

6 Forecast and assessment of social impact

6.1 Impact on migrants

(1) Impact on migrants' living styles

Most resettlement of migrants of hydropower project adopt the relatively centralized and scattered settlement. For migrants settled behind in situ, the production and living styles after settlement vary little against the former ones. They can adapt to local production and living styles quickly. The hydropower development on the upper reaches of the Ayeyawady River will not affect their living habits significantly.

For migrants of centralized settlement on both sides of the road, the migrants' living habits may be affected within a short time after resettlement, and the migrants will establish their homelands, adapt to new production styles and etc., especially the aged, women and other vulnerable groups. Due to weak adaptation to changes of environment, the cycle for adapting new environment and new living habit is longer. Meanwhile, improvement of infrastructures in the reservoir area and increase of foreign population affects the current living styles. But on a long term basis, traditional plantation conditions before and after the settlement are not changed fundamentally. Most migrants still live on crop farming and livestock breeding. In addition, some of the migrants can find laboring opportunities in the hydropower development, which plays an active role in improving living standard and adapting life styles.

(2) Impact on migrants' production and living quality

According to MOA, living standard after the settlement shall be not lower than the original level and will be relatively improved. Therefore, seen from influences on migrants' production and living, the issues of settlement arising of inundation of the reservoir are not outstanding. Under the prerequisite that a series of migrant settlement and reconstruction plans are carried out and a large number of funds are put into operation, the production and operation levels will be improved. For the migrants, in the process of the hydropower

development, if proper settlement measures are implemented, such as to ensure that the settlement fund for migrants are ready, to solve migrants' production and living facilities, the migrants' living environment, infrastructure and etc. will be improved.

The settlement of migrants makes former land around the reservoir and the migrant settlement area re-distributed, which may affect the former residents' production styles, structures and etc. in the settlement area. According to the survey, Myitsone reservoir banks and Myitkyina ~ Myitsone Road Course with a large number of migrants have a large number of spare plantation soil. The environment capacity of the land is relatively large, and influence of resettlement on the land bearing capacities is small, which will not impact the residents' production and living in the settlement area.

Besides, the hydropower stations have a long construction period, with a great number of construction workers in and out and large funds to be put into operation, which promote prosperity and development of catering industry, service industry, culture and entertainment, traffic and transportation and etc. along Myitkyina City, Myitkyina City ~ Myitsone Road Course and Myitsone ~ Chibwe. Meanwhile, it can offer some employment opportunities to the migrants and local residents, which are benefited for promoting economy, increasing income of residents living and improving living standards of residents in resettlement area. In the process of the project construction, the migrants' developing ideas, skills, the opportunity of being educated and training, medical care and disease control knowledge and etc. will be improved, and the life quality is benefited from the external environment.

6.2 Impact on social economy

As hydropower development area is minority zone, which largely depends on traditional agricultural economy, abundant electricity energy doesn't get explored and utilized. The resource advantage can't be transferred to economic advantage. With successive construction of cascade hydropower stations on upper reaches of Ayeyawady River, the transportation conditions will be greatly improved both outside and inside reservoir

areas. The capital investment on resettlement as well as the construction of hydropower development may bring a mass of employment chances to local people, and drive and boost the development of other industries. It is a hard-won opportunity for local people to get rid of poverty and bring quite positive impact on social economy. The hydropower development at upper reaches of Ayeyawady River will also promote the economic and social development for the whole drainage basin, Kachin State even in whole Myanmar. Specific functions shows as following:

(1) Promote local adjustment of industrial structure

The construction of cascade hydropower stations at upper reaches of the Ayeyawady River will inundation a part of arable lands and forests. The pattern of regional economies mainly depending on single plantation development will be altered. The forest industry, especial cash crop, fishery industry, mining industry and tourism industry, etc, will get benefits from the construction of hydropower stations and further develop, to form the developing pattern of industrial diversification. Especially the form of reservoir will drive the development of fishery industry in the reservoirs area and come into being regional fishery industry. The farmers around the reservoirs area will centre on requirement of hydropower stations construction on farm products and increase income by plantation and gradually to come into being vary industry for hydropower stations construction.

