Environmental, Technical and Safety Laws, Regulations and Standards Related to Power Line Construction in China

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Abstract

This paper discusses the laws, regulations and practices related to power line construction in China as they relate to the environment, technical issues, and safety. Specific emphasis is placed on the legal and technical requirements for environmental impact assessment related to construction and operation of power transmission lines. A summary environmental impact assessment is provided on the interconnection of the power grids of four southern Chinese provinces.

1. Introduction

The power industry of China has been experiencing rapid development in recent years, with 338.6 GW (gigawatt) installed capacity and 1483.8 TWh (Terawatt-hour) annual generation as of 2001, and with capacity and generation increasing at 6.0% and 8.4% annually, respectively. Remarkably, the construction of power networks is growing even faster. Construction of transmission lines at the 35kV (kilo-Volt) and higher voltage levels reached 7.8×10^5km in 2001, 7.67% greater than that in 2000, while the corresponding transformer capacity rose to 1.1×10^9kVA (kilo-Volt Ampere), a 12.2% increase over the level in 2003.

In China's existing 10th Five-Year Power Plan, a growth rate of 6% annually is expected for electricity demand between 2001 and 2005. With an ambitious target of a four-fold increase in national GDP by 2020 proposed by the top decision-makers of the country, growth in electricity demand even more rapid than that in recent years is foreseeable. To meet the increasing demand for electricity supplies in a more efficient and cost effective manner, it is anticipated that the transmission of power from the west to the east of China, as well nation-wide grid interconnection, will play important roles. Specifically, the potential of interconnecting electricity grids in China with those of Russia is under consideration. There will be, of course, a wide variety of benefits from the interconnection, including synergies having to do with hydroelectric power availability, load diversity, reliability, and other electricity system considerations.

This paper is intended to introduce the codes relating to the environmental, technical and safety aspects of power grid construction in China, and to discuss the regulations regarding environmental impact assessment of power line projects in additional detail. The goal is of this paper is therefore to contribute to a base of information supporting further exploitation of the potential of grid interconnections in Northeast Asia.

2. The Environmental Protection Code

Environmental protection is one of the necessary and important aspects of the construction of power lines. In general, assessment of the environmental impacts of power lines in China must be completed and reviewed prior to the start of line construction. In addition, measures are required to mitigate substantial negative impacts of the project, if any, and monitoring and post-construction evaluation of the performance of the construction project with respect to its impacts on the environment are also required.

The fundamental principles of the environmental protection code include:

- Environmental protection policy is one of the basic national development strategies;
- Environmental protection (application of environmental protection measures) and the construction of individual projects are conducted simultaneously; and
- Pollution is paid for by those who have produced the pollutants.

The sub-sections that follow discuss the code of environmental protection that applies to the construction of power lines in China.

2.1 Framework of Laws and Regulations

The laws and regulations relevant to environmental protection are governed by the Constitution, which is passed by the plenary national congress. The Electric Power Law (validated in 1996), the Environmental Protection Law (amended in 1989), and the Environmental Impacts Assessment (EIA) Law (validated in 2003) compose the core of the system, about which the standing committee of the national congress has the right to make decisions. In the category of laws regulating environmental impacts, specific laws are in place that complement the Environmental Protection Law, such as:

- Environmental Noises Mitigation Law (1996);
- Air Pollution Mitigation Law (Amended 2000);
- Water Pollution Mitigation Law (1996);
- Solid Wastes Pollution Mitigation Law (1995);
- Wild Animal Protection Law (1988); and
- Land Administration Law (Amended 1998).

To guide the practical implementation of these laws, relevant regulations and standards are issued by the State Council and its departments, respectively. The most relevant regulations relating to the environmental impacts of power lines are as follows:

- Procedure of Environmental Protection for Construction Projects (State Environmental Protection Administration, 1990);
- Regulation of Environmental Protection for Construction Projects (SEPA, 1998);
- Procedure of Checking and Acceptance of Environmental Protection for Construction Projects (SEPA, 2001);

- Administrative Categories of Environmental Protection for Construction Projects (SEPA, 2003);
- Administrative Guidelines on Environmental Protection for Radiation – Procedure and Standard for Assessment of Electromagnetic Environmental Impacts (HJ/T10.3-1996);
- Administrative Procedure of Environmental Protection for Electromagnetic Radiations (SEPA, 1997); and
- Technical Criteria on Assessment of Electromagnetic Radiation of Super High-Voltage Transmission and Transformation Projects At 500kV (HJ/T24[1] 1998).

Of course, local governments usually develop particular rules corresponding to many of these laws and the regulations, which are referred to as local regulations. Descriptions of local regulations are not included in this paper due to length constraints for this text. For the same reason, general specifications of the laws, regulations and standards listed above are also omitted from this paper in order to focus on detailed discussion on specific stipulations for transmission lines[2].

