2023 World Journal of Innovation and Modern Technology, Vol.6, Issue 6, (Dec)
ISSN 2682-5910
DOI: 10.53469/wjimt.2023.06(06).02

Analysis and Countermeasures of Hidden Dangers and Risks in Substation Operation and Maintenance

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Abstract: ***In the actual production and life, the existence and development of the power grid technology, to a large extent for the broad masses of people's life has brought convenience and fast, substation operation and maintenance efficient working mode replaced the traditional power supply system, better improve the phenomenon of frequent power outage, better meet people's demand for electricity. The hidden risks of substation operation are analyzed and discussed accordingly, and the corresponding risk coping strategies are put forward, in order to ensure the normal operation and development of the substation operation and maintenance work and ensure the safety and stability of the entire power system. "Policy co-ordination, facilities connectivity, unimpeded trade, financial integration, and people-to-people bonds" are the five major goals of "the Belt and Road" Initiative. By measuring the present situation of cooperation between China and India with the Five-Link index, the lack of infrastructure in India has damaged the facilities connectivity between China and India, and the lack of credit system in India has slowed down the process of financial integration between China and India. Since the Modi government focused on infrastructure construction and the development of manufacturing industry, China and India have a win-win effect under "The Belt and Road" Initiative.***

Keywords: Substation operation and maintenance risk analysis; Coping technique analysis.

From the analysis of the status quo of power system operation and development, it can be seen that there are various factors hindering and increasing the difficulty of related work during the implementation of power transformation and transportation work. By analyzing the hidden risks of power transformation operation and maintenance, relevant practitioners can know more about the contents and causes of hidden risks of power transformation operation and maintenance and formulate corresponding countermeasures for various hidden risks. To a large extent, it can provide relevant personnel with some guidance to deal with emergencies, to ensure that the substation operation and maintenance work in a safe and stable development state, but also better improve the quality and efficiency of the substation operation and maintenance work. Nearly all the segments of air material in typical equipment include acquisition, storage, supplying and management, which have close connections with the air material in typical equipment consumption information. The air material in typical equipment consumption rule has a great significance on all the segments about air material in typical equipment include acquisition, storage, supplying and management and improving the scientificity of air material in typical equipment support. Through an analysis of the maintenance method of air material in typical equipment whose life submits to normal distribution in some typical equipment, this paper has established consumption models of air material in typical equipment whose life submits to normal distribution according to stochastic processes and probability theory and mathematical statistics. Applicability of the models are given by way of a numerical example. The models provide a theoretical basis for calculating reserves of air material in typical equipment scientifically and have a vital important guiding significance.

"The Belt and Road" Initiative refers to "the Silk Road Economic Belt" and "21st Century Maritime Silk Road", a significant development strategy launched by the Chinese government with the intention of promoting economic co-operation among countries along the proposed Belt and Road routes. The Initiative has been designed to enhance the orderly free-flow of economic factors and the efficient allocation of resources. It is also intended to further market integration and create a regional economic co-operation framework of benefit to all. "the Silk Road Economic Belt" is divided into North, middle and South three lines, one line through Southeast Asia to South Asia and the India Ocean region, including India; "21st Century Maritime Silk Road" from the coastal areas of Chinese, over the South China Sea to India ocean, and extended to Europe, India is the only country covers by "the Silk Road Economic Belt" and "21st Century Maritime Silk Road". Secondly, as China's southern neighbors, India is the largest country in the South Asian subcontinent. According to World Bank statistics, India has a population of 1.31 billion, GDP is 2073.54 billion U.S. dollars, the economic growth rate reach to 7.6%, nearly accounting for 25% of total population and 10% of the total economy in the countries along "the Silk Road Economic Belt". India is the largest country with the biggest population and the biggest economic scale in the countries along "21st

Century Maritime Silk Road", also is the fastest growing economy covers by "the Belt and Road" initiative. China should pay attention to the invite India to join in cooperative development under "the Belt and Road" initiative.

