International Journal of Innovative
Computing, Information and Control
Volume **6**, Number **10**, October **2010**

ICIC International ©2010 ISSN 1349-4198
pp. 4631–4649

GENETIC ALGORITHM BASED OPTIMAL SIZING OF PV-DIESEL-BATTERY SYSTEM CONSIDERING CO_2 EMISSION AND RELIABILITY

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Received July 2009; revised January 2010

Abstract. *The reliability system concern and CO_2 emission reduction are still the main targets of optimization problem in the hybrid generation system components. This paper utilizes Genetic Algorithm (GA) method to determine the optimal capacities of PV system, battery bank and diesel generator (DG) unit according to the minimum cost objective functions that relate to these two factors. In this study, the cost objective function includes the annual capital cost (ACC), annual operation maintenance cost (AOM), annual replacement cost (ARC), annual fuel cost (AFC), annual emission cost (AEC) and annual customer damage cost (ADC). The proposed method has been tested in the hybrid power generation system located in East Nusa Tenggara, Indonesia (latitude 09.30S and longitude 122.0E). To show the effectiveness of this method, three different crystalline Silicon PV module technologies: ASE-300 (mc-Si based EFG), Kyocera KC-120 (mc-Si based wafer) and AstroPower AP-120 (thin-film Si) were used. Simulation results show that the optimum configuration can be achieved using thin-film Si technology of PV modules, battery banks and diesel generator unit with capacities of 139,250×120W, 5×5MWh and 12MW, respectively. This study also reveals the importance of PV and battery systems in the hybrid generation system from economical, reliability and environmental point of views.*

Keywords: PV system, Battery bank, Diesel generator, Genetic algorithm, Optimal size, Cost reduction

1. **Introduction.** Diesel generator (DG) unit is one of the suitable options for supplying electricity in remote areas due to their compact design and high specific power. The compact design makes it easy to install the unit in non-prepared and small area locations. The high specific power means that the ratio of output power to the weight of unit is considerably high. However, as an independent power source, the DG unit is facing significant problems. The maximum efficiency can only be achieved when the DG unit is operated close to the rated capacity. It is not recommended to operate the diesel unit below its minimum power specified by the manufacturer [1]. This might be problem in remote area application since the load profiles gap during day and night times are very different, depending on daily activities. In East Nusa Tenggara, Indonesia; the remote area case of this study, the daily activities are influenced by cultural and economic behaviors. The other problems of a single DG unit are related to the hard maintenance, fuel supply need and high generation cost [1-3]. To solve this kind of problems, hybrid generation