2.2 General procedure of environmental protection for construction projects

Although the regulatory compliance process has become more flexible since the entry of China into WTO, a strictly defined approval regime exists for infrastructure projects, including for the management of environmental protection in such projects. Moreover, priority has been placed on the environmental protection section of infrastructure projects, resulting in a veto in the approval process if the project fails in satisfying the requirements for environmental protection. In other words, protection of the environment is a mandatory part of infrastructure construction projects in China.

According to the Procedure of Environmental Protection for Construction Projects (SEPA, 1990), activities and responsibilities along the entire construction cycle are defined as shown in the following table.

Furthermore, the Procedure of Checking and Acceptance of Environmental Protection for Construction Projects (SEPA, 2001) defines the relevant requirements and processes in detail.

[1] The code 'HJ/T24' is the identification number of this standard in the framework of national standards, issued by the State Technical Monitoring Bureau. Here, 'HJ' refers to the category of 'environmental protection' in Chinese; 'T' means that this standard is of recommended standards rather than mandated ones, and; '24' is the sequence number.

[2] For detailed information of these laws and regulations, readers can turn to references 1 and 2, listed at the end of this paper.

Table 1: Procedure of Environmental Protection for Construction Projects

Phases of construction project	Procedure of Environmental Protection		
	Responsibility	**Activities**	**Remarks**
Pre-feasibility study period	Project proponent	Tentative analysis on environmental impacts in siting	Project proposal
	EP agencies	Participation in site investigation	
	Provincial EPA	Issuing of comments to be enclosed in the proposal	
Feasibility study period	SEPA and sector authority department	Review and approval of the project	EIA report or table
	Project proponent	Entrusting institute(s) with Grade A certificate to compile EIA table or EIA outlines (program of EIA)	Submitting to SEPA and copying to the sector authority
	SEPA	Issuing comments after reviewing	
	EIA institute	Conducting EIA and developing EIA report	
	Project proponent	Submitting EIA report or table to EP department of the sector authority	Copies to SEPA and local EP agencies
	Sector authority	Pre-reviewing of the EIA report/table and applying to SEPA for formal review and approval	Approval of pre-reviewi ng comments in
Preliminary design period	Design institute	Compiling EP chapters and elaborating mitigation measures proposed in the EIA report/table, budget estimation	
	Project proponent	Submitting design documents to EP departments	
	SEPA	Participating investigation and review on design	Provincial EPA for normal construction

Table 1 (continued): Procedure of Environmental Protection for Construction Projects

Phases of construction project	Environmental Protection Procedure		
	Responsibility	**Activities**	**Remarks**
Detailed design period	Project proponent	Elaborating EP engineering in shop drawings and relative budget	
	EPA	Supervising	
	Project proponent	Submitting application for construction start	
Construction period	Project proponent and builder	Documenting EP engineering for potential investigation, once every four months	
	EPA	Checking the integrity of procedures and the inclusion of EP engineering in the project	
	Project proponent and builder	Implementing the EP measures	Recovering the destroyed environment (builder)
Test operation, Inspection and Acceptance on completion period	Project proponent	Applying for test operation	EPA's approving in 30 days
	Project proponent	Starting test operation of EP engineering and main body of the project simultaneously; keeping records	Max. 1 year
	Local EP monitor	Monitoring and reporting	
	Project proponent	Applying to sector authority and EPA for Inspection and Acceptance of EP engineering with monitoring report attached	In 3 months
	Provincial EPA	Organizing pre-check-acceptance on EP engineering	
	Project proponent	Implementing comments raised in the pre-check-acceptance	
	Project proponent	Applying for formal Inspection and Acceptance	
	EPA	Participating formal Inspection and Acceptance and issuing qualification certificate to EP engineering	In 30 days

2.3 Environmental impact assessment

2.3.1 EIA regulations

Established as part of the pilot testing of the draft environmental protection law in 1979, environmental impact assessment has been playing the role of the fundamental mechanism assuring environmental protection in construction projects. With the Environmental Protection Law amended in 1989 and the EIA Law enforced in 2002, a sound legislation system was completed, as illustrated in Figure 1.