"The Belt and Road" initiative is a systematic project, which should be jointly built through consultation to meet the interests of all, and efforts should be made to integrate the development strategies of the countries along “the Belt and Road” initiative. It is aimed at promoting orderly and free flow of economic factors, highly efficient allocation of resources and deep integration of markets; encouraging the countries along policy co-ordination and carry out broader and more in-depth regional cooperation of higher standards; and jointly creating an open, inclusive and balanced regional economic cooperation architecture that benefits all. "The Belt and Road" Initiative aims to promote the connectivity of Asian, European and African continents and their adjacent seas, establish and strengthen partnerships among the countries along "the Belt and Road" initiative, set up all-dimensional, multitiered and composite connectivity networks, and realize diversified, independent, balanced and sustainable development in these countries. The connectivity projects of the Initiative will help align and coordinate the development strategies of the countries along "the Belt and Road" initiative, tap market potential in this region, promote investment and consumption, create demands and job opportunities, enhance people-to-people and cultural exchanges, and mutual learning among the peoples of the relevant countries, and enable them to understand, trust and respect each other and live in harmony, peace and prosperity. "Policy co-ordination, facilities connectivity, unimpeded trade, financial integration, and people-to-people bonds" is the five major goals of "the Belt and Road" initiative. The "Five-Link" is to promote the economics' interconnection along "the Belt and Road" initiative, which promotes practical cooperation in all fields, and works to build a community of shared interests, destiny and responsibility featuring mutual political trust, economic integration and cultural inclusiveness.

1. A BRIEF OVERVIEW OF THE SPECIFIC CONTENT OF POTENTIAL RISKS OF SUBSTATION OPERATION AND MAINTENANCE

From the classical trade theory, new classical trade theory, new trade theory and the new classical international trade theory, when relates to development of international trade theory, the relationship between technological innovation and international trade is an unavoidable topic. Because of non-competition and partial non-exclusiveness, it is possible for international trade to induce technology spillover. Under the open economy, the economic growth of a country benefits from the innovation input of its own country, meanwhile one country's innovation activities can be spread indirectly to other countries through import trade (Keller, Wolfgang, 2002). The earliest explanations of technology spill-over through international trade are mainly the theory of contagion (Findlay, 1978) and the explanation from the perspective of externality (Arrow, 1962). The new growth theory, represented by Romer (1986) and Lucas (1988), emphasizes the positive effect of technology spillover through international trade on technological innovation. Grossman & Helpman (1989) first study the relationship between technological change and economic growth in the open economy by the framework of general equilibrium. From then on, many scholars have joined the study of mechanism and conditions of technology spillover effects of import trade on the basis of the research of Grossman & Helpman (1989).

In the aspect of empirical research on technology spillover effects of import trade, based on "innovation driven" model, Coe & Helpman (1995) has been built the CH model, for the first time to calculate the effect of import country's R&D on the TFP from the perspective of evidence. After this, many research is mainly to improve the CH model, and the main features are as follows: on the one hand, the perfection of the variables, Coe, Helpman & Haffmaister (1997) took the variable "secondary education" into account to revise the CH model; and Sjoholm and Fredrik (1996) use the patent model; and Engelbrecht and Hans-Jeurgen (1997) added in human capital variable into the model. On the other hand, from the total amount of research to industry analysis. Keller and Wolfgang (2002) divides R&D into the domestic industry, other domestic industries, foreign trade and other foreign countries. Schiff, M. Yanling, W. and Olarreaga, M. (2002) examined the technology spillover effects of international trade between South and North countries and South-South countries from an industrial perspective.

The traditional analysis of trade effect of innovation output through international trade have adopted econometric method using attribute data, ignoring the analysis of relational data, so this paper employees the social network analysis method, with the research object defined in the variable trade relations, taking the use of UCINET6.0 as the analysis tool to calculate the centrality and structural holes of import trade network of EU Member States and use EVIEWS6.0 as the analysis tool, based on panel data from 2009 to 2015 to study the influence of the EU member countries import pattern on technological innovation of one country, and to discuss the role of import trade structure in technological innovation.

1.1 Transformer operation error risk

As the core equipment of the whole power system, the daily operation standard of transformer will greatly affect the safety and stability of the power system. During the whole process of substation operation and maintenance, if there is a transformer operation error, resulting in the transformer can not work normally and effectively, it will interfere with the normal working mode of the whole substation, and then lead to some hidden dangers and risks during the substation operation and maintenance work process, which is not conducive to the development of power enterprises. Combined with the practice content, we can know that the occurrence of transformer operation errors is related to the lack of professionalism and careless work of the operators.

