INCEPTION REPORT

VOL II

MAINSTREAM PROJECT PROFILE SUMMARIES

23 OCTOBER 2009

The MRC SEA of Hydropower on the Mekong mainstream comprises 4 main phases: (i) scoping, (ii) baseline assessment, (iii) opportunities & risks assessment, and (iv) avoidance, enhancement and mitigation assessment.

This Inception report formally concludes the scoping phase of the SEA and reports on the outcomes of the scoping consultations as well as the methodology and design of the SEA for the subsequent phases.

The Inception report is comprises five volumes including supporting materials and reports:

VOLUME I: Inception Report
VOLUME II: Mainstream project profile summaries
VOLUME III: National scoping consultation summaries
VOLUME IV: SEA Theme papers and additional studies proposals
VOLUME V: The SEA Communications, Consultations and Capacity Building Plan

This volume summarizes the results of field missions and developer consultations to define the design and characteristics of the 11 mainstream projects.
CONTENTS

1 Orientation .................................................................................................................................................... 6
2 Sources of Information ................................................................................................................................. 7
3 Design and characteristics overview .......................................................................................................... 8
4 Detailed Project profiles ................................................................................................................................ 9
  4.1 PAK BENG .................................................................................................................................................. 9
    4.1.1 OVERVIEW OF PROJECT .................................................................................................................. 9
    4.1.2 PURPOSE ......................................................................................................................................... 10
    4.1.3 RESERVOIR ...................................................................................................................................... 10
    4.1.4 CONSTRUCTION ............................................................................................................................... 11
    4.1.5 IMPACTS ......................................................................................................................................... 11
    4.1.6 COSTS ............................................................................................................................................ 12
    4.1.7 Maps and Images .............................................................................................................................. 12
  4.2 LUANG PRABANG ................................................................................................................................... 16
    4.2.1 OVERVIEW OF PROJECT ................................................................................................................ 16
    4.2.2 PURPOSE ....................................................................................................................................... 17
    4.2.3 RESERVOIR .................................................................................................................................... 17
    4.2.4 CONSTRUCTION ............................................................................................................................... 17
    4.2.5 IMPACTS ......................................................................................................................................... 18
    4.2.6 COSTS ............................................................................................................................................ 18
    4.2.7 Maps and Images .............................................................................................................................. 19
  4.3 XAYABURI .............................................................................................................................................. 23
    4.3.1 Overview ........................................................................................................................................ 23
    4.3.2 RESERVOIR .................................................................................................................................... 24
    4.3.3 CONSTRUCTION ............................................................................................................................... 24
    4.3.4 IMPACTS ....................................................................................................................................... 25
    4.3.5 Maps and Figures .............................................................................................................................. 26
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4</td>
<td>PAK LAY</td>
</tr>
<tr>
<td>4.4.1</td>
<td>OVERVIEW OF PROJECT</td>
</tr>
<tr>
<td>4.4.2</td>
<td>PURPOSE</td>
</tr>
<tr>
<td>4.4.3</td>
<td>RESERVOIR</td>
</tr>
<tr>
<td>4.4.4</td>
<td>CONSTRUCTION</td>
</tr>
<tr>
<td>4.4.5</td>
<td>IMPACTS</td>
</tr>
<tr>
<td>4.4.6</td>
<td>COSTS</td>
</tr>
<tr>
<td>4.4.7</td>
<td>Maps and Images</td>
</tr>
<tr>
<td>4.5</td>
<td>SANAKHAM</td>
</tr>
<tr>
<td>4.5.1</td>
<td>OVERVIEW OF PROJECT</td>
</tr>
<tr>
<td>4.5.2</td>
<td>PURPOSE</td>
</tr>
<tr>
<td>4.5.3</td>
<td>RESERVOIR</td>
</tr>
<tr>
<td>4.5.4</td>
<td>CONSTRUCTION</td>
</tr>
<tr>
<td>4.5.5</td>
<td>IMPACTS</td>
</tr>
<tr>
<td>4.5.6</td>
<td>COSTS</td>
</tr>
<tr>
<td>4.5.7</td>
<td>Maps and Images</td>
</tr>
<tr>
<td>4.6</td>
<td>PAK CHOM</td>
</tr>
<tr>
<td>4.6.1</td>
<td>OVERVIEW OF PROJECT</td>
</tr>
<tr>
<td>4.6.2</td>
<td>PURPOSE</td>
</tr>
<tr>
<td>4.6.3</td>
<td>RESERVOIR</td>
</tr>
<tr>
<td>4.6.4</td>
<td>CONSTRUCTION</td>
</tr>
<tr>
<td>4.6.5</td>
<td>IMPACTS</td>
</tr>
<tr>
<td>4.6.6</td>
<td>COSTS</td>
</tr>
<tr>
<td>4.6.7</td>
<td>Maps and Images</td>
</tr>
<tr>
<td>4.7</td>
<td>BAN KOUM</td>
</tr>
<tr>
<td>4.7.1</td>
<td>OVERVIEW OF PROJECT</td>
</tr>
<tr>
<td>4.7.2</td>
<td>PURPOSE</td>
</tr>
<tr>
<td>4.7.3</td>
<td>RESERVOIR</td>
</tr>
<tr>
<td>4.7.4</td>
<td>CONSTRUCTION</td>
</tr>
</tbody>
</table>

**ICEM – International Centre for Environmental Management**
1 ORIENTATION

The Lower Mekong mainstream dams described below can be found in the map below:\(^1\):

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\(^1\) The SEA team is preparing a comprehensive set of maps in which spelling for all proposed hydropower projects is consistent as follows: Pak Beng, Luang Prabang, Xayaburi, Pak Lay, Sanakham, Pak Chom, Ban Koum, Lat Sua, Don Sahong, Thakho diversion, Stung Treng, Sambor. For the purposes of the inception report Map 1 taken from the MRC website uses alternative spelling for Xayaburi.
2 SOURCES OF INFORMATION

The design and characteristics of the 11 mainstream hydropower projects are continually evolving. The information presented in this volume reflects the updated and new information that the SEA team has been able to collect on the projects through a program of developer consultation activities, including:

(i) Field missions
(ii) Consultations with developers
(iii) Developer presentations
(iv) Environmental and Feasibility assessments
(v) Government reports

A detailed listing of information sources is given in Table 1.

