Design and Analyzing Study of an Energy Saving Scheme For an Industrial Distribution Network in Baghdad Region Using Professional Power System Software (EDSA)

Abstract

This paper presents an attempt to study and analysis of an existing practical case of power factor correction for an 11 kV industrial distribution network in the Baghdad Region in the State of Iraq. The industrial power distribution networks of the State of Iraq and, also, in any country in the world, would have inductive loads at low power factor. One of the best solutions for the problem of low power factor or lagging current problem is commonly done by connecting shunt VAR compensation elements such as shunt capacitors bank or local capacitors at the desired locations to achieve the power factor correction. Shunt capacitors bank utilization in the power factor correction will produce economic saving in capital expenditures through the reduction of power losses through the distribution network which is the main goal of this study. In this study, the professional power system software (EDSA) has been used in developing the network model for the first time in Iraq. The power flow solution has been used in the determination of the energy after adding the shunt capacitors (i.e. after power factor correction). The on-site power factor enhancements and energy measurements have been conducted and verified by the network model that was developed by the professional power system software (EDSA), while Newton-Raphson method has been used to obtain the Power flow solution. Many goals have been achieved in this study, where in spite of the annual reduction in losses or energy saving of 120.96 MWhr (435456 MJ of energy for every one year), the power factor is enhanced to an excellent value (nearly 95 %), where reaching this value for such industrial loads give a remarkable excellent condition.

Keywords: EDSA program, VAR compensation, and power factor enhancement

This research has presented an attempt to analyze and study the existing practical case of power factor correction for an 11 kV industrial distribution network in the Baghdad Region in the State of Iraq. Industrial power distribution networks in Iraq and other countries worldwide often have inductive loads with low power factors. One of the best solutions for this problem is connecting shunt VAR compensation elements such as shunt capacitors banks or local capacitors at the desired locations to correct the power factor. Utilizing shunt capacitors banks in power factor correction can lead to economic savings in capital expenditures through the reduction of power losses through the distribution network, which is the main goal of this study. In this study, the professional power system software (EDSA) was used for the first time in Iraq to develop the network model. The power flow solution was used to determine the energy after adding the shunt capacitors (i.e. after power factor correction). On-site power factor enhancements and energy measurements were conducted and verified by the network model developed by EDSA, while the Newton-Raphson method was used to obtain the power flow solution. Many goals were achieved in this study, including an annual reduction in losses or energy saving of 120.96 MWh (435456 MJ of energy per year), with the power factor enhanced to an excellent value (nearly 95%), making this value remarkable for industrial loads.

Keywords: EDSA program, VAR compensation, and power factor enhancement