

A Pre-Feasibility Test for Promoting Renewable Hybrid System in Ulleung Island by 2030

¹Minho Baek, ²Seulgi Cho, and ^{3*}Suduk Kim

^{1,2,3}Graduate School of Energy Studies, Ajou University, Suwon, Korea

* Corresponding Author. Tel: 031-219-2689, Fax: 031-219-2969

E-mail: minhobaek83@gmail.com, seulgi.c.cho@hotmail.com, suduk@ajou.ac.kr

Overview:

‘Low Carbon Green Growth Policy and Law’ initiated by Korean government represents her objectives to reduce the future dependency on fossil fuel. A couple of projects for the promotion of Zero Carbon Island or Green Island as an off-grid power system are proposed around the world. In Korea, Ulleung local government declared ‘Carbon Neutral Plan’ and central government planned to promote the Ulleung Island as a prototype green island model of zero carbon emission without any fossil fuel use. This paper analyzes the economic feasibility of the promotion of renewable energy hybrid system in Ulleung Island by 2030 compared with the BAU scenario of maintaining current power generation system.

Method:

The BAU scenario is a case of maintaining current power generation system which is mainly composed of diesel power generators. Renewable hybrid system scenario is a case of integrating current power generation system with feasible renewable energy power facilities. HOMER (Hybrid Optimization for Energy Renewable) developed by NREL (National Renewable Energy Laboratory) includes modules for optimal design and operation of power generation system fitting the load profile at the lowest life cycle cost or net present cost (NPC). Using the hourly power demand forecast, diesel price forecast for year 2030 with assumptions on the future price of emission reduction credit (ERC), the sensitivity analysis is conducted for the promotion of renewable hybrid system in Ulleung Island. Comparing cost minimized NPC and the levelized cost of energy (LCOE) of BAU scenario and renewable hybrid system scenario in real price term, the economic feasibility is tested.

Expected Result:

Preliminary test result shows that NPC and the levelized cost of energy (LCOE) of BAU scenario may exceed those of renewable energy hybrid power generation system scenario. This is mainly due to the current government policy to subsidize the off-grid islands’ power supply through the subsidy on diesel price as well as on the retail power tariff.

Key words: *Hybrid Energy System, Renewable Energy, Ulleung Island, HOMER*

Reference:

Conti, Catherine, Phuyal, Dibya, Tate, Daniel, Yago Meniz, Jorge, Samsó: The Renewable Energy Island Analysis & Future Implementation, Local-RE Summer Program, August 2010

Hana JANG, Suduk KIM, A Pre-Feasibility Test of Introducing Renewable Energy Hybrid Systems: Case Studies for Three Off-Grid Islands, Environmental and Research Economics Review, Volume 15, Number 4, pp. 693~712, September 2006

Innovative policy solutions To Global Climate Change in Brief, Insights from Modeling Analysis of the Lieberman-Warner Climate Security Act (S. 2191), May 2008

Intergovernmental Panel for Climate Change (IPCC), IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation (SRREN), 2011

Korea Electric Power Corporation (KEPCO) Island Power Team, Hourly Power Generation in 2006~2010 (Internal Material), 2011 a

Korea Electric Power Corporation (KEPCO) Island Power Team, Independent Power Supply Island Operation Status in 2010 (Internal Material), 2011 b

Korea Electric Power Corporation (KEPCO) Island Power Team, Island (Ulleungdo) Supplied Fuel price for diesel power generation (Internal Material), 2011 c

Korea Electric Power Corporation (KEPCO), Statistics of Electric Power in Korea, Vol.80, 2011

Korea Institute of Energy Research (KIER), Ulleung County Energy Demand Projection (Internal Material), 2011

K.Y. Lau, M.F.M. Yousof, S.N.M. Arshad, M. Anwari, A.H.M. Yatim, Performance analysis of hybrid photovoltaic/diesel energy system under Malaysian conditions, Energy 35 3245-3255, 2010

M.J. Khan and M.T. Iqba, Pre-feasibility study of stand-alone hybrid energy systems for applications in Newfoundland, Renewable Energy 30 835–854, 2005

Mohammad Saad Alam and David W. Gao, Modeling and Analysis of a Wind/PV/Fuel Cell Hybrid Power System in HOMER, Second IEEE Conference on Industrial Electronics and Applications, 2007

Pavlos S. Georgilakis, STATE-OF-THE-ART OF DECISION SUPPORT SYSTEMS FOR THE CHOICE OF RENEWABLE ENERGY SOURCES FOR ENERGY SUPPLY IN ISOLATED REGIONS, International Journal of Distributed Energy Resources, Volume 2 Number 2 Pages 129-150, 2006

Ulleung Gun, Statistics Year Book of Ulleung Gun, Vol. 50, 2011

Ulleung Gun, Ulleung Gun New and Renewable Energy Feasibility Research Study, 2009

U.S. Energy Information Administration (EIA), Assumptions to Annual Energy Outlook 2011, July 2011

U.S. Climate Change Science Program Synthesis and Assessment Product 2.1a, Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations, 2007