1.2 Risk of bus operation error

Bus operation is the core of the whole substation operation and maintenance work. The occurrence of bus operation error will also bring certain obstacles to the substation operation and maintenance work to a large extent. The specific content is as follows: In practice, a large number of equipment and more dangerous operations are involved in the busbar operation process. The existence of these dangerous operations and equipment will develop into hidden risks of substation operation and maintenance, and bring certain adverse effects on the normal operation of the power system. For example, the occurrence of charging equipment failure of no-load bus will lead to bus operation errors, which will lead to hidden risks of substation operation and maintenance.

1.3 Risks of incomplete maintenance of related equipment

The implementation of substation operation and maintenance is related to the safety and stability of the whole power system. From the perspective of practice, it can be seen that equipment wear is easy to occur during the long time of power operation. Therefore, relevant personnel need to organize the maintenance of substation equipment. However, based on the careless work of maintenance personnel, Lack of professional knowledge and skills, and other phenomena, easy to appear related equipment maintenance is not in place phenomenon, the emergence and development of this phenomenon, not only can not achieve the purpose of equipment maintenance, but also may increase the life safety risk of employees, and will bring greater hidden risks to the entire power transformation operation and maintenance work.

1.4 Risks caused by environmental impact of power transformation operation and maintenance

In fact, the quality and efficiency of substation operation and maintenance work will be affected by the operation and maintenance environment. If the weather outside is severe, such as thunder and rain, it will increase the difficulty and safety risk of substation operation and maintenance work to a great extent. For another example, in the cold winter, the temperature of the external environment will have a certain impact on the charging equipment, resulting in loose wires, etc., thus increasing the potential risks of substation operation and maintenance work.

1.5 The management system is lack of scientific perfection

In most power enterprises, a scientific and perfect management system for power transformation operation and maintenance has not been established, and many power works cannot be carried out smoothly in the absence of institutional control. Some employees are easy to carry out power transformation operation and maintenance work arbitrarily in the absence of institutional constraints, which reduces the rigor and science during the work process and leads to the corresponding hidden risks of power transformation operation and maintenance.

2. ANALYZE AND DISCUSS THE COPING STRATEGIES FOR HIDDEN RISKS OF POWER TRANSFORMATION OPERATION AND MAINTENANCE

The innovation output index in GII is used to measure innovation output, and the global innovation index in GII comes from the average value of innovation output index and innovation input index. The composition of the innovation output index is shown in the Table 1:

Table 1: Composition of the Innovation Output Index (GII)

First level index	Second level index	Third level index
Knowledge and technology outputs	Knowledge creation	Patent applications by origin; PCT international applications by origin; Utility model applications by origin; Scientific and technical publications; Citable documents H index
	Knowledge impact	Growth rate of GDP per person engaged; New business density; Total computer software spending; ISO 9001 quality certificates; High-tech and medium high- tech output
	Knowledge diffusion	Intellectual property receipts; High-tech exports; ICT services exports; Foreign direct investment, net outflows
Creative outputs	Intangible assets	Trademark application class count by origin; Industrial designs by origin; ICTs and business model creation; ICTs and organizational model creation
	Creative goods& services	Cultural and creative services exports; National feature films produced, Global entertainment and media market; Printing and publishing output; Creative goods exports
	Online creativity	Generic top-level domains (gTLDs); Country-code top-level domains (ccTLDs); Wikipedia yearly edits; Video uploads on YouTube

In order to meet the needs of power system operation and development at the present stage and do a good job in power transformation operation and maintenance, the following measures can be taken in view of the hidden risks existing in the process:

Table 2: Composition of the Innovation Input Index (GII)

