IAEA FEC 2014

Contribution ID: **17** Type: **Poster**

Control Requirement of Tokamak Fusion Power Plant for Power Generation in Grid System

Thursday, October 16, 2014 8:30 AM (4 hours)

There are several plant controls for a power plant in the electric grid system. Electric power supply from a fusion power plant(FPP) has to be also matched with the grid operation. Moreover, the grid system is now being renovated to a so-called smart-grid system, and the control functionality of a power plant in the grid system must be more sophisticated in several ten years. More functionality of FPP in the grid system, more valuable FPP will become to the grid operation. This paper discusses control requirements for FPP in the grid system. First, the development priority of plant operation controls for FPP is clarified, and control requirements on the core plasma and the primary/secondary cooling system are investigated.
The controls for commissioning(COM) and tripping to house load(THL) have to be investigated more carefully for the DEMO design. COM is a special control to carry out the final demonstration of electric supply and safe grid connection. THL is considered as a high development priority for FPP in order to re-supply power immediately after the accident of the grid system, because FPP generally requires a large ramp-up electric power from the grid system.
Operation flexibility for the plant control of COM and THL is investigated. When the fusion power increases, the plasma current profile is usually changed from the peaked to the flat/hollow one, because of increase of bootstrap current. As for plasma equilibrium, flux supply for the current ramp-up is restricted for a small fusion power operation, due to the peaked current profile and the maximum experienced magnetic field on CS coils. The position control of divertor strike points consistent with the plasma shape control is also critical issue. To fix the divertor strike points, the X-point and plasma shape are changed, and triangularity decreases from the rated value of 0.3 to about 0.2.
Next, several controls of the fusion power are assessed to find an operational space for COM and THL. The high confinement improvement factor is found to be required. The plasma current control is also found to prioritize for the fusion power control. From another viewpoint, the tritium ratio control is preferable for COM, because of reducing the initial tritium loading. Application of the turbine bypass in the secondary cooling system is also proposed for another control option of the electric output.

Paper Number

SEE/P5-6

Country or International Organisation

Japan

Primary author: Dr HIWATARI, Ryoji (Central Research Institute of Electric Power Industry)

Co-authors: Dr SHINYA, Kichiro (TOSHIBA NUCLEAR ENGINEERING SERVICES); Dr OKANO, Kunihiko (Keio University)

Presenter: Dr HIWATARI, Ryoji (Central Research Institute of Electric Power Industry)

Session Classification: Poster 5