1 INTRODUCTION

In the following chapter is a brief review of the present situation, plans and development trends in the relevant sectors.

For the overall regional perspective this study has largely drawn on regional sector overviews recently prepared for the Mekong River Commission Secretariat as background documentation for the Basin Development Plan. The input to these studies has to a great extent been provided by governmental officials and reflects national priorities and plans.

Other sources of information are sector plans and programmes prepared by the relevant sector Ministries and Provinces and by International Funding Institutions and bilateral donors in co-operation with sector Ministries. Even with the official status of these documents, inconsistencies and differences in predictions as well as rather “over-optimistic” assumptions can be observed. To the degree possible the consultant has commented upon these matters and indicated what is seen to be the most realistic development.

The description of the developments in each sector is in most cases structured in three sections:

- The first covers the larger **regional** perspective, which for some issues coincide with the Mekong Basin.
- The second covers the **national Lao PDR** perspective.
- Finally the **local** perspective, which depending on the issue, sometimes will focus on the local river basins and sometimes focus on the 3 provinces directly influenced by the NT2 project.

As will be seen, the relevance and details given for each of these perspectives will differ depending on where its potential impacts will be seen when added to the potential impacts of the NT2 Project. The least developed sections are related to the local or provincial developments. as the time available did not alow for a comprehensive local information collection and consultation process.

2 HYDROPOWER

2.1 Regional Perspective

The total theoretical potential for hydropower production in the Mekong basin is estimated to about 43,000 megawatts (MW).

In the four Lower Mekong countries this potential is estimated to be about 30,000 megawatts (MW). Of this, 13,000 MW has been identified on the Mekong's mainstream. The remainder is found on the tributaries (13,000 MW in Lao PDR, 2,200 MW in Cambodia and 2,000 MW in Vietnam).

There is also considerable hydropower potential on Mekong (Lanchang Jiang) in the Yunnan Province of China. The total hydro potential is estimated to 23,000 MW.

Compared to the huge theoretical potential for hydropower development only a minor part has been developed so far. Only 5 percent (some 1,600 MW) of the Lower Mekong's hydro potential has been developed. All of these projects are on the tributaries. There are great differences between the countries. While Thailand has developed most of its potential on the tributaries, Lao PDR has developed only a few of its many possible projects. Cambodia is yet to construct its first hydropower project within the Mekong basin. Vietnam has prepared plans for a full development of its hydropower potential, and the first in a series of plants has recently been commissioned. China has an ambitious development plan for mainstream projects. Two large run-of-river projects totalling 2,850 MW have already been completed. Existing, larger hydropower projects are presented in Table 1.

Table 1: Existing Mekong Basin Hydropower projects - Larger than 10MW.

Country	Name	Location	Type	Capacity MW	Output GWh/year	Year of completion
China	Man-wan	M	RoR	1,500	7,870	1993
	Da-chao-shan	M	RoR	1,350	5.930	2001
Lao PDR	Nam Ngum	TR	SS	150	900	1971
	Xeset	TR	RoR	45	150	1991
	Theun Hinboun	TR	RoR	210	1,645	1998
	Houay Ho	TR	SS	150	600	1999
	Nam Leuk	TR	SS	60	184	2000
Thailand	Sirindhorn	TR	SS	36	115	1968
	Chulabhorn	TR	SS	15	62	1971
	Ubonratana	TR	SS	25	75	1966
	Pak Mun	TR	RoR	136	462	1997
Vietnam	Dray Ling	TR	RoR	13	70	1995
	Ialy	TR	SS	720	3,642	2000

Source: MRCS 2001, Legend: M = Mainstream, TR = Tributary, SS = Seasonal Storage, RoR = Run-of-River.

A number of plans and studies exist for hydropower development in the Mekong Basin. In particular the Mekong Committee (the forerunner of The Mekong River Commission) was active in investigating the potential of power production in the Basin and in preparing pre-feasibility and feasibility plans for certain projects. The responsibility for planning has over the last 20 years been assumed by the countries themselves. Also the economic and technical development and the increasingly stronger environmental and social concerns have made many of the old schemes obsolete. This is particularly true for the cascades of mainstream power plants planned for Lao PDR.

Each of the Mekong countries have over the last decades prepared a whole series of hydropower master plans and hydropower development strategies. Many projects have been studied to the level of prefeasibility and even feasibility level. The technical, economic, and environmental options and conditions are, however, constantly changing and thus the feasibility of the projects. In addition the increasingly stronger element of private sector investment and initiative has made it difficult to establish realistic national programmes for project sequencing and implementation.

2.1.1 China (Yunnan)

Chinese authorities have so far planned and implemented their projects without formal consultation with the downstream countries. It appears that no EIAs have been prepared to cover the transboundary impacts of the planned developments. Thailand has, however, indirectly accepted these mainstream plans by signing an MOU for purchasing 3000 MW from China (Yunnan) by year 2017.