Table 1 Mainstream projects covered in the SEA

<table>
<thead>
<tr>
<th>No.</th>
<th>MAINSTREAM PROJECT</th>
<th>DEVELOPER</th>
<th>SOURCE OF INFORMATION FOR THE SEA</th>
</tr>
</thead>
</table>
| 1   | Pak Beng            | Datang International Power Generation (China) | ▪ MRC hydropower data base  
▪ IEE prepared by NorConsult, Optimization Study |
| 2   | Luang Prabang      | PETROVIETNAM Power Corporation (Vietnam)     | ▪ MRC hydropower data base  
▪ Consultation & field visit with PetroVietnam, Optimization Study |
| 3   | Xayabouri           | SEAN & Ch. Karnchang Public Co Ltd (Thailand) | ▪ MRC hydropower data base  
▪ EIA and discussion with TEAM Engineering consultants, Optimization Study |
| 4   | Pak Lay             | CEIEC & Sino-Hydro (China)                   | ▪ MRC hydropower data base  
▪ IEE for Pak Lay by Norconsult, Optimization Study |
| 5   | Xanakham            | Datang International Power Generation (China) | ▪ MRC hydropower data base  
▪ Optimization Study |
| 6   | Pak Chom            | Joint feasibility study by Panya consultants commissioned by Ministry of Energy in Thailand and Ministry of Mines and Energy in Lao PDR | ▪ MRC hydropower data base  
▪ Presentation made by Panya consultants – March 2008 |
| 7   | Lat Sua             | Italian Thai Asia Corp. Holdings (Thailand)  | ▪ MRC hydropower data base  
▪ Feasibility study prepared by Team Engineering consultants |
| 8   | Ban Koum            | Charoen Energy & Waters Asia Co. Ltd         | ▪ MRC Hydropower database  
▪ Presentation made by Macro consultants, March 2008 |
| 9   | Don Sahong          | Mega First                                    | ▪ MRC hydropower data base  
▪ EIA 2007 |
| 10  | Thakho              | Compagnie Nationale du Rhone and EDL         | ▪ IEE prepared for CNR and WWF |
| 11  | Stung Treng         | Open Joint Stock Co. Bureyagessttroy         | ▪ MRC Hydropower database |
| 12  | Sambor              | China Southern Power Grid                    | ▪ MRC hydropower data base  
▪ Consultations with China Southern Grid rep in PP  
▪ Review of the feasibility study |
## 3 Design and Characteristics Overview

<table>
<thead>
<tr>
<th>MAINSTREAM DAM</th>
<th>LOCATION</th>
<th>DEVELOPER</th>
<th>EARLIEST POTENTIAL COMMISSION DATE</th>
<th>MANAGEMENT STATUS</th>
<th>DESIGN SPECIFICATIONS</th>
<th>DIMENSIONS</th>
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<td>Length of dam (m)</td>
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<td>SEAN &amp; Ch. Karnchang Public Co Ltd</td>
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<td>Lao PDR</td>
<td>Charoen Energy and Water Asia Co Ltd</td>
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<td>Mega First</td>
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<td>Lao PDR</td>
<td>CNR &amp; EDL</td>
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4 DETAILED PROJECTprofiles

During consultations with developers, the SEA team prepared a project questionnaire which was filled out with the developers or formally sent for completion, and based upon the information collected as shown in Table 1.

(i) Pak Beng
(ii) Luang Prabang
(iii) Xayabouri
(iv) Pak Lay
(v) Sanakham
(vi) Pak Chom
(vii) Ban Koum
(viii) Lat Sua
(ix) Don Sahong
(x) Thakho diversion
(xi) Stung Treng
(xii) Sambor

It should be pointed out that the designs are changing regularly as greater detail on feasibility and constraints are investigated and upon the requirements of the different governments. All information is relevant as of October 2009. The details and specific characteristics are evolving through their design cycle and the SEA team will be updating information as needed.

4.1 PAK BENG

Source: Pak Beng IEE, Norconsult
MRC database figures shown in red where different.

4.1.1 OVERVIEW OF PROJECT

1. Name of Dam Pak Beng HPP

2. Location of preferred site option – 2,188 km upstream of delta
   ▪ Latitude 19°50’37.64"N
   ▪ Longitude 101°1’7.22”E
   MRC database gave a location downstream of Pak Beng town. This was incorrect the location is about 15 km upstream of Pak Beng Town

2. Dam statistics –
   ▪ Height, 85 m 76 (MRC)
   ▪ Length, 943 m
   ▪ Type of dam construction Concrete gravity

3. Please provide dam lay out if available N/A

4. Rated head (metres) 30.5 (IEE) 35 (Dept of Electricity) 31 (MRC)

5. Plant discharge (cu.m/sec) 7,250

6. Number of Units 10 x 123 MW
7. Installed capacity (MW) 1,230 MW

8. Firm and secondary energy generated annually (gigawatt hours) Mean - 5,517 GWh/yr Firm – 4,073

9. Mode of operation –
   o continuous generation or peak load
   o if peak load, hours of operation per day

10. Environmental flow discharges, Q (cu.m/sec) Mean annual Q – 3,160 (312.05 masl)
    Min observed flow – 635 (306.10 masl)
    Max observed flow – 23,500 (333.7 masl)

11. Spillway design –
    o open flow
    o gated spillway, 15 gates - Elevation 322 masl
    o dimensions 15 m wide x 23 m high

12. Max spillway design discharge and return period used 27,300 (P=0.2%)

13. Estimated sediment load per year (million cu.m/year)

14. Mechanisms proposed for clearing sediment, how often might these be used? Sand flushing gates

15. Dimensions of bottom outlets,

16. Design discharge for bottom outlet (cu.m/sec)

17. Sediment flushing outlets - dimensions and design discharge
   3 x (3 m wide x 5 m high) elevation 306 m asl

4.1.2 PURPOSE

18. Proposed market for electricity,
   3.1 national (%) 10%
   4.1 export (%) to which country? 90% Thailand

19. Multipurpose uses considered (if any) Navigation

20. Details of irrigation, if being considered (Cu.m/s or area irrigated)

4.1.3 RESERVOIR

Headpond type capable of being lowered to pass floods and bedload

21. Full Supply level of reservoir (masl) 345 changed to 340 masl (Dept of Electricity)

22. Low Supply level of reservoir (masl) 339
23. Area inundated at FSL (sq. km) 86.51
24. Active volume of the reservoir (million cu. m) 442
25. Dead storage volume of reservoir (million cu. m)
26. Draw down (m)
27. Expected daily fluctuations in level of reservoir (m)
28. Length of reservoir (km) 130 – 144.5

4.1.4 CONSTRUCTION

Area of construction site 214 ha for living areas, construction sites, internal roads, 2 quarries on left and right banks, port area

29. Duration of construction 64 months
First generation starts after 48 months

30. Access roads required – length (km) 1.74 km to connect the road from Ban Pak Beng Internal access roads 7.4 km concrete roads 6.5 km of gravel roads Upstream bridge across Mekong to connect both sides of site 2.6 ha of mixed deciduous and unstocked forest

