

Research of Security Constrained Dispatching for Monthly Generation Plan

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ABSTRACT

The dispatching for monthly generation plan is to manage the congestion considering the security constrains of the power grid, where the monthly generation plan is the result of vary monthly power exchange, including long-term power contract, power exchange among provinces and generation constitution exchanges. The application of monthly security constrained dispatching is with significant meaning for the security and stability of power grid. This paper brings forward the purpose and contents of security dispatching and introduces the working procedure and mathematic models. At last, the practical example of the Anhui Province power grid is introduced to explain the models.

Keywords: Direct Purchase by Major Users; Security Constrained Dispatching; Monthly Generation Plan

1. Introduction

The medium and long-term contract transaction safe examination and the blocking management are mainly examine the electric transmission cross section transmitting capacity and satisfy the tendering space safely the load demand [1-3]. The Anhui Province accent must plan considered that power plant power capacity, peak load ability, the electrical network safe operation, the net woven net damages and so on factors, decided that the substitution electricity generation trades whether to become effective, and is responsible for the substitution electricity generation transaction arrangement implementation which will become effective. The monthly security examination is the indicator to the electric quantity plan security constraint adjustment, its major function is examines and adjusts the month electric quantity plan, causes it to satisfy the regional security constraint condition, here month electric quantity including decomposes to the month yearly contract, outside the power transmission contract as well as the substitution electricity generation tendering electric quantity. The medium and long-term safe examination's implementation revolution regarding guaranteed that the electrical network safe operation, enhances the electric quantity plan the perform ability to have the important meaning [4, 5].

The needle returning to parents' home electric quantity time span is big, the uncertainty strong characteristic, this article unifies Anhui electrical network characteristic, proposed that the electrical network monthly electrical

energy plan safe examination's content and the work flow, use the tie line race the average stable quota to take the regional security constraint condition to carry on the examination computation, and carries on the confirmation by the actual electrical network data.

2. Monthly Electricity Generation Plan Safe Examination Goal and Localization

2.1. Current Buys Sells the Electricity Transaction Pattern and the Market Mechanism

As shown in **Figure 1**, current Anhui Province Electricity company monthly transaction including the following several kinds:

As seen in **Figure 1**, in buys in straight the electricity transaction take the province as the unit, has the following market main body:

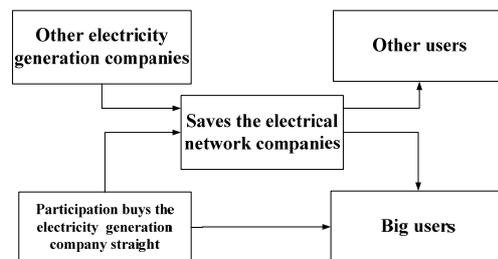


Figure 1. The big user buys the electricity transaction condition straight.

1) The provincial power grid company

Responsibility with not to participation to this province buys the electricity the electricity generation company to sign the order electricity contract straight, buys with other provinces electrical network sign both sides sells the electricity contract, and guaranteed that electrical network's dispatch and the electric power are balanced;

2) Participate in direct purchase of electricity generation companies

Direct purchase of electricity by large users' platform, users with large purchase contract entered into directly; direct power reduction of big users of electricity trade surplus space, with grid electricity sales contract signed.

Current will participate in the big user buying the electricity the electricity generation company is straight in 2004 and the later new production, conforms to the national capital construction examination procedure and obtains the electricity generation service permit the thermolectricity generation enterprise (including nuclear power) and the hydraulic electro generating enterprise. Among them, the thermal power companies as stand-alone capacity of 300,000 kw and above business, hydroelectric companies for stand-alone capacity of 10 kilowatts or more businesses.

3) Other provinces and Power Company

Power trading with other provinces and cities mainly bilateral purchase and sale of electricity trading;

4) The province did not participate in direct purchase of electricity generation companies and signed the grid electricity sales contract.

5) Large users

The large user may act according to own electric power demand, the complete demand or a part, buys the electricity platform and the electricity generation company straight through the big user signs buys the electricity contract directly, the surplus demand may also purchase to the electrical network company.

2.2. Monthly Electrical Energy Transaction Type Analysis

Whatever Key Performance Indices are selected, they must reflect the goals of the business, they must be key to its success, and they must be quantifiable (measurable). Key Performance Indices usually are long-term considerations. The definition of what they are and how they are measured do not change often. The goals for a particular Key Performance Indicator may change as the business goals change, or as it get closer to achieving a goal.

Impact of various types of monthly energy fairs monthly power plant planning, in which different transaction price of the contract, scheduling rights and other regulations also affect the monthly security correction.

