

# INVESTIGATING THE IMPACT OF RESIDENTIAL SOLAR PV SYSTEM INTEGRATION ON POWER QUALITY IN A DISTRIBUTION NETWORK

## 1. BACKGROUND

The intermittent nature of photovoltaic (PV) system generation can negatively impact the distribution network resulting in power quality issues. Power quality issues include overvoltage, poor power factor, total harmonic distortion and voltage fluctuations which can lead to low efficiency and equipment damage.

## 2. OBJECTIVES

- Review of power quality challenges in a distribution network.
- Review of the impact of residential PV system integration on power quality.
- Design a distribution network with PV system integration.
- Develop a criterion for investigating the power quality deviation

## 3. APPROACH

The design of two PV integrated distribution networks to produce voltage and frequency profiles of the system was done using DigSILENT PowerFactory. The loading and penetration levels of the system was varied to observe how these parameters affect power quality.

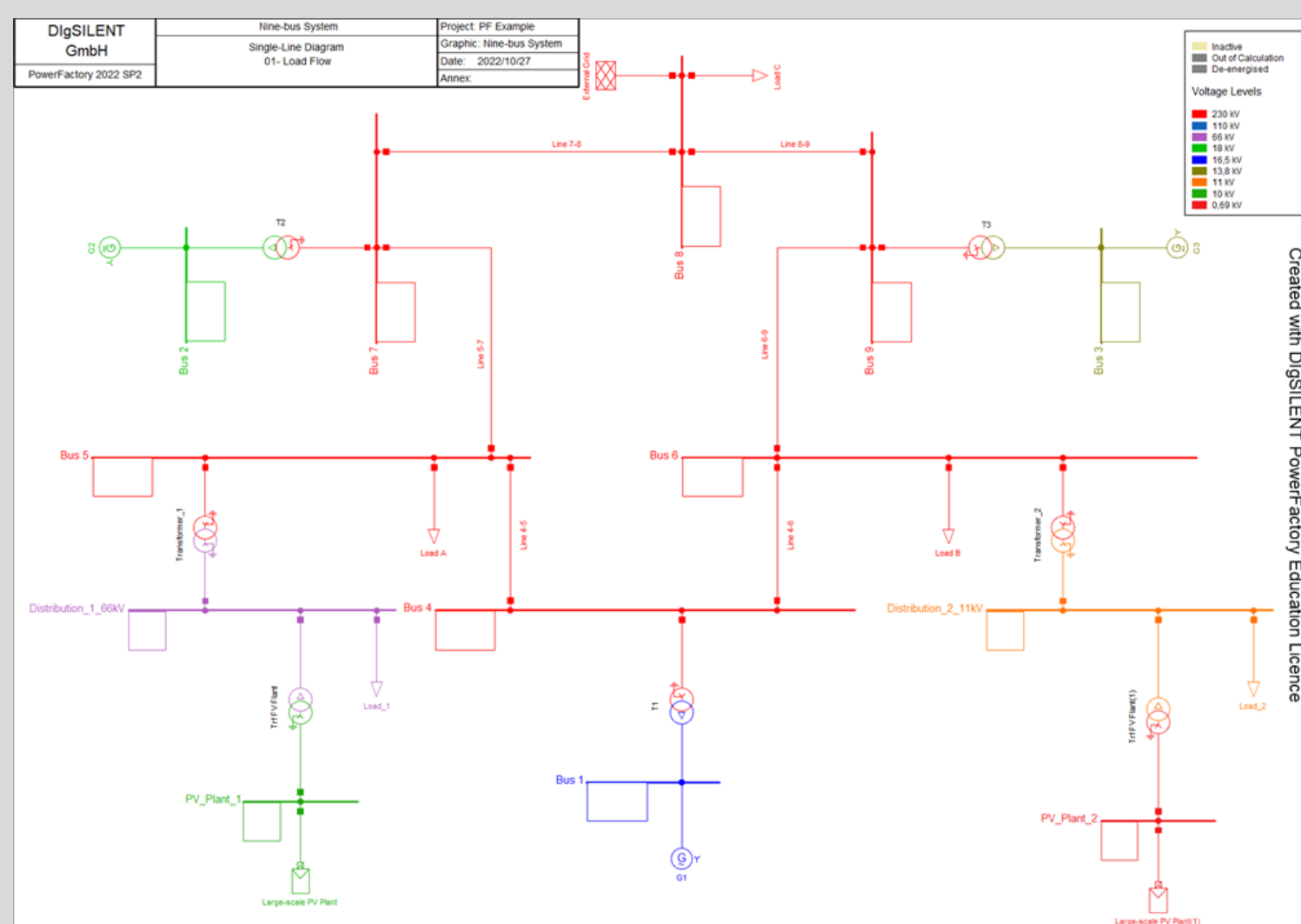


Figure 1: IEEE 9-bus system with distribution networks and PV plant integration

## 4. RESULTS

The figures below depict the voltage and frequency profiles (respectively) for two PV integrated distribution networks along with the voltage and frequency profiles of the distribution network without PV integration. The results clearly show deviation in both the voltage and frequency profiles.