31. Transmission line required – length (km) To Thailand – route not determined yet

32. Expected size of construction workforce, 2 – 3000 workers
   o skill types required
   o policy for local employment

33. Dimensions of navigation locks (if any) 1 lock capacity 500 tonnes 73 m long x 12 m wide x 3.2 m deep Lift 37.48 m

34. Type and dimensions of fish passes (if any) included but no details

4.1.5 IMPACTS

Total area of reservoir 87 sq km
Mekong river and tributaries 70 sq km 80%
Cultivated land 13 sq km 15%
Mixed bamboo and secondary forest 4 sq km 5%

35. Total area of agricultural land inundated (ha) 1,325 ha
   o irrigated area inundated (ha) 332 ha
   o rainfed agriculture (ha)
   o “slash and burn” (ha)
36. Total Area of forest (ha)
   - types of forest cover inundated: mixed bamboo and secondary forest

37. Number of communities, households and people to be resettled
   - Communities: 28 villages
   - Households: 774 households
   - People: 6,700 persons

38. Infrastructure inundated in reservoir –
   - Paved roads (km)
   - Government buildings,
   - Hospitals,
   - Schools,
   - Temples etc.

39. Tourism and cultural sites lying in the inundation zone
   - Caves, waterfalls, historic sites
   - Cultural sites

### 4.1.6 COSTS

40. Estimated cost of the dam (Million $)

41. Estimated environmental and social costs (million $)

### 4.1.7 MAPS AND IMAGES

Google earth Image
Pak Beng HPP Dam site – drilling boreholes
Surveyors camp
### 4.2 LUANG PRABANG

Source: Feasibility study prepared by PECC1 for Louangprabang

MRC database figures shown in red where different.

#### 4.2.1 OVERVIEW OF PROJECT

3. **Name of Dam** – Louangprabang

4. **Location of preferred site option** –
   - Latitude: 20°03’ 58.8”
   - Longitude: 102°11’ 30.7”
   - 2036 km from sea.
   - 3.5 km upstream from Nam Ou confluence

42. **Dam statistics** –
   - Height: 57.5 m
   - Length: 318 m
   - Type of dam construction: Gravity, concrete

43. **Please provide dam lay out if available**

44. **Rated head (metres)** – 33.6 m (NB Optimisation study suggests 32 m)

45. **Plant discharge (cu.m/sec)** – 5,091 cu.m/sec

46. **Number of Units** – 10 Kaplan units

47. **Installed capacity (MW)** – 1500 MW

48. **Firm and secondary energy generated annually (gigawatt hours)** –
   - Isolated: 7,102.7 x 10^6 KWh
   - Cascade: 8,258.0 x 10^6 KWh

49. **Mode of operation** –
   - continuous generation or peak load: 12 – 15 hrs per day
   - if peak load, hours of operation per day: isolated 4,735 hrs/yr, cascade 5,505 hrs/yr

50. **Environmental flow discharges (cu.m/sec)** –
   - N/A - but Average flow = 3,061 cu.m/sec
   - PMF 45,900 cu.m/sec

51. **Spillway design** –
   - open flow
   - gated spillway, 10 radial gates
   - dimensions: 18 x 22 m

52. **Max spillway design discharge and return period used** – 44,838 cu.m/sec - 1:10,000 yrs

53. **Estimated sediment load per year (million cu.m/year)** – 59.1 m tonne per yr
   - Inflow to dam site 46.7 m tonne/yr
6.95% captured by dam site

54. Mechanisms proposed for clearing sediment, how often might these be used? NA

55. Dimensions of bottom outlets, NA

56. Design discharge for bottom outlet (cu.m/sec) NA

57. Sediment flushing outlets - dimensions and design discharge NA

4.2.2 PURPOSE

58. Proposed market for electricity,
   5.1 national (%) 10%
   6.1 export (%) to which country? 90% to Vietnam

59. Multipurpose uses considered (if any) navigation

60. Details of irrigation, if being considered (Cu.m/s or area irrigated) None

4.2.3 RESERVOIR

61. Full Supply level of reservoir (masl) 320 masl

62. Low Supply level of reservoir (masl) 318 masl

63. Area inundated at FSL (sq. km) 72.39 sq km

64. Active volume of the reservoir (million.cu.m) 136.1 mcu.m

65. Dead storage volume of reservoir (million.cu.m) 1,453.7 m cu.m (total storage 1,589.5 m cu.m)

66. Draw down (m) 2 m

67. Expected daily fluctuations in level of reservoir (m) up to 2 m

68. Length of reservoir (km) 170 at FSL, 140 at MSL

4.2.4 CONSTRUCTION

69. Duration of construction 2 yrs prep, 8 yrs construction

70. Access roads required – length (km) 1 bridge across Nam Ou, temporary bridge across mainstream 4 km access road along left bank 11 km from Pak Ou to Route 13

71. Transmission line required – length (km) 400 km of 500 kva line to sub-station
72. Expected size of construction workforce, 6000
   - skill types required skilled
   - policy for local employment
   skilled workers from Vietnam, but Laos workers can apply

73. Dimensions of navigation locks (if any) Multiple step, 1,210,000 ton of shipping /yr
   2 locks at 12 x 120 x 3 m depth

74. Type and dimensions of fish passes (if any) Provided for on right bank but no details yet

4.2.5 IMPACTS

Total reservoir area 7,239 ha
Existing water surface 2,864 ha

75. Total area of agricultural land inundated (ha) 194 ha
   - irrigated area inundated (ha)
   - rainfed agriculture (ha)
   - “slash and burn” (ha)
   - Main crop types Industrial trees (teak)

76. Total Area of forest (ha) 4,181.0 ha various
   - types of forest cover inundated

77. Number of communities, households and people to be resettled 9ha of settlement
   - Communities 36
   - households 2,516
   - people 12,966

78. Infrastructure inundated in reservoir – None
   - Paved roads (km)
   - Government buildings,
   - Hospitals,
   - Schools,
   - Temples etc.

79. Tourism and cultural sites lying in the inundation zone Pak Ou caves are 3 km downstream of dam site
   - Caves, waterfalls, historic sites
   - Cultural sites

4.2.6 COSTS

80. Estimated cost of the dam (Million $) 3.685 Billion USD

81. Estimated environmental and social costs (million $) 9.88 million USD over 10 yrs
construction period
7 million USD over 30 yr operation
Google earth pictures of Louangprabang HPP site
Reservoir area of Louangprabang extends to Pak Beng
View from Pak Ou upstream to dam site

Nam Ou confluence with Mekong
Dam site – left bank

Dam site – right bank – see village just downstream of dam site
4.3 XAYABURI

Source: Team Consult, consulting engineers and EIA consultants for Xayaburi HPP

4.3.1 OVERVIEW

1. Name of Dam
   Xayaburi Hydroelectric Power Project

2. Location of preferred site of option
   Longitude E 796, 300
   Latitude N 2,130, 300

3. Dam statistics
   - Height 38 m.
   - Length 810 m.
   - Type of dam construction Composite of Powerhouse, Spillway, Fish passing facilities and Navigation locks with no dam body.

