

## Principal Research Results

# Comparative Evaluations of Various Transmission Line Congestion Elimination Techniques for Bilateral Transaction

## – Development of an Evaluation Model from the Viewpoints of Fairness and Economic Efficiency –

### Background

Depending on the increase of electricity transactions under the competitive electricity market, the transmission line congestion is expected to happen frequently. When there is not enough available transmission capacity for the market participants in the planning stage of the bilateral transaction where there is enough time to negotiate, the congestion elimination method of achieving fairness as well as economic efficiency should be applied.

### Objectives

In the planning stage of bilateral transactions where the total request for power transaction of market participants is larger than the available transmission capacity, the quantitative evaluation of various congestion elimination techniques is performed from the points of fairness and economic efficiency.

### Principal Results

#### 1. Development of a model to evaluate the transmission congestion elimination technique for bilateral transaction

The model to evaluate the transmission line congestion elimination technique in the planning stage of the bilateral transaction from the points of fairness and economic efficiency was developed (Fig.1). The basic idea of the model is as follows, and its characteristic is in the framework of evaluating the fairness.

- The fairness of the congestion elimination technique is evaluated by the difference of the congestion unit price which should be charged for each transaction when the elimination is hypothetically achieved under the market mechanism. Specifically, it is assumed that the fairness is high when the congestion is eliminated equivalently by the market mechanism without large difference of congestion unit charge among participants.
- The economic efficiency of the congestion elimination technique is estimated based on the social welfare. It is assumed that the economic efficiency of the technique is high when the congestion is eliminated with less reduction of the social welfare.

#### 2. Evaluation of fairness and economic efficiency of congestion elimination technique

The congestion elimination techniques which are actually applied such as transmission loading relief (TLR) and the priority method, etc. were evaluated under the model systems (a simple model and IEEJ EAST10 model) using the method developed here, and the following were clarified (Fig.2).

- Generally, large difference of the congestion charge is necessary to achieve the same congestion elimination results as TLR or priority method based on the market mechanism. It can be said that these techniques are not always fair for market participants from the economic point of view.
- Relatively high social welfare as well as fairness can be achieved by the congestion elimination technique using uniform congestion unit charges and the market mechanism.

### Future development

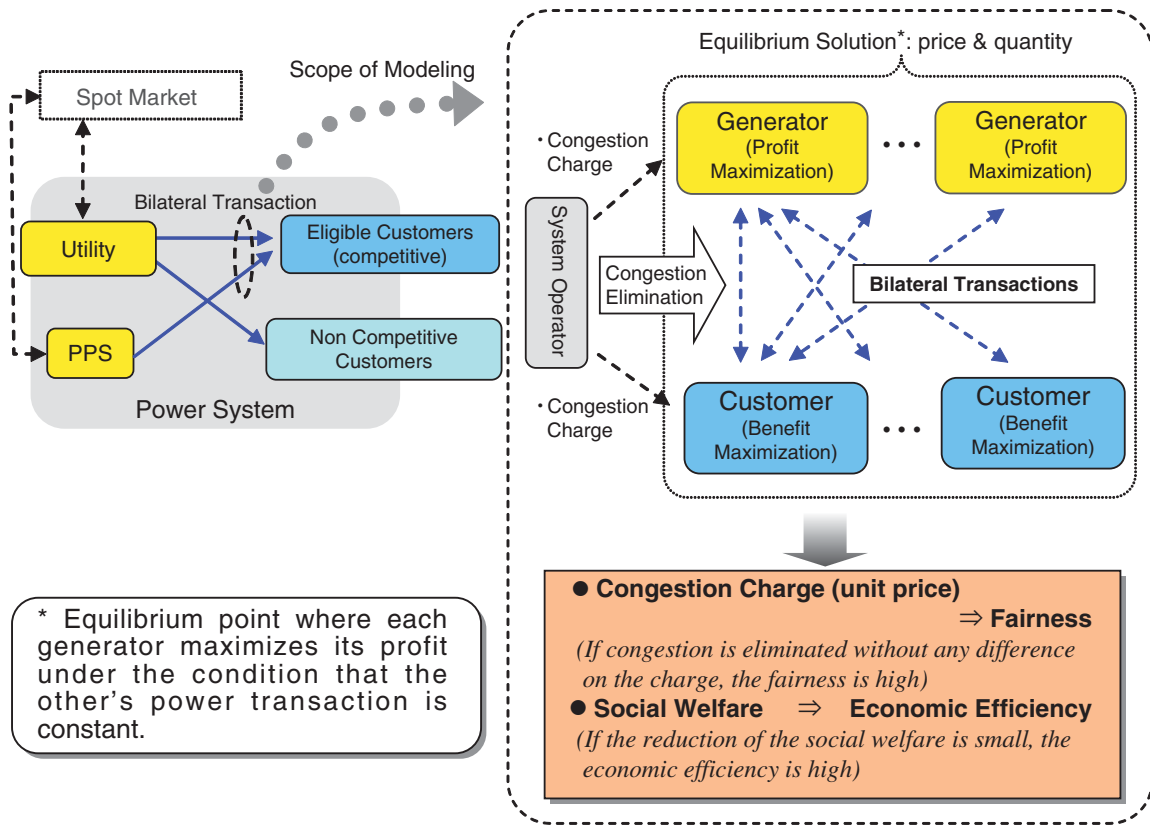
The possibility of transmission right as one of the congestion management methods will be discussed. Moreover, discussions on the effects of the installation of the power flow control equipments and on the boundary between transmission line investment and the congestion management will be performed on the basis of current status in Japan.