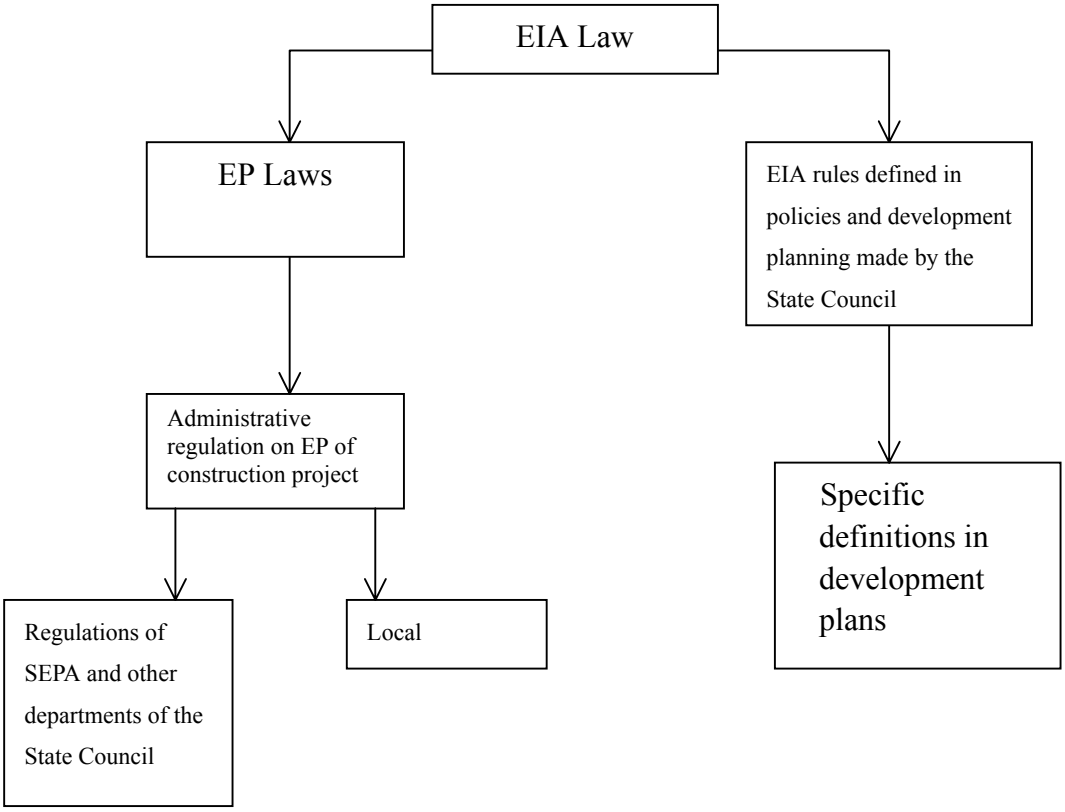

Figure 1: EIA Regulations

As indicated in section 2.2, EIA is included in the review and approval process for construction projects, and plays a critical role in the decision-making process leading toward the project approval. Two other features of the EIA regime are identified as follows:

- Differentiated management: As defined in Article 16 of EIA Law and Article 7 of Regulation of Environmental Protection for Construction Projects (SEPA, 1998), differentiated management is applicable to construction projects with respect to the extent of environmental impacts. An EIA report is required for construction projects where the environmental impacts are substantial, while an EIA table is allowed when relatively slight impacts are possible. In cases where the environmental impacts are too small to evaluate, an environmental impact registration table is required instead of the more detailed EIA formats. Qualifications for different categories are established in the document Administrative Categories of Environmental Protection for Construction Projects (SEPA, 2003).
- Qualification certificates: As defined in Article 19 of the EIA Law, institutions must

obtain qualification certificates issued by SEPA before they are entrusted to provide EIA services.

As the core law governing the field of environmental impact assessment, the EIA Law has succeeded in promoting EIA for planning and for post-project evaluation. Recent years mark the first time that EIA has been mandated for social and economic planning under this law. The application of EIA for construction projects and for planning are differentiated and face to different stipulations. Specific provisions for the application of EIA in different planning contexts are quoted as follows:

- The relevant departments of the State Council and local governments at levels higher than municipalities with district jurisdictions should manage environmental impacts assessment in the process of development of planning on land-use, regional, river basin or sea area exploration and utilization (Article 7).
- The relevant departments of the State Council and local governments at levels higher than municipalities with district jurisdictions should manage environmental impacts assessment for specific planning with respect to industry, agriculture, stock raising, forest, energy, water resources, transportation, municipal facilities, tourism and exploration of natural resources before submission for approval (Article 8).

The project proponent is required to conduct a post-project evaluation of the environmental impacts of the project if the approved EIA documents are not kept in compliance with the Law (Article 27).

Unfortunately, public involvement has not as of yet received due consideration, as no mandatory requirements for involving the project in EIA assembly or review have been defined in the current EIA Law.

2.3.2 EIA procedure

As indicated in Table 1, an EIA is conducted during the feasibility study period of construction projects. Once the project proposal is approved, the project proponent chooses an appropriate EIA category under the direction of Administrative Categories of Environmental Protection for Construction Projects (SEPA, 2003), as agreed to by the authority from which approval in being sought. If an EIA report is required, an institute certified as Grade A (in terms of its qualifications to compile EIAs) is entrusted to work out the outlines of the EIA. With the outline commented upon and determined to be acceptable by the authority, the EIA report is developed and submitted to environmental protection agencies for review and approval. The detailed procedure for EIA preparation and review is illustrated in Figure 2.

