

1. Introduction

The global energy matrix is constantly being reformulated, especially with the growing demand for electricity. It is in this sense that photovoltaic and wind farms have grown too much, structuring new models of electrical systems with the presence of distributed generation (DG) [1]. In this sense, the present work proposes to analyse the electrical losses and voltage levels in a distribution system (specifically a large feeder) of a Brazilian electric utility.

2. Brazilian Real Feeder

In the Fig. 1 is presented the single-line diagram provided by OpenDSS of the network that represents the feeder under study. The data provided by the electric utility describe the medium voltage of the feeder.

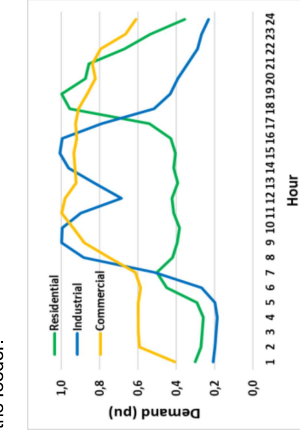


Fig. 1. Typical demand curves, in pu, used in this work.

Scenario 1: **1.15 MWp** (12.4% of the feeder's demand at 11 am);
Scenario 2: **1.15 MWp + 3.45 MWp** (49.6% of the feeder's demand at 11 am);
Total feeder's demand at 11 am: 9.27 MW.

Table I. Feeder Description

INFORMATION:		VALOR	UNIT
Nominal voltage		13,80	kV
Transformers		244	units
Total Power Transformers		18,79	MVA
Feeder Extension (Medium Voltage)		18,50	km
Number of Residential Consumers		777	units
Number of Commercial Consumers		257	units
Number of Industrial Consumers		2	units

Figure 1. Single Feeder Diagram with GD - Scenario 1 (red) and Scenario 2 (red + green)

3. OpenDSS Approach and Simulation Results

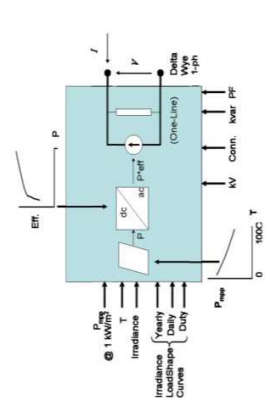


Fig. 3. Model of the photovoltaic generator used in OpenDSS and all the quantities required for its declaration. [2]

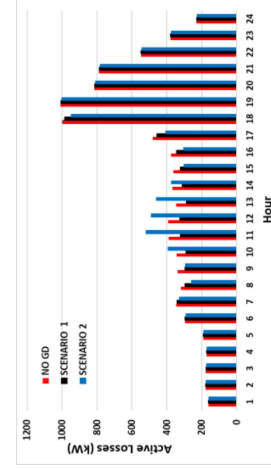


Fig. 4. Comparison of losses for the different scenarios.

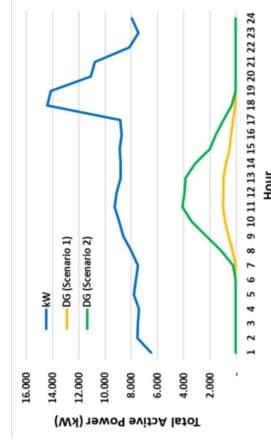


Fig. 5. Demand curve of the analyzed feeder.

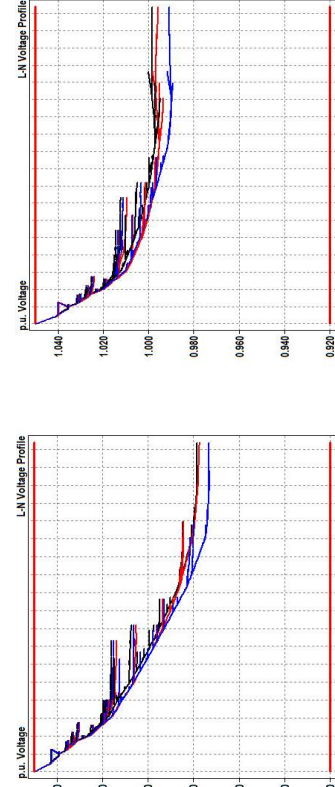


Fig. 6. Voltage levels for the system without DG in maximum demand.

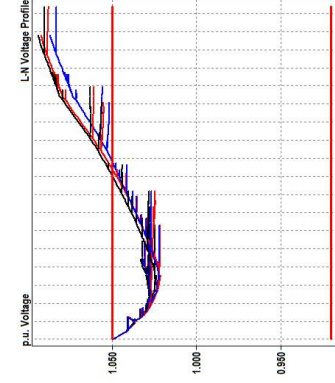


Fig. 7. Voltage levels for Scenario 1 in maximum demand.

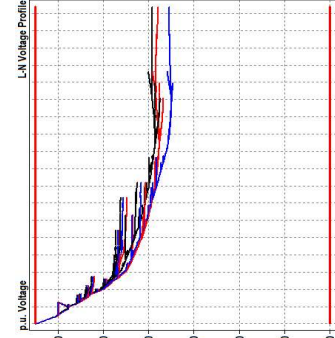


Fig. 8. Voltage levels for Scenario 2 in maximum demand.

5. Conclusion

In this work, a real system of distribution with and without distributed generation using OpenDSS software was used as support. Therefore, it is concluded that in the near future the insertion of DG will cause serious consequences to the feeders and with that, one must initiate discussions about the Brazilian regulations, that is, these analyses are important to the utilities and regulators to define actions in that they touch the considerable increase of DG in the distribution systems.

6. References

- [1] Agência Nacional De Energia Elétrica – ANEEL, Geração distribuída - Brasil ultrapassa marca de 1GW em geração distribuída: Regulamentos da Agência possibilitaram avanço da geração distribuída, 2019. Available in: < <http://www.aneel.gov.br/>>.
- [2] Sourceforge, "Opends Software Manual", 2019. Available in: <<https://sourceforge.net/projects/electricdss/>>.