For satisfying outside power transmission contract, transaction with power plant between; The province inside and outside power transmission tender the market transaction; Saves outside power transmission bilateral contract between the net and the power plant; Substitution electricity generation transaction between power plant; Power plant increase electricity generation contract.

2.3. Monthly Security Examination Goal and Localization

With the electricity trading institutions have been built at all levels, the monthly consumption of electricity market trading as the main form of the transaction. Scheduling is based on monthly domestic electricity power plants are given the full month of the total electricity generation. However, how does the electric quantity plan carries on the electrical network to examine safely, the direct relation monthly plan execution's feasibility, becomes the question which urgently awaits to be solved. The present solution is: ①The electric quantity examination way, soon electrical network's electric power restraint conversion for the monthly electric quantity restraint, this way serious influence power plant entire month power rate; ②The electric power examination way, decomposes the various power plants' monthly electric quantity into the electric power plan, then carries on the safe examination, but the electric quantity decomposition principle determined with difficulty.

2.4. Security Check on the Contents of Anhui

According to Anhui Province's actual situation, this report proposed that Anhui electrical network monthly security examination's pattern is as follows:

1) The examination object -- power plant monthly buys the electricity plan straight

Anhui monthly security check of the calibration grid target is based on the types of transactions monthly power generation projects, including the province transactions: decomposition of the annual contract to replace the contract; province of: tie-line planning, delivery power contracts.

New power plant signed monthly direct power schemes need confirmation through security check and adjust the order of security checking transactions by direct power to declare the order of execution.

2) Examination content -- four safe examinations

Anhui electrical network monthly security examination will carry on the following four examinations to various power plants' electricity generation plan:

Monthly total electric quantity examination: Forecast according to the monthly electricity consumption that carries on the safe examination to various power plants

monthly plan electric quantity, and carries on the safe adjustment according to the check result.

On way to check the maximum: the maximum load forecast based on month, the maximum load on the output mode of the plant for security check;

Month master curve: Forecast according to the month typical date 96 spot loads that carries on the decomposition to the power plant monthly electricity generation contract, and considered that the unit overhauls, situations and so on line overhaul, carries on day after day 96 model load diagram.

3) Anhui electrical network district analysis sites model

We can introduce the conception of KPI to the analysis of electricity market, which is one of the most important tasks of market surveillance committee.

According to the electrical network district analysis sites model's construction thought that may carry on the safe area division to Anhui electrical network, and establishes the corresponding computation model. According to Anhui electrical network's geographic distribution characteristic and the safe stable regulations, Anhui electrical network may divide into A, B, C, D, E, F, G, H, I altogether 9 security district, in each security district contains the ration the power set and the system load, its analysis sites connection relations see also Figure 2:

When concrete division safe area, needs to solve the following problem:

- a) Various power plants and safe area subordination relations;
- b) Each main load and safe area subordination relations;
- c) Various transformer substations and safe area subordination relations.

When divides the security cross section, needs to solve the following problem:

According to the above safe area actual model, may carry on the simplification, obtains analysis situs model which the electrical network calculates, like **Figure 2**:

- a) To connect the different safe area the tie line race forms the security cross section;
- b) Determines between various tie lines and the cross section subordination relations.
- 4) Safe examination step and algorithm

Anhui electrical network monthly security examination may divide into the following four main steps:

a) District load forecast

The district load forecast is responsible to act according to the monthly safe area the division, forecasts various safe areas separately the electricity consumption or the load, including the following four targets:

- Various safe areas monthly electricity consumption;
- Various safe areas monthly valley even three time interval electricity consumption;
- Various safe areas month biggest load;

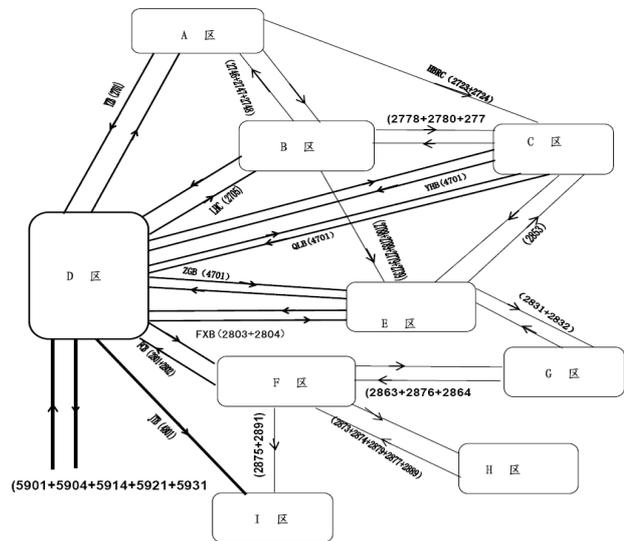


Figure 2. Anhui electrical network safe examination computing network model.