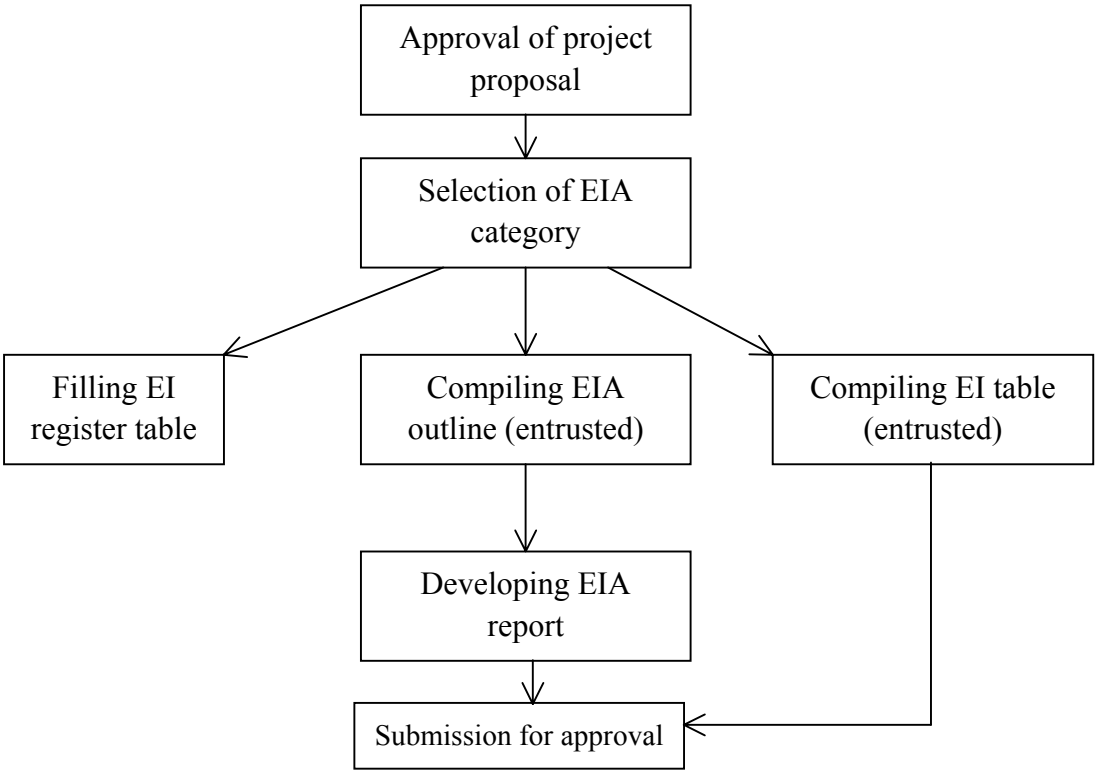

Figure 2: EIA Procedure

Article 17 of the EIA Law states that the EIA report should cover the following aspects:

- General description of the construction project;
- Current status of the environment adjacent to the project;
- Analysis, forecast and assessment on the potential impacts of the project on the environment;
- Environmental protection measures applicable, and corresponding technical and economic evaluation of those measures;
- Cost and benefit analysis of the environmental impacts of the project;
- Suggestions on environmental monitoring; and
- Conclusions of EIA.

Flexibility is allowed for the format of the EIA report; the report can either compare cases with and without the project or organize the report outline by types of environmental indicators.

2.4 EIA for power line construction projects

It is stipulated in Article 15 of the Electricity Law that transmission projects and environmental protection engineering should proceed at the same pace with related generation projects with respect to design, construction, inspection and acceptance, and commissioning.

According to the 'Administrative Categories', EIA reports are required for transmission and transformer projects at voltages of 500kV and above. The same requirement is applicable

for transmission and transformer projects at voltages lower than 500kV, if the projects are sited in ecological sensitive areas. Only an environmental impact table is required for projects at voltage levels lower than 500kV in non-sensitive areas, and for DC transmission projects.

In practice, however, relatively few environmental impact assessments have been carried out for transmission projects since the early 1990s in China. As a notable exception, an EIA was conducted for the 500kV transmission system connected to the Qinbei Power Plant in Henan Province, central China, in 1993 (Zhu Lin, 2000).

In a notable example of recent progress in environmental assessment, the Nanjing Environmental Protection Research Institute (NEPRI) completed an EIA for a 500kV transmission system in Jiangsu Province, in eastern China. In addition, NEPRI is conducting post-project evaluation of the environmental impacts of a few 500kV transmission lines constructed in China, in studies commissioned by the government.

Beginning this year, NEPRI and Tsinghua University are in cooperation on a research project expected to project the overall environmental impacts of power development through 2020. In this project the preparation of an EIA for the overall power grid development plan has been given high priority by the State Grid Corporation of China, which has commissioned the project.

The environmental impacts of transmission and transformer projects, which are typically composed of transmission lines, substations, transmission corridors, and roads, are usually grouped into two categories:

- Electromagnetic radiation induced by transmission lines and substations;
- Potential impacts on ecosystems when transmission lines and corridors pass through ecologically sensitive areas such as forests and natural reserves.

