

Summary of Prof. Felix Wu's Sub-theme of 973 Program

Global concern over climate change has propelled renewed interests, with much more intense urgency, in recent years in energy research. In China, accompanying with dramatic economic growth, undesirable effects, such as the depletion of energy resources and pollution of environment, have been happened. The government of China is pursuing aggressively the development of renewable energy integration. Currently, eight huge wind farms, more than 10GW each, have been planned. Wind power in China has grown dramatically, more than 40 GW today, with a projection to reach 100-150 GW by 2020. On the commitment for the future carbon emission reduction, China has pledged to cut the unit GDP carbon dioxide emission level in 2020 by a range of 40 percent to 45 percent over 2005. To implement these ambitious targets, a fundamental transformation of electricity generation, transmission and utilization must take place.

Wind power contributes significantly to the environment. However, it is generally variable and largely uncertain. The current power system planning and operation paradigms were designed for the system with controllable generation and predictable load. Due to a lack of storage capability in the grid, the main challenge in power system operation has always been the requirement for instantaneous power balance. The high penetration of wind power with additional variability and uncertainty imposes an immense challenge to the planning and operation of the electric grid. In China, highly centralized utilization of wind power significantly aggravates this challenge.

In this year, Chinese government has approved a National Basic Research Program (also called 973 Program) on study of large-scale wind power integration. Prof. Felix Wu, one of the most prestigious professors in the area of power system planning and operation, Philip Wong Wilson Wong Professor in Electrical Engineering of The University of Hong Kong, will lead one of the six sub-themes entitled 'Fundamental Research on Power System Planning and Operation with High Penetration of Wind Power' of this '973 Program'.

A comprehensive research, which covers critical scientific problems of power system planning and operation with large-scale wind power integration, will be conducted in this timely research sub-theme. Major research areas are organized as a series of coherent topics: theory of wind power's capacity credit evaluation, risk assessment of the power system with large-scale wind integration, power system planning methodology for generation capacity adequacy with wind power, and sophisticated power system operating philosophy with high percentage of wind generation.

Findings of this research will be a series of fundamental innovation on power system planning and operation under new energy paradigm. Accomplishment of this sub-theme is expected to meet the nation's strategic needs for large-scale wind power integration and, ultimately implements a reliable, secure, economic, efficient, environmentally friendly, and safe energy infrastructure.