International Journal of Innovative Computing, Information and Control
Volume **7**, Number **5(B)**, May **2011**

ICIC International ©2011 ISSN 1349-4198
pp. 2651–2668

AN OPTIMIZATION MODEL BASED DECISION SUPPORT SYSTEM FOR DISTRIBUTED ENERGY SYSTEMS PLANNING

Weijun Gao[1] and Hongbo Ren[2]

[1]Faculty of Environmental Engineering
The University of Kitakyushu
1-1 Hibikino, Wakamatsuku, Kitakyushu, 808-0135, Japan
weijun@env.kitakyu-u.ac.jp

[2]Ritsumeikan Global Innovation Research Organization
Ritsumeikan University
56-1 Toji-in Kitamachi, Kita-ku, Kyoto 603-8577, Japan
tjrhb@fc.ritsumei.ac.jp

Received February 2010; revised May 2010

Abstract. *Planning of distributed energy systems is a challenging task, involving a lot of technical, economic, environmental and political factors. In this study, an optimization model based decision support system and relevant software package have been developed to provide comprehensive analysis of economic, energetic and environmental issues within a distributed energy system framework. The optimization problem is formulated as a mixed integer linear programming (MILP) model with an objective to minimize overall cost of the distributed energy system including both investment and running ones. The branch and bound (B&B) algorithm in combination with the simplex one has been employed to solve the model. By enduing a user-friendly interface, the system can be easily used without the necessity to understand special expertise and knowledge on energy system planning and decision analysis. In addition, besides the distributed energy system planning, it can be also employed for examining and visualizing effects of local energy and environmental policies, regional development policies, as well as climate change policies within a local framework.*
Keywords: Optimization model, Decision support system, Distributed energy resource, Mixed integer linear programming, LINGO

1. **Introduction.** Distributed energy resources (DER) are taking an increasingly important role in the current open energy market. Comparing with the conventional power supply system, a DER system is a relatively complex one which may utilize a wide range of energy suppliers including combined heat and power (CHP) plants and some renewable technologies, such as photovoltaic (PV), wind turbine and so on. Due to its win–win–win advantages (to the customer, the utility and the society, as a whole), both the developed and developing countries are experiencing an increasing contribution of DER to their electricity supply. According to the previous investigation, global installed DER equipment capacity stood at around 282.3 GWe by the year 2005, which held an 8–9% capacity share of the world's power market [1]. The DER system has been expected to spread to increase the total efficiency of energy supply and address increasingly severe global environmental problems. However, as the penetration increases, it will also pose challenges for the decision makers to plan a DER system as it results in more complex system structure due to the introduction of physical connections between traditionally separate supply and demand sectors. Actually, many factors are involved in DER system planning such as