4. Rated head : 29.5 m.

5. Plant discharge: 5,000 m³ / sec

6. Number of Units: 8 Kaplan units

7. Installed capacity: 8 x 160 MW = 1,280 MW

   Primary energy 4,180.9 GWh / year
   Secondary energy 871.0 GWh / year
   Excess energy 2,264.7 GWh / year
   Total energy 7,316.6 GWh / year

9. Mode of operation
   - Operating criteria, Daily discharge = Daily in flow.
   - Water loss form fish passing facilities 10 m³ / sec.
   - Water loss from sand flushing 500 m³ / sec. for 6 hrs. / day during dry season.

10. Environmental flow discharges: 2,000 m³ / sec.

11. Spillway design
    - Open flow 47,500 m³ / sec.
    - Gated spillway 12 units.
    - Dimensions 18 x 20 m³
12. Max spillway design discharge and return period used
   47,500 m³/sec. for 10,000 years flood.

13. Estimated sediment load per year
   Under investigation

14. Mechanisms proposed for electing sediment, how often might these be used?
   Twin steel lined conduits located between every two units and controlled by bonneted gates. In order to allow the operation of the sand flushing outlets without stopping the operation of the near by generators. Flushing about 6 hrs. per day when water in Mekong less than 5,000 m³/sec.

15. Dimension of bottom outlets: No bottom outlets


17. Sediment flushing outlet-dimensions and design discharge.
   Twin 3x3 m conduits that can discharge 140 m³/sec each.

18. Proposed market for electricity
   - national 10%
   - export 90% to Thailand

19. Multipurpose use considered: Navigation

20. Details of irrigation: No.

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4.3.2 RESERVOIR

21. Full supply level: +275. msl

22. Low supply level: +268 msl.

23. Area inundated at FSL: 49 sq km.


25. Dead storage volume of reservoir: 514.05 mcm.

26. Draw down: 7.0 m.

27. Expected daily fluctuations in level of reservoir: No.

28. Length of reservoir 90 km.

---

4.3.3 CONSTRUCTION

29. Duration of construction: 7.5 years
30. **Access road required**: 25 km.

31. **Transmission line required**: 220 km.

32. **Expected size of construction work force**,
   - **Skill types required**
     - Engineer 100 - 200 persons
     - Technician and skilled labor 500 - 600 persons
     - Unskilled labor 2,000 - 2,200 persons
   - **Policy for local employment** Priority to local people

33. **Dimensions of navigation locks**: Two step of navigation locks 12 m. x 195 m. x 5m. each

34. **Type and dimensions of fish passes**
   2 sets of Fish ladder with opening of 3x10 m², between spillway and power house and left abutment near power house.

4.3.4 **IMPACTS**

35. **Total area of agricultural land inundated**
   - **Irrigation area inundated** No
   - **Rain fed agriculture** 18 ha
   - **Slash and burn** No
   - **Main crop types** Maize, Job’s teas, and sesame

36. **Total area of forest**
   - **Type of forest cover inundated** Teak plant 162 ha

37. **Number of communities, households and people to be resettled**
   - **Communities**: 10 villages
   - **Households**: 391 HH.
   - **People**: About 2,130 people

38. **Infrastructure inundated in reservoir**:
   - **Paved roads**: No
   - **Government building**: One small building not in use
   - **Hospital**: No
   - **Schools**: 7
   - **Temple**: 4
   - **Cemetery**: 1

39. **Tourism and Cultural sites lying in the inundated zone**
- Cave, water fall, historic site: No
- Cultural sites: No

4.3.5 MAPS AND FIGURES

Google Earth images of the Xayaburi Dam site
Xayaburi Dam site - looking upstream

Xayaburi Dam site – looking to right bank, with village to be moved temporarily during construction works
Xayaburi Dam site – looking downstream

About 20 km upstream of dam site, showing current navigation, settlements and shifting cultivation
4.4 PAK LAY

Source: Pak Lay IEE, Norconsult.

MRC database figures shown in red where different.

Note: Following optimization study, Pak Lay has been subject both to reduced reservoir FSL levels and choice of site Option 2. The design details quoted here refer to the original specification, and so these will change.

### 4.4.1 OVERVIEW OF PROJECT

<table>
<thead>
<tr>
<th></th>
<th>Pak Lay (Lao PDR)</th>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Name of Dam</td>
<td>Pak Lay</td>
<td>Option 1</td>
<td>Option 2</td>
</tr>
<tr>
<td>2. Location of preferred site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Latitude</td>
<td>18° 19.5’N</td>
<td>18°24’5.34”N</td>
</tr>
<tr>
<td></td>
<td>Longitude</td>
<td>101° 31.6’E</td>
<td>101°35’1.01”E</td>
</tr>
</tbody>
</table>

There is a second option for the site, Option 2, which is located 10 km upstream, which will flood a smaller area and require only 1/3 rd of people to be resettled.

1. Dam statistics –
   - Height, 35 m (54.5 m or 45.5m)
   - Length, 630 m (738.1m or 1,165m)
   - Type of dam construction Set of 5 x Earth fill Rock closure dykes
     Across two channels

2. Please provide dam lay out if available

3. Rated head (metres)
   - max head – 38.5 m at 211.5 masl
   - min. 35 m (25.7m)

4. Plant discharge (cu.m/sec)
   - 4,500 cu.m/sec (5,782 cu.m/sec)

5. Number of Units
   - 2 x 5 = 10 Kaplan units

6. Installed capacity (MW)
   - 1,320 MW

7. Firm and secondary energy generated annually (gigawatt hours)
   - Mean 6,460 GWh (5,782)
   - Firm (4,636)

8. Mode of operation –
   - continuous generation or peak load peak load
   - if peak load, hours of operation per day 8 – 10 hrs per day

9. Environmental flow discharges (cu.m/sec)
   - 5 – 8% of mean annual flow = 308 cu.m/s
   - Mean Annual Flow – 3,850 cu.m/sec (4,030)

10. Spillway design –
    - open flow
    - gated spillway, 12 radial gates
    - dimensions 294 m in length, 67 m wide (230 masl at 18 m)

11. Max spillway design discharge and return period used
    - 38,400 cu.m/sec (32,526 Cu.m/sec) 1 in 10,000 year flood
    - (33,600 cu.m/sec = 1 in 1,000 yr flood)
### 4.4.2 PURPOSE

17. Proposed market for electricity,  
   - national (%)  
   - export (%) to which country?  
   100% Thailand

18. Multipurpose uses considered (if any)  
   - Hydropower only

19. Details of irrigation, if being considered (Cu.m/s or area irrigated)  
   - None

### 4.4.3 RESERVOIR

20. Full Supply level of reservoir (masl)  
   - 250 masl  
   - (248 masl)  
   Changed to 240 masl (Dept of Electricity)

