

# A Decision Support System to Analyze the Influence of Distributed Generation in Energy Distribution Networks

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**Summary.** Recent changes in electric network infrastructure and government policies have created opportunities for the employment of distributed generation to achieve a variety of benefits. In this paper we propose a decisions support system to assess some of the technical benefits, namely: (1) voltage profile improvement; (2) power losses reduction; and (3) network capacity investment deferral, brought through branches congestion reduction. The simulation platform incorporates the classical Newton–Raphson algorithm to solve the power flow equations. Simulation results are given for a real Semiurban medium voltage network, considering different load scenarios (Summer, Winter, Valley, Peak and In Between Hours), different levels of microgeneration penetration, and different location distributions for the microgeneration units.

## 4.1 Introduction

Several benefits can be achieved by integrating Distributed Generation (DG) with utility networks. These benefits should be clearly understood, analyzed, and quantified in order to increase the potential and value of DG penetration. The benefits of DG have been evaluated and quantified in terms of capacity credit, energy value, and energy cost saving [17, 20]. DG is expected to play a major role in future power systems, since it is able to reduce transmission losses, improve power quality to end users, and smooth peaks in demand patterns.

Besides that, another main driver for DG penetration growth is the development of new renewable DG (wind turbines, photovoltaic, biomass, etc.) and some fossil DG that have combined heat and power capabilities. The European Union (EU) Commission has set a target of 12% by 2010 for microgeneration integration in Low Voltage (LV) and Medium Voltage (MV) networks. Proliferation of renewable energy sources is being encouraged in order to progress towards the Kyoto agreement. Bearing in mind this agreement and considering each country specificities, EU proposed in September 2001 the Directive