First level index	Second level index	Third level index
Institutions	Political environment	Political stability and absence of violence/terrorism; Government effectiveness
	Regulatory environment	Regulatory quality; Rule of law; Cost of redundancy dismissal
	Business environment	Ease of starting a business; Ease of resolving insolvency; Ease of paying taxes
Human capital and research	Education	Expenditure on education; Government expenditure on education per pupil, secondary; School life expectancy; Assessment in reading, mathematics, and science; Pupil-teacher ratio, secondary
	Tertiary education	Tertiary enrolment; Graduates in science and engineering; Tertiary level inbound mobility
	(R&D)	Researchers; Gross expenditure on R&D (GERD); Global R&D companies, average expenditure top 3; QS university ranking average score top 3 universities
Infrastructure	(ICTs)	ICT access; ICT use; Government's online service; Online e-participation
	General infrastructure	Electricity output; Logistics performance; Gross capital formation
	Ecological sustainability	GDP per unit of energy use; Environmental performance; ISO 14001 environmental certificates
Market sophistication	Credit	Ease of getting credit; Domestic credit to private sector; Microfinance institutions' gross loan portfolio
	Investment	Ease of protecting minority investors; Market capitalization; Venture capital deals
	Trade, competition , & market scale	Applied tariff rate, weighted mean; Intensity of local competition; Domestic market scale
Business sophistication	Knowledge workers	Employment in knowledge-intensive services; Firms offering formal training; GERD performed by business enterprise; GERD financed by business enterprise; Females employed with advanced degrees

	Innovation linkages	University/industry research collaboration; State of cluster development; GERD financed by abroad; Joint venture/strategic alliance deals; Patent families filed in at least two offices
	Knowledge absorption	Intellectual property payments; High-tech imports; ICT services imports; Foreign direct investment, net inflows; Research talent in business enterprise

Source: Ithaca, Fontainebleau, Geneva, 2016. The Global Innovation Index: Winning with Global Innovation.Cornell University, INSEAD, and WIPO.

2.1 Increase the hidden danger risk assessment in advance

Based on the discussion results of hidden risks during the operation and maintenance of power transformation, it can be seen that in the actual process of carrying out the operation and maintenance of power transformation, due to the influence and effect of various elements, a variety of hidden risks are prone to appear. In order to reduce the possibility of these hidden risks and minimize the harm brought by them, we should do a good job of hidden risks assessment in advance. It is helpful for the staff to have a good sense of hidden danger and risk prevention, and carry out the substation operation and maintenance work scientifically and reasonably. The specific measures are as follows: the staff should first have a good sense of hidden danger risk assessment, and formulate a professional risk assessment database according to the actual development of the substation operation and maintenance work and various work criteria. During the whole process of the substation operation and maintenance work, the establishment of the database can provide real-time monitoring of risk points for the grid staff Data support can improve the efficiency of problem discovery and solution. Secondly, operators also need to make use of modern science and technology to organize the screening and sorting of relevant data in the database, timely sort out and classify possible problems during substation operation and maintenance work, and formulate corresponding countermeasures, so that the staff can more comprehensively understand the types and possibilities of substation operation and maintenance problems during the process.

2.2 Strengthen the management of substation operation and maintenance

During the whole process of the implementation of transformer operation and maintenance work, the occurrence of non-standard transformer operation will largely lead to the occurrence of hidden risks. In order to reduce the hidden risks brought by such problems, power enterprises need to pay attention to and increase the management of transformer operation and maintenance work. Specific measures are as follows: Power enterprises need to formulate corresponding standards and norms of operation behavior specifically for the operation work of all kinds of equipment, clarify the standards of equipment operation, and ensure that every staff has sufficient cognition and understanding of the corresponding standards and norms based on the implementation of organizational training work. During the specific operation activities, It can also carry out corresponding operation activities in strict accordance with the corresponding standards and specifications, so as to reduce the probability of hidden risks to a large extent.

2.3 Pay attention to and strengthen the professional training of staff

From the perspective of the development of power transformation operation and maintenance work, it can be seen that during the whole implementation of power transformation operation and maintenance work, the comprehensive ability level of staff will largely affect the quality and efficiency of power transformation operation and maintenance work. To this end, power enterprises need to organize and carry out a variety of professional training work, and reduce the hidden risks of power transformation operation and maintenance under the condition of constantly strengthening and improving the comprehensive ability of staff. The main measures are as follows: power enterprises first need to carry out safety awareness education and training, based on safety knowledge publicity, safety activities and other diversified forms, Strengthen the safety awareness of staff, so that they can face the importance of their work, seriously carry out the corresponding operational activities; Secondly, power enterprises also need to organize emergency drills and training activities to strengthen staff's emergency response ability in the face of emergencies, so as to effectively prepare for reducing the harm brought by hidden risks.

