Research on power Trade Arrangement and Risk Management in South and Southeast Asia

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Abstract. In recent years, with the continuous growth of economy in South and Southeast Asia, the demand for energy and electricity is also increasing. In terms of power supply and demand, there are complementarities, among which international power trade can realize the optimal allocation of resources among countries and achieve the goal of mutual benefit and win-win results. Now parts of South Asia, southeast Asia within the scope of power trade between overall is still sporadic, and belongs to the power flow on the basis of bilateral one-way trade, electricity trade amount and scale are small, the current trade arrangements to see also is not very perfect, also can’t fully meet the needs of the development of South Asia power trade further in southeast Asia. Therefore, it is necessary to study the power trade arrangement in South Asia and Southeast Asia. At the same time, closely related to trade arrangements is the issue of risk, because many risks are often caused by unreasonable trade arrangements. Due to the differences of power construction status and national level among countries in South Asia and Southeast Asia, there are many risks in carrying out power trade, such as political system, environment and economy. Therefore, this paper studies the risk management of power trade in South Asia and Southeast Asia, in order to clearly understand the risks, and take corresponding countermeasures to solve them timely and properly, so as to realize the ultimate goal of power trade in the sub-region smoothly.

1. Power trade Arrangement in South and Southeast Asia

1.1. International power type selection
The existing forms and arrangements of international power trade worldwide vary from country to region, depending on the scale and complexity of trade and the corresponding level of integration among trading partners. Although the evolution of trade arrangements varies slightly in each case, the evolution from simple bilateral contracts to more integrated multi-country transactions often involves the simultaneous development of institutions, business and operational rules, and related entities and mechanisms (such as national regulators). As shown in figure 1.
1.2. **Influencing factors of power trade in South Asia and Southeast Asia**

At present, the electricity trade in South and Southeast Asia mainly adopts bilateral trade and long-term electricity purchase and sale agreement. For larger trade projects that require investment in power generation, inter-governmental agreements may be needed, especially where private sector, sovereign government investment and yield guarantees are involved.

Factors influencing power trade arrangements in South and Southeast Asia include the following aspects: (1) The need for new transmission lines. (2) Accession of third party transit countries. (3) Weak institutional, legal and business environment. (4) Credit problems of some potential purchasers. (5) The member states are basically post-conflict countries.

In the following analysis, we classify typical international trade arrangements into four types related to south and Southeast Asia. The four types are as follows. The first type is bilateral trade between neighboring countries, which is embodied in transmission between national power companies. The second type is bilateral trade through transit countries, the third type is inter-synchronous system trade and the fourth type is multilateral trade within the power storage mechanism.

2. **Establishment of risk management model in South Asia and Southeast Asia**

The risk analysis and risk assessment model of power trade is constructed by combining the risk assessment index system of power trade system with various methods. The steps are as follows: to determine the objects of the risk analysis and risk assessment model of power trade, such as the risk
level of power trade or a certain risk source. The risk criteria are shown in Table 1, the risk assessment in Table 2, and the risk source assessment in Table 3.

Table 1 Risk criteria

| Possibility | The more frequent the occurrence is, the higher the probability value is, the more harmful people are, and the higher the value is |
|-------------|--------------------------------------------------------------------------------------------------|
| K1: frequency | 5 1 to 2 months | 4 2-6 months | 3 6 months to 1 year | 2 1 year to 2 years | 1 More than 2 years |

Table 2 Risk assessment

| Severity K2 | The greater the harm, the greater the severity |
|-------------|--------------------------------------------------------------------------------------------------|
| K2 severity | 5 There are 8-9 sources of risk | 4 There are 6-7 sources of risk | 3 There are 4-5 sources of risk |

Table 3 Risk source assessment

| Risk source number | Risk source                          | Value at risk |
|--------------------|--------------------------------------|---------------|
| 1                  | The risk of supply and demand         | K1            |
| 2                  | Market power risk                     | K2            |
| 3                  | Trading risk                          | K3            |
| 4                  | Regulatory risk                       | K4            |
| 5                  | Grid security risks                   | K5            |
| 6                  | System planning risk                  | K6            |
| 7                  | Sketching risk                        | K7            |
| 8                  | Social risk                           | K8            |
| 9                  | The economic risks                    | K9            |

Where the risk value is the product of the probability of each risk and the hazard value. According to the calculated risk value, the risk level is determined through expert discussion. The risk level is divided as follows: the risk with a risk value of 0 is a small risk; The risk of value-at-risk is medium risk; the risk of value-at-risk is large risk; A risk of var is a very serious risk. The boundary value is medium risk, large risk and very serious risk respectively. According to the risk criteria in Table 3, the risk levels are divided into four categories: risk with value of risk is small risk; The risk of value-at-risk is medium risk; The risk with value of risk is a large risk; A risk of var is a very serious risk. The boundary value is medium risk, large risk and very serious risk respectively. That is, the risk levels of power trade are divided into four grey classes, so the establishment functions are as follows [1-16]:
The grey clustering method was used to determine the risk level, and the risk value was scored according to the expert score. The comprehensive risk value was shown in Table 4.

### Table 4 Value at risk results

| The serial number | indicators             | A value at risk | Value at risk of B | Value at risk of C | D value at risk |
|-------------------|------------------------|-----------------|--------------------|--------------------|-----------------|
| 1                 | The supply and demand  | 0.385           | 0.385              | 0.385              | 0.385           |
| 2                 | Market power           | 0.809           | 0.809              | 0.809              | 0.809           |
| 3                 | trading                | 2.959           | 2.959              | 2.959              | 2.959           |
| 4                 | regulatory             | 0.616           | 0.616              | 0.616              | 0.616           |
| 5                 | The chariot net        | 0.165           | 0.165              | 0.165              | 0.165           |
| 6                 | System planning        | 0.143           | 0.143              | 0.143              | 0.143           |
| 7                 | sketching              | 0.58            | 0.58               | 0.58               | 0.829           |
| 8                 | social                 | 1.666           | 1.944              | 1.666              | 1.666           |
| 9                 | economic               | 0.011           | 0.011              | 0.011              | 0.011           |

### 3. Conclusion

The introduction of power trade mechanism into the risk prevention measures of power trade in South Asia and Southeast Asia can better promote enterprise competition, improve the corresponding operation efficiency, reduce the operating cost and fully realize the optimal allocation of resources. At present, power trade participants in South Asia and Southeast Asia are gradually expanding the existing conditions, so as to fully adapt to the new situation. However, in the power system of trade, there are always many uncertain factors, because of these factors, leading to some risks. These risks are mainly manifested in the volatility of electricity prices. Therefore, when electricity in South Asia and Southeast Asia becomes tradable, sufficient attention must be paid to the risks in trade, so as to take necessary precautions against risks, so as to make a fair competition and a healthy development.

Based on the analysis and comparison of the existing risk analysis and risk assessment methods, and combined with the characteristics of the power trade risk assessment index system, the risk analysis and risk assessment model of power trade is constructed. Combining the theory of entropy weight method with the selected risk analysis and risk evaluation method, the influence of human factors in the process of risk analysis and risk evaluation is reduced, and a set of relatively perfect risk analysis and risk evaluation model of power trade is established.
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