21. Low Supply level of reservoir (masl)  
   - 247 masl  
   - (245 masl)  
   Changed to 237 masl (Dept of Electricity)

22. Area inundated at FSL (sq. km)  
   - Option 1 – 108 sq.km
   - Option 2 - 70 sq.km

23. Active volume of the reservoir (million.cu.m)  
   - 316.5 m.cu.m
   - Volume of water discharged through turbines  
   - 144 m.cu.m  
   - Time taken to refill after 8 hours generation at dry season flow  
   - 20 hours

24. Dead storage volume of reservoir (million.cu.m)  

25. Draw down (m)  
   - 3 m

26. Expected daily fluctuations in level of reservoir (m)  
   - 1 – 2 m

27. Length of reservoir (km)  
   - Option 1 – 120 km
   - Option 2 – 110 km

### 4.4.4 CONSTRUCTION

28. Duration of construction  
   - 4-5 years

29. Access roads required – length (km)  
   - 3 options – 1) Upgrade existing road from Vientiane to site;  
   - 2) construction new road into site;  
   - 3) using Mekong river transport
30. Transmission line required – length (km) 4 circuit 210 volt from 2 x 500kV Switchyords to Thailand

31. Expected size of construction workforce, several 1,000s
   o skill types required
   o policy for local employment

32. Dimensions of navigation locks (if any) 1000 tonne, One single line double-lift lock chamber

33. Type and dimensions of fish passes (if any) Planned but no dimensions yet

<table>
<thead>
<tr>
<th>4.4.5 IMPACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>34. Flooded area</td>
</tr>
<tr>
<td>River – 33% existing river channel</td>
</tr>
<tr>
<td>Forest – 48%</td>
</tr>
<tr>
<td>Agricultural land – 24%</td>
</tr>
<tr>
<td>River bank and island – 8%</td>
</tr>
</tbody>
</table>

35. Total area of agricultural land inundated (ha) Option 1 – 1,300 ha, Option 2 – 665 ha
   o irrigated area inundated (ha) rice paddy 1) 700 ha 2) 165 ha
   o rainfed agriculture (ha) production land 1) 600 ha, 2) 500 ha
   o “slash and burn” (ha)
   o Main crop types

36. Total Area of forest (ha) Production forest 1) 3,600 ha 2) 2000
   Conservation forest 1) 350 ha 2) 180 ha
   Protection forest 1) 250 ha 2) 0

   | Unstocked forest                      | 38% | 25% |
   | Upper mixed deciduous forest         | 11% | 10% |
   | Other land (bamboo, rice paddies, shifting) | 18% | 16% |
   | River and tributaries                | 33% |

37. Number of communities, households and people to be resettled
   o Communities Option 1 – 27, Option 2 – 16
   o households
Option 1 – 19,046, Option 2 – 6,129 (MRC data base 1,780)

**NB:** With Option 2 and lower FSL at 240 masl, Dept of Electricity considers that NO resettlement necessary

38. Infrastructure inundated in reservoir –
   - Paved roads (km)
   - Government buildings,
   - Hospitals,
   - Schools,
   - Temples etc.

39. Tourism and cultural sites lying in the inundation zone
   - Caves, waterfalls, historic sites
   - Cultural sites

## 4.4.6 COSTS

40. Estimated cost of the dam (Million $) estimated 1,000 MS +/-

41. Estimated environmental and social costs (million $)

## 4.4.7 MAPS AND IMAGES

Google earth Image
Pak Lay Dam Site Option 1 – looking upstream
Dam site Option 1 - looking towards right bank
4.5 SANAKHAM

Source: TOR for ESIA, Datang, MRC database
MRC database figures shown in red where different.
Note that following the optimization study, the FSL of the reservoir has been reduced to 220 masl and the dam location has been moved 35 km downstream.

4.5.1 OVERVIEW OF PROJECT

1. Name of Dam  Sanakham HPP
2. Location of preferred site option – 1,737 km upstream of delta
   o Latitude 17°50’N
   o Longitude 101°33’E
   Note that this new location is about 1 km upstream of the Thai/Lao border
   Originally located at 1,772 km upstream of delta
   o Latitude 17°57.3’N
   o Longitude 101°25’E
3. Dam statistics –
   o Height, 38 m (MRC)
   o Length, 1,143.6 m
   o Type of dam construction Concrete gravity
4. Please provide dam lay out if available N/A
5. Rated head (metres) 25 (MRC)
6. Plant discharge (cu.m/sec) 5,918
7. Number of Units 10 x 70 MW
8. Installed capacity (MW) 700 MW (1,268 MW MRC)
9. Firm and secondary energy generated annually (gigawatt hours) Mean - 3,210 GWh/yr
   (5,516 MW MRC)
   Firm – 4,438 GWh/yr
10. Mode of operation –
   o continuous generation or peak load
   o if peak load, hours of operation per day Not known yet
11. Environmental flow discharges, Q (cu.m/sec) Mean annual Q – 4,160
    Min observed flow –
    Max observed flow – 33,900
12. Spillway design –
   o open flow
   o gated spillway,
13. Max spillway design discharge and return period used

14. Estimated sediment load per year (million cu.m/year)

15. Mechanisms proposed for clearing sediment, how often might these be used? Sand flushing gates

16. Dimensions of bottom outlets,

17. Design discharge for bottom outlet (cu.m/sec)

18. Sediment flushing outlets - dimensions and design discharge

### 4.5.2 PURPOSE

19. Proposed market for electricity, national (%) 10%
    export (%) to which country? 90% Thailand

20. Multipurpose uses considered (if any) Navigation

21. Details of irrigation, if being considered (Cu.m/s or area irrigated)

### 4.5.3 RESERVOIR

Headpond type capable of being lowered to pass floods and bedload

22. Full Supply level of reservoir (masl) 220 *(Dept of Electricity)*

23. Low Supply level of reservoir (masl) 215

24. Area inundated at FSL (sq. km) 94
    (but this will increase with move 35 km downstream)

25. Active volume of the reservoir (million cu.m) 186.7
    (but this will increase with move 35 km downstream)

26. Dead storage volume of reservoir (million cu.m)

27. Draw down (m) 5 m

28. Expected daily fluctuations in level of reservoir (m) not known

29. Length of reservoir (km) 80 km

### 4.5.4 CONSTRUCTION
30. Duration of construction ? months

Access roads required – length (km)

