The 23rd General Meeting and Singapore Forum
November 21–24, 2023

Introduction to the Market-online Hardware-in-the-loop Simulation Experimental Environment Established by Sino-Europe Cooperation

Hao Yuan[1], Weijin Zhuang [1], Nuno Pinho da Silva[2], Zhiyuan Gao[1], Chao Xia[1,2], Tao Chen[3]
1. China Electric Power Research Institute Co. Ltd Nanjing Branch, Nanjing, China;
2. Centro de Investigação em Energia, REN-State Grid S.A, Lisbon, Portugal;
3. Southeast University, Nanjing, China

Keywords: *Aggregation, electricity market, hardware-in-loop.*

Abstract:

To tackle global climate change, we must construct a new power system that relies mainly on renewable energy sources. One way to ensure the safe and cost-effective operation of this new system is to optimize the aggregation of distributed flexibility resources. Europe has established a fair, standard, open, and economic user-side energy ecosystem with sound legal and policy systems. China has developed the construction of an internet of electricity and energy internet, and has great device manufacturing ability with wide application and rich engineering practice experience. There is a strong complementary relationship between the two sides. To provide economic and effective solutions for the flexible application of distributed resources worldwide, and to help China's construction of a unified power market, China Electric Power Research Institute and R&D Nester have jointly carried out a pilot research project.

The project aims to promote China's advantages in equipment and device manufacturing through researching and exploring business cooperation models in micro-grid and community energy in combination with European advanced operation and market mechanisms. The project will build a market-online hardware-in-the-loop experimental simulation environment platform at R&D Nester lab, integrating European market mechanisms and resource characteristics with Chinese distribution network structure and terminal products. The project will use the hardware-in-the-loop simulation, which is a real-time simulation technology that has been widely used in the fields of automobile, aviation, and power systems. The different application scenarios of distributed resources in China and Europe will be constructed in the experimental simulation environment. The European team will develop the forecasting technology for the profile of load and DERs in the different scenarios, and build the models in terms of typical flexibility resources based on market competition within the aggregator. The Chinese team will develop the aggregator terminal which integrated at least three types of DERs. Both teams will work together to ensure the dynamic terminal-in-the-loop operation of the experiment by carrying out environmental debugging work.

The market-online hardware-in-the-loop simulation experimental environment established by Sino-Europe cooperation is a promising technique that can help us to achieve a sustainable energy future. By completing and verifying the feasibility of bilateral technological cooperation of China and Europe, a business model that combines experimentation to achieve technology fusion will do a great favor to the international cooperation.

note: This document will be opened to the participants on IERE website before the Forum and opened to the public afterward.