Restructured power system helps to meet the active power requirements of the consumers in an effective way. In an Independent System Operator (ISO) model of restructured power system, Available Transfer Capability (ATC) is calculated so as to determine how much extra power can be injected into one site apart from base consumption. ATC computation plays a significant role during power transactions because it helps the participants to schedule their transaction more effectively and quickly. This paper mainly focuses on ATC calculation using linear sensitivity factors for normal mode and line outage mode.

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1. Introduction

Earlier, vertically integrated power systems were in use. In this system, all the operations such as generation, transmission and distribution were integrated in a single entity. For developing countries with high demand growth, power system management and making of tariff policies had become a difficult task. Therefore, they switched to restructured power system. Developed countries, on the other hand, opted for restructured power system to provide more choices for their customers. Thus, restructured power system came into existence due to scarcity of financial resources in developing countries and developed countries like UK and Sweden came up with this idea to sell electricity at lower prices. Unlike the vertically integrated utility, restructured power system is not bundled thus
ensuring transparency in transactions. Two types of model are prevalent in this unbundled system: Independent System operator model (ISO) and Transmission System operator (TSO) model. ISOs are capable of owning and controlling the generation and distribution companies and they encourage a healthy competition between the markets. On the other hand, TSOs are known for their non-discrimination and all eligible markets are provided an open access to the power transmission system.

The few reasons why development of restructured power system is beneficial and economical are:

There is an advantage of selectivity that is the seller can choose its buyer. Apart from the conventional power producers, private power producers can also become a part of the generation unit in a restructured power system. This system is about breaking the monopoly that already exists in the sector. New framework is created to operate the power industry. The advantages of the system are cheaper electricity price, choice for customers, customer-centric service and innovation

A full understanding of transmission capacity and transfer capability is of greater importance in the deregulated power market for the following reasons.

i) The expansion of transmission corridor is limited by environmental and economic constraints

ii) In deregulated market, the generation and demand inputs have significantly different patterns compared with regulated industry

Therefore, effective transmission network and transaction management by ATC determination at regular intervals is needed to commit the established contract between buyer and seller.

Available transfer capability is a measure of the transfer capability remaining in the physical transmission network for the further commercial activity over and above already committed uses [1]. The ATC definitions, guidelines approved by NREC report, and several concepts of ATC and technical challenges of its determination are well documented in [2].

Mathematically,

\[ \text{ATC} = \text{TTC} - \text{TRM} - (\text{CBM} + \text{ETC}) \]  

TTC - Total Transfer Capability - The amount of transmission transfer capability which can be transferred through the network with all the uncertainties and contingencies considered;

ETC - Existing Transfer Capability - The amount of transmission transfer capability which is required for committed transactions.

TRM - Transmission reliability margin - The amount of transmission transfer capability which is essential to ensure the safety of the transmission network system under reasonable range of uncertainties.

CBM - Capability benefit margin - The amount of transmission transfer capability which is reserved by the suppliers so that when used, the supplier gains profit. This power transfer capability is accessed when required for interconnected systems.

Power system is stochastic in nature and hence the Independent System Operator has to continuously monitor and update ATC after every transaction.

Repeated power flow (RPF) is a steady state solution of a power system network. The main information obtained from repeated power flow are magnitude and phase angles of load bus voltages, reactive powers at generator buses, real and reactive flows on transmission lines. ATC determination techniques based on repeated power flow approach have been proposed by many in [5–9]. The results are accurate but time consuming and cannot be implemented for the stochastic nature of power system. In static ATC determination a constant PQ load is considered. The nature of load plays an important role in transfer capability calculations.

The power system behaviour in static and dynamic studies are fundamentally different and in the latter case the problem is whether the transmission capacity will be immediately available to the system for satisfying the load in
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