(2) Increase business tax revenue, and bring dramatic promotion function to local economic development

The construction of hydropower stations will bring new opportunities to the regional economic development and inject fresh growing power to local financial revenue. The source of new added financial income as well as the development of related industries can push all-round development of local economies. With new financial support from government, there will be new investing chances into regional infrastructure, for instance new roads, more medical equipment, more education investment, more culture construction, etc which directly promote sustainable development of local economy.

Improvement of local business tax income will be better to establish long term migration compensation system and replacement industry cultivation system. It also will be better to solve capital shortage problem of local economic and social development projects, and promote harmonious development between area economy and society.

(3) Drive the development of local other related industries

The construction of hydropower stations will certainly directly drive the development of local other related industries and will be favorable to promote the combination of hydropower and local advantage resources. Power guarantee will promote improvement of local industry supported environment, and it will boost the mating development of power related industries and open developing way to dominant new industrialization. Since the establishment of hydropower stations, in the reservoir scope, it will also form fine conditions for developing tourism industry in reservoir area.

(4) Provide energy guarantee for regional economic development

The construction of hydropower stations fundamentally opened power guarantee environment for enlarging local development, and will be favorable to propel regional economic development, which is embodied by support efforts against regional economy enhanced by hydropower stations, such as to the benefit of promoting regional economy structure adjustment, industrial pattern, labor force employment, output and increasing income, etc, to the benefit of optimizing configuration of resource and to create optimized environment for searching better development of regional economy.

(5) Promote ability of economic integration

Besides the benefits of power generation and flood control, the construction of the hydropower stations also can propel the development of shipping industry in the watershed, in order to activate local various increasing factors to development economy. The projects will bring previous economic development opportunities to local people. As local government increases local GDP and financial income, the backward industries structure also may be adjusted to realize industrial diversification, promote regional industrial

structure upgrade, and push economic development process.

In a conclusion, the comprehensive influence on regional economic development by the construction of cascade hydropower stations lies in to break through single industry development mode of local economy, promote various industrial development and combination, and finally to form whole ability to enhance regional economic synthetic effectiveness promotion. In addition, the construction of hydropower stations will comprehensively push regional infrastructure improvement, and will greatly increase regional GDP and financial income, improve regional investment environment and promote regional economic and social sustainable development.

6.3 Impact on religion and ethnic culture

(1) Impact on religion

The implementation of hydropower development on upper reaches of Ayeyawady River will submerge some religion buildings such as local religion memorial halls, temples, churches, etc. For example Myitsone reservoir will submerge totally 83 religion buildings. During implementing hydropower development, it should respect religion customs, effectively communicate with local believers, negotiate and solve relocation plan, and to get rid of contradiction caused by misunderstanding. During removing and arranging of the important religion buildings, different strategies shall be adopted toward the problem of submerged religion buildings, and fully consider religion real needs of mass of different minorities and cope with it properly. Meanwhile, it should strengthen rebuilding work of key churches, pagodas, try to reduce diversification influence on ethnic cultures caused by migration; realize properly arranging migrants, protecting faith and cultures.

With the implementation of cascade hydropower stations, the economic society in hydropower development area will be further improved; culture, education and medical causes will be continuously improved; science and technology knowledge will get timely propagation through movies, broadcast, television and network; people's life will get

guarantee; all these will change local residents' ideas.

(2) Impact on ethnic culture

The minorities live in hydropower development area includes Keqin nationality, Mian nationality, Dan nationality, etc, among of which Keqin nationality is local original one. Construction of hydropower project will refer to minority migration and residential change, which will Influences on district space combination structure of minority cultures. With the promotion of hydropower development and unceasing development, alien cultures will impose certain Influences on minority culture. Project related Keqin nationality; Mian nationality and Dan nationality are bigger nationalities with long culture, deep history, so the alien Influences is limited.

(3) Impact on ethnic relationships

The implementation of cascade hydropower stations exerts positive effect on local ethnic I relationships. The project area is Keqin autonomous region, local residents are mainly from Keqin nationality and other minorities, economy develops slowly, the project is good to promote local economic and social improvement, to improve local people's production and living level; and to enhance further national unite and cooperation; it is also good to push to solve difficulties and problems met in developing local national relationships. During relocating migrants, adopt suitable arrangement way for single nation village and living together nationalities; adopt entire arrangement for single nation village, try not to disturb the space and atmosphere of their traditional cultures, reduce the influences on all minorities migrants; adopt various migrants arrangement ways for living together nationalities according to actual needs.

(4) Impact on national culture

National culture is a process of protection, succession and development. A nation can develop only by being incorporated into world and protect its own cultural tradition at the same time. Therefore, the construction of hydropower project will cause a part of regional national culture to run off and inheritance ways to change; meanwhile, it will

bring local nations with new opportunities to develop and it will form new national culture pattern.

Since the construction of hydropower project, modern elements including modern new idea, new technologies, large equipment, professional technicians, etc will continuously enter in, and inject into local production way, living way, national culture as well as various customs and to form Influences factor with modern flavor, in order to promote to optimize local folk thinking and cultural idea, enhance adaptability of local traditional culture to be adapt to modern social development, and be better to serve local economic society.

Meanwhile, after the implementation of hydropower development, with local economic development, more human, material and financial resources will be invested into national cultural protection, succession, and development, which will push sustainable development of national cultural diversification. Thus, a certain positive effect also exists on the aspect of folk development influence by local national culture.

Influences on minority national culture in hydropower project by the implementation of cascade hydropower stations mainly embodies that during removing migrants, original geographic environment and social environment of national culture will change to form new folk cultural pattern.

6.4 Impact on land resources

The construction of cascade hydropower stations except Myitsone Hydropower stations at upper reaches of the Ayeyawady River above Myikyina, the popularity in reservoir area is less, so is submerged arable land, and so is the submerging proportion. Land submerged by the reservoir can be divided into five classifications: arable land, forest (including wood land, non forest land, and other forest lands), waters (rivers), building land (rural settlements, other building lands), unused lands (such as marsh), and see statistics result in table 6.4-1.

Table 6.4-1 Land Utilization Classification Statistics Table in Reservoir Submerged area

Unit: hm²

Land Type		Reservoir Submerging Area								Perct.of relevant land types in comment area (%)
		Chibwe	Wutsok	Pisa	Kaunglanhpu	Yenan	Laza	Myitsone	Total	
Arable		53.66					550.38	519.76	1123.8	17.22
F O R E S T	wooden	2703.01	1142.5	468.8	2473.65	1713.29	22852.44	32424.65	63778.34	1.97
	Non-forest	109.1		2.06		21.35	347.18	1491.83	1971.52	2.23
	Other	22.39			10.41		119.38	79.65	231.83	2.10
	Total	2834.5	1142.5	470.86	2484.06	1734.64	23319	33996.13	65981.69	1.98
W A T E R S	River	928.37	838.25	564.96	1022	524.28	3430.45	3817.6	11125.91	42.73
B U I L D I N G	Rural settlements						32.08	346.91	378.99	10.20
	other building lands	13.04			9.42		70.11	313.46	406.03	34.69
	Total	13.04	0	0	9.42	0	102.19	660.37	785.02	16.07
U N U S E D L A N D	Mash	151.6	27.89	17.48	43.88	31	1145.88	1488.95	2906.68	37.19
Total		3981.17	2008.64	1053.3	3559.36	2289.92	28547.9	40482.81	81923.1	2.43

From Table 6.4-1, we can see in land utilization in reservoir area, the forest area is 660km², occupies 1.95% of total area, and it is most important land type in reservoir area. The reservoir inundation will change original land utilization structure in reservoir area, the

original forest land, arable land, and other lands will be changed to water area. Water area is increased, but arable land and forest area, etc will be decreased. After this hydropower project is done, the most in affected area is forest land, however, compared to 33318km² of commented forest land, its occupied proportion is only 1.98%, if cultivation conditions of forest land is fine, it won't result in obvious Influences on local forest resources; the reservoir submerged arable land occupies 17.22% of commented arable area, which will produce a certain influences on local agriculture, but with gradually recovering arable land in the process of arranging migrants, the negative influences will gradually be reduced.