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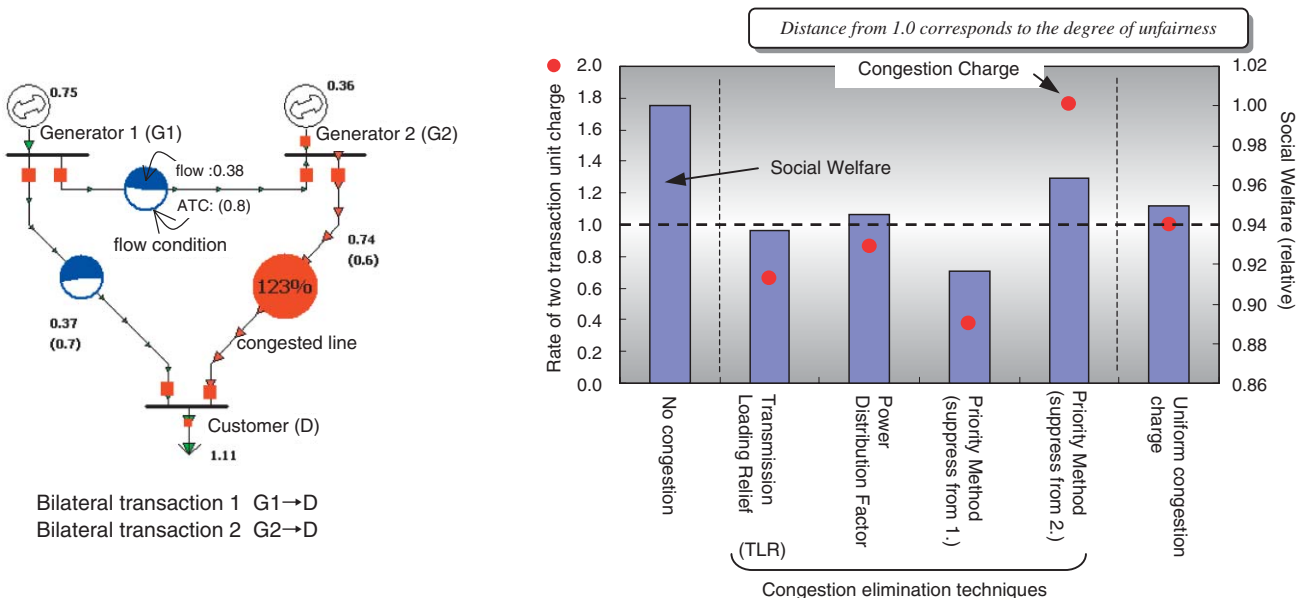
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**References:** Evaluation of congestion management methods on bilateral transaction - Congestion relief methods at the stage of transaction subscription from the point of view of fairness and economic efficiency - CRIEPI Report R04006, April 2005.

#### 4. Power Delivery - Cost reduction and ensuring reliability of power delivering



**Fig.1** A model of evaluating transmission congestion elimination technique for bilateral transaction



**Fig.2** Evaluation of fairness and economic efficiency of congestion elimination techniques (simple model)