2.4 Apply the integrated mode in substation operation and maintenance

For the implementation of substation operation and maintenance work, the application and development of the integrated mode is conducive to the organic unity of power grid operation and maintenance to a large extent. Therefore, power enterprises need to pay attention to and increase the application of the integrated mode.

According to the practice content, under the application of the integrated mode, the operation and maintenance working mode of the substation is as follows: The on-duty personnel are arranged to be responsible for and organize the operation and maintenance work of the substation 24 hours a day, which ensures the safety of the operation and maintenance work to a large extent. In addition, according to the existing operation and maintenance work flow of the substation and the needs of the operation and maintenance work, the optimization of the operation and maintenance work flow of the substation is realized and some unnecessary work flow is reduced. Some more automatic, more intelligent work flow to replace the traditional work flow, better improve the efficiency of the staff.

From the results of model 1, it can be seen that the impact of innovation input on innovation output is obvious, and the revised coefficient can reach 0.82. Model 2 and model 3 respectively added import trade network centrality degree differential and import trade network structure hole grade difference. Model 4 adds these two explanatory variables to the model simultaneously. From the results, the model 2, 3 and 4 of the correction coefficient of determination quickly dropped to 0.75, and can not pass the T-test and F-test, furthermore. From the results of granger causality test, the differential of hole degree and centrality degree does not constitute the granger reason of innovation output, so in the end the two explanatory variables is removed from the model. Model 5 takes the network center of import trade multiplied by innovation input into account. According to the simulation results, the model 5 correction coefficient of determination is improved from 0.82to 0.86, passing the T-test and F-test, and the coefficient is positive.

In summary, it can be assumed that hypotheses 1, 2, 3 and 4 have been validated.

(1)The structure of import trade network does not directly affect innovation output. The CH model and the CHH model are the basis for the study of technology spillovers through international trade, and the empirical analysis of relevant literature is based on this model (Peiyuan Xu, Weisheng Gao, 2010). The technology spillover through import is an important form of technology spillover, and it emphasizes that importing countries can obtain the product by reverse engineering and imitation of imported products (Keller, Wolfgang, 2004). Due to the uncertainty of technology spillover, human capital, trade structure, degree of opening conditions, the number and share of imports, import trade network pattern does not directly affect the importing country innovation output.

(2)Centrality of import trade network plays a positive moderating role in the function of innovation input on output. Centrality reflects the centrality of a country in the European Union's trade network, symbolizing the strong ties between a country and other countries. The higher the centrality, the more a country can integrate resources at a deeper and broader level, and innovation input can better promote the innovation output of a country through the resource integration ability.

(3)structure holes of import trade network play a positive moderating role in the function of innovation input on innovation output. Occupying the location of the structure holes, can obtain a large number of non redundant heterogeneous resources, and bring more trade advantage. So, this advantage further evolved into the country's social capital, and weakening effects of technology spillover in uncertainty.

3. CONCLUSION

In general, during the whole process of power system operation and development, it has extremely important practical value to do a good job in power transformation operation and maintenance. However, due to the influence and effect of environment, system, personnel and other factors, it is easy to cause hidden risks in power transformation operation and maintenance, which is not only detrimental to the normal operation and development of power system. Moreover, it will increase the safety and stability of the power system to a large extent. The analysis of hidden risks of power transformation operation and maintenance and the adoption of corresponding hidden risks coping strategies, such as improving the power transformation operation and maintenance management system, are conducive to the active development of power transformation operation and maintenance work.

In the perspective of social network, the conclusion of this article is that the import trade network pattern does not directly affect the output of innovation, but the import trade structure plays a positive regulatory role in function of innovation input affecting on innovation output. Import trade will influence the innovation output through technical spill over, but the capital goods and intermediate goods will directly improve the production efficiency as materializing technology, at the same time as the operation and use of machinery and equipment, technology

and non-materialization of tacit knowledge has been transferred (Xu, Wang, 1999), However, in this paper, there is no classification of capital goods and non- capital goods. Secondly, there are many constraints on technology spillover through import trade, which include human capital, product structure, openness and so on. Therefore, the follow-up study of this paper can be extended from the following two aspects: (1) to investigate the role of capital goods and intermediate goods import trade pattern in the function of effect of innovation input on output; (2) to consider more constraints to the model.

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