6.5 Impact on water resources utilization

6.5.1 Impacts on utilization of water resources

As water resources in Myanmar is rich, the three river systems of Ayeyawady River, Qindun River, Salween River longitudinally throughout South and North Myanmar, national water resources theoretic reserves is about 70000MW, and technical exportable amount is about 60000MW. But due to capital shortage and power market limitation, the exploring ratio is only 2%.

Water power resources in upper reaches of drainage basin of Ayeyawady River are abundant, so is hydraulic theoretic reserves. To explore rich hydraulic resources in this drainage basin can transfer resources advantage to economic advantage, and promote Myanmar economic society development. The implementation of cascade hydropower stations at upper reaches of the Ayeyawady River above Myitkyina can be divided into seven grades, total installed capacity may reach 18400MW, this will increase water energy resources utilization factor of upper reaches of Ayeyawady River to above 86%.

6.5.2 Impact on water supply in Myitkyina

Myitkyina lies in west bank of the Malikha River in upper reaches of Ayeyawady River, north of Myanmar borders the town the capital of Kachin. This city occupies about 10km², with about 240,000 population, and being as most important railway terminal, and junction of road, waterway and aviation in north Myanmar, the south of road passes Bhamo and can

reach Wanding in Yunnan Province in China, the north of road passes Grape City and can arrive Tibet of China, so it's a Rangoon-Myitkyina railway terminal throughout south and north, also the most north terminal of Ayeyawady navigation. At present, the water supply in Myitkyina is mainly underground water, there's no water carrying facility at the river in Myitkyina of Ayeyawady River.

The implementation of cascade hydropower stations in upper reaches of Ayeyawady River will produce certain influence on quantity of water and water level in down reaches of Myitkyina reiver, it mainly embodies that in low flow period (from November to next April) water coming quantity will be increased compared to that in natural situation, the water level will also increased under natural situation; in high flow period (from May to October), the water coming quantity will be decreased compared to that in natural situation, but the extent of decreasing or reducing are both small, meanwhile, since Myitkyina mainly depends on underground water, there's no water carrying facility at the river in Myitkyina of Ayeyawady River. Therefore, The implementation of hydropower development on upper reaches of Ayeyawady River won't basically bring certain impact upon urban water supply in Myitkyina.

6.5.3 Impact on downstream shipping

Due to weak economic foundation, Myanmar's land transport is backward with bad road conditions. Inland river shipping plays a significant role in its domestic transportation. The Ayeyawady River is the mother river of Myanmar, passing through Myanmar from north to south, and it is the golden watercourse for the inland transportation in Myanmar. The North Myanmar is rich in a variety of jades, ambers, and diamonds. Most agricultural products from Middle Myanmar are transported to the places over Myanmar through the Myanmar and its tributaries.

Myitkyina is the northernmost end open to navigation in the the Ayeyawady River. Bhamo which is 193km from the south is the northern limit of navigation all the year around. At present, over 500t ships can pass through 1307km shipping channel from Bhamo to Rangoon. Over 800t vessels can be allowed to navigate the lower reach in Mandalay. The

river course from Myitkyina to Bhamo is about 169km long. During low flow period, the river is 400m~800m wide, with an average depth of 9m for main river course. Small ships can be open to navigation during flood period. The river above Myitkyina is not suitable for shipping.

Construction of cascade hydropower stations on the upper reaches of the Ayeyawady River will submerge many water drop structures and dangerous shoals, which can provide opportunities for shipping in reservoir area and benefit for development in transport, economy and culture along the river and further release the economic development potential. Meanwhile, through effective storage regulating by the reservoirs on the upper reach, water flow of the Ayeyawady River can be adjusted in low flow period and high flow, and discharge of the river course on lower reach will be increased. To some extent, the shipping conditions in the lower reach can be improved.

6.5.4 Impact on Downstream Irrigation

The upper reaches of the Ayeyawady River is above the Mandalay. In the north are hills and mountains, without irrigation facilities. The middle reach of the river which is from Mandalay to Thayetmyo is of valley plain. It is an agricultural region. It is the well-known arid area in Myanmar, with lowest rainfall of annually 500mm~1000mm. As early as 1000 years ago, the medieval period of Myanmar, people constructed dams and canal for irrigation and planting paddy. The lower river reaches from Thayetmyo to estuary. The downstream valley plain expands from Thayetmyo to Myanaung. To the south of Myanaung, the Ayeyawady River is separated into numerous distributaries, which form the famous Ayeyawady River Delta.

The construction of cascade hydropower stations on the upper reaches of Ayeyawady River will have impact on water flow and level of the lower reach. In comparison with national conditions, the flow in low flow period will be raised, with increase water level; the flow in high flow period will be reduced, with slightly decreased water level. Thanks to no irrigation facilities from Myitsone Hydropower stations to the upper reaches of Mandalay, construction of cascade hydropower stations will have no impact on irrigation on the upper

reach. Irrigation areas are mainly located in the middle and lower reaches of the Ayeyawady River, but main distributaries extend from Myitsone Hydropower stations to river mouth, such as Daying River, Ruili River and Nandu River, and irrigation on middle and lower reaches will not be affected by the hydropower development.

6.6 Impact on Landscape and Tourism

The hydropower development area in the upper reaches of Ayeyawady River has no famous tourist attraction or human landscape. However the Ayeyawady River is the local famous natural landscape and resource. The drainage basin on the upper reaches of the Ayeyawady River has not been developed yet, natural and beautiful scenery is the local precious landscape resource, and Myitsone is one of the typical scenic spots of Kachin State. Construction of the cascade hydropower stations has impact on the natural landscape at the confluence of two rivers of Myitsone, and dam construction will change visual effect of natural landscape.

The confluence at Myitsone is formed by the Nmaiha River and the Malikha River. The dam of Myitsone Hydropower station is located at 7km below the confluence. The reservoir is formed by building dams. The reservoir will be divided into two sections of the Nmaiha River and the Malikha River. The torrents and dangerous shoal before construction of the reservoirs will become deep lake. After construction, natural landscape at confluence of the two rivers of Myitsone cannot remain, but new scenic spot consisting of natural and human landscape will be shown.

Rising of water level in the reservoir area can provide opportunities for development of shipping industry and greatly heighten accessibility. As a result, the hidden landscape resources can be developed to display new appearance to the tourists. The tourism of the reservoir area will emerge, and religious culture and ethnic customs and tourist resources will be furthered. The tourism infrastructures will be improved.

Hydropower Development will greatly promote development of local economy, regional tourism and tourism infrastructures. with the construction of hydropower stations and

resettlement funds input, External and internal transport and other infrastructures will be apparently improved. This can create fundamental conditions for development of regional tourism, and meanwhile, surrounding tourist areas will be connected, to impel joint development of surrounding tourist industry.

6.7 Impact on Infrastructure

(1) Transportation

Presently, the upper reaches of the Ayeyawady River can contact with the outside world by waterway and roads. Due to gradient and rushing waters, shipping is dangerous and overturning often occurs. There are three roads, the ones from Myitkyina to Putao along the Malikha River, from Myitkyina to Chibwe on the left bank of the Nmai hka River, and from Jiangyang to Chibwe on the right bank of the Nmai hka River. Among them, the widest road bed is 5 ~ 6m and the narrowest 3 ~ 4m. The roads were built along the mountains and lines are bad. The pavement structures consist of clay and crushed stones and are uneven. The roads are muddy during rainy season, and flow slide often occurs, causing interruption of transport.



**Road along the upper reaches
of the Ayeyawady River**



**Watercourse of upper reaches
of the Ayeyawady River**

In the upper reaches of the Ayeyawady River, the residents live along the roads or rivers, so big and small villages have been evolved. Some villages are located along the roads, and some are accessed by the branches of the above roads, and others are inaccessible by

roads.

For the purpose of material transport and hydro power development, roads along the rivers need to be reconstructed or widened. The dams area will have the roads leading to the towns. The transport conditions of the reservoir area will be improved greatly. Therefore, hydropower development will perfect the transport conditions to help residents living along upper reaches of the Ayeyawady River and is convenient to connect to the outside world and obviously promote economic exchange and cultural communication between residents in the reservoir area and the outside.

