A new technique for islanding operation of distribution network connected with mini hydro

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Abstract: An islanding operation of a distribution network is a topic of interest due to the significant penetration of distributed generation (DG) in a power system network. However, controlling the frequency of an islanded distribution system remains an unresolved issue, especially when the load exceeds the generation. This paper presents a new technique for a successful islanding operation of a distribution network connected with multiple mini hydro-based DGs. The proposed technique is based on three main parts. The first part uses an islanding detection technique to detect the islanding event correctly. The second part consists of a power imbalance estimation module (PIEM), which determines the power imbalance between the generation and load demand. The third part consists of a load shedding controller, which receives the power imbalance value and performs load shedding according to load priority. The proposed technique is validated on an 11 kV existing Malaysian distribution network. The simulation results show that the proposed technique is effective in performing a successful islanding operation by shedding a significant number of loads.

Key words: Islanding operation, Mini hydro, Distributed generation (DG), Islanding detection, Load shedding.

1 Introduction

The popularity of distributed generation (DG) has been rapidly increasing over the last decade due to exponential growth in electricity demand and environmental pollution (Golkar and Hajizadeh, 2009; Silva et al., 2012; Ebrahimi et al., 2013; Cheng et al., 2014). Currently, DG has been widely employed as an alternative option for electric power generation, both from power quality and system reliability perspectives. In fact, many power utilities around the world possess significant DG penetration in their distribution networks; e.g., the United States has increased its DG capacity from 9579 MW in 2004 to 22,936 MW in 2008 (EIA, 2009), while the UK has increased its installed DG capacity from 1.2 GW in 1994 to over 12 GW in 2008 (Jenkins et al., 2010). The World Alliance for Decentralized Energy (WADE) presented in its report that in 2004 various developed and developing countries had a significant amount of DG penetration in their distribution networks, varying from 8.5% in Australia to 35% in Germany (WADE, 2008).

In addition to this installed DG capacity, the countries...