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# Distribution Networks' Energy Losses Versus Hosting Capacity of Wind Power in the Presence of Demand Flexibility

Alireza Soroudi, Abbas Rabiee, Andrew Keane

## Abstract

With the increasing share of renewable energy sources (RES) in demand supply, the distribution network operators (DNOs) are facing with new challenges. In one hand, it is desirable to increase the ability of the network in absorbing more renewable power generation units (or increasing the hosting capacity (HC)). On the other hand, power injection to the distribution network by renewable resources may increase the active power losses (if not properly allocated) which reduces the efficiency of the network. Thus, the DNO should make a balance between these two incommensurate objective functions. The Demand Response (DR) in context of smart grids can be used by DNO to facilitate this action. This paper provides an approach in which a multi-objective and multi-period NLP optimization model is formulated where the DR is utilized as an effective tool to increase HC and decrease the energy losses simultaneously. In order to quantify the benefits of the proposed method, it is applied on a 69-bus distribution network. The numerical results substantiate that the proposed approach gives optimal locations and capacity of RES, as well as minimum energy losses by load shifting capability provided via DR programs.

## Index Terms

Demand response (DR), hosting capacity (HC), total energy losses, wind energy.

## I. NOMENCLATURE

### A. Sets and indices

$i, j$	Index of distribution network nodes
$sb$	Index of slack bus
$t$	Index of operating periods

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