Nouakchott microgrid operation

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In this work a novel metaheuristic technique is used to obtain the optimal set point of the different sources used in the proposed system of three interconnected multi-MGs. the metaheuristic technique is one to one based optimizer (OOBO), that can tackle with different optimization difficulties and can give more adequate, acceptable, and satisfied results compared with other optimization techniques22,23. The OOBO is used to obtain the optimal set point of the two batteries in both MG1 and MG2. While the Lagrange multiplier approach. is used to obtain the optimal set point of the Diesel generators of MG1, MG2, and micro gas turbine of MG3 as indicated in the proposed model in the following section during both modes of operation, Grid connected mode and autonomous mode.

The main contributions of this work can be listed as:

proposing an effective day-ahead scheduling for three-interconnected multi-MGs based on a cutting-edge meta-heuristic technique, OOBO, with the goal of minimizing daily operating costs by calculating the optimal set points of the different energy sources. The optimal set-points for diesel generators and MGT are obtained using the Lagrange multiplier approach.

Applying a load-shifting technique-based load management approach to reduce the operational costs of a multi-interconnected microgrid during both grid-connected and islanded operation modes.

The remainder of the paper is organized as follows: Section "Multi-microgrid system" illustrates the components of the proposed three- interconnected MGs system. Section "The energy management system (EMS)" elaborates the optimization technique used to obtain the optimal set point of the proposed system. Section "One to one based optimizer (OOBO)" elaborates the EMS for the proposed system for the most efficient technical operation including optimal set points, EMS cost function, and restrictions of the different components of the proposed system. The obtained simulation results are reviewed and assessed in section "Simulation results". The conclusion from this work is discussed in the last section "Conclusion".

Proposed model of three interconnected MGs.

MG"s operating considerations vary depending on the mode of operation. The most effective system operation

strategies prioritize cost-effectiveness, dependability, and low emissions. The optimal dispatch challenge of DG units in MGs is to minimize generation costs and reduce environmental pollution. An MG"s generation expenses include fuel, emissions, operation, maintenance, and purchasing/selling costs. To assess the cost of MG generation, the proposed methodology took into account the power production of renewable energy DGs and the fuel cost of non-renewable energy DGs24,25.

The PV array consists of numerous PV modules connected in parallel and series. This turns the incident solar irradiance into photovoltaic current. The extracted power from PV module is illustrated in the following equation25:

Wind turbines convert wind"s kinetic energy (KE) into mechanical energy. The power extracted from wind turbine depend on wind speed as indicated in the following equation25:

The operating cost of diesel generator can be stated as a quadratic polynomial function of its actual output power.as indicated in the following equation25: