

CHAPTER 5

GMS TRANSPORTATION, ENERGY AND ENVIRONMENTAL PROTECTION COOPERATION

The six countries' GMS Economic Cooperation led by the Asian Development Bank and small regional "Quadrangle Economic Cooperation (QEC)" advocated by Thailand now has entered implementation period, which made the subregion appear good development trend that "political stability stimulated economic development, economic prosperity promoted political stability". The social civilization and progress of this region will make economic development as the motive force, international cooperation as the condition. It is only through cooperation that can promote environmental protection.

ENERGY AND ENVIRONMENTAL PROTECTION COOPERATION: THAILAND AND CHINA JOINTLY INVESTED TO BUILD JINGHONG HYDROPOWER STATION IN ORDER TO TRANSMIT ELECTRICITY TO THAILAND

From 1990's of the 20th century, by regarding the development of the Lancang-Mekong River Basin as a bond, the Asian Development Bank actively promoted the riparian six countries' economic and technical cooperation. In GMS cooperation mechanism, eight cooperative sectors have been decided, including transportation, energy, telecommunication, tourism, investment and trade, human resources development, environmental protection and banning drug. The economic project of Sino-Thai priority cooperation is to jointly invest to build Jinghong Hydropower Station in order to transmit electricity to Thailand.

1. The Development and Exploitation Characteristics of International River

The international river flows across two countries or many countries, and becomes transborder river or boundary river. The development and utilization of international river is related to factors such as the political and economic situation of riparian region,

the relations of along the bank countries, their demand for water resources etc. Because of the difference of geographic environment, objectively there are objectives differences on the development of water resources among the riparian different countries. The international river travels across the national boundary, which makes the social, ecological and environment influence caused by the development bear the characteristics of internationalization. Therefore it is necessary to give consideration to the riparian different countries' objectives and interest in the development, utilization and management of international river water resources, and manifest equality and rationality.

First of all, there are conflicts of objectives of different countries' international river development. Because of the different geographic location of riparian different countries as well as the gap of social and economic development level, it has resulted in different countries' different demand for water resources, which manifests as the objective conflicts of different countries' riparian development. In terms of the upstream countries, because the elevation is high, the drop is big, the river valley is narrow, the flow is small and the river flows fast, the development of hydropower has great advantage. The mountainous terrain made the cultivation situation worse and the water consumption amount is small. By contrast, in terms of downstream countries, because the altitude is low, the drop is small, the terrain is flat, the flow is big and the flowing speed is slow, it formed flood plain, lakes and marsh characteristics. The main advantage lies in agricultural irrigation, navigation and fishery. The land cultivation condition is good and the water consumption amount is big. Generally speaking, the upstream countries focus on hydropower development while the downstream countries emphasize irrigation, navigation and fishery. The development projects of upstream countries will usually bring benefits or loss to the downstream countries. Usually the upstream countries will emphasize the beneficial aspects that the dam building will play regulation role to the downstream water amount. However, the downstream countries emphasize the affected aspects that the upstream dams will have negative influence on downstream etc... Based on individual countries' national interest, the riparian different countries usually unilaterally emphasize that other countries'

development will bring loss to one's country and neglect the positive influence and function. This one-sided perception will directly influence the implementation of riparian planned projects and cooperative progress of different countries. In order to deal with this conflict, China usually takes very prudent attitude and makes long-term research before the implementation of any dam project. Then it will provide scientific data to analyze the benefit and loss of the project and draw a conclusion. In short, China tries to convince people by reasoning.

Secondly, there are transborder pollution and transborder ecological influence in the development and utilization of international river. With the strengthened extent of riparian development by human beings, the irrigation, navigation, industrialization and urbanization etc. reasons have caused transborder pollution. The completion of dams will cause the changes of river flow, water environment, the land salination and seawater intrusion, which has resulted in water quality pollution. Generally, the development project lacks consideration for the river ecological influence. The river aquatic ecology, as "voiceless party", is usually neglected.

Thirdly, the development and exploitation of international rivers, in the aspects of dam building, channel water to irrigate, transborder pollution, ecological influence, flood disaster etc. even provoke the conflicts and disputes among riparian different countries' government. The water scarcity of international rivers easily resulted in conflicts between different countries on water amount demand. The transborder pollution and transborder ecological influence will not only result in a series of environmental and social problems, but also will provoke water disputes among different government. The ecological construction of the river basin is contradictory to the local grain yield and firewood. The contradiction between dam building and the subsistence of the migrants will further spark off conflicts among national interest, local interest and individual interest. The focus that different interest groups concerned about is different. The government pays more attention to the national holistic interest. The private investment pursues for high repayment. The NGOs are more concerned with environmental and social influence. Through the participation of the public and relevant interest groups, it will further be favorable to the rationality and smooth



implement of the plans.

Fourthly, the mainstream hydropower development of big river basin has both positive and negative extensive influence on the society, economy and ecological environment of local, upstream and downstream. The developed countries emphasize the negative influence of dam construction on environment, and hold negative attitude on dams. However, the developing countries insist on the necessity of dam construction from the real demand of economic development for energy.

In order to avoid and eradicate the conflicts between different countries and regional contradictions in the development and exploitation of international rivers, it should map out water resources from the whole river basin's angle instead from the angle of a nation. The international river itself is a whole in nature. There are inevitable contacts between different areas within the river basin, especially between the upstream and downstream countries. A single country cannot solve transborder problems such as soil erosion, salination, river channel dredgement, water waste and water pollution etc. The activities of the upstream will bring influence to the downstream. The flow control of the downstream will also need the cooperation of upstream countries. Objectively, it is necessary to regard the international river basin as a whole, and to uniformly consider flood control, hydropower development, irrigation and navigation within the river basin. In the aspect of multi-purposes water utilization, different countries' government should coordinate with each other and equally deal with the objective differences of different countries. Different countries should strengthen cooperation. The upstream and the downstream should coordinate to act. Different countries should make moderate development, limit the impact of human beings on ecological system within its endurance, protect the "voiceless interest" of the river ecological system, maintain the riparian sustainable development, consider the influence of current decision on the future, make the economic objective be in accordance with ecological objective, the coordinated development of man and nature¹.

2. The Development and Utilization of Lancang-Mekong River Water Resources

The Lancang-Mekong River is one of the international large rivers in Asia, which runs through six countries. From North to South it flows through Qinghai, Tibet,

Yunnan Province of China as well as Myanmar, Laos, Thailand, Cambodia and Vietnam five countries. The mainstream is 4,880 km in total length. The water and hydropower resources are abundant. The hydropower reserves of the whole river basin are 90.06 million kw, and the exploitable amount is 64.37 million kw. According to Patrick Maccully and other hydrologists, kw is the abbreviation form of kilowatt, which is a world widely-used term and means unit of power equal to 1,000 WATTS. The hydropower development mainly concentrates on the mainstream of the Lancang River and the tributaries of the Mekong River. Regionally it mainly distributes in Yunnan Province of China, Laos and Cambodia. At present, the total installed capacity of the whole river is only 2.35 million kw, among which the Lancang River Basin is 1.9 million kw, and the Mekong River Basin is 450,000 kw. The hydropower utilization rate is lower than 5%².

The terrain of the whole river basin is high in the north and low in the south. There are six main kinds of landforms: the V-shaped high mountains and gorges of the Lancang River, the north mountainous area, the Korat plateau, the east mountainous area and the south lowlands. It spans seven climate zones from the frigid zone to the tropics. It is one of the areas in the world, which has the most plentiful biodiversities. The total discharge of the Lancang-Mekong River is abundant but the distribution of time and space is unbalanced. In terms of time, 70% of the discharge concentrates in summer of a year. In terms of space, the riparian countries contribute to the total flow: 35% from Laos, 18% from Cambodia, 17% from Thailand, 16% from China, 11% from Vietnam, and 2% from Myanmar. The upstream contributes one half to the total flow but the water consumption is small. The downstream consumes a great deal of water. The unbalanced distribution of time and space has caused the flood of the lowlands in the rainy season, and severe scarce of water in the dry season, which resulted in the seawater intrusion and land salination. Therefore, the water problem of the Lancang-Mekong Rive Basin is mainly caused by the difference between the water distribution of time, space and water demand. At present, the development extent of the river basin is low. The projects concerning to the water utilization mainly concentrate in the tributaries. There are few projects to control the mainstream. The whole river basin

is in a very weak state to control the river. Drought, flood disasters frequently strike. The irrigation demand can't be satisfied. Therefore, it is possible to realize the regulation of time and space of water resources through the control of the river.

Because the riparian countries are in different geographic locations and their resources' condition differs from each other, different countries' concern on water resources is different. What China, which is in the upstream, concerns most are the problems of the hydropower development and navigation of the Lancang River. However, the downstream Mekong River riparian different countries focus on water consumption problems of agricultural irrigation, flood control and fishery. In terms of riparian resources development, there are interest contradictions among different countries in water amount distribution, transborder pollution, biological influence etc. Nevertheless, a series of real problems that the riparian is faced with such as drought, flood, pollution, poverty, the degradation of biological environment, the protection of biodiversity etc. are all transborder problems, which are difficult to be solved by local government and the independent action of a single country. It is a must to base on the interest of the whole river basin, make joint efforts, act as a whole and coordinate the objective benefits of different countries. Otherwise, partial contradiction will upgrade to conflicts between different countries. Although there exist certain interest contradictions among the Lancang-Mekong River riparian different countries, all of them have shown friendly, active and cooperative attitude. Concerning to the Lancang-Mekong River, such a large and complicated international river, there weren't successful example to develop it as a whole in the past. Until now there isn't sustainable development plan of the whole rive basin. If the development plans of the upstream and downstream can be comprehensively coordinated, it will make obvious comprehensive benefits. The Lancang-Mekong River is a common wealth for the riparian countries. With the implementation of comprehensive development projects on the main stream of the Lancang River and the tributaries of the Mekong River, it is necessary to strengthen negotiations and cooperations between riparian countries on the basis of equality and mutual benefit. It is also very important for each country to emphasize the environmental protection and make the development of the river not only complies

with the need of economic and social development of individual countries, but also complies with the long-term interests of these countries. This is a matter of fundamental importance, which will benefit the future generation.

3. The Current Situation of Development and Utilization of the Lancang River Water Resources

The Lancang River is 2,130 km in total length. The upstream 592 km above Changdu is characterized by high mountains and river valleys. The middle reaches 814 km from Changdu to Gongguoqiao is typical high mountains and valleys, which is the narrowest section of Lancang Basin. The watershed of both banks is only more than 20 km. The downstream 724 km from Guoguoqiao to Nane river mouth is the landform of middle-height mountains and wide valleys. The upper and middle reaches contribute less water flow, while the tributaries of the lower reaches contribute large amount of flow with plentiful rainfall. The Lancang River flows through the V-shaped high mountains and valleys areas of the west of Yunnan Province, China. It is 1,217 km long within the territory of Yunnan Province³. The downstream of Lancang River are mainly mountains and hills. There are few cultivated lands and ever fewer paddy fields. The mountainous terrain resulted in the difficulty of agricultural irrigation and drinking water of man and livestock of lower reaches. Therefore the consumption of irrigation water is less.

The development and utilization of Lancang River water resources are mainly hydropower development and utilization, and the water consumption is little. The abundant flow and great fall contribute to the abundant hydropower resources of the Lancang River Basin. The hydropower reserves are 36.56 million kw. The exploitable electricity amount is 27.37 million kw, which mainly concentrate in the mainstream of Yunnan Province⁴. From the end of the 1960's of the 20th century, China started to investigate the hydropower resources of the Lancang River and has built a series of hydropower stations on the tributaries. In the beginning of the 1980's of the 20th century, according to the plans of the central government and the local government, China planned to build 14 cascade dams on the mainstream of the Lancang River. At present the water resources development and utilization rate of the Lancang River Basin is still

very low, which only makes up 2.3% and mainly concentrates in the mainstream of Lancang River in Yunnan Province. The water resources of Qinghai Province and Tibet have not been developed yet. The ecological influence problem of Lancang River cascade dams has drawn the wide attention of the downstream countries and international communities, especially concerning Xiaowan Hydropower Station⁵.

4. The Current Situation of Development and Utilization of the Mekong River Water Resources

The mainstream of Mekong River is 2,750 km in total length. It has vast drainage area and plentiful rainfall. According to Professor He Damin, the Director of Asian International River Center of Yunnan University, the water resources account for 84% of the total water amount of Mekong River. In Cambodian Mekong means “the Mother of Happiness”. The Cambodian and Vietnamese people living in the Mekong Delta said “Thank the Mekong River for bringing fertile soil”. The Mekong River flows through the west of Laos and became the boundary river of Laos and Thailand. It flows through the east of Thailand, travels across Vietnam and Cambodia from north to south and enters Vietnam in two tributaries, which was called the Nine Dragons’ River. In short, the Mekong River flows through the North of Laos, East of Myanmar, and the mountains of North Thailand. From the Korat Plateau of Northeast Thailand, it flows towards the eastern mountains of Laos and Vietnam, and then enters Vientiane Plain and Mekong River Delta lowland. It empties itself into the South China Sea in six tributaries to nine big estuaries.

In the 1980’s of the 20th century, the development and utilization of Mekong River water resources are mainly agricultural irrigation, navigation and fishery. The agricultural irrigation consumption is the biggest water consumption of the river basin. As the main rice production areas in the world, Thailand and Vietnam are the biggest rice export countries in the world. The area of paddy fields covers 63% of the arable lands of Mekong River Basin. The water consumption of agricultural irrigation accounts for more than 85% of that of the river basin. However, there are lots of arable lands lack of water to irrigate. The Korat Plateau of Northeast Thailand has abundant land resources; the arable lands account for one half of the total amount of the country

but the water resources are insufficient. The irrigation area only accounts for 6% of the arable lands. The water resources of Laos are abundant but the arable lands are insufficient. Below Vientiane of Laos the water consumption is mainly used in urban living, irrigation, navigation, industry and the prevention of seawater intrusion and generating electricity. For more than one million hectares' lowlands of Mekong River Delta in Cambodia and Vietnam, in the dry season most lands suffer from the seawater intrusion. In the rainy season they suffer from the acid water of the acid soil. Therefore, these lands need to be rinsed by the Mekong River throughout the year. Vietnam is most concerned about the upstream water flow. Therefore in the Northeast of Thailand, Vietnam and Cambodia Mekong River Delta, cultivated lands and densely populated areas are the biggest water consumption areas of the Lancang- Mekong River Basin, especially in dry season.

The Mekong River is huge, undeveloped resource for Laos, Thailand, Cambodia and Vietnam. But for different reasons, their objectives of development and utilization are different. The report of Asian Development Bank has analyzed the motivation and objectives of the riparian countries in GMS economic cooperation. The development objective of Laos is to make use of hydropower to promote the prosperity of industry, agriculture and forestry. The development of hydropower on the tributaries can already satisfy domestic demand. In the future to develop the hydropower of the Mekong River mainstream on the border can export electricity to earn foreign exchange. Vietnam's interest in the mainstream development only limits in the Delta area, which is the main grain production area of the country. Its development requirement is to control flood, irrigation and the prevention of land salination, to increase water flow in dry season in order to ensure the agricultural development of the Delta. The balanced, coordinated development of Thailand needs to develop the agriculture of its Northeast. Therefore Thailand needs to channel water from the Mekong River for irrigation. The development objective of Thailand is mainly irrigation consumption, water for living usage and to develop hydropower. At the end of the 1980's of the 20th century, the Thai government needed to draw water from the Mekong River to supply Chaophraya water system in order to satisfy the water demand of its center-Bangkok. The government has

also designed Khong-Chi-Mun water distribution scheme in order to irrigate large areas of lands in its Northeast, which has caused long-term divergence with Laos and Vietnam. Therefore the contradiction of water amount mainly concentrated among downstream different countries of the Mekong River. The joint participation and the comprehensive development of different countries' government in irrigation, hydropower, fishery and other industries of the Mekong River can not only contribute to numerous population within the river basin, but also can nurture large population outside the river basin.

The total hydropower reserves of the Mekong River riparian five countries are 58 million kw. The exploitable power amount is 33.17 million kw, which mainly concentrates in the tributaries, 51% within Laos, and 33% in Cambodia. From 1957 after the establishment of the Mekong River Committee, it has proposed to construct multi-purpose dams on the mainstream of the Mekong River, and make cascade development in order to develop hydropower, irrigation and navigation. In 1970 the Secretariat of the Mekong River Committee has planned fifteen cascade dams on the mainstream of the Mekong River. The total installed capacity is 23.91 million kw. Five Hydropower Stations have been planned in Laos, namely, Luang Prabang, Xayaboury etc, with the total installed capacity of 8 million kw. Chiang Khan, Lower Pa Mong five hydropower stations have been planned on the boundary river of Laos and Thailand with the installed capacity of 7.45 million kw. The one million kw Khone Fall Hydropower Station has been planned on the bordering area of Laos and Cambodia. Within the boundary of Cambodia four hydropower stations, namely, Stung Treng, Tongle Sap, and Sombor etc. have been planned with installed capacity of 8.62 million kw. In the revised plan of 1987, eight cascade dams have been selected as long-term development projects, among which Pa Mong Dam and Stung Treng Dam were the key of development. Until now the hydropower resources development projects on the mainstream of the Mekong River still remains in the planning period. There are only fifteen main tributary dams, which are under construction⁶.

5. The Key Projects of Lancang-Mekong River Hydropower Resources Cooperative Development

From the end of the 1980's of the 20th century, the riparian different countries have entered economic fast growth period either early or late. The huge demand for energy prompted different countries to regard the utilization of hydropower resources as the main development project. At present, among twenty-five important hydropower projects listed in the plan on the Lancang-Mekong River, there are fourteen projects on the mainstream of the Lancang River within Chinese boundary, and eleven projects on the main tributaries of the Mekong River. Concerning the water using conflict between the agricultural sector and industrial sector, in China the government has ordered paper mills and other polluting factories along the banks of the Lancang River to close down. In addition, in the Lancang River Basin the mountains are high and slopes are steep; therefore, the water consumption for agricultural irrigation is little.

In 1987 eight cascade dams on the mainstream of the Mekong River have been planned in the revised plan of the Mekong River Committee with the total installed capacity of 22.25 million kw. Because of funds and environmental etc. many reasons, until now the mainstream dams' project of the Mekong River can't be implemented. In the early 1980's of the 20th century, China has planned to build fourteen cascade hydropower stations on the mainstream of the Lancang River, with the total installed capacity of 22.16 million kw, among which there are six on the upstream of the Lancang River. Now China focuses on the development of the following eight dams on the downstream of the Lancang River, namely, Gongguoqiao(installed capacity 750,000 kw), Xiaowan(4.2 million kw, under construction), Manwan(1.5 million kw, already in operation), Dachaoshan(1.35 million kw, already in operation), Nuozhadu(5.5 million kw), Jinghong(1.5 million kw), Ganlanba(150,000 kw), Mengsong(600,000 kw)). (See Map 4)

Now the hydropower development on the mainstream of the Lancang-Mekong whole river basin is only conducted in Lancang River Basin. Because the mainstream of the Lancang River is mainly high mountains and valley areas, where the hydropower congregates, the cultivated lands are less with low population density. The riparian social economy is not developed and the industry is backward. Compared with other dams in the world and the dams planned on the mainstream of the Mekong River, the

development of cascade hydropower stations on the mainstream of Lancang River will lead to the submerging of less lands, less resettlement and less economic loss. The economic and technical index of hydropower project is very advantageous. However, if hydropower stations were built on the mainstream of the Mekong River, the submerging loss would be bigger and the resettlement population would be more. The negative impact on ecology, environment and society would be much bigger than building hydropower stations on the Lancang River. In order to prove this, China has made 40 years' hydrological analysis and simulated calculation on it.

The development of Lancang river hydropower resources is an important area of subregional cooperative cooperation. China has made nearly 40 years' hydrological analysis and simulated calculation on it. In terms of economic and technical index, the submerging loss, project amount, investment capacity, environmental influence, market prospect, electricity transmission distance etc. factors, to focus on the cooperative development of the cascade hydropower stations on the downstream of the Lancang River in order to transmit electricity to five countries on the Indochinese Peninsula has double advantages: resources advantage and geographic advantage. In the near future, China will develop Xiaowan, Nuozhadu and Jinghong etc. cascade hydropower stations on the downstream of the Lancang River. Later it will develop other dams step by step.

5.1. China and Thailand jointly invested to build Jinghong hydropower station in order to transmit electricity to Thailand.

The electricity transmission project from Jinghong Hydropower Station of Yunnan Province to Thailand is one of the biggest projects of subregional energy cooperation led by Asian Development Bank, which will further push forward the progress of subregional cooperation. The installed capacity of Jinghong Hydropower Station is 1.5 million kw, which is on the 6th level of the cascade hydropower stations on the downstream of the Lancang River. The feasibility study report was finished in 1987. In March 1999 it has gone through the national examination. After many years' negotiation and joint previous stage work, in June 2000 during the period of Kunming Export Commodities Fair, China and Thailand both sides formally signed the

agreement to jointly invest to build Jinghong Hydropower Station, which set a precedent to directly make use of foreign funds to participate in shareholding to build huge hydropower station. Because of the regulation role of the reservoir, the downstream countries will benefit from the following aspects: flood control, agricultural irrigation, enhancing navigation capability, preventing seawater intrusion and the improvement of ecological environment. The total investment of this project is about US\$1 billion, the investment share of Thai side by private company is 70% and Chinese side is 30%. It was planned to start construction in 2006, put into operation in 2013 and transmit electricity to Thailand in 2014. The Energy Generation Authority of Thailand (EGAT) has listed the project of purchasing electricity from China in the long-term plan of electric power development, and encouraged to purchase electricity from China. By 2017 Thailand will purchase 3 million kw's electricity from China. In the Subregional Electric Power Forum organized by Asian Development Bank, the government of Laos expressed its support on Jinghong power transmission lines going across its territory. In 1996 the government of Laos and Thailand have signed Electric Power Cooperation Memorandum, which has solved the problem of electricity transmission lines going across the third country.

The transportation of Jinghong Hydropower Station is convenient; the geographic location and development condition is advantageous. It is located in the North of Jinghong only about 300 km from Chiang Rai of Thailand. It has favorable conditions to transmit electricity abroad and to introduce foreign capital for construction. It is the first project of Sino-Thai electric power cooperation, and also the biggest cooperative project between Yunnan and Thailand until now. The market prospect and potential to develop hydropower resources of Yunnan Province in order to transmit to Thailand is huge. China is actively supporting this project because it is beneficial to both sides. It not only can solve the electricity consumption problem of Thailand but also can push forward the economic development of Lancang River Basin. The significance of cooperation not only lies in energy cooperation but also in further pushing forward Sino-Thai economic cooperation.

5.2. Xiaowan Hydropower Station

The installed capacity of Xiaowan Hydropower Station is 4.2 million kw, which is on the 2nd level of the cascade hydropower stations on the downstream of the Lancang River. (The first level of the downstream is Gongguoqiao Hydropower Station with the installed capacity of 750,000 kw). The estimated investment is US\$2.27 billion. It was planned to start construction in January 2002 and put into operation in 2010. Xiaowan dam is the key control project of Lancang River cascade hydropower stations. It has good regulation function for many years, and the electricity generation profit is huge. After completion, it will make the dry season electricity generation amount of three hydropower stations on the lower reaches, namely Manwan, Dachaoshan and Jinghong, increase 2.7 billion kw.t.,

Xiaowan Hydropower Station is within 300 km from the load center of Yunnan Province. The electricity transmission distance to Guangdong Province is 1,500 km. It is a large-scale symbolic fundamental project to realize optimizing deployment of Chinese resources, and to implement the transmission electricity from the West to the East, the transmission of electricity of Yunnan Province to other places. It can ensure the balanced transmission of electricity to the East of China both in the rainy season and in the dry season. It is also the priority project to realize the sustainable development of Yunnan's economy and the West Region Big Development.

5.3. Nuozhadu Hydropower Station

The installed capacity of Nuozhadu Hydropower Station is 5.5 million kw, which is on the 5th level of the cascade hydropower stations on the Lancang River. The estimated investment is about US\$1.4 billion. It has gone through the national examination in 1998. It was planned to start construction in 2005 and put into operation in 2014 in order to transmit electricity to Thailand and other neighboring countries. The regulative storage capacity of Nuozhadu Hydropower Station is big. The electricity amount of the dry season is plentiful; what's more, the electricity power quality is superior, which means the electricity amount is plentiful and stable. The construction condition is very good. It is the key project of hydropower development on the downstream of Lancang River, which has regulation function for many years. It is also the main electric source of Yunnan Province to transmit electricity to other places.

The going into operation of Nuozhadu Hydropower Station can further strengthen the regulation capability of downstream cascade dams, and improve the quality of electric power supply, which means the voltage keeps stable. The electricity transmission distance between this plant and Chiang Rai of Thailand is about 400 km, and about 1,500 km from Guangdong Province, China. It is the important guarantee to supply steady and plentiful electricity to Thailand and Guangdong Province of China.

On the downstream of the Lancang River along Kunming-Bangkok Road, Ganlanba Hydropower Station with the installed capacity of 150,000 kw and Mengsong Hydropower Station with the installed capacity of 600,000 kw have also been planned.

The hydropower belongs to high-investment, high-output, capital-intensive and technology-intensive industry. It has the following characteristics: big investment for one time, long construction period, long duration after completion, low cost to operate, production without pollution, good comprehensive profits etc.. Now one of the main problems of Lancang River cascade hydropower stations' construction is the shortage of funds. China can't spare more funds to support Lancang River hydropower projects. Therefore, it is necessary to establish the mechanism to make use of electricity to nurture electricity. At the same time, it needs to further attract domestic and foreign funds to invest in hydropower development. China's hydropower should implement the following principles of "River Basin, Cascade, Rolling and Comprehensive Development". It is the inevitable requirement of market economy and also the summary of successful experience of some river basin development in the world. It is also the basic method to make full use of river resources to develop riparian economy. This principle is also the policy foundation of Lancang River Basin development. After the development of Manwan and Dachaoshan Hydropower Stations, the rolling development can be achieved as soon as the Xiaowan Hydropower Station is put into operation.

5.4. The Key Projects of Mekong River Hydropower Resources Development

The hydropower reserves of the mainstream and tributaries of Mekong River are about 58 million kw; about 33.17 million kw installed capacity is feasible in terms of technology and economy. Now eleven dams are under construction on the tributaries,

among which there are four within the boundary of Laos, four on the bordering area of Laos and Thailand, Laos and Cambodia, three within the boundary of Cambodia. The biggest one is the Nam Ngum Hydropower Station within the boundary of Laos with the total installed capacity of 1,500,000 kw. 80% of the electricity generated was exported to Thailand. The hydropower resources of Laos are important source to export electricity in order to earn foreign exchange. At the same it has brought huge benefit to the downstream development. The exploitable hydropower amount of Laos accounts for 40% of the total of the Mekong River Basin. Now fifty-eighty hydropower development plans have been made out with the total installed capacity of 10.7 million kw, which is attracting investors and introducing capital abroad. The electric power of Cambodia is scarce. It has scarce coal, oil resources but has abundant hydropower resources with the exploitable amount over 8 million kw. The Cambodian government regarded the hydropower development as an urgent task. At least seventeen hydropower projects have been listed as priority projects. The Asian Development Bank estimated that about US\$230 billion's investment is needed since Cambodia is lack of funds and needs to introduce foreign capital urgently. ADB will also provide funds and technical assistance to dam construction in Cambodia.

In 1970 the Mekong River Committee has planned fifteen cascade hydropower stations on the mainstream of the Mekong River. In the revised plan of 1987 the joint development of Chiang Khan and Lower Pa Mong (210m) were used to replace Pa Mong (250m). The plan has been changed to build eight cascade dams with the total installed capacity of 22.25 million kw, four on the mainstream of the Mekong River, four on the main tributaries. The Lower Pa Mong project will be the first development project of eight cascade dams. Pa Mong Dam is the mainstream project on the border of Thailand and Laos. It is situated 20 km above the upstream of Vientiane with the installed capacity of 4.8 million kw, which is the key project of Mekong River development, and has been studied for several decades. In the 1950's of the 20th century, it was the most important project on the mainstream, and the emphasis of Mekong River Committee's research. (See Map 5) The research report of 1979 indicates that the Pa Mong Dam would generate the following profits: it could not only irrigate 1.6

million hectares' lands of Laos and Thailand both countries and generate huge electricity, the huge storage capacity would play the role to increase the amount of electricity generated by downstream dams. Laos and Thailand could directly benefit from the aspects of electricity and lands. Thailand could benefit a lot from Pa Mong plan because Laos would export all its electricity shares to Thailand, which means Thailand could use all the electricity generated. Pa Mong Dam would also increase the downstream flow in dry season, improve irrigation and navigation, reduce downstream seawater intrusion, bring fresh water irrigation to about one million hectares' land of downstream, and build a "fresh water barrier" in the Delta to prevent seawater intrusion. Cambodia and Vietnam would benefit from the flood control in the rainy season and the increase of flow in dry season. Pa Mong project would make fishery production benefit from it. The construction of dam would cause an annual loss of US\$1 million of the fishery. However, the fish breeding in the reservoir would obtain an annual net profit of US\$3.5 million. The fishes provide 60% of the animal protein that the riparian inhabitants need.

It is a pity that the construction of the Pa Mong Dam will submerge 37 million km² land of Thailand and Laos, and result in the resettlement of up to 300,000 population. In 1987 the Mekong River Committee estimated that the dam needs an investment of US\$2.1 billion, the construction period will be 11 years, and the resettlement cost will be US\$488 million. However, the dam will not be permitted to be constructed before 2003. With the installed capacity of 6 million kw, Stung Treng Dam will be the biggest project on the mainstream of the Mekong River. The huge storage capacity will have great regulation function. Because of many reasons and the influence of many important factors such as capital and environment, the hydropower resources projects on the mainstream of the Mekong River have always remained in the planning period, and can't be implemented until now. Therefore, the hydropower development on the mainstream of the whole river basin can only be carried out in the Lancang River Basin⁷.

6. The Market Prospect of Lancang-Mekong River Hydropower Resources

The hydropower is clean reproducible energy with no pollution. With the process

of China's modernized construction and riparian countries' economic development, their demand for energy will certainly continuously grow. Different countries regard hydropower as important energy of the future and strengthen its development. The Lancang-Mekong River has abundant hydropower resources. Through cooperative development, the resources advantage can be converted to economic advantage. The hydropower has vast market prospect and obvious rationality.

6.1. The Chinese Market

First of all, the rolling development of cascade hydropower stations on the downstream of the Lancang River is the internal need of national economic development of Yunnan Province. The terrain of Yunnan Plateau is high in the west and low in the east. The landforms are high mountains alternated with gorges, which are typical "longitudinal gorges in the West of Yunnan Province". From the west to the east, three big high mountains and three big rivers range longitudinally from north to south. The Nujiang River, Lancang River, Jinshajiang River three rivers run paralleled to the south and form three big canyons. The vertical height from the mountaintop to the bottom of the canyon is 3,000 to 4,000 meters. The mainstreams of three rivers account for about 90% of the water resources of the whole province.

There are six big river systems running across Yunnan Province from west to east. Big and small tributaries form about 600 big or small rivers of Yunnan Province, among which Dulongjiang River-Irrawaddy River, Nujiang River-Salween River, Lancang-Mekong River, and Yuanjiang River-Red River are the four international rivers. The abundant water resources have become prominent advantage of Yunnan Province. What's more, the distribution is not only concentrated but also far-ranging. But the economic developed area, which makes up 66% of the GDP of Yunnan Province, is in the water-shortage area and moderate-water area. The per capita water resources of Kunming, the capital of Yunnan Province, is only 13% of the national average level, which is only equivalent to the average level of Israel, and caused the situation that the abundance and shortage of water resources coexist. In addition, the overall water resources development and utilization rate of Yunnan Province is low, which only reaches 15% of the exploitable amount. As a result, the contradiction of

supply and demand became obvious, which restricted the social and economic development of Yunnan Province, caused the deterioration of water ecological system day by day. The waterpower resources of the downstream of the Lancang River are in urgent need to be developed. The electricity supply of along the bank of Simao and Xishuangbanna Prefectures mainly depends on the hydropower of tributaries. In dry season the electricity is in great shortage. The living energy relies on firewood, which destroyed forests, and caused ecological and environmental pressure. Therefore, the government of Yunnan Province has proposed that in the West Region Development, it is a must to nurture the hydropower of Yunnan Province to make it become new pillar industry. The development objective of waterpower resources of Yunnan Province is to speed up the hydropower cascade development of the Lancang River Basin. It was estimated that during the Tenth Five Year Plan (2001-2005), the national economic development of Yunnan Province and electric power market needs newly installed capacity of 9.5 million kw. After repeated demonstration of many schemes, Yunnan should rely on rolling development the cascade hydropower stations in order to satisfy the growing demand for electricity. First, the construction of Xiaowan Hydropower Station can satisfy the load demand. Secondly, it is the need of transmitting electricity from the West to the East, the purpose of which is to adjust the electric power structure of China. In the East of China, especially the South China, there is very big demand for energy. Guangdong Province is the electricity big consumer of South China. In 1998 the electricity consumption amount reached 100.4 billion units, which was equivalent to the total amount of southwest four Provinces. In the period of the Tenth Five-Year Plan, a new increase of 15 million kw installed capacity is needed. The purpose to transmit electricity of Yunnan Province to the East has a bright future.

The developed countries in the world put priority on the development of hydropower. The development and utilization rate reached 50-80%. By comparison, China's hydropower development only reached 14%. The development and utilization rate of Lancang River Hydropower Stations of Yunnan Province is low. The installed capacity of finished projects only accounts for 5.5% of the planned capacity. At present 80% is thermal power in China. By contrast, the hydropower cost is low and the

environmental benefit is good, which can gradually substitute thermal power. In 1999, according to the statistics of Electricity Generation Authority of Yunnan Province, the average electricity price of Yunnan was RMB¥314 Yuan/kw.t, that is RMB¥314 Yuan/1000 unit. It is about 1.6 Baht per unit(RMB¥1 Yuan=5 Baht). The statistics also show that the electricity price of Thailand was RMB¥1220 Yuan/kw.t. That is to say, the electricity price of Thailand is about 6 Baht per unit. The price of Yunnan's electricity is about one fourth of that of Thailand, and one third lower than that of Myanmar and Vietnam. In addition, the electricity for Yunnanese civil use is 2 Baht/unit and while for commercial use is 4 Baht/unit. The Lancang River is one of the 12th big hydropower bases that China emphasized to develop (The biggest one is Jingshajiang River Hydropower Base). The Lancang River is also the main base of Yunnan Province to transmit electricity from the West to the East and to other places. The rolling development of cascade hydropower stations on the Lancang River is not only infrastructure construction but also resources development. It can expand domestic demand and promote economic growth, promote the economic development and social progress of ethnic areas of the Lancang River Basin, and realize the eradication of poverty and becoming rich. It will produce considerable social and economic benefits.

6.2. The Riparian Different Countries' Market

It was predicted that the current electricity installed capacity of Indochinese Peninsula five countries Myanmar, Laos, Thailand, Cambodia and Vietnam is 19.85 million kw. Until 2008 the installed capacity of electric power demand will reach 40.15 million kw, the gap is 20.30 million kw. By 2018 the gap between electric power supply and demand of five countries will reach 52.68 million kw, among which the gap of Thailand, Vietnam, Cambodia and Myanmar is bigger. The electric power demand of Thailand and Cambodia will be 300% and 670% higher than the current installed capacity, especially in Thailand where the industrialization level is higher and development speed is faster. Its economic scale and economic development level is much higher than the other four countries. Therefore the increase of electricity demand is very fast. The energy demand prediction material of the Secretariat of Mekong River Commission indicates that by 2020 electric power demand will concentrate in Thailand

and Vietnam. The energy shortage areas will mainly distribute in North Thailand and Bangkok, the Center, South, and West of Vietnam, as well as Phnom Penh area of Cambodia. The economy of Yunnan Province, Myanmar, Laos and Cambodia comparatively lagged behind and the economic scale is small. Therefore, the electric power demand is not much.

According to Energy Generation Authority of Thailand (EGAT), Thailand is a country where energy resources are scarce and electric power is not adequate. It is short of waterpower resources. The reserves are 10.62 million kw and 2.42 million kw has been developed. The remaining majority is not easily to be developed because of the existence of environmental and social problems. Originally it has been planned to build six nuclear power plants step by step. However, because of the strong opposition of the public, it cannot be implemented. At present, Thailand mainly relies on thermal power generation. However, relying on fuel oil, thermal power generation to increase the supply of electric power will become not to its benefit with the rising of crude oil price. It was estimated that the reserves of oil and natural gas will exhaust within 20 years. Therefore Thailand will increase the proportion of purchasing electricity from neighboring countries. According to the statistics of the monthly report of Bank of Thailand, now in Thailand there are 13 power plants, the raw material of which is oil, 8 natural gas power plants, 10 hydropower stations and 7 brown coal power plants. The main power plants are North Bangkok Power Plant with the installed capacity of 240,000 kw, the South Bangkok Plant with the installed capacity of 1.3 million kw, Bhumibol Hydropower Station with the installed capacity of 420,000 kw, Sirikit Hydropower Station with the installed capacity of 380,000 kw, Mae Glong Hydropower Power Station(360,000 kw), Mae Moh Brown Coal Power Plant(90,000 kw), Krabi Brown Coal Power Plant(60,000 kw), as well as Hat Yai Natural Gas Power Plant.

In order to solve the electricity consumption problem of economic development, Thailand has proposed the principle to combine domestic supply with foreign supply. The hydropower potential of Thailand and Vietnam is limited but the energy market is big. By contrast, Laos and Cambodia where energy market is small are endowed with

never exhausted energy. Thailand borders Myanmar, Laos, and Cambodia. Because of their weak economic real strength, the development of abundant hydropower resources of the three countries still remains in the starting period. What's more, if hydropower station is built in the middle and lower reaches of the Mekong River, the economic and technical index will be much worse than that of the Lancang River, and the negative impact will be bigger. At present Laos doesn't have the capability to develop its hydropower resources by only relying on its real strength. Consequently, Thailand's plan to purchase a great deal of electricity from Laos is difficult to realize. The electricity supply of Laos, Myanmar and Vietnam are transferring to rely on market abroad. The North of Laos is the area, which is short of electricity. In January 1999 the National Electric Power Corporation of Laos signed an agreement with Yunnan Electric Power Group Co., Ltd., to transmit electricity to the North of Laos. From 2001 electricity will be transmitted from Mengla Transformer Station of Yunnan Province to the North of Laos. The bordering area of Myanmar and Yunnan has imported considerable electricity from Yunnan Province in recent years. In the future 20 years Vietnam will also be faced with energy crisis. In the bordering areas of Yunnan, small hydropower stations will be built in order to transmit electricity to Vietnam.

In the future 20 years, the electric power demand of five countries on the Indochinese Peninsula will far surpass the current electricity generation capability. Because all the rivers, which flow into the five countries, originate in Yunnan Province, after entering peninsula the flow of water is stable and slow, and the electricity generation potential is limited. In order to make up for the gap between supply and demand, they will purchase electricity from Yunnan Province on a large scale. In fact to transmit electricity from Yunnan Province to five countries on the Peninsula is very reliable, which has resources and geographic advantages that other countries can't substitute. Therefore the hydropower market of Yunnan Province is very broad. It has important meaning for subregional six countries to cooperate to develop hydropower resources.

7. The Influence of the Development of Lancang-Mekong Hydropower Resources on Ecological Environment

Since 1960's of the 20th century, there have been many cascade hydropower development plans on the Mekong River Basin, which were opposed because of ecological and environmental problems. These plans were laid aside because of the strong opposition from international NGO. From 1993 onwards, the Asian Development Bank has been pushing forward GMS economic cooperation with great strength. The energy cooperation projects made slow progress because of the opposition from NGO of downstream different countries and international NGOs, organizations. The influence of hydropower development on ecological system and the water quality of Lancang River are two main problems that both China and downstream countries are concerned about. The water quality protection of Lancang River is also the key of environmental protection.

7.1. The Negative Influence of Lancang-Mekong River Cascade Hydropower Development on Ecological Environment

The Lancang-Mekong River cascade hydropower development will have a series of influences on ecological environment. Some of the most important influences are analyzed as follows. First, the influence on forest resources. Resettlement and the loss of submerged land are two main influential index of hydropower station construction. The direct influence of dam construction on forest resources is that the construction will submerge forest and land, and will make land living creatures migrate or disappear. The hydropower development on big rivers usually tends to design mainstream cascade development on upstream. Except from making use of the advantage of concentrated falls, it is for the reduction of migrants and the loss of submerged land. The mainstream of the Lancang River is mostly high mountains and gorges areas. The hydropower is concentrated. The submerged loss of dams is small, and has relatively smaller influence on land living creatures. After the completion of eight cascade dams on the downstream of the Lancang River in Yunnan Province, the total installed capacity will reach 15.5 million kw, which will submerge 10,000 hectares land and forest. Averagely every 10,000 km² only submerge five hectares' of land. The index is very superior even in the world. The dam will make 75,000 population resettle, result in the decreasing of forest coverage, a few rare and precious species of plants will disappear and have influence on

the livelihood of birds and creatures in the shrubwood of river valley. However, if dams were built in the middle and lower reaches of the Mekong River, the submerged area would be bigger, the loss of land greater and would have huge impact on the living creatures. In 1987 the Mekong River Committee has planned Luang Prabang, Chiang Khan, Lower Pa Mong, Stung Treng etc. eight hydropower stations on the mainstream of the Mekong River with the total installed capacity of 22.25 million kw. The huge electricity generation and irrigation function will produce huge social and economic benefits. But we can't be too optimistic about the negative influence on the ecological environment of the river basin. The Lower Pa Mong Dam project on the border of Laos and Thailand with the installed capacity of 4.8 million kw will submerge 3,700 km² land of the two countries and result in the resettlement of 300,000 people. Therefore until now the project has not been implemented.

The key of Mekong River development is the development and exploitation of water resources. The development projects include hydropower, irrigation and navigation etc.. In May 1989 the Mekong River Interim Committee comprising of Laos, Thailand and Vietnam emphasized that the development of water resources will bring destructive influence to ecological environment. They held that the comprehensive development projects of Mekong River mainstream will result in the submerging of good fields, and population resettlement. To dredge the river course will make the river change its course. The deforestation will endanger the livelihood of wild animals. The reduction of sediments will cause land salination, which will result in the deterioration of ecological environment of the whole Peninsula. Therefore, the comprehensive development of Mekong River can't make big progress until nowadays.

According to the report of Bangkok Post on February 2nd, 1995, which was entitled 'Savit: Dams will Not be Built for Power Production', Thailand's development plan to draw Mekong River for irrigating its Northeast had to be cancelled because of strong opposition from downstream countries Cambodia and Vietnam. Again Thailand planned to build Pak Mun Dam on the river mouth of the Mun River, which is the tributary of Mekong River in the Northeast with the installed capacity of 136,000 kw. The project was strongly opposed by the environmentalist and the local inhabitants,

which nearly evolved from demonstration and protest to violent conflict. After the completion of the dam, the inhabitants who have been influenced have struggled for nearly six years in order to get enough compensation. The result of Thailand's anti-dam construction movement has negative international and domestic influence on Energy Generation Authority of Thailand (EGAT). In early 1995, the Prime Minister's Office declared that 'for the sake of environmental protection', Thailand would 'no longer build dams for power production'. EGAT planned to purchase electricity abroad, through the import of electricity to export the environmental and social problems caused by dam construction to other countries. Its neighboring countries and Yunnan Province are in the candidate list⁸.

Secondly, the influence on fishery resources.

Generally speaking, the dam will dam up the natural channel of aquatic living creatures, result in the change of aquatic living creatures and the quantity of living creatures, and cause harm to the river aquatic ecological system. According to the statistics of the Mekong River Commission in 1997, there are 1,200 species of fishes in the Mekong River, among which there are 153 species in Yunnan Province, 650 species in Thailand, and 850 species in Cambodia. The migratory fishes mainly distribute in the downstream of the Mekong River. The dam project will cause the change of hydrology, silt, and water quality etc. water environment. It will influence the nutrient source of fishes and their habitat, and cause the change of ecological conditions of spawning. What is the most important is the obstruction of the resettlement of fishes, and the disappearance of migratory fishes. The fishes and algae in the reservoir will change to be the species, which adjust to static water environment. The development of more than ten hydropower projects on the tributaries in Laos will cause big influence on aquatic ecology and fishery. The dam on the mainstream of the Mekong River had larger influence on the resettlement of fishes. According to the conclusion of Mekong River Committee in 1992, dam construction on the mainstream of the Mekong River will cause fish output reduce 400,000 tons annually. At that time the environmental experts believed that the dam construction will bring too much change to ecological environment, and will also cause unfavorable influence to the agriculture on the plain.

Fishes are the main source of animal protein for millions of inhabitants in the lower reaches. Therefore, the influence of hydropower stations on the mainstream of Lancang-Mekong River on the river ecological system and local people's life has always been the concern of subregional international community.

Thirdly, the influence on water quality.

Water quality refers to the content of microorganism and silt in the water. At present, the water quality problem is mainly pollution brought about by silt and agriculture production. The silt problem, as the main problem of riparian water quality, has caused the attention of riparian countries and international communities⁹. The silt of Lancang-Mekong River is from two sources: first, the earth's surface erosion within the river basin, and second from the erosion of water on its riverbed. According to the analysis of hydrological material of the whole river basin, it was found that the silt problem is caused by deforestation on the mountains of the whole river basin, and by soil erosion. The consumption of living energy mainly relies on firewood. The upstream mountainous agriculture is deforestation and opening up wasteland. The rural energy structure mainly relies on firewood. At present the timber, which the riparian several countries' inhabitants use as fuel, is as much as 100 million m³. In addition to commercial deforestation, it has caused great destruction to the forest and worsened soil erosion. The sediment of silt made the electricity generation capacity of dams greatly weakened. If the future hydropower development can solve the energy problem of the riparian inhabitants, it will greatly promote economic and social development. In the meanwhile, it will protect the environment and safeguard the riparian ecological environment. Besides, because the cultivated land is wide and population is dense in the downstream, and the consumption amount of pesticide is much, the chemical fertilizer and pesticide are important pollutant source of groundwater. The pollution of groundwater will further result in the spread of disease.

7.2. The Unfavorable Influence of Lancang River Hydropower Development on the Downstream Mekong River

The water amount flowing out of China will be reduced during the reserving water period of Xiaowan and Nuozhadu two reservoirs. However, the Lancang River water

amount only accounts for 16% of the total water amount of the Mekong River. In the future after the completion of eight cascade hydropower stations on the lower reaches of the Lancang River, to discharge water in turn can avoid the decreasing of water amount flowing out of China.

After the development of Lancang River cascade dams, fourteen artificial dams will dam up the river and form a series of reservoirs, which will bring deep changes to the river water environment (silt, water temperature and water quality) and aquatic ecological environment. Xiaowan and Nuozhadu two reservoirs are only 550 km and 100 km away from the border respectively. The fishes and algae in the reservoir will change to species, which adjust to static water. The low temperature water (increase and decrease 2 degrees) discharged by the tail water of large scale hydropower stations abroad will recover its natural state usually after 100 km up the flow path. Therefore the two dams might have certain influence on the aquatic living creatures within 100 km in the upstream off the Mekong River outside China and agricultural products, which were directly irrigated by the channeled water. The movement scope of some tropical fishes might become smaller.

China's research result indicates that the Lancang River hydropower development basically has no unfavorable influence on the water amount, water quality, water temperature and aquatic living creature etc. of Mekong River Basin. Furthermore, in the aspects of irrigation, flood prevention and navigation etc., there are many favorable factors. The Lancang River cascade development will not cause substantial harm to the silt alluvial change of the downstream Mekong River mainstream and the delta areas, as well as the diversity of fishes. The silt of Mekong River mainstream mainly comes from the North of Laos instead of from the Lancang River Basin. In short, the development of Lancang River cascade hydropower stations will have far more advantages than disadvantages to the middle and lower reaches of the Mekong River and riparian countries¹⁰.

7.3. The Lancang River Mainstream Cascade Development and The Downstream Development of The Mekong River

The hydropower development on the mainstreams of international rivers will have

both positive and negative influence on the society, economy, ecology and environment of upstream and downstream. The cascade hydropower stations are important projects, which can satisfy energy demand, irrigation and flow control. China's Lancang River development is prudent and has been testified by many parties. According to nearly 40 years' hydrological analysis and the simulated calculation of cascade hydropower stations, the construction of Lancang River cascade hydropower stations has obvious regulation function on the downstream Mekong River: in the rainy season it can reduce the volume of flow of flood peak, while in the dry season it can increase the flow volume and raise water level. This kind of regulation function has very good comprehensive benefits on the alleviation of downstream Mekong River flood, increase the dry season irrigation of Northeast Thailand and Vientiane Plain of Laos, improve navigation conditions and reduce the seawater intrusion. After the completion of Manwan and Nuozhadu dams, which have regulation function for many years and huge electricity generation profit on the downstream of the Lancang River, the regulation benefit on Lancang River natural flow will become more obvious. At present, the riparian different countries need to make joint research and reach common understanding, and eradicate misunderstandings.

7.3.1. The Lancang River Mainstream Cascade Development and The Navigation Condition Of The Mekong River

After the opening navigation of four countries' merchant ships, the river course above Vientiane within the boundary of Laos is still natural river course. Altogether there are 100 rapids, among them there are 54 bigger ones. Therefore only seasonal opening navigation is possible. The transportation amount is very limited. However, the river course dredgement project is a very big one. If Xiaowan and Nuozhadu dams were put into operation, they could raise the water level of river course in the dry season, improve navigation conditions, and raise transportation capacity. At present the Mekong River navigation channel dredgement project within Laos has cleared away some reefs, which obstruct navigation, and made the river flow speed in some river section become faster.

7.3.2. The Lancang River Mainstream Cascade Development and The Function

Of Flood Prevention Of The Mekong River Downstream

There are more important cities and paddy fields below Vientiane. Xiaowan and Nuozhadu two dams will reduce the volume of flow of flood peak, and alleviate the downstream flood disaster.

7.3.3. The Lancang River Mainstream Cascade Development and The Mekong River Delta

The low and flat land in the Delta is important grain base of Vietnam. In the dry season because of the reduction of river flow pouring into the sea, it often result in sea intrusion and makes a great number of fields salination. The regulation function of Xiaowan and Nuozhadu two dams can increase the river flow in the dry season. It plays obvious roles in preventing the seawater intrusion of Mekong River lower reaches. At the same time it can also increase the riparian agriculture irrigation water amount of the lower reaches.

7.3.4. The Lancang River Mainstream Cascade Development and The Water Quality Flowing Out of China

The reservoirs of Lancang River dams reserve water. After the upstream pollutants have been decomposed by algae in the reservoir and photosynthesis, the water quality flowing out of China will improve to a certain extent. A great deal of silt was dammed up in the reservoir, which could purify the water flowing out of the reservoir and reduce downstream riverbed silt.

7.3.5. The Construction of Hydropower Stations and The Environmental Protection

After the completion of eight cascade hydropower stations on the lower reaches of the Lancang River, every year it can reduce 37.4 million tons of fuel coal, therefore greatly reduce the discharge of SO₂, CO₂, waste gas, waste water and waste residue, reduce the formation of sour rain, and greatly improve environmental quality. The installed capacity of four planned cascade hydropower stations above Vientiane in Laos is 8.2 million kw. It can increase the electricity generation amount 3.3 billion kw.t and the benefit will be considerable. Therefore, the development of Lancang-Mekong River hydropower resources can reduce the construction of oil fuel power plants and thermal

power plants, which is favorable to environmental protection.

8. The Ecological and Environmental Protection Cooperation in the Comprehensive Development of the Lancang-Mekong River

After the history has entered the 21st century, the Lancang-Mekong River, as the common wealth of the riparian six countries, obviously can't remain in a natural state. In GMS economic cooperation, the six countries should jointly participate, develop, utilize and protect water resources.

It is important to exert the Mekong River's economic and social benefits in order to satisfy the current economic development demand of different countries, on the other hand, to pay attention to ecology, environmental protection, and to give consideration to the long-term benefits of different countries. In the development of big river, it is necessary to tend to profits and avoid harms and march on the way of sustainable development.

8.1. The Current Environmental Situation of the Lancang-Mekong River Basin

The Lancang River Basin is about 91,000 km² in Yunnan Province, which covers 23% of the total area of Yunnan Province. Altogether there are 8 prefectures and 39 counties within the river basin, where many ethnic groups live together. The population is 1.86 million, accounting for 26% of the total population of the province. The hydrological, mineral, biological, tourism etc. natural resources are very abundant. It is the area with the most abundant biodiversity in the world. The whole river basin is mainly mountains with little arable land. The forest coverage rate is 46%, which are mainly in the downstream area. The soil erosion is serious in the middle reaches. There are three earthquake belts, which belong to strong earthquake popular area and high altitude area. Avalanche, landslide, mud-rock flow etc. disasters frequently strike.

It is mainly agricultural economy within the Lancang River Basin; the industrial production scale is small. At present, the whole river basin is still in the closed and backward agricultural society. The grain yield is lower than the population growth. Therefore, the extensive cultivation mode is taken to yield grain. The excessive cultivation, deforestation, opening up waste land have resulted in soil erosion and forest destruction etc. a series of ecological and environmental problems, influenced the

benefit of cascade hydropower stations on the Lancang River, their fixed years of operation and navigation, which in turn restricted the development of local economy. It formed the vicious circle of the more reclamation, the poorer; the poorer the more reclamation. Therefore the economic development of the Lancang River must change slash-and-burn model, adjust agricultural structure, construct high-output, high-quality, highly-effective modernized agriculture, establish coordinated, sustainable development model between ecological environment and economy, which is the only path for riparian people to change from poverty to having enough food and clothing, from having enough food and clothing to comparatively well-off. To protect and improve riparian environment is an important issue for study for Lancang River Basin development.

The upstream of the Mekong River flows through the Northeast of Myanmar, the North of Thailand and Laos etc. poverty and backward areas. The primitive mode of production of slash and burn of mountainous ethnic groups, commercial deforestation, and opening up wasteland has made the forest coverage rate of the middle reaches decrease and soil erosion. Below Vientiane the terrain is flat. The downstream Cambodia and Vietnam two countries are in severe shortage of water conservancy facilities. In summer the flood will submerge large areas of agricultural fields, which will make fertility decrease. The chemical fertilizer will pollute the water quality. In the dry season the sea intrusion of Mekong River Delta will cause soil salination.

The Lancang-Mekong River Basin is a multi-ethnic area where more than 50 ethnic groups inhabit. Multi-ethnics and multi-culture coexist. The industry is not developed in the river basin and industrial pollution is little. Most areas are in backward agricultural society, which are undeveloped areas. Nowadays the development level of the river basin is low where the exploitation of natural resources is not adequate. The export products are mainly agricultural and forest raw materials and prime products with low added-value; the advantage of natural resources has not been converted to economic advantage. There remained low productivity and low-income level. Therefore the economy lagged behind, the resources destruction is serious and the environment tended to be worsening. The whole river basin is in a vicious circle.

Resources and environment are in degradation. It is necessary to adjust the current resources development model. The problem in the resources development is the result that the whole river basin development hasn't been conducted. With the implementation of GMS projects, it is expected that the Lancang-Mekong River Basin will take on a new look through the continuous efforts of the riparian countries.

8.2. The Reasons That Caused Environmental Problems of the Lancang-Mekong River

There are many reasons that caused environmental problems of the Lancang-Mekong River. According to Professor He Damin, some of the most important reasons are as follows:

First, natural factors. The geological structure movement in the Lancang River Basin is active so that earthquake disasters are frequent. The landforms that high mountains and gorges alternate with each other made the climate complicated, which resulted in natural disasters and severe soil erosion within the river basin. There are landslide, mud-rock flow and soil erosion etc. many kinds of natural disasters in this region, among which soil erosion easily resulted in environmental disputes between the downstream countries and China concerning.

Secondly, human factors. All the countries and areas within the river basin are not developed. The traditional development model is characterized by large consumption of resources. The population growth enlarged the demand for grain and energy, resulted deforestation, and made the vegetation suffer serious destruction. The soil erosion worsening will make the natural disasters intensified. The traditional development model destroyed ecological system by human force.

Thirdly, the influence of waterpower resources development on environment is mainly the reservoir submerging, resettlement as well as the influence of project construction on aquatic ecological system, land system and land utilization. The water reserves of dams caused the changes of hydrology, silt, water temperature, water quality etc. water environment, which resulted in the change of aquatic living creatures and the their amount.

Fourthly, the influence of tourism resources development on environment. The

construction of excessively too many unreasonable tourist facilities will destroy ecological system. The tourist garbage and waste will pollute water body and environment.

8.3. The Main Content of GMS Environmental Protection Cooperation

The environmental protection cooperation is one of the eight areas of GMS economic cooperation. From the 1960's of the 20th century, the Asian Development Bank actively pushed forward the cooperation of subregional countries in the environmental protection area and set up environmental working team. By April 2000, six working team conferences have been held. The main content of environmental protection cooperation are as follows:

- (1) To cooperate to conduct the construction of shelter belt system of the Lancang-Mekong River Basin. Under the precondition to protect and utilize current resources, to promote the ecological benign circulation as the center, to cooperate to conduct overall planning and implement the construction of shelter belt project, to eliminate barren mountains and prevent soil erosion.
- (2) To cooperate to conduct research on earthquake, landslide, mud-rock flow, and serious natural disasters. To establish joint prediction, forecasting system. Through disaster management and information exchange to realize disaster prevention and disaster reduction of Lancang-Mekong River earthquake belt.
- (3) To cooperate to establish Lancang-Mekong River environmental monitoring and information system. It is necessary to establish environmental monitor and information network of the whole river basin. The riparian different countries should establish hydrological monitor station on the mainstream of the Lancang-Mekong River and relevant sections of main tributaries. To map out water quality and water quantity standard of the whole area, and further establish network to exchange information in time, which is helpful for riparian different countries to enjoy rights, interests and perform their duties equally and reasonably.

8.3.1. Solution and Strategies

Concerning the environmental protection issue, according to GMS Economic Cooperation Mechanism, the following solutions should be taken: to map out

sustainable development strategy and plans of Lancang River Basin within the boundary of China; and to map out comprehensive utilization plan of Lancang River water resources. China is in the upstream or head of four international rivers. The environmental situation is related to the whole subregion, which made China faced with great pressure in environmental sector. As a responsible big nation, China pays much attention to environmental cooperation. The environmental problem is an international hot issue. Based on the common consensus on subregional environmental protection cooperation, China will introduce more funds for subregional environmental cooperation, jointly prevent, forecast earthquake etc. natural disasters and prevent soil erosion. The downstream countries have been very concerned about China's development of Lancang River hydropower resources, which might cause changes of water amount, silt amount, water quality and biodiversity etc.. Therefore to establish ecological environmental monitoring station can not only conduct water quality, hydrology etc. routine monitoring, but also possess the ability of weather observation, vegetation, aquatic living creatures and ecological environment monitoring. The environmental information system, which can comprehensively reflect river environmental situation, will become an important component part of the environmental information network of the Lancang-Mekong whole river basin.

It is necessary to conduct hydropower multi-purpose development in the whole river basin, and concentrate the hydropower development of mainstream on the Lancang River, and concentrate the hydropower development of the tributaries on the Mekong River, to cancel the mainstream cascade of downstream Mekong River, to implement regional electricity grid, form the advantages supplement of electric power demand and supply, which can not only satisfy the regional energy demand, reduce the negative influence of dam construction on ecology, but also can reduce big investment and migrants relocation, reduce land submerging and destruction of land aquatic ecological system. In addition it can promote irrigation, improve navigation condition, reduce soil salination, and bring obvious social, economic and ecological benefits to the riparian different countries¹¹.

WATER TRANSPORTATION COOPERATION: THE LANCANG-MEKONG RIVER FOUR COUNTRIES' MERCHANT SHIPS FORMALLY OPENING TO NAVIGATION

On June 26th 2001, China, Laos, Myanmar and Thailand held grand ceremony to celebrate Lancang-Mekong River four countries' merchant ships formal opening to navigation. From then on four countries merchant ships can navigate on the 897 km channel between Simao Port and Luang Prabang. The ships can call at any of these 14 ports on the channel freely, load and unload goods and transport passengers without paying any tax or fees. Favorable treatment has been given in dealing with entering and leaving the port formalities and service, which has achieved the goal of joint development and common benefit, joint protection and common prosperity.

The 14 ports are: Simao, Jinghong, Mohan, Guanlei of China, Bansai, Banxiangguo, Mengmo, Wanbalun, Huei Sai and Luang Prabang of Laos, Vienjing and Vienbeng of Myanmar, Chiang Sean, Chiang Khong of Thailand.

1. Ten years' continuous efforts led to the formal opening to navigation.

Lancang-Mekong River links up six countries. It has multi-functions such as trade, tourism and transportation passage. In addition it has the multi-nature of inland river, boundary river and international river. It is the only natural water course from Yunnan Province of China to Indochinese four countries. From the ancient time "The Danube of the Orient" has been a natural bond, nationalities' corridor and economic passage, which links society, economy and culture between Southwest China and Southeast Asia closely. After the WWII, the riparian five countries have developed and utilized Mekong River navigation to different extent. The middle and lower reaches of the river have become the water transportation artery of Laos, Thailand, Cambodia and Vietnam etc. countries. Because of the international and domestic reasons, the upper reaches of the Mekong River and the navigation development of the Lancang River within the boundary of China has not started yet.

In the 1970's of the 20th century, Yunnan Province opened the 292 km channel from

Nandeba Port, Simao to No. 243 boundary marker of Chinese and Burmese border. With the deepening and expanding of China's reform and opening up, Yunnan Province started Lancang-Mekong River international navigation development. In the 1990's of the 20th century, Yunnan Province has dredged three sections of the river course: Nandeba---Xiaoganlanba 104 km, Xiaoganlanba---Jinghong 85 km and Jinghong---Sino-Burmese boundary river 31 km river course. At present, this river course has reached the standard of the sixth grade navigation channel. 100 to 150 tons' motor-driven ships can navigate on the river throughout the year¹².

At the end of the 1980's and the beginning of the 1990's, the Indochinese Peninsula has entered a peaceful period. The relations between China and Southeast Asian countries have been comprehensively normalized. Economic reform and opening up to the outside have become international trend. The economic and trade cooperation among riparian countries developed fast. The Lancang-Mekong River's international navigation has been proposed to agenda again. In August 1990 the basic principles set by Yunnan Province were "first opening to navigation; second unobstructed, from near to far, from small to big, increasing gradually". The Lancang-Mekong River international navigation has changed from envision to reality, which has experienced more than ten years and several periods.

1.1. The Period of Joint Trial Voyage Inspection Made by China and Laos (May, 1990 to December, 1992)

From May to November 1990 China and Laos jointly made empty ship investigation on the 700 km's river section from Jinghong Yunnan Province to Luang Prabang during the dry season (May-June). They also made the trial voyage loaded with goods on the 1172 km's river course from Jinghong to Vientiane during the rainy season (Oct.-Nov.). Both investigations were successful. It has been proved that Lancang-Mekong River navigation is feasible. 60 tons cargo ships can navigate on the natural river course. After a little dredgement, 100 tons cargo ships and passenger ships can navigate on the natural river course¹³.

In August 1992 eight ministries and committee of China have jointly made investigation on Lancang River and proposed 13 pieces of advice on the

Lancang-Mekong River development. In December 1992 China and Laos signed the Lancang-Mekong River Temporary Opening to Navigation Agreement, which raised the curtain of Lancang-Mekong River international navigation.

1.2. China, Laos, Myanmar and Thailand four countries conducted multilateral cooperation; the international navigation was becoming more matured (December 1993 to June 2001)

From 1993 the process of the four countries' joint development of Lancang-Mekong international navigation was becoming faster and faster. From February to May 1993 the four countries collaborated to make investigation on the 263 km river section from Guanlei Port Jinghong to Chiang Sean Port of Thailand in dry season. The four countries' experts, engineers and technicians have finished their investigation, measurement, research, and dredgement on 100 reefs rapids, which obstruct navigation. On the basis of their work, they have finished joint research report. The conclusion is that there aren't rapids in this river section, which obstruct navigation in dry season. After the main rapids that obstruct navigation have been dredged, 100 to 150 tons of motor-driven vessels can navigate throughout the year. After further dredgement, 300-tons vessels can navigate throughout the year¹⁴.

In August, September 1994 the four countries made joint investigation on the transportation situation of 786 km river course from Xiaoganlanba, Simao to Luang Prabang Laos, which has strengthened their mutual understanding and their confidence on joint development.

On April 20th, 2000 after many years' joint discussion and difficult negotiation, the four countries' government finally reached consensus and formally signed the Four Countries' Lancang-Mekong River Opening to Navigation Agreement. They decided to develop 897 km chanel from Simao Port to Luang Prabang and 14 ports. The agreement would take effect after one year, which would make one-day outbound tour from Simao, Jinghong to four countries become possible, and the freight transportation to go there and back in three days become reality.

In November 2000 Chinese Prime Minister Zhu Rongji stated that the Chinese government would provide US\$5 million special funds to help to dredge the Mekong

River navigation channel within the boundaries of Laos, Myanmar in order to ensure the smooth opening to navigation of Lancang-Mekong River¹⁵.

2. The Navigation Channel Improvement Project on the Upper Mekong River

After several times' investigation in dry season and rainy season, large amount of materials have shown that the natural condition of this whole river section is good. The riverbed is stable with plenty water supply. The river flow is small. The depth of more than 90% navigation channel in dry season is over 3 meters. The river course slope is stable and the current is stable, which is advantageous to develop international navigation and of great development value.

The key point that influenced formal opening to navigation is the channel dredgement. The emphasis should be put on the improvement of 331 km river section from the No. 243 boundary marker of Chinese, Burmese border to Houei Sai Laos. This is the worst section among the river sections that opened to navigation, which belong to natural river course. Altogether there are 100 rapids, among which there are 54 bigger ones. There are more obvious reefs, hidden rocks, and the current is disorder. For more than half of a year it is unable to navigate because of many reefs and rapids. From the four countries trial navigation in 1993 to the present time, about 50 sea loss accidents have happened on vessels, which brought about severe property loss and personnel casualties of crew of the four countries. Among ten times' recorded boat sinking sea accidents, 9 times were striking reefs. The places where 70% of these accidents happened are in the upper Mekong River course.

After the four countries' transportation ministers have formally signed the Four Countries' Agreement on April 20th, 2000, they have also signed the agreement to blast the reefs of the Mekong River, and to channel the upstream of the Mekong River so that 500-tons up vessels can pass through.

In November 2001 the four countries' navigation channel, environmental protection and border experts have made joint investigation on blasting reefs and dredging project from No. 243 boundary marker to Houei Sai Laos 331 km river course.

The purpose to develop this river course is to improve the international navigation

of the four countries, facilitate trade and tourism industry, strengthen the cooperation of merchant ships, ensure the safe navigation of ships, reduce property and life loss, reduce the fuel oil leaking pollution caused by the accident. This project is favorable to the sustainable development of the Lancang-Mekong economy. It will stimulate the tourism industry and trade development between the Southeast Asian four countries and other countries. In the meanwhile, it will provide more employment opportunities to the local people, and raise the life standard and life quality of the riparian countries' people.

The upper Mekong River navigation channel improvement project was funded by the Chinese government, so that 100-150 tons of vessels can navigate freely from Simao Port, China to Luang Prabang, Laos in 95% time of a year. According to the experts' research and estimation, the whole navigation channel improvement project needs to blast 30,000 m³ on the water and nearly 40,000 m³ under the water, and construct 40,000 m³ dams. It is necessary to install 100 buoys, 106 signal boards, purchase navigation mark boat, and set up 4 rapids stations. The total investment is about US\$4 million¹⁶. The experts believe that the navigation channel improvement will not influence the flow itself, its direction, and national boundary. They have also proposed detailed plan on navigation channel improvement. The whole project was divided into three periods.

The first period improvement project was implemented from November 2000 the dry season to May 2001 the rainy season. In order to ensure the four countries' opening navigation ceremony proceed safely, it is a must to blast and dredge 11 rapids that seriously obstruct navigation and 10 places of scattered reefs in the 331 km river section from No. 243 Sino-Burmese boundary marker to Houei Sai that the navigation must pass through before May 2001. The technology of eradicating obstacles projects is feasible, the construction is simple, the period is short, and the investment is little while the effect is obvious. The river section of eradicating obstacles is mainly in the Laos side of the Laos-Burmese boundary river. The plan of eradicating obstacles of river section was decided after the on-the-spot survey and design, discussion made by the four countries' experts.

The second period of improvement project was continued in December 2001 the dry season and was finished in April 2003. The project has eliminated 51 rapids of this river course so that 300-tons cargo ships can navigate about 11 months in a year. According to the report of China Daily on 20th April, 2003, after the completion of the upper Mekong River navigation channel main body improvement project on April 15th, China, Laos, Myanmar and Thailand four countries' experts all hold that the quality of the whole project is very good. The construction speed is quick and it has reached the requirement of security and environmental protection. The strict environmental measures taken by China during the construction process has been highly praised by the four countries' experts and riparian inhabitants. After making investigation, the observers of both Vietnam and Cambodia believe that the navigation channel improvement project will not cause negative influence on environmental protection of lower reaches countries.

The third period plans to dig this river section deeply so that 500-tons cargo ships can navigate about 11 months in a year.

After the investigation, measurement, many times' research made by the four countries' government, and nearly ten years' vessel trial voyage transportation, it has provided reliable technical material for navigation channel improvement and eradicating obstacles. In April 2001 the four countries established the environmental appraisal and detailed survey expert teams of improving navigation channel. They entered the spot to measure and collect hydrologic information in detail. The two expert teams have finished the Environmental Impact Appraisal (EIA) report, survey and design reports by the end of August 2001. In September 2001 the reports have been submitted to the four countries' government to be examined and approved. Then the reports have been approved by joint coordinating committee.

As mentioned in the previous page, the practice proves that the implementation of the upper Mekong River navigation improvement project will not have long-term negative influence on the surrounding environment. The blasting and dredgement will not change the direction of water flow and flow amount. It will not cause new scour to the cliff on the both banks and will not cause collapse. Therefore it will not affect the

territory and boundary of the two countries. On the contrary, because the navigation channel has been dredged and the flow condition has been changed, it will also alleviate the scouring pressure of the current on the soil on both sides of the river. It will play the role of protecting land. After the completion of improvement project, it will greatly improve the conditions of opening to navigation. It will safeguard the safe navigation of ships, reduce the loss of property and the personnel casualty, and reduce the fuel leakage pollution cause by the sea loss accidents of the ships. After having being improved, the navigation channel will reach 5th grade standard, and 100 tons motor-driven vessels can navigate on the river throughout the year, which will greatly promote the economic cooperation and development of Lancang-Mekong River Basin.

3. The international navigation is from starting point to taking off period, which has a bright prospect.

After 10 years' efforts, the Lancang-Mekong River's international navigation grew out of nothing, from small to big and it is developing at a steady speed. Different countries can benefit from it and it can promote the development and utilization of other resources. The domestic and foreign investors have gained good economic profit in participating in international navigation. The benefit rate of investment is usually around 40%. The navigation and shipbuilding industry are becoming investment hot spot. In 1990 the trial voyage transportation amount was just 450 tons. However, in 1999 the freight transportation amount reached 150,000 tons and the number of passenger transported was 30,000 person times. The enterprises, which participated in navigation, have developed from one to 21. The vessels that participated in international navigation have increased from more than 30 in 1996 to 140 up in 1999.

Thailand, Laos, and Myanmar three countries expressed active attitude on international navigation. Thailand has invested nearly 500 million Baht in Chiang Saen etc. to build harbors, bonded warehouses, and many luxurious passenger ships. Thailand has invested several hundred million Baht to open the transnational tour among four countries. It will make use of water transportation combined with land transportation to make the "Golden Triangle" become regional tourism center. More than 100 10-20 tons small boats of Laos, Myanmar and Thailand have sailed on the

Lancang River. Above Houei Sai, Laos has newly built and improved four roads, which extend to the Mekong River. It will list Momeng Port as the national key construction project. Myanmar also has four roads extending to the Mekong River side. It also built Wanbeng, Xiangla, Nanyong River Mouth and Nanlei River Mouth four ports. There are about 60 transportation ships of the three countries to participate in the international navigation.

In 1993 the Simao Port of Yunnan Province has built harbor service building according to the first grade port of national standard. It has built No.1 and No.2 warehouses and built the road to link the port. Until now Simao Port is the port with large construction scale, and completed facilities, which enjoys high reputation in Thailand. In 2001 four docks, four shipbuilding plants and seven shipping companies have been built. There are altogether 43 big and small vessels, which mainly deal with freight transportation and the passenger transportation as complement.

The Jinghong Port of Yunnan Province is an international port, which mainly deals with passenger transportation and the freight transportation as complement. It is 87 km away from Simao Port above and 73 km from No. 243 boundary marker of Myanmar below. In Lancang-Mekong River international navigation, the Jinghong Port has become important transportation hub. In 1999 there were 67 passenger ships and cargo ships and the inbound and outbound passenger number via Jinghong Port reached more than 30,000 person times.

The important dock of Jinghong Port, Guanlei Port is in the middle part of the Lancang-Mekong River junction. It is 83 km from Jinghong Port and 251 km from the Golden Triangle. It is 318 km to Houei Sai of Laos, Chiang Khong of Thailand. The modernized Guanlei Port has been reputed as the "Golden Port". More than 100 cargo and passenger ships can call at the port. There are average 5 foreign ships that get in and out the port everyday.

After China has entered into WTO, the tariff barrier will be torn down or the tariff rate will be reduced, which stimulated the world economic integration. Chinese products have been exported more abroad and the foreign commodities will also crowd into the Chinese market. The increasing flow of different countries' people, goods and

materials will greatly stimulate the development of navigation etc. transportation industry and bring new opportunities to the port economy. Secondly, the vessels, which berth at the ports, are exempted tax and fees mutually. The transportation cost will be further reduced and the profit will further increase. The Lancang-Mekong River is the most convenient passage for west Yunnan Province to link with Southeast Asia. After the opening of international navigation, the transportation of goods and materials from Yunnan Province to Southeast Asia will reduce 3,000 km in distance, five sixth times, and 60% transportation fee than the roundabout transportation via ports in South China. The goods can be transported from Chiang Saen, Chiang Khong ports of Thailand via short-distance roads to Chiang Mai, and then they can be transported to Malaysia and Singapore by railway. It can also be transported from Mae Sai of Thailand to Tachilek Myanmar, and further transported to eastern cities such as Keng Tung, Dongchi of Myanmar. The cost of international navigation is low. To develop trade transportation can earn US\$6.5 million more every year. To develop tourism can directly earn foreign exchange of more than US\$45 billion. The social effect is bigger and all four countries can benefit from it¹⁷.

The Lancang-Mekong international navigation is transforming from starting period to developing period. It is playing the role of "Golden River Course". In ten years' navigation development, it is the four countries' small border trade that is playing the main role. The import and export goods are mainly agricultural products, by-products and some light industry products, household appliances. China's export products are mainly temperate zone fruits, the cargo transportation amount of which is 60% of the total amount. Apples and pears are large amount of products. In addition, there are garlic, dried hot pepper and dried mushrooms. Articles of daily use, small household appliances, and small machineries occupy 20% of the transportation amount. Textile and cloth make up 10%. The construction materials account for 5%. The import products are mainly tropical fruits. There are Thai longan, litchi, mango, as well as articles for daily use, costume, preserved canned food etc. Also there are rubber, dried rubber chip and timber from Thailand, Laos and Myanmar. In the recent two years, Thailand has a large demand for the oxen of Yunnan Province. Annually the export

amount is about 10,000. Large-scale oxen market will be built in Simao Port. To raise the oxen can make the local peasants out of poverty and become rich. There are one kilometer's long apples and tea wholesale market and food stands along the Mekong River of Chiang Saen. The commodities were transported through the Lancang-Mekong River. On one side of the Golden Triangle, the Mengmo Port of Laos and Tachilek of Myanmar are selling Chinese commodities transported along the Mekong River. The quality of Yunnan products is stable and enjoys good sale in the north Thai market. Chiang Saen became prosperous because of Chinese ships.

4. The opening to navigation of the Lancang-Mekong River has important meaning.

As an upstream country, China has reached consensus with the downstream countries to make joint development and utilization of the Lancang-Mekong River in early time. And it is the earliest to realize that to conduct international navigation, solve the transportation problem that limited the regional economic development is the urgent task of Mekong River development and cooperation. From 1991, the four countries have started to utilize this river to conduct bilateral trial voyage transportation. After the opening to navigation of the four countries' merchant ships, there are the following meanings:

First, it has greatly facilitated the transportation contact between Yunnan Province and Myanmar, Laos and three peninsula countries. It made communication of both sides in human resources, goods, materials, capita, and information etc. become faster. The economic and trade relations have been greatly strengthened. Yunnan has changed from the end of opening up to the outside world to the front. It promoted Yunnan's opening up to the outside world, and made China and ASEAN two huge market approach each other further.

Secondly, the success of Lancang-Mekong international navigation has strengthened the four countries confidence in transportation cooperation set a good example for the four countries' future cooperation in road, railway construction etc., and strengthened Yunnan's determination in constructing international passages.

Thirdly, the opening to international navigation is favorable to the economic

development and communication with the outside for the riparian frontier where minorities inhabit. It will change the situation of inaccessible transportation and backward economy of the frontier region, and will be favorable to change people's moral ideas and promote social civilization and progress.

Fourthly, it is favorable to strengthen China's economic and trade relations with the Southeast Asian countries, promote China's opening up to the outside world, strengthen bilateral good-neighborliness and trustful partnership, and create a good neighboring security environment.

After the formal opening to international navigation, it is estimate that by 2010 the cargo transportation amount will reach over 1.5 million tons and the passenger transportation amount will be over 400,000, which has obvious economic and social benefits.

ROAD TRANSPORTATION COOPERATION: KUNMING-BANGKOK HIGHWAY WILL BE COMPLETED IN 2004

The upgrading and reconstruction project of Kunming-Bangkok Road is one of the priority cooperation projects of GMS economic cooperation led by the Asian Development Bank. It has been listed in the year 2000 cooperation plan of this mechanism. The reconstruction of Kunming-Bangkok high-grade road has been paid much attention to by the government of Thailand and China and has been supported by the Asian Development Bank. On April 20th 2000 China, Laos and Thailand three parties reached an agreement. They have decided to quicken the construction of Kunming-Bangkok Road in order to link it up before 2004, and make it become high-speed, high-grade transnational main line.

The Kunming-Bangkok Road is 1,800 km in total length. It consists of Chinese section, Laotian section and Thai section. In terms of international passage construction between Yunnan Province and Southeast Asian countries, the Kunming Bangkok Road is the project with least investment and shortest construction period. It is the most direct and convenient road passage for Kunming of Yunnan Province to link Bangkok of

Thailand. It is also the most important North-South Passage of GMS cooperation. Until now the low-grade road has opened to traffic. However, the reconstruction of high-grade road is under way.

The 704 km Yunnan section has been divided into 6 sections to be constructed. At present the 203 km Kunming-Yuxi-Yuanjiang section has been built to highway. In 1999 the 147 km Yuanjiang-Mohei section obtained US\$250 million loans from the Asian Development Bank. The construction started in 2000 and will be built to highway in 2003. The 71 km Mohei-Simao section has been built to second grade road in 1996. In 2003 it will be built to highway. The 97 km Simao-Xiaomengyang section has applied for US\$150 million loans from the Asian Development Bank, and has been listed in the 3 years loans' plan of the bank. Its reconstruction started in 2001. The 186 km Xiaomengyang-Mohan Port will be invested US\$600 million to be transformed to 2nd grade road.

The road section within Laos is 247 km in total length, which is from the No. 29 boundary marker of China and Laos to Houei Sai. Because the financial strength of Laos has always been insufficient, the road there has not been upgraded and transformed. The 62 km section from the No. 29 boundary marker of China and Laos to Namtha is 3rd grade road, which was supported to be built by China in 1960's of the 20th century. The 113 km section from Houei Sai, which is near the Thai-Laotian border, to Puka coal mine is 3rd grade road, which was supported to be built by Thailand. The 72 km section in the middle from Namtha to Puka coalmine is not a grade road. It is a soil road without road surface. In the rainy season, it can't handle traffic. In order to make Kunming-Bangkok Road link up as early as possible, China, Thailand and the Asian Development Bank have pledged to invest to help to build this road section. Each of them will undertake one third of the construction task. The three countries will organize construction respectively and complete at the same time.

The Kunming-Bangkok Road enters Chiang Khong from Houei Sai of Laos. Then it extends from Chiang Khong to Chiang Rai, Phitsanulok and Bangkok. The total length is 846 km, which is basically separated one-way highway. The road section is good and one can get to Bangkok within one day¹⁸.

The Kunming-Bangkok Road goes through Kunming, Yuxi, Simao and Xishuangbanna Dai Autonomous Prefecture, which are areas with most developed economy and great development potential in Yunnan Province. It extends through the areas with abundant waterpower, biology, mineral resources and tourism resources of Yunnan Province. It passes west of Laos, which will promote the development of five underdeveloped provinces with rich resources in the north of Laos. It enters Chiang Khong of Thailand from Houei Sai of Laos by going across the Mekong River Bridge. It extends to Chiang Mai, Chiang Rai, which are the economic center, trade and tourism cities of north Thailand. And then it goes to the economically developed central areas.

In 1998 the GMS ministerial meeting has proposed to develop the transportation passage to economic corridor, then construct to modernized economic belt. The Kunming-Bangkok Highway as a convenient passage will link Kunming, Laos and Bangkok together. It will make the economic and trade transactions between China and ASEAN change to road transportation-oriented. It can fulfill thousands of tons of transportation capacity and create considerable road transportation profits, and further stimulate the economic development along the line. The Kunming-Bangkok Road will become important North-South Economic Corridor of GMS. Different cities along the line will become big, middle or small economic centers of this corridor. They will play radiating roles respectively, and promote the social and economic development of West Yunnan Province, North Laos, North Myanmar, and North Thailand frontier areas. The Kunming-Bangkok Road connects the longest transportation artery-Asia No. 13 Road. It can reach Phnom Penh and Ho Chi Minh City. It will become part of Asian road network. The convenient transportation will promote the domestic and foreign tourism within the region. The Minister of Transport and Minister of Tourism of Thailand have expressed for many times that once the Kunming-Bangkok Highway opens to traffic, they will organize one to two million car times to visit China every year. Some Thai businessmen and entrepreneurs will drive to Xishuangbanna to spend their weekend.

Notes

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- ³ *Ibid.*, p.8.
- ⁴ *Ibid.*, p.12.
- ⁵ Yigan Li et al., The Cooperative Development between Southwest China and Lancang-Mekong Subregion (Kunming: Yunnan Nationalities Press, 2001), pp.128-129.
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- ¹¹ Lihui Chen, The Integrated Development and Management of International River Basin (Kunming: Yunnan Science and Technology Press, 2002), pp.103-108.
- ¹² Shilu Wang, "The Big Breakthrough of Lancang-Mekong River International Navigation Development", Southeast Asia 3 (2001), pp.30-36.
- ¹³ *Ibid.*, pp.37-45.
- ¹⁴ See The Cooperative Development between Southwest China and Lancang-Mekong Subregion, p.133.
- ¹⁵ Ping Li, "A Review and Prospect of the International Shipping on Lancang-Mekong River," Asian Studies 2(2002), pp.3-7.
- ¹⁶ Yigan Li and Yiqiang Mao, Yunnan Province and Shanghai Cooperated to Participate in the Lancang-Mekong Subregional Cooperative Research (Kunming: Yunnan Nationalities Press, 2001), p.223.
- ¹⁷ _____ "The Golden Waterway to Asia and Pacific," The Mekong River 10(2002), pp.25-29.
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CONCLUSION

It took me one more year from the selection of topic, collecting information, making repeated changes to the completion of the thesis. In order to collect information, I interviewed Mr. Supalak Ganjanakhundee on GMS economic cooperation in Bangkok, who is a journalist of The Nation. I have been to the Agency for Coordinating Mekong Tourism Activities (AMTA), which is subordinate to Tourism Authority of Thailand (TAT). In addition, I have been to the libraries of Thammasat University and Huachiew Chalermprakiet University. From March 8th to 9th, 2003, I attended the Conference on “Mekong Spirit” in Bangkok, which was organized by the Japan Center for Area Studies, National Museum of Ethnology of Japan.

In Kunming, the capital city of Yunnan Province, I have interviewed the directors and research fellows of the Southeast Asian Research Institute of Yunnan Province, Yunnan Institute of International Studies, and the International Relations Institute of Yunnan University. Professor He Daming, the Director of Asian International River Center of Yunnan University, has given me a lot of help and valuable information. In addition, I have been to the Lancang-Mekong River Research Association of Yunnan Province several times in order to collect information on the progress of GMS economic cooperation.

In short, through one more year's continuous effort, I have obtained all kinds of materials and information on the development and research of the Lancang-Mekong River from both the Thai side and the Chinese side. Most of these materials are closely related to Thailand and China's participation in GMS economic cooperation. But I have difficulty in collecting information about Myanmar, Laos, Vietnam and Cambodia four countries' participation in GMS. Neither do I have enough budget nor time to do field research in these countries. Therefore, the analysis on these countries is inadequate in my thesis.

In order to know about the current situation of border trade between Yunnan Province and North Thailand, I made one week field study on my own expense in

North Thailand in July this year. I saw more than twenty Chinese ships from Jinghong and Simao Port were berthed at Chiang Saen Port. The workers were unloading Chinese garlic, chili, dried mushroom from the ships. Then hundreds boxes of dried longan of Chiang Mai were loaded on the ships. The dried longan will be further transported to Jiangsu and Zhejiang Province of China via waterway, roads and railways. In the eastern and South China, the dried longan from Thailand is famous nourishing food, which sells well in the market and favored by Chinese consumers. Along the bank of the Chiang Saen Port, there is a commodity wholesale market, which extends about one kilometer's long. Most commodities are Chinese small articles of daily use transported by Chinese ships. The ripe apples and pears of Yunnan will be transported here and sold in the market in August. In order to cope with the daily increasing Sino-Thai trade demand, the new Chiang Saen Port Office Building will be finished very soon.

It is because I have selected Thailand and China in Greater Mekong Subregional (GMS) Economic Cooperation as the research topic that prompted me to read a lot of materials on GMS. Therefore, I had initial understanding in theory on priority cooperative projects, including Lancang-Mekong River international navigation, the construction of Kunming-Bangkok Road, Sino-Thai Electricity Power Grid Project etc.. In addition, the field study has deepened my impression on the "River of Trade".

During the last period of revising my thesis in September this year, I got warm help from the thesis committee members, especially Ajarn Pornpimon Trichot, the Assistant Director of Institute of Asian Studies, Chulalongkorn University. She has spared her precious time to help me collect more information and provided me very good advice. Owing to these teachers' guidance and encouragement, I can complete the thesis on schedule.

In the previous four chapters, I have made initial analysis and study on the situation of GMS economic cooperation from 1992 to 2002, which was led by Asian Development Bank and supported by the riparian six countries. Based on the above content, I think the following conclusions can be made:

First, it is an inevitable choice for the riparian six countries to participate in GMS

economic cooperation in order to develop their economy. GMS cooperative mechanism is a successful model to achieve common prosperity and development. The main condition for success lies in the fact that the financial support provided by the Asian Development Bank has made cooperation projects be implemented. On November 3rd, 2002, the first GMS Summit Meeting attended by leaders of the Greater Mekong Subregion was held in Phnom Penh, Cambodia. During the meeting, GMS leaders pledge closer economic and regional cooperation. The Prime Minister of Cambodia Hun Sen praised GMS economic cooperation and said during the past ten years GMS Program has played important role for the stability and development of the subregion. When the other regions and places experienced turbulence in recent years, GMS developed quickly and became a center of peace, cooperation and development. The six countries leaders also expressed their satisfaction to the progress made in transportation, tourism, energy cooperation etc.. area They all felt that China has provided more free support(funds, technology and manpower) mainly to the road building, bridge construction in Laos, Myanmar and Vietnam. The Chinese Prime Minister Zhu Rongji said that China is willing to participate in GMS economic cooperation in a more active posture in the future. The president of Asian Development Bank, Mr. Tadao Chino said the summit allows all of us to reaffirm our commitment to our share vision of creating a prosperous and equitable subregion in the countries that share the Mekong River. In the joint declaration made in the meeting, it states that "our most important achievement has been the growing trust and confidence among our countries, which has provided a favorable environment for trade and investment, economic growth and social well-being. Looking ahead, the GMS leaders underscored their strong commitments to "human resource development, environmental protection, the development of energy and telecommunication infrastructure linking the subregion, creating a favorable trade and investment climate and promoting tourism.

Secondly, Thailand and China's active participation in GMS economic cooperation not only complies with the historic trend, they have also played duty-bound role as greater power and big nation, which is in accordance with both

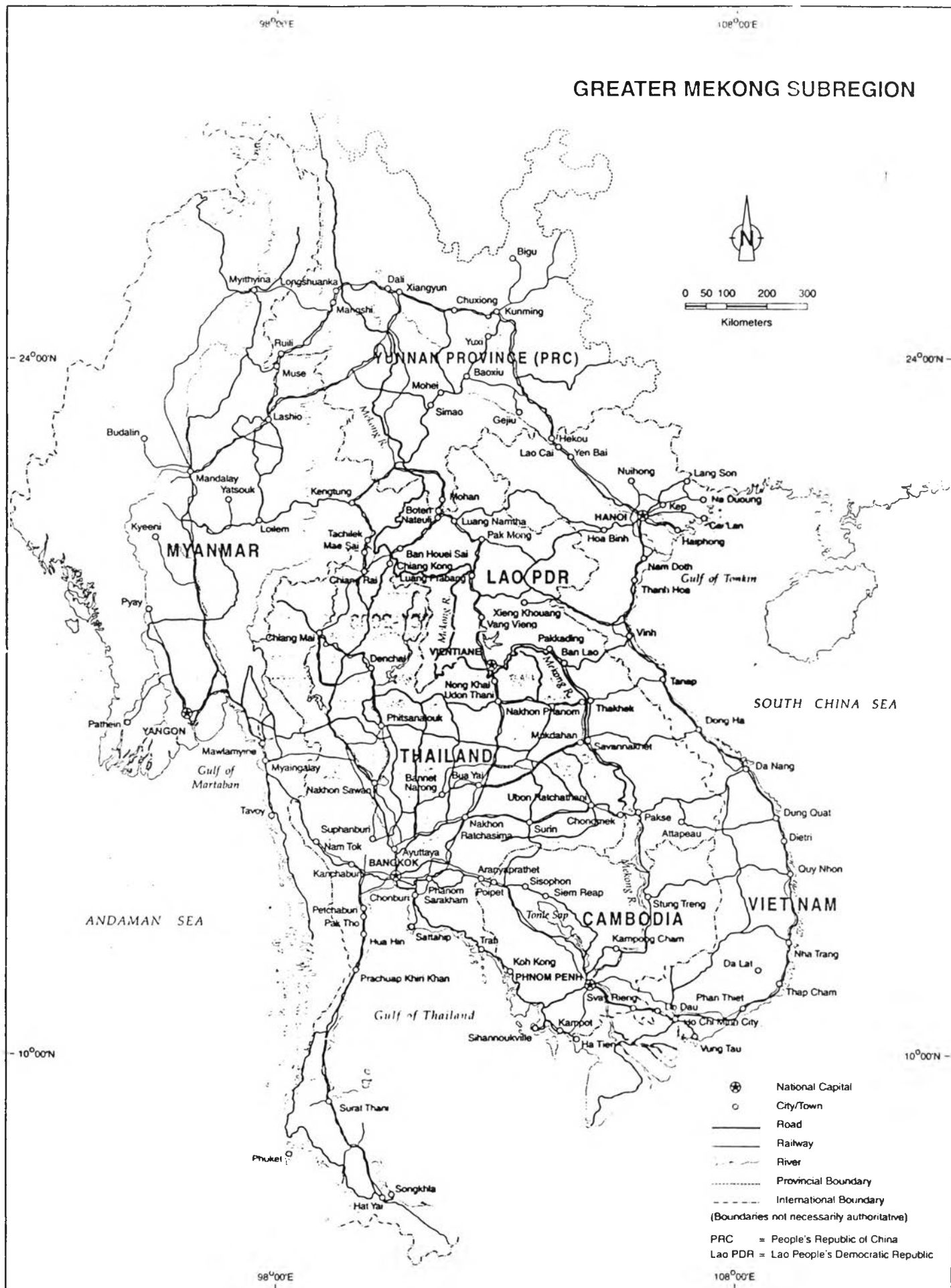
countries' national interest.

Thirdly, GMS economic cooperation not only has economic significance that many countries can benefit from it, but also has political meaning to safeguard regional peace, stability and security, which has strengthened the relations between China and ASEAN.

Fourthly, the cooperative development will make the riparian poverty regions to change from natural economy to modern economy and promote the progress of social civilization of the frontier regions.

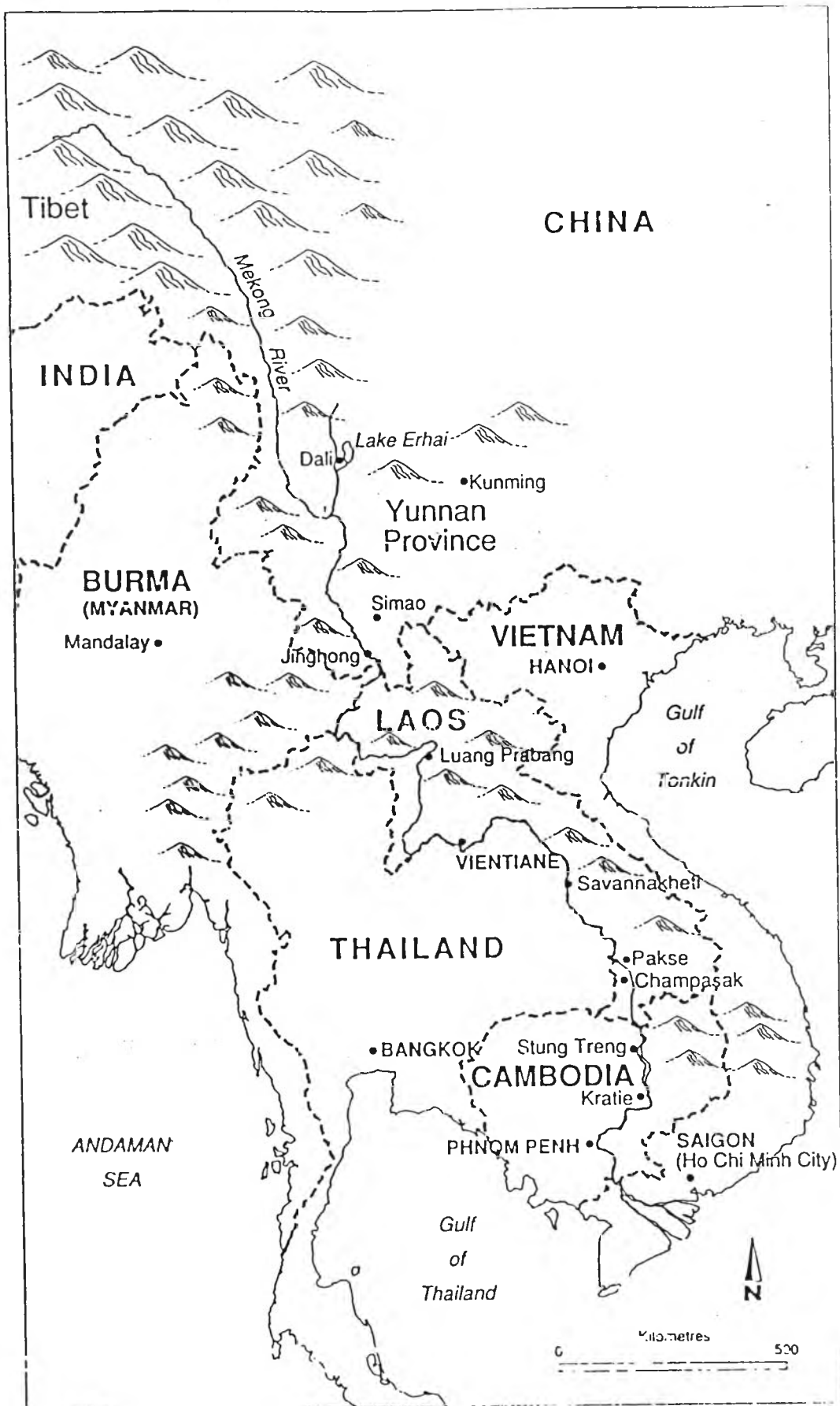
Fifthly, the formal opening of the Lancang-Mekong River international navigation and the completion of Kunming-Bangkok Highway will stimulate subregional economic vitality; spur on the development of Sino-Thai trade and tourism industry. In 2002 Thailand's Ambassador to China has expressed that the huge Chinese market has provided good opportunities for entering of Thai agricultural products, processed agricultural products and industrial products.

According to the Agreement made by the Thai and Chinese government, from October 2003 the tariff on some agricultural products of both countries will be reduced to zero. By then, it is expected that both countries' people's life will really benefit from it.



Map. 1

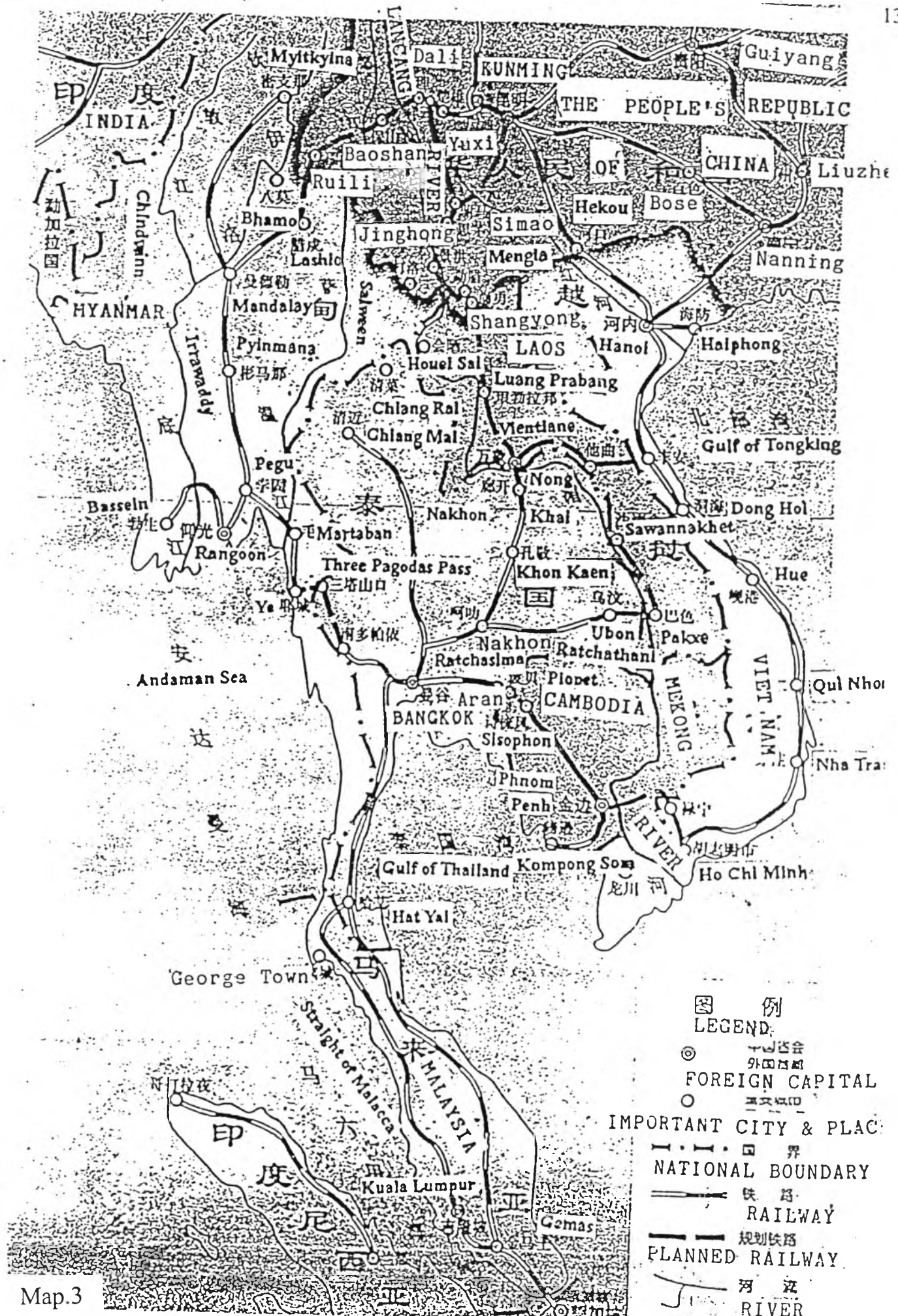
Source: Economic Cooperation in the Greater Mekong Subregion: An Overview (Manila: Asian Development Bank, 1999)



Map.2

The course of the Mekong

Source: *The Mekong Turbulent Past Uncertain Future*
 (Brisbane: Allen & Unwin, 2000)



图例
 LEGEND:
 ◎ 外国国会
 外国首都
 FOREIGN CAPITAL
 ○ 重要城市及地方
 IMPORTANT CITY & PLACE
 - - - - 国界
 NATIONAL BOUNDARY
 ———— 铁路
 RAILWAY
 - - - - 规划铁路
 PLANNED RAILWAY
 ~~~~~ 河流  
 RIVER

Map.3

Source: Singapore-Kunming Railway:  
 A Research on Singapore to Kunming Passage  
 (Kunming:Yunnan Nationalities Press,2000)



## Holding back the waters

China's eight hydro-electric dams on the Lancang river (Upper Mekong) in Yunnan province.

| Dam           | Construction period          |
|---------------|------------------------------|
| ① Manwan      | 1986-96                      |
| ② Dachaoshan  | 1996-2003                    |
| ③ Jinghong    | at the planning stage (2006) |
| ④ Xiaowan     | 2002-12                      |
| ⑤ Nuozhadu    | at the planning stage        |
| ⑥ Mengsong    | at the planning stage        |
| ⑦ Gongguaqiao | at the planning stage        |
| ⑧ Ganlanba    | at the planning stage        |

| Dam         | Power capacity (MW) |
|-------------|---------------------|
| Manwan      | 1,500               |
| Dachaoshan  | 1,350               |
| Jinghong    | 1,500               |
| Xiaowan     | 4,200               |
| Nuozhadu    | 5,500               |
| Mengsong    | 600                 |
| Gongguaqiao | 750                 |
| Ganlanba    | 150                 |



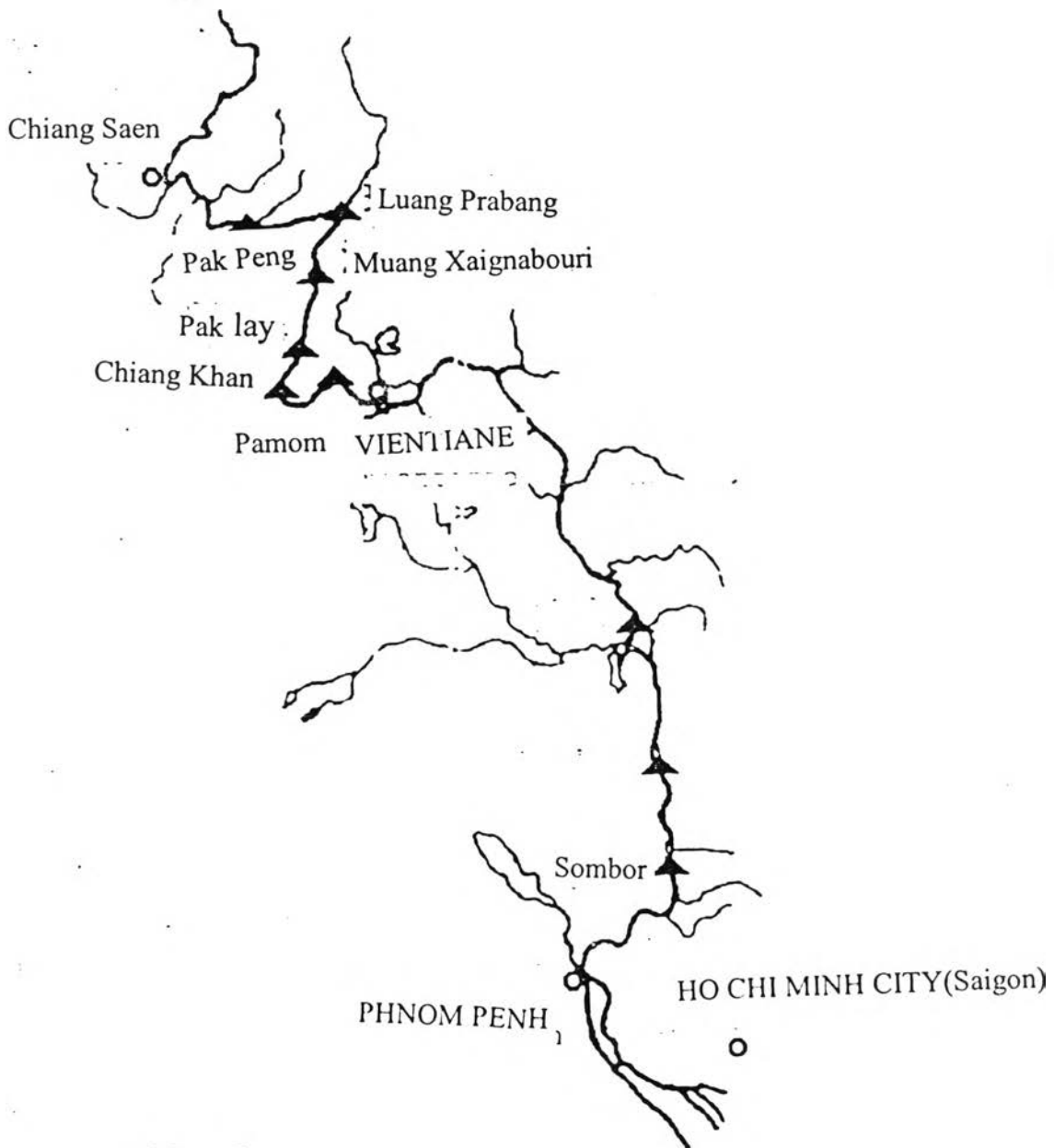
Map. 4

THE MAP OF CHINA'S EIGHT HYDROELECTRIC DAMS ON THE LANCANG RIVER

Source: "Upstream Power Play" Bangkok Post, 22 Dec. 2002



THE MAP OF PLANNED CASCADE HYDROPOWER STATIONS ON THE  
MAINSTREAM OF THE MEKONG RIVER



Map. 5

Source: The Integrated Development and Management of  
International River Basin  
(Kunming: Yunnan Science and Technology Press, 2002)