

Flexible resource planning for high-renewable energy system using a multi-model method

Meng-ying Lee¹, Ya-hsuan Chiu^{1,2}

Abstract

Renewable energy plays a pivot role in achieving net-zero targets. However, the intermittency and variability of renewable energy pose challenges to maintaining power system stability with its growing trend. To ensure system reliability, flexible resource planning is crucial in the long-term energy supply-demand planning towards the net-zero target. This study focuses on establishing an integrated simulation mechanism combining Taiwan TIMES model for long term energy planning with a operational power system model using PLEXOS software to examine system reliability under Taiwan's net-zero target. The subsequent flexible resource assessment process examines the effectiveness of energy storage and power-to-gas (P2G) strategies in managing the growing share of renewable energy. The results reveal that the TIMES model simulations may underestimate instances of power shortages and surpluses. Complemented by the power system model simulations, this study enables the exploration of phased capacity planning for flexible resources, such as battery storage and power-to-gas, while maintaining power supply-demand balance.

Keywords: Soft-link approach, Energy System Optimization Model, Economic Dispatch, Flexible resource planning

• The views expressed are those of the individual authors and do not reflect those of Industrial Technology Research Institute and Energy Administration, Ministry of Economic Affairs, Taiwan.

¹ Green Energy & Environment Research Laboratories, Industrial Technology Research Institute (ITRI), Hsinchu, Taiwan

² Corresponding author: chiu.yahsuan@itri.org.tw