(2) Others

The infrastructures for hydropower development in the upper reaches of Ayeyawady River are developing stage and are relatively weak. The reservoir impoundment in this planning will submerge some infrastructures such as schools and hospitals. However the quantity of the submerged infrastructures is less. Relatively, the impact on the local infrastructures is minor. Through reconstruction of infrastructures, the losses can be compensated and the local infrastructures of medical care and education will be properly perfected.

In addition, the construction of cascade hydropower powerstations can speed the development of water conservancy, power supply, and posts and communication, laying solid foundation for local economic development.

As a whole, the hydropower development will obviously improve the local infrastructures.

6.8 Impact on Population health

Currently, the epidemic disease in the hydropower development area is mainly classified into insect-borne diseases, food-borne diseases and water-borne diseases. Malaria, cholera, diarrhea, fasciolopsiasis, trematodiasis, hepatitis, typhoid, etc. are very common.

The impact of construction of cascade hydropower stations on the population health will be mainly caused by reservoir impoundment, construction of the project, and resettlement of

migrants..

Due to initial impoundment of cascade reservoirs, water level will rise, and this will cause rats and mice migrate to the surroundings of the reservoirs. In some surroundings areas, intensity of rats and mice and opportunities of contacts between people and rates and mice will increased. If no measures are taken, incidence of plague and natural focal diseases will be increased possibly. Additionally, water area will be expanded after impoundment of cascade reservoirs. Branches and bays of the reservoirs and shallow water area favorable for growth of float grass. The wet ecological environment of the reservoir banks provides the conditions for propagation of mosquito. Therefore, the mosquito-borne and rat-borne diseases will spread during impoundment of reservoirs if no health and epidemic prevention measures are taken.

During construction of the cascade hydropower stations, construction workers personnel will gather at the site, and intensity of regional population will increase. Diarrhea, virus hepatitis and other intestinal infectious diseases will spread if sanitation of environment, drinking water and food fails to be strengthened. The construction workers and technical workers from other region are more apt to be affected by endemic disease as compared to local people. The construction workers from difference places may carry with pathogen from their previous place. Consequently, epidemic diseases will prevail if prevention is not strengthened.

In the process of relocation and resettlement of migrants, large population movement, imperfect sanitary facilities, and poor environment sanitation management may increase incidence of endemic diseases. This will have some impact on the surrounding population health. The local climate is hot and wet, so that insects and animals which are carriers of disease and pathogenic microorganism propagate quickly. Attention should be paid to food-borne and water-borne diseases to prevent serious impact on the health of the migrants and local residents.

6.9 Impact on Flood Control

The Ayeyawady River basin is located in the Asian Southwest monsoon region. Whenever rainy season comes, southwest monsoon prevails and the river rises sharply. When the Nmaiha River and the Malikha River are merged, the Ayeyawady River flows into plain areas, flood will be caused easily. Based on the hydrological data over 30 years (since 1971), Myitkyina has witnessed 7 flood. In 2006, the flood destroyed part of railway from Mandalay to Myitkyina, and Mandalay Airport was surrounded by the floodwater. Frequent flood disasters have caused greater damages to social and economic development.

The catchment area of Myitsone Hydropower project is 47,300 km², which accounts for 98.8% of Ayeyawady river basin area above Myitkyina City. It can control most flood discharge of upstream above Myitkyina City from flowing into the Ayeyawady River. The Kachin State capital, Myitkyina City is 45km from the lower reach of Myitsone Hydropower station. The normal pool level of Myitsone reservoir is 245m. The initially proposed flood control level is 242.5m during flood season. The reservoir reserves approximately 850 million m³ reservoir storage for flood control. The flood control standard of Myitkyina City can be improved from current "5-year return period" to "20-year return period". Myitsone Hydropower station can heighten flood control capability of Myitkyina City and reduce the losses caused by flood disaster. Meanwhile, it also plays a positive role in flood control in the lower reach of the Ayeyawady River.