Of course, potential noise pollution created during the construction period and over the operational lifetime of transmission projects is another focus of environmental impact assessments of transmission systems. Experience has shown that some substations cause noise problems, to which certain technical standards are applicable. This paper will not go through the details of the relative standards for noise pollution[3], but additional detail is provided in the following subsections sections on the electromagnetic and ecological impacts of power lines, and the regulation of those impacts in China.

2.4.1 Electromagnetic radiation

Several guides to the analysis of electromagnetic radiation, and to the relevant standards and regulations addressing electromagnetic radiation, are available in China, including the Administrative Guidelines on Environmental Protection for Radiation – Procedure and Standard for Assessment of Electromagnetic Environmental Impacts (HJ/T10.3-1996); the Administrative Procedure of Environmental Protection for Electromagnetic Radiations (issued 1997); and the Technical Criteria on Assessment of Electromagnetic Radiation of Super High-Voltage Transmission and Transformation Projects at 500kV (HJ/T24-1998) .

It is specified in Article 15 of the second document listed above that EIA reports on electromagnetic radiation should be completed in two phases: (1) an EIA report during the feasibility study period, which must be completed prior to the approval of the project; and (2) an

[3] For detailed information, please turn to reference 3 listed at the end of this paper.

EIA report reflecting "realistic" operation of the project as installed, which must be completed before inspection and acceptance of the project. More specifically, it is stipulated that an EIA report/table has to be developed for each transmission system of voltage greater than 100kV.

In a corresponding manner, the Technical Criteria document sets forth the requirements that EIAs covering electromagnetic radiation for 500kV transmission projects be conducted in two phases: (1) primary assessment, which is conducted once the construction project is approved; and (2) final assessment, which is completed within one year of the start of operation of the project. Evaluations are required on the impacts of electromagnetic radiation on human health, radio broadcasting and navigation facilities. Detailed methodologies are also defined in the Technical Criteria document for coverage of the assessment, governing the criteria for the evaluation and measurement of electromagnetic fields. Moreover, stipulations are provided as to the implementation of field surveys, to the preparation of cost and benefit analyses of environmental impacts, and to requirements for public involvement in the EIA process.

Specific technical standards are in place covering the electromagnetic impacts of transmission systems, and are described in guides such as:

- Design practices of disturbance of transmission line to telecommunication lin*es* (DL/T5063-1996);
- Design practices of impacts of high voltage transmission line to wireless radio stations (DL/T5040-1995);
- Design practices of hazards induced by transmission line to telecommunication lines (DL5033-1994); and
- Limits on wireless disturbances of overhead HVAC lines (GB15707-1995).

2.4.2 Ecological impacts

The ecological impacts of transmission projects may occur when the site is cleared, when the land used for the project is occupied, when plants are cleared to provide the transmission corridor or for roads, or when roads are paved. These impacts usually take the form of loss of natural habitat and the invasion of imported species because of the increase in anthropogenic disturbance.

In 1998, the EIA Technical Guidelines: Non-Pollutant Ecological Impacts (HJ/T19-1997) were established. This set of technical standards categorizes ecological impacts assessment into three grades according to the extent and domain of the impacts of the project on the ecosystem. While evaluations on the current status of and forecast for ecological impacts are required for projects categorized at Grade 2 and Grade 3, additional post-project evaluation of impacts is also required for projects at Grade 1. These post-project evaluations are to be completed after a certain time period of actual operation of the project, and are to include analyses of the impact of the project on regional sustainable development. Specific definitions in the Guidelines cover project investigation and analysis, the field survey of ecosystems, the evaluation of the current status of ecosystems, and the forecast of potential impacts and mitigation measures or alternatives. The Guidelines provide instructions as to the coverage of the evaluation, the methodologies to be used, flow charts for the evaluation process, and other technical aspects of the evaluation of the ecological impacts of a project.

There has not as yet been concrete evidence to show the hazardous influences of wireless disturbance or electromagnetic fields on the physiology of creatures. As a consequence, no specific rules or stipulations have been developed in China to govern these types of impacts.

3. Technical Standards for Power Line Construction

With regard to the construction of power lines in China, the following technical standards are applicable:

- Design practices of 110~500kV overhead transmission lines (DL/T5092-1999);
- Standards on construction and check-and-acceptance for 110~500kV overhead transmission lines (GBJ233-1990);
- Technical practices of design of transformer substations 220~500kV (SDJ2-1988);
- Technical practices of design of overhead distribution lines (SDJ206-1987);
- Design practices of selection and laying of cables for power plants and transformer substations (SDJ26-1989);
- Guidelines to selection of HV cables (DL401-2002); and
- Design practices of distribution systems (GB50052-1995).

