Economic Dispatch Strategy for Solar Hybrid System using Lambda Iteration Method

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***Abstract*—A method for optimal power dispatch of hybrid system consisting of Solar-Diesel-Battery systems in remote area is presented. The aim of this paper is to provide a performance analysis of the method applied for cost reduction related to the constraint and satisfaction of load demand. The method presented utilizes the data and parameter of the Bario Solar Hybrid Central Station, Bario, Sarawak, Malaysia (3.7350° N, 115.4793° E). This work proposes a MATLAB software package to estimate optimal real power value with the least generating cost for the system. The operation, maintenance and investment costs are specified in the cost functions of the energy sources and will consider the assumption of equal incremental cost. Different case study has been carried out to solve the system equation and finally, the result from the proposed method is to be compared to a reduced gradient optimization method. It is found out the method in this study proved to be effective by giving an improved optimization results and efficiency for obtaining optimal power dispatch with few parameters in various tested conditions.**

***Index Terms*—Economic Dispatch; Solar Hybrid; Lambda Iteration; Reduced Gradient Method.**

I. INTRODUCTION

Solar Hybrid system is expected to become part of the next electric power system evolution, targeting rural and remote area, where the grid connection is almost impossible in term of cost and geography concern. [1]. A typical hybrid energy station consisting two or more energy systems, energy storage system, power converting equipment and a controller. They are generally islanded and centralized electric power grid that used in remote areas [2]. The higher cost to transport the fuels to this area is considered one of the major issues in reducing the cost of power generation. [3]. To overcome the increment of power generating cost for diesel system, photovoltaic system is one of the solutions as solar power is often the most economical alternative energy source for remote regions. [4]. The investment and fuel cost need to be minimized while meeting the power demand thus various optimization techniques are being introduced to give minimal cost on fuel and operation of the whole system. [6]-[7].

In this paper, an economic dispatch optimization is considered and the computational Lambda Iteration and Reduced Gradient Method is implemented to obtain the minimum cost of the system. The Lambda Iteration Method is considered based on its effectiveness to achieve optimal cost condition of the generating system. [5]-[8].

In this paper, economic dispatch optimization in solar hybrid system is considered. The Lambda Iteration Method and Reduced Gradient Method is implemented to obtain the minimum cost of the system. However, this computational method works well by considering generator constraints without the transmission loss and it heavily depends on the selection of initial generator value [9].

The structure of hybrid system with different energy sources is discussed in Section II followed by the elaborations of mathematical formulation for the economic dispatch in Section III. Section IV discusses the Lambda Iteration Method and Reduced Gradient Method for optimization analysis and the comparison results by with different scenarios are presented in Section V. Section VI concludes the comparative findings followed by the references.

II. SOLAR HYBRID STRUCTURE

Figure 1 shows the Solar Hybrid system with the capacity 200kW, 550kW, 250kW diesel generator, 385kW battery as storage and 887kW at standard test condition photovoltaic array. The system is considering 3696 unit of solar panels and 720 unit of lead-acid batteries with the capacity of 2680AH supplying 2.072MW at full running capacity. Generator 3 is used to provide a reliable source of energy during power outage while battery is used as energy storage. The 24 hours of a day load data for the analysis is presented in Table 1.

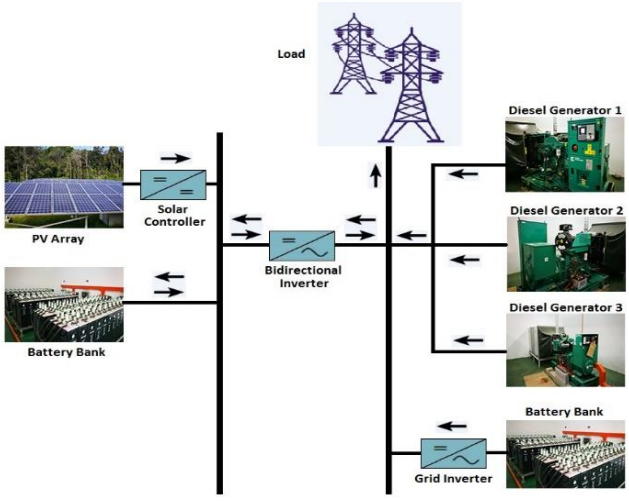

Figure 1: A Solar Hybrid System with Load and All Energy Sources