As noted above two hydropower plants already exist on the mainstream of the Upper Mekong. According to available information no new power plants will commence operation before 2010 in China. However, construction has started on one of the two largest reservoir projects, the Xiaowan HPP, with an expected date of commercial operation just after 2010. In the period 2010 to 2025, five large new plants are assumed to start operation including the 5500 MW Nuozhadu HPP, see Table 2.

Table 2. Existing and planned projects in Yunnan

No.	Project	Year of commissioning	Installed capacity (MW)	Active storage (mill. m^3)
1	Manwan	1993-96	1500	257
2	Dachaoshan	2001-2004	1350	367
3	Xiaowan	2010-14	4200	9900
4	Gonguoqiao	2012	750	120
5	Jinghong	2013	1500	249
6	Nuozhadu	2014	5500	12300
7	Mengsong	Before 2025	600	-
8	Ganlanba	Before 2025	150	-

2.1.2 *Lao PDR*

A number of potential hydropower projects on mainstream Mekong in Lao PDR have been identified. Except for a small run-of-river project (Phapheng), which will utilise a minor part of the water flow in the Khone Falls, none of these are included in current development plans. Hydropower Development Plans for Lao PDR are described in more detail under Lao Perspective.

2.1.3 *Thailand*

Thailand has no new major hydropower plants in its Power Development Programme (PDP) except for an extension of the capacity of the pumped storage project now under construction at Lam Takhong and a new pumped storage plant at Kiridharn (outside the Mekong Basin). Opposition against new hydropower projects in Thailand is strong, and, because of this, mainstream projects along the Lao/Thai stretch of the Mekong are not a realistic option. However, some large multipurpose reservoirs have been established over the last 40 years in the Thai part of the Mekong Basin (Table 3).

Table 3. Existing Projects in Thailand within Mekong Basin (EGAT 2004).

No.[1]	Project [2]	Year of commissioning	Installed capacity (MW)	Irrigation area (Ha)	Active storage (mill. m^3)
32	Nam Pung	1965	6	32000	122
33	Ubol Ratana	1966	25	40700	1695
34	Lam Phra	1967		10097	145
35	Nam Pao	1971		50416	1260
36	Sirindhorn	1971	36	24000	1191
37	Nam Oon	1973		29728	475
38	Huai Luang	1984		12800	113
39	Chulabhorn	1972	40	9600	145
40	Lam Takhong	2002	500	22000	320 / 10

[1] Numbers in this table corresponds to numbers in Map 3
[2] Run-of-river projects and small reservoirs are not included.

Pak Mun and Huai Kum are not included in the estimates on future water flow in Mekong since Pak Mun is a run-of-river project and Huai Kum has a small active storage.

2.1.4 *Cambodia*

The present few and small hydropower plants in operation in Cambodia are all located outside the Mekong basin. Some project alternatives on the Mekong and Mekong tributaries have been identified. However, it is uncertain if any of these projects are going to be constructed in the near future. The present alternatives have a low internal rate of return. Establishment of upstream reservoirs in Vietnam would however be beneficial for the projects in Cambodia. The original plans of the listed projects were controversial due to large shallow reservoirs requiring a substantial relocation of people. However, more recent studies (Halcrow, 1998) have identified new locations of dams with smaller reservoirs.

Table 4. Planned projects in Cambodia within Mekong Basin.

No.	Project name	Year of commissioning	Installed capacity (MW)	Active storage (Mill. m^3)
55	Lower Se San 2D	Before 2025	185	Not available
56	Lower Se San 2U	Before 2025	153	Not available
57	Lower Sre Pok 2	Before 2025	205	Not available

At this stage no priority or time schedule for implementation are available for these projects. In addition to the seasonal storage projects, Sambor, a 465 MV run-of-river project on the Mekong main stream is included in the Cambodian Power Development Plan. All the potential projects have in common that they are to large to be developed for domestic supply alone. If developed, they will be built for export to southern Vietnam or Thailand, which have large power deficits.

2.1.5 *Myanmar*

No hydropower projects are expected to be constructed within the Mekong river basin in the next 20 years.

2.1.6 *Vietnam*

A hydropower master plan is under preparation for Vietnam. Preliminary data from this study has been included here in addition to data from the “Se Kong – Se San and Nam Theun River Basins Hydropower Study” by Halcrow (1999). The projects are found on the major tributaries of Mekong, the Se San and Sre Pok rivers. The projects are listed in Table 5.

Table 5. Existing and planned projects in Vietnam within Mekong Basin. (Hydropower Master Plan 2004).

No.	Project	Year of commissioning	Installed capacity (MW)	Active storage (Mill. m^3)
43	Yali	1999	720	779
44	U. Kontum	Before 2025	220	123
45	Pleikrong	Before 2025	110	1022
46	Se San 4	Before 2025	330	470
47	D. Xuyen	Before 2025	100	484
48	Ban Tou Srah	Before 2025	84	483

[1] Run-of-river projects and small reservoirs are not included.

Existing Dray Ling is a run-of-river and the planned projects Se San 3 (273 MW), Se San 3A (100 MW), Boun Koup (280 MW), Srepok 3 (195 MW) and Srepok 4 (33 MW) all have small active storage.

2.1.7 *Summary of Power Development Plans*

The sum of current active storage and the expected 2010 and 2025 situation total for all countries are presented in Table 6.

Table 6. Existing and Predicted Active Storage Volume (mill m^3) in the Mekong Basin.

	China	Lao PDR	Thailand	Cambodia	Vietnam	Total	NT2-portion
2004	624	5,194	5,529	N/A	888	12,235	-
2010	10,524	12,949	5,529	N/A	921	29,923	12%
2025	23,193	22,608	5,529	N/A	3,589	54,919	6%

The Nam Theun 2 project with 3510 mill m^3 of active storage will account for a larger portion of the total active storage in Mekong in 2010 (12%) than in 2025 (6%). The average discharge into the Mekong at the outlet in Vietnam is assumed to be 14,500 m^3/s or 460.000 mill.m^3 per year. Hence, the total reservoir regulation coefficient would be 0.12 in 2025 calculated at the Mekong outlet. The contribution of NT2 to this will in 2025 be 0.008.

The seasonal variation in flow would be reduced directly in relation to the upstream regulation coefficient. For example, in the Mekong at the border between China and Lao PDR, the variation in seasonal flow, in %, would be drastically reduced, almost eliminating the seasonal difference. The same would happen in the larger tributaries of the Mekong, Nam Ngum, Nam Theun and Se Kong-Se San, whereas the Mekong itself in its downstream reaches would still have a distinct difference between dry season and wet season flow.

2.2 Lao Perspective

2.2.1 Development Plans and Trends

The Power Sector Policy Statement of the Lao PDR government includes, among others, the following priorities:

- Maintain and expand an affordable, reliable and sustainable electricity supply in Lao PDR to promote economic and social development
- Promote power generation for export to provide revenues for meeting GoL development objectives
- A stated target of the policy is to supply electricity to 90% of the population by 2020

A number of strategic plans for power development have been proposed over the years. Efforts have been made to find the optimal sequence of hydropower and transmission line developments, both for the domestic market and for export markets. In recent studies, issues such as environmental standards and greenhouse emissions have been important elements in the prioritisation process together with traditional focus on production and transmission costs.

In the Power System Development Plan, PSDP (Meritec and Lahmeyer, 2004) a long list of about 30 projects, including both project for domestic consumption and for export, has recently been studied and prioritised. The PSDP is based on a least cost expansion priority and partly adjusted to the domestic demand (size of project). Another priority list for hydropower development is found in the Electricité du Lao (EdL) Generation Expansion Plan 2005–2020. Combining the two priority lists by one arrives at a list of 17 seasonal storage projects that aremost likely to be built in the within the time period 2004-2020.

Table 7. EdL Generation Expansion Plan (2004-2020) for domestic projects and the most promising export projects (PSDP).

No.	Project	Year of commissioning	Installed capacity (MW)	Active storage (Mill. m^3)
1	Nam Ngum 1	1972-78 (export)	150	4714
2	Huoay Ho	1999 (domestic.)	150	480
3	Nam Leuk	2000 (domestic.)	60	123
4	Nam Lik	2007 (domestic.)	100	826
5	Nam Theun 2	2009 (export)	1074	3510
6	Theun Hinboun Ext.	2009 (domestic.)	105	2870
7	Xepon	2008 (domestic.)	74	361
8	Nam Ngum 3E	2020 (export)	580	983
9	Nam Ngum 2B	2022 (export)	183	150
10	Nam Ngum 5	2012 (domestic)	90	252
11	Nam Ngum 4A	2015 (domestic.)	55	337
12	Nam Bak 2B	2018 (domestic.)	116	119
13	Xe Kaman 3	2011 (export)	250	108
14	Xe Kaman 1	2014 (export)	468	3340
15	Xe Kong 5	2017 (export)	248	2210
16	Nam Kong 3	2016 (domestic.)	25	299
17	Xe Xou	2020 (domestic.)	59	1710

Run-of-river projects and small reservoirs are not included.

In addition to the hydropower development plans described above, the Hydropower Development Strategy Study (Lahmayer/Worley, 2000) describes and ranks around 50 different projects and project alternatives. The actual development sequence will depend on a number of factors, which will not only be purely economic but involve political, environmental and social considerations.

2.3 Local Perspective

As seen from Table 7 the extension of the capacity of Theun-Hinboun by 105 MW is foreseen to be finished in 2009. The construction of NT2 would accelerate the plans for NT3, since NT3 would compensate for the loss of production at the Theun Hinboun caused by the operation of NT2. The economical benefit of NT3 would increase after inauguration of NT2.

The plan is to extend Theun Hinboun by one unit, i.e. a 50% increase in installed capacity. In addition to this, the present THB Extension project consists of a dam equal to the dam proposed for NT3 (but without the power plant). Some alternatives of Theun Hinboun Extension have been evaluated in the PSDP and the conclusion is that the most viable project is an extension of THB by one unit and construction of Nam Theun 3 dam without the large power plant at the foot of the dam.