The specific stipulations of DL/T5092-1999 fall into the following categories:

- Selection of route: options should be compared with respect to conditions for construction, operation, and transportation as well as the length of the power line, and the extent to which the corridor avoids passing through severe frozen regions, bad geological conditions and virgin forests;
- Meteorology: the maximum design wind speed is 30m/s for 500kV lines and the minimum reappearance period for high winds is 30 years;
- Conductor and grounding wire: the cross sectional area of the conductor is determined based the economic current density and verified by analyses of the line's corona and wireless disturbance; the safety factor for the grounding wire design is to be not less than 2.5;
- Insulator, hardware and accessories: the secure and reliable performance of the power lines should be guaranteed in cases of power frequency overvoltage, switching overvoltage and lightning overvoltage;
- Lightning protection and grounding: double grounding is required along the full length of 500kV transmission lines;
- Layout of conductors and pole towers: guyed towers and reinforced concrete poles are applicable in plain areas, and towers with a triangle layout of conductors are suitable for narrow corridors or where the cost of clearance is higher; and
- Supporting facilities: maintenance depots are required for new transmission lines located in areas where transportation is difficult.

4. Safety Code of the Power Grid

The technical requirements for security of the power grid are defined in Guidelines for

Security and Stability of Power Systems (DL755-2001), which includes the basic requirements for power systems above 220kV, standards of security and stability, and computation methodologies for determining system security and stability. General stipulations are also made for the structure of power grid, reactive balance and compensation, coordination between generation units and the power grid, protection of power systems from collapse, and recovery of power grids after system outages (including "black start" procedures).

Specifically, standards of security and stability of power systems, and for the capability of power systems to endure disturbances, are identified at three levels. Level 1 is defined as the sustainability of stable operation and a normal supply of electricity in case of a maximum disturbance; level 2 refers to the sustainability of stable operation after a disturbance allowing for the loss of a portion of the load; level 3 means prevention of system collapse with as little load loss as possible in cases where normal operation cannot be sustained.

With regarding to the calculation and analyses of system security and stability, rules have been established for static stability, transient stability, dynamic stability, voltage stability and re-synchronizing security. Verification of security and stability should be made based upon the most adverse case and based on three options of operation, that is, normal operation, accident conditions, and special conditions.

It is noted that a "N-1" criterion is adopted for static security analysis of power system, which is defined as the sustainability of stable operation and normal power supply in case one component of the system is switched off under normal conditions, without overvoltage on the other components, and with keeping voltage and frequency within the allowed range.

5. Regional Environmental Impacts of Interconnection in Southern China

This section provides a brief introduction to the analyses conducted during the Sino-Canada Southern China Strategic Energy Planning Project, focusing on regional environmental impacts assessment. The domain covered by these analyses covers Yunnan Province, Guizhou Province, Guangxi Zhuang Autonomous Region and Guangdong Province, southern China (Huanan region).

In this region of China (HN), Guangdong (GD) and Guangxi (GX) are the leading centers of economic development. These areas are, however, restricted by the lack of energy resources. Conversely, Yunnan (YN) and Guizhou (GZ), the western provinces, have abundant hydropower and coal resources that are far beyond local demand. As planned, four AC and two DC high voltage transmission lines are under construction and are expected to be in operation prior to 2005. These lines will transmit 7000 MW of power from the west to Guangdong, as shown in Figure 3.

