | 11.300 | 100.000 | 23.0 | 25.000 | 4.999 | 0.438 | 0.272 | Bus_2 | 25.702 | -2.224 | 1318.1 | -99.6 | |
| | | | | | | | | Bus_5 | 20.057 | -0.976 | 1026.0 | -99.9 | |
| | | | | | | | | Bus_6 | -21.197 | 7.927 | 1156.3 | -93.7 | |
| Bus_4 | 11.330 | 98.087 | 4.7 | 0.000 | 0.000 | 0.257 | 0.159 | Bus1 | 10.472 | -5.536 | 615.4 | -88.4 | |
| | | | | | | | | Bus_7 | -10.730 | 5.376 | 623.5 | -89.4 | |
| Bus_5 | 11.220 | 98.192 | 15.0 | 0.000 | 0.000 | 1.042 | 0.645 | Bus_8 | 12.909 | -2.342 | 687.5 | -98.4 | |
| | | | | | | | | Bus_2 | 5.281 | -1.971 | 295.4 | -93.7 | |
| | | | | | | | | Bus_3 | -19.231 | 3.668 | 1026.0 | -98.2 | |
| Bus_6 | 11.300 | 100.296 | 32.0 | 0.000 | 0.000 | 0.263 | 0.163 | Bus_3 | 22.246 | -4.509 | 1156.3 | -98.0 | |
| | | | | | | | | Bus_9 | -22.509 | 4.346 | 1167.8 | -98.2 | |
| Bus_7 | 11.132 | 98.763 | 9.7 | 0.000 | 0.000 | 0.685 | 0.424 | Bus_4 | 11.035 | -4.383 | 623.5 | -92.9 | |
| | | | | | | | | Bus_8 | -11.720 | 3.958 | 649.6 | -94.7 | |
| Bus_8 | 11.176 | 98.531 | 14.9 | 0.000 | 0.000 | 0.850 | 0.527 | Bus_5 | -12.900 | 2.353 | 687.5 | -98.4 | |
| | | | | | | | | Bus_7 | 12.050 | -2.880 | 649.6 | -97.3 | |
| * Bus_9 | 10.000 | 100.000 | 33.3 | 25.000 | -2.296 | 2.465 | 1.528 | Bus_6 | 22.535 | -3.824 | 1319.7 | -98.6 | |

* Indicates a voltage regulated bus ( voltage controlled or swing type machine connected to it)

\# Indicates a bus with a load mismatch of more than 0.1 MVA

## Bus Loading Summary Report

| Bus | | | Directly Connected Load | | | | | | | | Total Bus Load | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Constant kVA | | Constant Z | | Constant I | | Generic | | | | | Percent |
| ID | kV | Rated Amp | MW | Mvar | MW | Mvar | MW | Mvar | MW | Mvar | MVA | % PF | Amp | Loading |
| Bus1 | 11.330 | | | | | | | | | | 43.476 | 86.1 | 2215.4 | |
| Bus_2 | 11.330 | | 0.204 | 0.126 | 0.062 | 0.039 | | | | | 30.899 | 95.6 | 1613.9 | |
| Bus_3 | 11.300 | | 0.340 | 0.211 | 0.098 | 0.061 | | | | | 46.919 | 98.5 | 2397.2 | |
| Bus_4 | 11.330 | | 0.204 | 0.126 | 0.053 | 0.033 | | | | | 12.074 | 88.9 | 627.2 | |
| Bus_5 | 11.220 | | 0.820 | 0.508 | 0.221 | 0.137 | | | | | 19.709 | 97.6 | 1032.8 | |
| Bus_6 | 11.300 | | 0.204 | 0.126 | 0.059 | 0.037 | | | | | 22.956 | 98.1 | 1169.4 | |
| Bus_7 | 11.132 | | 0.544 | 0.337 | 0.141 | 0.087 | | | | | 12.512 | 93.7 | 657.1 | |
| Bus_8 | 11.176 | | 0.666 | 0.413 | 0.183 | 0.114 | | | | | 13.218 | 97.6 | 693.0 | |
| Bus_9 | 10.000 | | 1.972 | 1.222 | 0.493 | 0.306 | | | | | 25.291 | 98.9 | 1460.2 | |

* Indicates operating load of a bus exceeds the bus critical limit ( 100.0% of the Continuous Ampere rating).
# Indicates operating load of a bus exceeds the bus marginal limit (95.0% of the Continuous Ampere rating).

