Chapter 9

Conclusions and Future Researches

Deregulation of power industry and increasing activity in deregulated market promote the significance of ATC values. Under the environment of maximizing profit of each entity, stakeholders in the market probably neglect security of the system since it is out of their responsibility. Therefore, Independent System Operator or organizations managing the market must realize and prepare for defensive control of the system before a major blackout or interruption will take place. ATC is used to measure the system security margin, therefore, all of regional councils in the United States have obligations to perform ATC calculation and post these values in a regular basis for the customers prior to the transaction. As discussed in chapter 1, presently, ATC procedure in regional councils employs semi-automatic calculation combining automated calculation and manual coordination. Therefore, one of a contribution of this dissertation is the development of the real-time ATC calculation that is the future purpose of electric utility.

In this dissertation a practical method to determine real-time Available Transfer Capability has been proposed. Thermal limits, voltage magnitude limits, voltage stability limits and transient stability limits are included as the constraints to prevent power system from operating in insecure zone during the operation of Thailand deregulated market. Including in calculation procedures, Transmission Reliability Margin is a portion of reserved transmission capability in the system with the purpose to cope with nonlinearity and unexpected situation in power system. Since this dissertation focuses on the real-time ATC calculation that is an operation quantity, Capacity Benefit Margin (CBM), reserved transmission capability for long-term commercial purpose, is excluded from ATC formula because it is a planning quantity..

According other ATC calculation procedures using in regional councils across the United States, there is no regional council currently employ real-time ATC calculation in their system since it is involved in tremendous real-time information and contains difficulties. Interpretation and implementation of several studies such as contingency analysis and reliability must-run units in real-time operation are relatively complicate.

This dissertation overcomes these difficulties by combining a portion of off-line study in the real-time study. Contingency analysis has been modified to re-calculate if only a change in the system may affect ATC values of the system. Therefore, contingency analysis is not necessary to be re-calculated every time when ATC values are updated. In addition to contingency analysis, reliability-must-run study in this dissertation provides both the location of reliability-must run units and their reliability must-run quantities. From therefore, a generation facility qualified as must-run unit is still can participate in scheduling process. However, the reliability must-run quantity must be available whenever is needed.

According to the study results, Thailand power system is relatively strong since it contains fairly high transmission capability and generation reserve. There is no local area or transmission congestion area observed in this dissertation base on the present information. This may result from economic crisis in 1997 that depresses electricity demanded about 20-30% below load forecasting.

In addition to the present work proposed in this dissertation, there are several interesting topics can be done based this work as follows:

9.1 Including of Dynamic stability in real-time ATC

Sufficiency and accuracy of data are important issues to integrate dynamic stability study in real-time ATC calculation. This study will help to ensure security of the system during the long-term dynamics that oscillations are always observed in the system particularly in interconnected power system with long transmission lines. Dynamic stability will be counted as a limit of Total Transfer Capability calculation in ATC formula. Beside the ATC calculation, dynamic stability study may be included in reliability must-run units study. Reliability must-run quantities reserved by reliability must-run units must be able to ensure security of the system both in static and dynamic modes.

9.2 Calculation of Transmission Reliability Margin

Statistical approach can be used to determine Transmission Reliability Margin instead of deterministic approach. From this approach statistical information of equipment in the system such as failure rate of transmission lines, generators etc must be available. However, TRM values from this method will be represented as the transmission capability reserved to satisfy with a degree of security (statistical point of view). By the way, TRM must be studied off-line covering all possible cases since statistical approach such as Monte Carlo simulation requires massive computation time.

9.3 Network Partitioning Technique for Portfolio Total Transfer Capability Calculation

As seen from chapter 7, this dissertation proposes a new concept of performing TTC calculation between sub-portfolio instead of entire portfolio with the counterpart. The network partitioning technique can be used to group generation facilities by their electrical distance instead of geographical distance. This will help defining the accurate sub-portfolios for TTC calculation and economic operation inside sub-portfolios.

9.4 Simultaneous Available Transfer Capability

The concept of real-time available transfer capability in this dissertation can be developed to simultaneous available transfer capability since the basic concepts for ATC calculation are similar. However, it is foreseeable that numerous of possible cases result from many ATC interfaces are allowed to perform transaction at the same time is the major difficulty for simultaneous off-line ATC calculation where the management of transmission requests is the problem of on-line ATC. In order to solve this problem, appropriate technique such as congestion management, transmission loading relieve or market rules should be applied base on ATC values of each ATC interface. This will result in better stability of both system security and financial.

9.5 ATC Posting Conflict Advisory Procedure

Since transparency of management is a major concern of deregulated market, every procedure in the market should be opened for dispute and verification. Therefore, ATC Posting Conflict Advisory Procedure, a consistent procedure to resolve dispute regarding posted ATC values, is a primary procedure to satisfy this need. The purpose of this procedure is to construct a process to resolve most of dispute submitted by market participants that will alleviate the burden of ISO.