Various safe areas which month typical date 96 load diagram.

b) The electricity generation plans the pre-decomposition strategy

According to the total electric quantity examination, three time interval electric quantity examination, the biggest load examination and 96 typical date curve examination's request, the power plant monthly plan carries on the decomposition to the province, satisfies the safe examination the need.

c) District cross section safe examination algorithm

There are two typical indices to explain the risk of generators' bidding strategy.

According to the safe area division, to between various safe areas' tie line race, forms the security cross section. The distinction computation each security cross section may transmit capacity ATC; Decompose according to the district load forecast and various power plants plan, carry on the district electric power balance computation, according to the computed result, verifies each security cross section one by one actual transmission electric quantity and may transmit the capacity.

d) Multi-criterion safe adjustment

To surpasses the cross section to be possible to transmit the capacity situation, should the overall evaluation electrical network security goal, the economic target, the energy conservation goal, the contract progress goal and so on carry on the multi-objectives the overall evaluations, makes the optimized adjustment to the related district electricity generation plan, completes the safe adjustment. Like **Figure 3**:

3. Example Analysis

Below take Anhui electrical network some safe area as

an example, carries on the synthesis confirmation to the monthly electricity generation plan safe examination algorithm, and gives the monthly electricity generation plan safe examination the adjustment effect. According to the safe area which and the tie line race assigns define, follow the district adjustment the thought that before having given the adjustment, this safe area electric quantity balanced plan, see **Table 1**.

Through to the power rate, always shoulders, the tie line race tidal current upper limit to carry on the electric quantity balanced to be possible to know that a area primitive electric quantity transaction plans excessively high, the monthly power rate plan is bigger than always shoulders transmits the upper limit sum total with various tie lines race:

$$20.67 > 11.36 + 2.45 + 3.11 + 3.23 = 20.15$$

The actual execution had certain difficulty, after **Table 2** has given the adjustment a area electric quantity balanced plan.

This adjustment scheme scaled down in this safe area the power plant power rate. In guaranteed that under entire net power supply total quantity certain premise, changes by other safe area increases the electricity generation output.

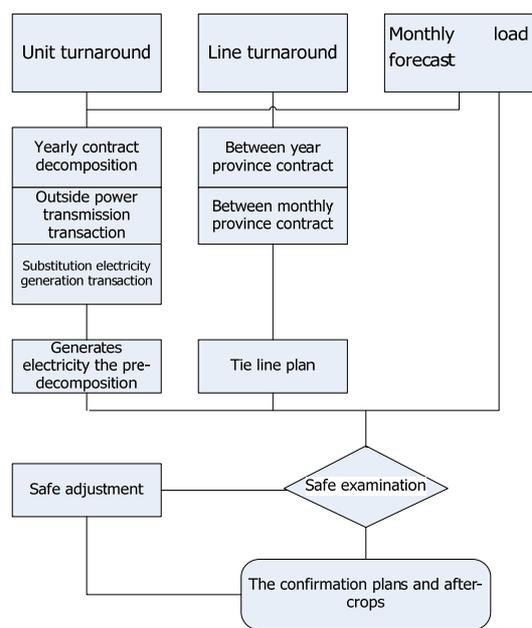


Figure 3. Anhui electrical network monthly security examination flow.

Table 1. Before the adjustment, safe area electrical network electric quantity balanced plan.

Power rate	Total load	Tie line race 1 upper limit	Tie line race 2 upper limit	Tie line race 3 upper limit
20.67	11.36	2.45	3.11	3.23

Table 2. After the adjustment, a area electrical network electric quantity balanced plan.

Power rate	Total load	Tie line race 1 upper limit	Tie line race 2 upper limit	Tie line race 3 upper limit
20.15	11.36	2.45	3.11	3.23

Looking from the electrical network actual operational aspect, after the revision electric quantity plan has the strong feasibility, has safeguarded electrical network's security reliability service, have received the movement personnel's consistent high praise.

4. Conclusions

This article links to the provincial level electrical network reality, proposed the monthly electrical energy plan safe examination work's content, the duty and the examination method, lay the rationale for Our country Provincial level Electrical network Company monthly security examination work's development. Anhui electrical network's application example indicated that this article proposed the algorithm can propose the important criterion for the pre-electric quantity transaction plan, regarding maintenance substitution electricity generation electric power market public, fair, fair principle, guaranteed that the electrical network safe operation has the important meaning.

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