## Branch Loading Summary Report

| CKT / Branch | | Busway / Cable & Reactor | | | Transformer | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Loading (input) | | Loading (output) | |
| ID | Type | Ampacity (Amp) | Loading Amp | % | Capability (MVA) | MVA | % | MVA | % |
| Cable3 | Cable | 6144.38 | 687.52 | 11.19 | | | | | |
| T1 | Transformer | | | | 100.000 | 22.925 | 22.9 | 22.857 | 22.9 |

* Indicates a branch with operating load exceeding the branch capability.

## Branch Losses Summary Report

| Branch ID | From-To Bus Flow | | To-From Bus Flow | | Losses | | % Bus Voltage | | Vd % Drop |
|---|---|---|---|---|---|---|---|---|---|
| | MW | Mvar | MW | Mvar | kW | kvar | From | To | in Vmag |
| Cable3 | 12.909 | -2.342 | -12.900 | 2.353 | 8.6 | 11.7 | 98.2 | 98.5 | 0.05 |
| Line1 | -24.340 | 6.666 | 25.702 | -2.224 | 1362.5 | 4442.2 | 97.6 | 100.0 | 2.17 |
| Line10 | -11.720 | 3.958 | 12.050 | -2.880 | 330.9 | 1078.5 | 98.8 | 98.5 | 0.16 |
| Line12 | -5.212 | 2.194 | 5.281 | -1.971 | 68.4 | 222.5 | 97.6 | 98.2 | 0.32 |
| Line14 | 20.057 | -0.976 | -19.231 | 3.668 | 825.5 | 2691.1 | 100.0 | 98.2 | 2.50 |
| Line16 | -21.197 | 7.927 | 22.246 | -4.509 | 1048.5 | 3418.3 | 100.0 | 100.3 | 0.30 |
| Line4 | -27.276 | 15.575 | 29.286 | -9.025 | 2009.1 | 6550.7 | 100.0 | 97.6 | 2.44 |
| Line6 | -10.175 | 6.504 | 10.472 | -5.536 | 297.0 | 967.8 | 100.0 | 98.1 | 1.91 |
| Line8 | -10.730 | 5.376 | 11.035 | -4.383 | 304.9 | 993.5 | 98.1 | 98.8 | 1.05 |
| T1 | -22.509 | 4.346 | 22.535 | -3.824 | 26.0 | 521.8 | 100.3 | 100.0 | 0.30 |
| | | | | | 6281.5 | 20898.0 | | | |

* This Transmission Line includes Series Capacitor.

## Alert Summary Report

### % Alert Settings

| | Critical | Marginal |
|---|---|---|
| **Loading** | | |
| Bus | 100.0 | 95.0 |
| Cable / Busway | 100.0 | 95.0 |
| Reactor | 100.0 | 95.0 |
| Line | 100.0 | 95.0 |
| Transformer | 100.0 | 95.0 |
| Panel | 100.0 | 95.0 |
| Protective Device | 100.0 | 95.0 |
| Generator | 100.0 | 95.0 |
| Inverter/Charger | 100.0 | 95.0 |
| **Bus Voltage** | | |
| OverVoltage | 105.0 | 102.0 |
| UnderVoltage | 95.0 | 98.0 |
| **Generator Excitation** | | |
| OverExcited (Q Max.) | 100.0 | 95.0 |
| UnderExcited (Q Min.) | 100.0 | |

## Critical Report

| Device ID | Type | Condition | Rating/Limit | Unit | Operating | % Operating | Phase Type |
|---|---|---|---|---|---|---|---|
| Gen1 | Generator | Under Power | 0.000 | MW | -37.452 | 0.0 | 3-Phase |

## Marginal Report

| Device ID | Type | Condition | Rating/Limit | Unit | Operating | % Operating | Phase Type |
|---|---|---|---|---|---|---|---|
| Bus_2 | Bus | Under Voltage | 11.330 | kV | 11.054 | 97.6 | 3-Phase |

## SUMMARY OF TOTAL GENERATION , LOADING & DEMAND

| | MW | Mvar | MVA | % PF |
|---|---|---|---|---|
| Source (Swing Buses): | -37.452 | 22.079 | 43.476 | 86.14 Leading |
| Source (Non-Swing Buses): | 50.000 | 2.703 | 50.073 | 99.85 Lagging |
| Total Demand: | 12.548 | 24.782 | 27.777 | 45.17 Lagging |
| Total Motor Load: | 4.954 | 3.071 | 5.829 | 85.00 Lagging |
| Total Static Load: | 1.312 | 0.813 | 1.544 | 85.00 Lagging |
| Total Constant I Load: | 0.000 | 0.000 | 0.000 | |
| Total Generic Load: | 0.000 | 0.000 | 0.000 | |
| Apparent Losses: | 6.281 | 20.898 | | |
| System Mismatch: | 0.000 | 0.000 | | |

Number of Iterations: 1