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Abstract

RESEARCH ON LOOP FLOW PROBLEM AND ITS SOLUTIONS IN MACAU POWER SYSTEM

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The research of this thesis is under the background that Macau power system is constructing its second interconnection path with Guangdong power system. The enforced interconnection with Guangdong power system will bring many benefits to Macau power system, such as reinforcing frequency stability of system and increasing power transfer between two systems, but it also brings the possibility of loop flow problem in Macau power system due to the loop structure between two systems.

From load flow analysis, it is found that loop flows will exist in Macau power system after its second interconnection path with Guangdong power system constructed. The amount of the loop flows are relatively large, compared to the load demand in Macau power system. This will cause economic loss to CEM and limit the extendibility of the system, and in some cases, jeopardize the reliability of energy supply in Macau. Adjusting generation plans can reduce the amount of loop flows to some extent, but not eliminate it. Therefore it is necessary for CEM to adopt some effective methods to overcome the problems caused by loop flows.

Power flow control by phase angle regulators and system separations are studied as solutions to loop flow problem in Macau power system. By installing phase angle regulators in one of the interconnection paths between Macau power system and Guangdong power system, loop flow can be eliminated. Mechanical phase shifting transformer (the conventional phase angle regulator), and thyristor-controlled phase angle regulator (the advanced phase angle regulator), are introduced as power flow controllers. The economic feasibility of them is discussed. Regarding to system separation, four separation schemes are proposed to meet the requirements from CEM as much as possible. The benefits from system separation and the problems in separated Macau power system are discussed respectively.

From the analysis, system separation could be adopted as a solution to loop flow problem when reducing short circuit current is a pursuit too, however, other measures must be taken to guarantee the reliability of power supply in Macau power system.

Power flow control by phase angle regulators can solve the loop flow problem and improve the reliability of power supply in Macau power system, which is the goal of constructing the second interconnection path with Guangdong power system. Mechanical phase shifting transformer is a more cost-effective solution under the circumstance that high response of controller is not required in solving loop flow problem. As an advanced technology with good performance in dynamics, thyristor-controlled phase angle regulator is suggested to be considered for the sake of improving dynamic performance of the system

Key words: loop flows, power flow Control, system separation