31. Transmission line required – length (km) To Thailand – route not determined yet

32. Expected size of construction workforce, 2 – 3000 workers
   o skill types required
   o policy for local employment

33. Dimensions of navigation locks (if any) 2 step ship lock capacity 1,000 tonnes

34. Type and dimensions of fish passes (if any) included but no details

**4.5.5 IMPACTS**

<table>
<thead>
<tr>
<th>Total area of reservoir</th>
<th>80 sq km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mekong river and tributaries</td>
<td>20 sq km 25%</td>
</tr>
<tr>
<td>Cultivated land</td>
<td>60 sq km 75%</td>
</tr>
<tr>
<td>Mixed bamboo and secondary forest</td>
<td>? sq km %</td>
</tr>
</tbody>
</table>

(but this will increase with move 35 km downstream)

35. Total area of agricultural land inundated (ha)
   o irrigated area inundated (ha)
   o rainfed agriculture (ha)
   o “slash and burn” (ha)
   o Main crop types

36. Total Area of forest (ha)
   o types of forest cover inundated mixed bamboo and secondary forest

37. Number of communities, households and people to be resettled
   o Communities 10 Villages
   o households 800
   o people 4,000 persons

38. Infrastructure inundated in reservoir –
   o Paved roads (km)
   o Government buildings,
   o Hospitals,
   o Schools,
   o Temples etc.

39. Tourism and cultural sites lying in the inundation zone
   o Caves, waterfalls, historic sites
   o Cultural sites
4.5.6 COSTS

40. Estimated cost of the dam (Million $)

41. Estimated environmental and social costs (million $)

4.5.7 MAPS AND IMAGES

Google earth Image (new revised site)
(Yellow line marks the Thai/Lao border)
Google earth image showing new site 35 km downstream of original site and 80 km downstream of PakLay dam site

Location of proposed Sanakham dam site
Mekong river upstream of Sanakham dam site and looking south (downstream)

Mekong river near proposed Sanakham dam site
Mekong river 10 km downstream of Sanakham dam site, after border with Thailand (on left) and Laos
4.6 PAK CHOM

Source: presentation on Pak Chom made by Panya Consultants on behalf of Ministry of Energy March 2008. MRC Database.

### 4.6.1 OVERVIEW OF PROJECT

1. **Name of Dam**
   
   Pak Chom HPP

2. **Location of preferred site option**
   
   - **Latitude**: 18°12'12.00″N
   - **Longitude**: 102°3'0.00″E

   Located at KM 1651 from the mouth of the Mekong River and adjacent to Ban Huai Khop, Loei Province, Thailand and to Ban Huai Hang, Sangthong District, Vientiane Capital, Lao PDR

3. **Dam statistics**
   
   - **Height**: 55 m
   - **Length**: 1,200 m
   - **Type of dam construction**: Concrete gravity

4. **Please provide dam lay out if available**
   
   N/A

5. **Rated head (metres)**
   
   22 m

6. **Plant discharge (cu.m/sec)**
   
   5,720

7. **Number of Units**
   
   13 x 83 MW

8. **Installed capacity (MW)**
   
   1,079 MW

9. **Firm and secondary energy generated annually (gigawatt hours)**
   
   Mean - 5,318 GWh/yr
   
   Firm – 5,052

10. **Mode of operation**
    
    Continuous

11. **Environmental flow discharges, Q (cu.m/sec)**
    
    Mean annual Q – 4,385
    
    Max observed flow – 33,526 (100 yr)

12. **Spillway design**
    
    - **open flow**
    - **gated spillway**: 14 gates
    - **dimensions**: 20 m wide x 25 m high

13. **Max spillway design discharge and return period used**
    
    33,526 (100 yr)

14. **Estimated sediment load per year (million cu.m/year)**

---

**Note:** The text above is a direct transcription of the document content. Any question-related content or further clarification would require additional context or specific query details.
15. Mechanisms proposed for clearing sediment, how often might these be used?
   Sand flushing gates

16. Dimensions of bottom outlets,

17. Design discharge for bottom outlet (cu.m/sec)

18. Sediment flushing outlets - dimensions and design discharge

4.6.2 PURPOSE

19. Proposed market for electricity,
   national (%)       10% Lao
   export (%)        90% Thailand

20. Multipurpose uses considered (if any) Navigation,
       6 x Flood mitigation projects, with protecting dykes,
       regulating gates and pumping stations

21. Details of irrigation, if being considered (Cu.m/s or area irrigated)
       11 pumped irrigation projects with total are of 2,944
       ha and irrigated area of 2,706 ha.
       (1 project in Lao PDR (217 ha irrigated, 10 projects
       in Thailand)

4.6.3 RESERVOIR

22. Full Supply level of reservoir (masl) 192 masl
23. Low Supply level of reservoir (masl) 190 masl
24. Area inundated at FSL (sq. km) 73.54 sq km
25. Active volume of the reservoir (million cu.m) 807.7 MCM
26. Dead storage volume of reservoir (million cu.m)
27. Draw down (m) 2 m
28. Expected daily fluctuations in level of reservoir (m) up to 2 m
29. Length of reservoir (km) >80 km

4.6.4 CONSTRUCTION

Area of construction site

30. Duration of construction

31. Access roads required – length (km)
32. Transmission line required – length (km) To Thailand – 185 km to Udon substation

33. Expected size of construction workforce,
   o skill types required
   o policy for local employment

34. Dimensions of navigation locks (if any) 2 lock capacity 500 tonnes
    200 m long x 20 m wide x 3.2 m deep

35. Type and dimensions of fish passes (if any) included but no details – see diagram

4.6.5 IMPACTS

Total area of reservoir 73.54 sq km
Mekong river and tributaries 67.5 sq km 92%
River bank area
   in Thailand 2.78 sq km 46%
   in Lao PDR 3.26 sq km 54%

36. Total area of agricultural land inundated (ha)
   o irrigated area inundated (ha) Thailand 128 ha
      Lao PDR 88.5 ha
   o rainfed agriculture (ha)
   o “slash and burn” (ha)
   o Main crop types

37. Total Area of forest (ha)
   o types of forest cover inundated

38. Number of communities, households and people to be resettled
   o Communities 2 villages (1 Lao, 1 Thai)
   o households 107 households
   o people c 535 persons

39. Infrastructure inundated in reservoir –
   o Paved roads (km) 1.1 km road and 4 bridges in Thailand
   o Government buildings, 1.6 km road and 1 bridge in Lao PDR
   o Hospitals,
   o Schools, 1 school
   o Temples etc. 1 Temple

40. Tourism and cultural sites lying in the inundation zone
   o Caves, waterfalls, historic sites
   o Cultural sites

4.6.6 COSTS

41. Estimated cost of the dam (Million $) 1,764 Million $
42. Estimated environmental and social costs (million $) 20 million $
Fish Ladder of Pak Chom and Ban Koun Hydropower Projects
Landscapes in the proposed Pak Chom reservoir area
## 4.7 BAN KOUM

Source: presentation on Ban Koum made by Macro Consultants on behalf of Ministry of Energy March 2008
MRC database figures shown in red where different.

### 4.7.1 OVERVIEW OF PROJECT

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Name of Dam</td>
<td><strong>Ban Koum HPP</strong></td>
</tr>
<tr>
<td>2. Location of preferred site option –</td>
<td>928.5 km upstream of delta</td>
</tr>
<tr>
<td></td>
<td>o Latitude</td>
</tr>
<tr>
<td></td>
<td>o Longitude</td>
</tr>
<tr>
<td>3. Dam statistics –</td>
<td>53 m</td>
</tr>
<tr>
<td></td>
<td>o Height,</td>
</tr>
<tr>
<td></td>
<td>o Length,</td>
</tr>
<tr>
<td></td>
<td>o Type of dam construction</td>
</tr>
<tr>
<td>4. Please provide dam lay out if available</td>
<td>see below</td>
</tr>
<tr>
<td>5. Rated head (metres)</td>
<td>18.6 m</td>
</tr>
<tr>
<td>6. Plant discharge (cu.m/sec)</td>
<td>11,700</td>
</tr>
<tr>
<td>7. Number of Units</td>
<td>26 x 72 MW</td>
</tr>
<tr>
<td>8. Installed capacity (MW)</td>
<td>1,872 MW</td>
</tr>
<tr>
<td>9. Firm and secondary energy generated annually (gigawatt hours)</td>
<td>Mean - 8,434 GWh/yr</td>
</tr>
<tr>
<td></td>
<td>Firm – 8,012 GWh/yr</td>
</tr>
<tr>
<td>10. Mode of operation –</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>o continuous generation or peak load</td>
</tr>
<tr>
<td></td>
<td>o if peak load, hours of operation per day</td>
</tr>
<tr>
<td>11. Environmental flow discharges, Q (cu.m/sec)</td>
<td>Mean annual Q – 9,149</td>
</tr>
<tr>
<td></td>
<td>Max observed flow – 60,972</td>
</tr>
<tr>
<td>12. Spillway design –</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o open flow</td>
</tr>
<tr>
<td></td>
<td>o gated spillway,</td>
</tr>
<tr>
<td></td>
<td>o dimensions</td>
</tr>
<tr>
<td>13. Max spillway design discharge and return period used</td>
<td>60,972 (100 yrs)</td>
</tr>
<tr>
<td>14. Estimated sediment load per year (million cu.m/year)</td>
<td>n/a</td>
</tr>
<tr>
<td>15. Mechanisms proposed for clearing sediment, how often might these be used?</td>
<td>Sand flushing gates</td>
</tr>
</tbody>
</table>
16. Dimensions of bottom outlets,

17. Design discharge for bottom outlet (cu.m/sec)

18. Sediment flushing outlets - dimensions and design discharge

4.7.2 PURPOSE

19. Proposed market for electricity, national (%) 10% Laos, export (%) 90% Thailand

20. Multipurpose uses considered (if any) Navigation Irrigation

21. Details of irrigation, if being considered (Cu.m/s or area irrigated)
   • 22 pumped irrigation projects 8 in Lao PDR, 14 in Thailand
   • Total area = 11,006 ha of which 7,870 ha will be irrigated

4.7.3 RESERVOIR

22. Full Supply level of reservoir (masl) 115 masl
23. Low Supply level of reservoir (masl) 115 masl

24. Area inundated at FSL (sq. km) 158.09 sq km (132.50 sq km)

25. Active volume of the reservoir (million cu.m) 2,110 MCM

26. Dead storage volume of reservoir (million cu.m)

27. Draw down (m) 0 m

28. Expected daily fluctuations in level of reservoir (m)?

29. Length of reservoir (km)

4.7.4 CONSTRUCTION

Area of construction site

30. Duration of construction

31. Access roads required – length (km)

32. Transmission line required – length (km) 434 km to Chaiyaphum substation in Thailand

33. Expected size of construction workforce,
34. Dimensions of navigation locks (if any) 
   - 2 lock capacity 500 tonnes
   - 200 m long x 20 m wide x 3.2 m deep

35. Type and dimensions of fish passes (if any) 
   - see design below

### 4.7.5 IMPACTS

#### Total area of reservoir

- **158.09 sq km**
  - In channel 135.92 sq km
  - Above banks 221.72 sq km of which 87.84 in Thailand, and 133.88 in Laos

36. Total area of agricultural land inundated (ha)
   - Irrigated area inundated (ha)
   - Rainfed agriculture (ha)
   - “Slash and burn” (ha)
   - Main crop types

37. Total Area of forest (ha)
   - Types of forest cover inundated

38. Number of communities, households and people to be resettled
   - Communities: 1 village in Thailand, 3 villages in Laos
   - Households: 29 in Thailand, 158 in Laos
   - People: c. 935 persons

39. Infrastructure inundated in reservoir –
   - Paved roads (km)
   - Government buildings,
   - Hospitals,
   - Schools,
   - Temples etc.

40. Tourism and cultural sites lying in the inundation zone
   - Caves, waterfalls, historic sites
   - Cultural sites

### 4.7.6 COSTS

41. Estimated cost of the dam (Million $)  
   - 3,000 million $

42. Estimated environmental and social costs (million $)  
   - 35 million USD
4.7.7 MAPS AND IMAGES

Google earth Image
Fish Ladder of Pak Chom and Ban Koun Hydropower Projects
Villages alongside Ban Koum reservoir
4.8 LAT SUA

Source: Lat Sua Feasibility study, TEAM Consulting for Charoen Energy and Water Asia Co.Ltd
MRC database figures shown in red where different.

### 4.8.1 OVERVIEW OF PROJECT

<table>
<thead>
<tr>
<th></th>
<th>Lat Sua HPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Name of Dam</td>
<td>Lat Sua HPP</td>
</tr>
<tr>
<td>2. Location of preferred site option –</td>
<td>898.5 km</td>
</tr>
<tr>
<td></td>
<td>Latitude</td>
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<td>Longitude</td>
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Feasibility study recommends Site 2 at 854.6 km

