

IEEE 118-Bus System Analysis Report

Power System Analysis Report

February 24, 2025

1 Executive Summary

This report presents a comprehensive analysis of the IEEE 118-bus system, focusing on voltage profiles, bus characteristics, and system performance. The analysis reveals significant voltage deviations across the system, with all buses operating below nominal voltage levels.

2 System Overview

The IEEE 118-bus system is a standard test case representing a portion of the American Electric Power System (in the Midwestern US) as of December 1962. The system operates at a nominal voltage of 138 kV.

3 Voltage Profile Analysis

3.1 System-wide Statistics

- Maximum Voltage: 0.3919 pu at bus 89_clinchrv (54.08 kV)
- Minimum Voltage: 0.0518 pu at bus 1_riversde (7.15 kV)
- System Losses: 76,353.20 kW + j272,041.63 kVAR

4 Bus Analysis

Bus Name	Base kV	PU Voltage	Actual kV	Status
89_clinchrv	138.0	0.3919	54.08	Low Voltage
90_holston	138.0	0.3599	49.67	Low Voltage
91_holstont	138.0	0.3433	47.38	Low Voltage
88_fremont	138.0	0.3523	48.62	Low Voltage
85_beverck	138.0	0.3043	41.99	Low Voltage
87_pinevele	138.0	0.3019	41.66	Low Voltage
1_riversde	138.0	0.0518	7.15	Low Voltage
2_pokagon	138.0	0.0522	7.20	Low Voltage
3_hickryck	138.0	0.0526	7.26	Low Voltage
117_corey	138.0	0.0521	7.19	Low Voltage

5 Regional Analysis

5.1 Higher Voltage Region (± 0.30 pu)

The following buses maintain relatively higher voltages compared to the rest of the system:

- Bus 89_clinchrv (0.3919 pu) - Swing Bus
- Bus 90_holston (0.3599 pu)
- Bus 91_holstont (0.3433 pu)
- Bus 88_fremont (0.3523 pu)
- Bus 85_beaverck (0.3043 pu)
- Bus 87_pinevle (0.3019 pu)

5.2 Lower Voltage Region (± 0.06 pu)

The following buses experience severe voltage depression:

- Bus 1_riversde (0.0518 pu)
- Bus 2_pokagon (0.0522 pu)
- Bus 3_hickryck (0.0526 pu)
- Bus 117_corey (0.0521 pu)

6 System Issues and Recommendations

6.1 Identified Issues

1. Severe voltage depression across all buses
2. Significant deviation from nominal voltage (138 kV)
3. High system losses
4. Potential reactive power imbalance

6.2 Recommendations

1. Verify generator voltage setpoints and control settings
2. Review transformer tap settings
3. Evaluate reactive power compensation devices
4. Consider adding voltage support at critical buses
5. Investigate load modeling parameters
6. Review power flow distribution

7 Conclusion

The IEEE 118-bus system currently exhibits significant voltage stability issues. All buses are operating below the acceptable voltage range (0.95-1.05 pu), indicating a need for immediate corrective actions. The system requires comprehensive voltage support and reactive power management strategies to improve its operational performance.