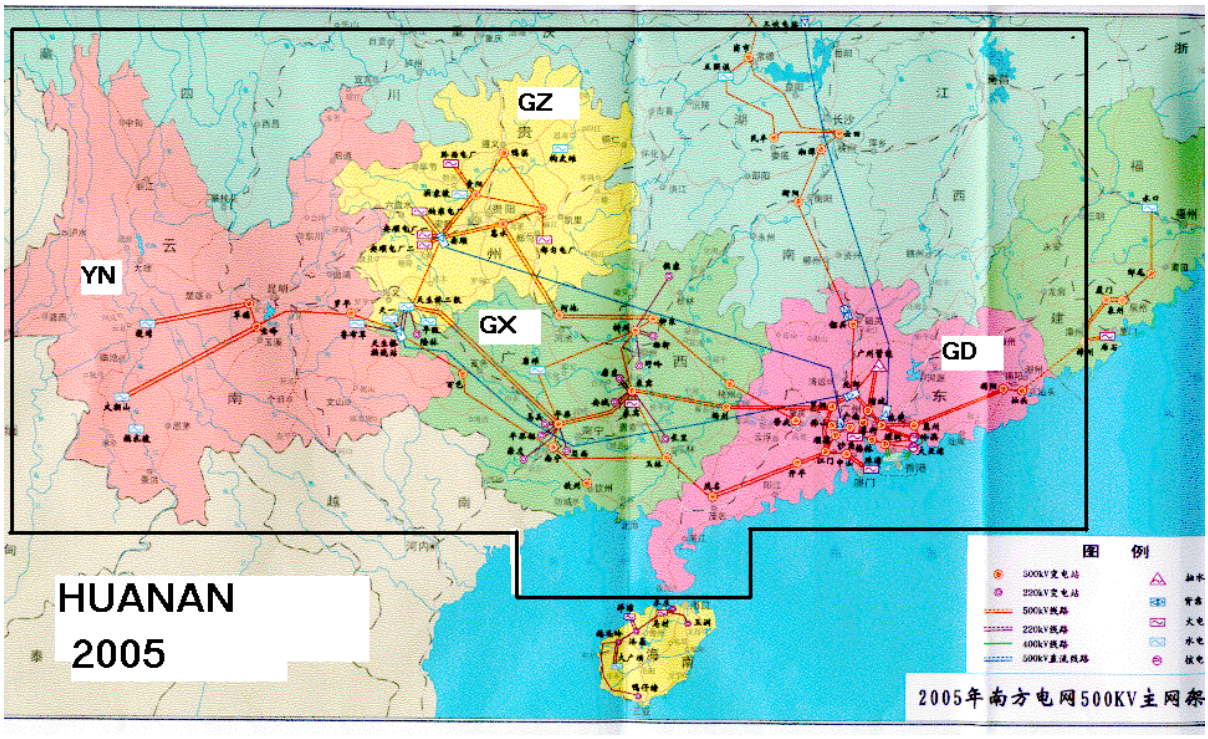

Figure 3: Interconnections in Southern China, 2005

To investigate the impacts of inter-provincial transmission with respect to technical, environmental and socio-economic aspects, four cases of power development were simulated, including:

- Reference case: Interconnection and cooperation among the four provincial power systems is limited to the existing capability in 2000;
- Base case: New transmission lines are constructed as scheduled but inter-provincial cooperation is limited to firm long-term contracts only;
- Integrated operation case: Provincial power grids are connected and full cooperation in planning and operation
  - With capacity savings
  - Without capacity savings

The results of these simulations include the estimates for the output of coal-fired generation of electricity in 2015, as given in Table 2.

Table 2: Coal-fired Generation in Huanan in 2015 (GWh)

Case	GD	GX	GZ	YN	HN
Reference	224,007	27,906	47,852	21,751	321,517
Base	185,290	27,906	72,870	39,671	325,737
Integrated [no capacity savings]	163,834	29,457	88,139	47,605	329,034
Integrated [with capacity savings]	171,944	31,875	83,328	41,714	328,860

The environmental impacts assessment carried out as a part of this simulation focused on SO_2 emissions and sulfur deposition rather than on the direct environmental impacts of the construction of transmission lines. The analytical steps in this assessment were:

- Initially SO_2 emissions were estimated for each system expansion case with no SO_2 mitigation;
- Wet limestone FGD (Flue gas desulfurization) devices were assumed to be installed in units/plants exceeding point source emission regulations; and
- Additional FGD devices were assumed to be installed in years when SO_2 emissions exceed year 2000 caps in individual provinces.

Levelized annual SO_2 emissions from 2000 to 2015 (using a discount rate of 10% per year) are illustrated in Figure 4 for the four cases modeled, with no FGD and with FDG installed to meet point source regulations and a year 2000 cap. Figure 4 shows that the regional SO_2 emissions increase with the addition of interconnection in the case where no FGD are installed on new generation units. This surprising increase in SO_2 emissions indicates that more economic thermal units in the western provinces are operating more hours than in the reference case. Furthermore, the higher content of sulphur in the fuel coal used for the western thermal units pushes the emission even higher.

Cost analysis shows that a net present value cost increase of 1.827 billion RMB (discounted at 10%/yr to 1998 RMB) will be necessary to keep the SO_2 emissions at the same level as in the reference case. This negative impact will offset the benefit from the interconnection, calculated at 9.294 billion RMB (2000-2015), by 19.7%.

In other words, in the analysis for the southern China interconnection, the benefits could be overestimated by nearly 20% if impacts on the regional air pollution are excluded in the considerations.

The experience of the Southern China Strategic Energy Planning study demonstrates the necessity of taking secondary impacts into account. For power systems with different generation mixes, the interconnection will definitely change the operational mode of each system, resulting in increases or decreases in local air emissions. It is likely that such secondary impacts could exceed the direct environmental impact of the construction of the transmission lines.