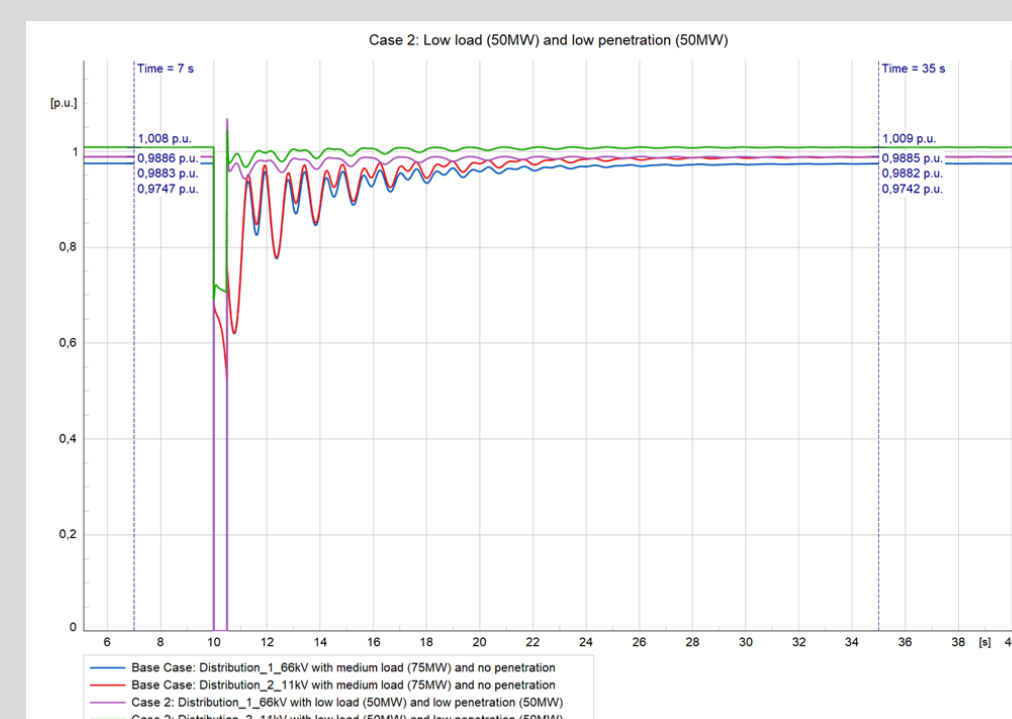


Figure 2: Voltage profile of the PV integrated distribution system

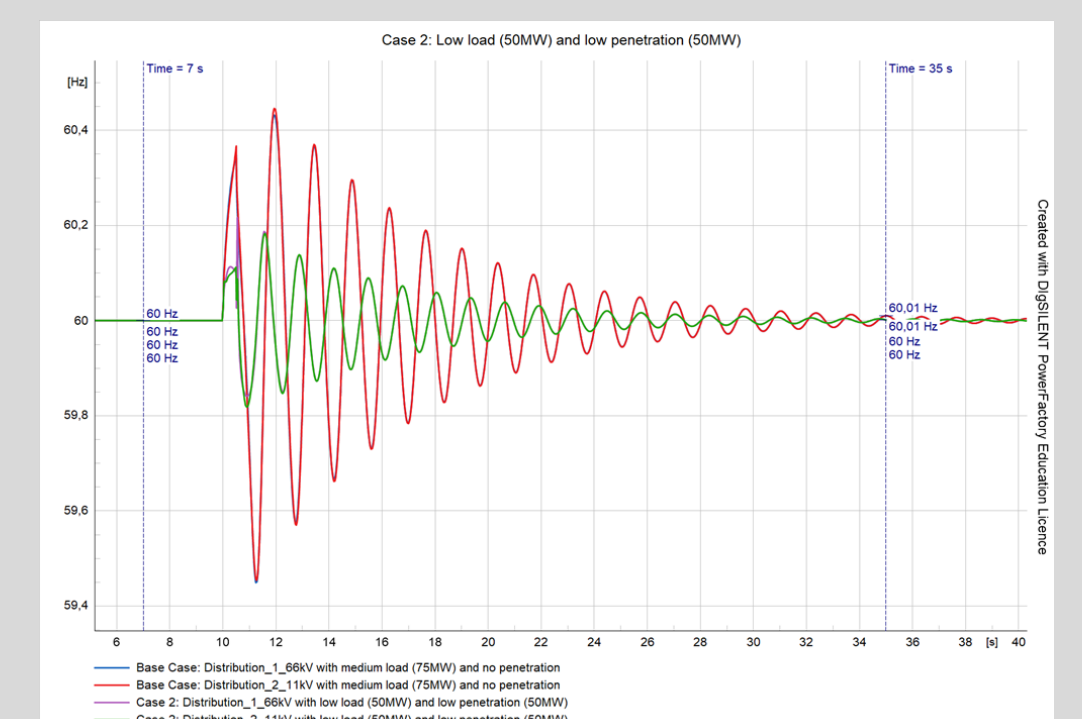


Figure 3: Frequency profile of the PV integrated distribution system

## 5. CONCLUSIONS

- Voltage is more affected than frequency.
- High voltage distribution systems experience less power quality issues.
- Higher penetration levels cause greater deviation in the power quality.
- Different loadings affect power quality.
- Voltage magnitudes comply with SA Grid Codes for distributed generation.