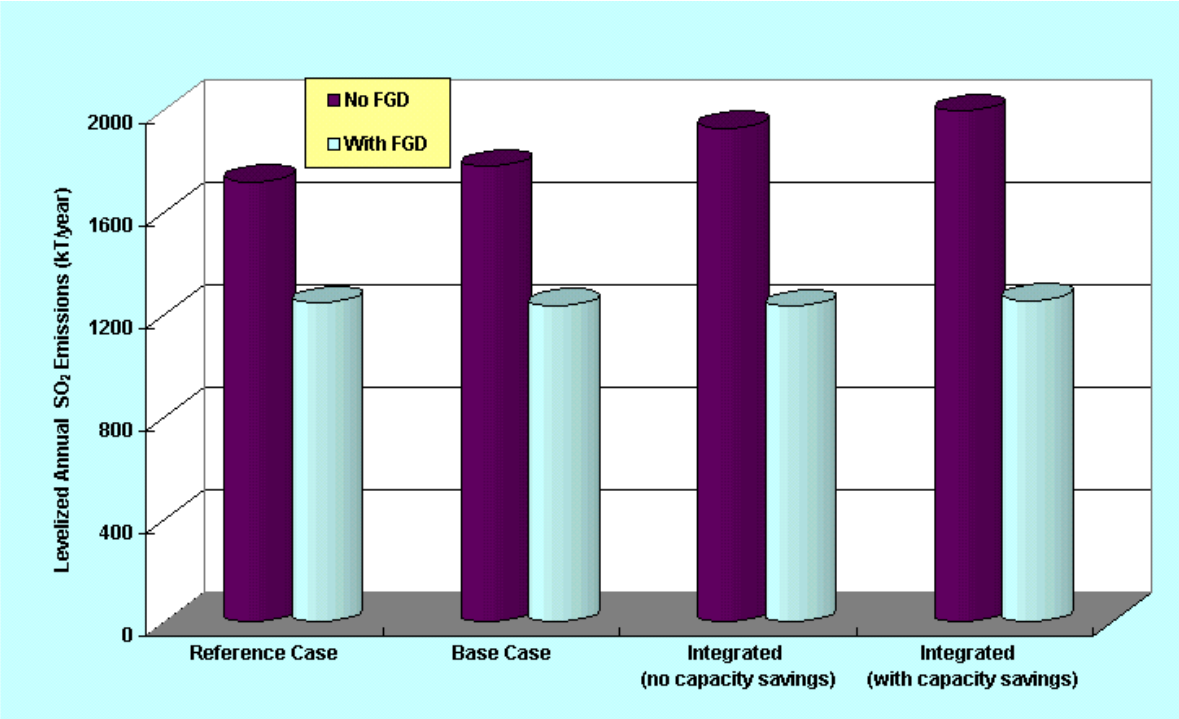

Figure 4: Levelized Annual SO_2 Emissions with and without FGD to meet SO_2 Emissions Regulations

6. Conclusions and Issues

It can be seen from the above discussions that a complex system of technical, environmental and safety codes, laws and practices exists to provide direction to power line planning and construction in China. In particular, the increasing enforcement of the Environmental Impact Assessment Law is setting more strict requirements for the assessment of the environmental impacts of construction projects.

Analysis of regional air pollutants in Huanan implies that the influences of interconnection on the operational modes of individual power systems are substantial and therefore should not be omitted from consideration. Evaluation of this type of secondary impacts appears to be valuable for the analysis of potential interconnections in North Asia.

There are a few uncertainties underlying the application of codes and regulations relevant to power line environmental impacts assessment in China:

- Institutional reform in power sector of China: the formal process of power sector reform was launched at the end of 2002, with five nationwide generation companies established to take over the generation facilities owned by former State Power Corporation of China and an additional two grid companies established to provide transmission and distribution services. The State Electric Regulatory Commission, the regulator, is working out a series of market rules, which are certain to affect power line construction in China. As a company independent from the generation business, the State Grid Corporation, the transmission system operator, is likely to develop additional rules and standards geared toward providing power supplies with higher

efficiency and reliability.

- Restructuring of government departments: since the creation of the existing cabinet, governmental departments have been in the process of rearrangement. The establishment of the energy bureau in the State Reform and Development Commission probably implies coordinated and integrated development of the energy sector rather than independent development of the power sector. In establishing this mode of coordinated development, new regulations and rules are likely to come into practice, with influences on the construction of power lines.
- The targeted four-fold GDP increase by 2020: as the central government has proposed an ambitious growth target of four-fold increase in China's GDP by 2020, the relevant authorities are reconsidering the existing five-year and long-term power development plans. Interconnections will, of course, be facilitated further by additional policies and regulations geared toward providing more efficient management and operation of interconnected power grids.
- Global climate change: if the Kyoto Protocol is validated, the government of China will surely take climate change into consideration when evaluating international interconnections.

7. References

[1] Luo Hong, Zhou Lin. The New Progress of the System of Chinese Environmental Impact Assessment[J]. Environment Herald, Issue 6, 1999, pp.40-41. (In Chinese)

[2] Department of Supervision and Management of SEPA. China Environmental Impact Assessment[M]. Beijing: Chemical Industry Press, 2000

[3] Department of Electric Power of the State Economy and Trade Commission of China, et al. Compilation of Technical Standards in Electric Power Sector[M]. Beijing: China Electric Power Press, 2002. (In Chinese)

[4] Zhu Lin. Electromagnetic Radiation and Environmental Impact Assessment of High Voltage Transmission Projects[J], Electric Environmental Protection, Volume 16, Issue 1 (March, 2000), pp.45-48. (In Chinese)