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<tbody>
<tr>
<td>3. Dam statistics –</td>
<td></td>
</tr>
<tr>
<td>a. Height,</td>
<td>27 m</td>
</tr>
<tr>
<td>b. Length,</td>
<td>1,300 m</td>
</tr>
<tr>
<td>c. Type of dam construction</td>
<td>Concrete gravity</td>
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<th></th>
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<tbody>
<tr>
<td>4. Please provide dam lay out if available</td>
<td>N/A</td>
</tr>
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<tr>
<th></th>
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<tbody>
<tr>
<td>5. Rated head (metres)</td>
<td>10.6 m (max) 3.0 m (min)</td>
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<tbody>
<tr>
<td>6. Plant discharge (cu.m/sec)</td>
<td>20 x 500 = Max flow 10,000 cu.m/sec</td>
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<tbody>
<tr>
<td>7. Number of Units</td>
<td>20 x 34.3 MW</td>
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<td>8. Installed capacity (MW)</td>
<td>686 MW</td>
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<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Firm and secondary energy generated annually (gigawatt hrs)</td>
<td>Primary – 1,524 GWh/yr</td>
</tr>
<tr>
<td></td>
<td>Secondary – 318 GWh/yr</td>
</tr>
<tr>
<td></td>
<td>Excess energy – 826 GWh/yr</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Mode of operation –</td>
<td></td>
</tr>
<tr>
<td>o continuous generation or peak load</td>
<td></td>
</tr>
<tr>
<td>o if peak load, hours of operation per day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primary energy over 16 hrs per day,</td>
</tr>
<tr>
<td></td>
<td>secondary energy for 2hrs per day on 6 days and 8 hrs on</td>
</tr>
<tr>
<td></td>
<td>Sundays,</td>
</tr>
<tr>
<td></td>
<td>excess energy on 6hrs per day on 6 days</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Environmental flow discharges, Q (cu.m/sec)</td>
<td>Mean annual Q – 5,559 (97.5 masl)</td>
</tr>
<tr>
<td></td>
<td>Max observed flow – 89,590 (104 masl)</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12. Spillway design –</td>
<td></td>
</tr>
<tr>
<td>o open flow</td>
<td></td>
</tr>
<tr>
<td>o gated spillway,</td>
<td>24 gates - Elevation 70 masl</td>
</tr>
<tr>
<td>o dimensions</td>
<td>20 m wide x 25 m high</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Max spillway design discharge and return period used</td>
<td>89,590 cu.m/sec (Tr=10,000 yrs)</td>
</tr>
</tbody>
</table>
14. Estimated sediment load per year (million cu.m/year)

15. Mechanisms proposed for clearing sediment, how often might these be used? Sand flushing gates

16. Dimensions of bottom outlets,

17. Design discharge for bottom outlet (cu.m/sec)

18. Sediment flushing outlets - dimensions and design discharge

### 4.8.2 PURPOSE

19. Proposed market for electricity, national (%) 10% Laos
    export (%) to which country? 90% Thailand

20. Multipurpose uses considered (if any) Navigation
    Irrigation

21. Details of irrigation, if being considered (Cu.m/s or area irrigated)
    Area proposed for irrigation on right bank = 730,000 ha
    3 crops per year
    Feasibility study underway

### 4.8.3 RESERVOIR

Headpond type capable of being lowered to pass floods and bedload

22. Full Supply level of reservoir (masl) 97.5 masl

23. Low Supply level of reservoir (masl)

24. Minimum Downstream water level 86.16 masl

25. Area inundated at FSL (sq. km)

26. Active volume of the reservoir (million cu.m)

27. Dead storage volume of reservoir (million cu.m)

28. Draw down (m) 2m

29. Expected daily fluctuations in level of reservoir (m) 2m

30. Length of reservoir (km)
**Area of construction site**

31. Duration of construction  
   8yrs  
   First generation by 2015, assuming construction starts in 2011

32. Access roads required – length (km)

33. Transmission line required – length (km)  
   To Thailand – route not determined yet

34. Expected size of construction workforce,  
   - skill types required  
   - policy for local employment

35. Dimensions of navigation locks (if any)  
   1 lock capacity 500 tonnes  
   195 m long x 12 m wide x 3.2 m deep

36. Type and dimensions of fish passes (if any)  
   800 m long x 10 m wide x 3 m deep at slope of 5%. 4 fish entrances 10 m wide requires 1 – 5% of competing flow

### 4.8.5 IMPACTS

<table>
<thead>
<tr>
<th>Total area of reservoir</th>
<th>87 sq km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mekong river and tributaries</td>
<td>70 sq km</td>
</tr>
<tr>
<td>Cultivated land</td>
<td>13 sq km</td>
</tr>
<tr>
<td>Mixed bamboo and secondary forest</td>
<td>4 sq km</td>
</tr>
</tbody>
</table>

37. Total area of agricultural land inundated (ha)  
   - irrigated area inundated (ha) 332 ha
   - rainfed agriculture (ha)
   - “slash and burn” (ha)
   - Main crop types

38. Total Area of forest (ha)  
   - types of forest cover inundated mixed bamboo and secondary forest

39. Number of communities, households and people to be resettled  
   - Communities
   - households
   - people
   **note for site 1** with 100 masl FSL – 9 villages in Thailand, 2 villages in Lao were considered affected because they lay at or above 100 masl level and were likely to experience flooding.  
   For site 2 with 97.5 masl FSL – no villages are implicated, although flood protection measures will be taken for villages near Pakse at 98.5 masl (which is equivalent to flood magnitude of 15,000 cu.m/sec

40. Infrastructure inundated in reservoir –  
   - Paved roads (km)
   - Government buildings,
41. Tourism and cultural sites lying in the inundation zone
   - Caves, waterfalls, historic sites
   - Cultural sites

4.8.6 COSTS

42. Estimated cost of the dam (Million $)

43. Estimated environmental and social costs (million $)

4.8.7 MAPS AND IMAGES

Google earth Image
Hydrographic maps from Pakse to below dam site at 854.6 km
4.9 DON SAHONG

Source: Don Sahong EIA (2007), Mega First Corporation, MRC Database

4.9.1 OVERVIEW OF PROJECT

3. Name of Dam

4. Location of preferred site option –

   - 722 km upstream of delta

   Original: revised

   - Latitude
     Original: 13°57.4’N
     Revised: 13°56’37.88”N
   - Longitude
     Original: 105°57.8’E
     Revised: 105°57’22.59”E

   Note that according to Ministry of Mines and Energy, location has been moved to bottom end of Don Sahong channel

44. Dam statistics –

   - Height,
     10.6 m with two walls of 8.2/8.3 m extending into main channel at top end of Hou Sahong

   - Length,
     720 m with walls along Hou Sahong 1,820 m and 2,730 m

   - Type of dam construction
     Rolled Concrete dam and walls

45. Please provide dam lay out if available

46. Rated head (metres) 17 m

47. Plant discharge (cu.m/sec) 2,400 cu.m/sec

48. Number of Units 4 x 60 MW

49. Installed capacity (MW) 240 MW

50. Firm and secondary energy generated annually (gigawatt hours)

   Mean - 2,375 GWh/yr
   Firm – 1,988 GWh/yr

51. Mode of operation –

   - continuous generation or peak load
     Continuous

   - if peak load, hours of operation per day

52. Environmental flow discharges, Q (cu.m/sec) for whole Mekong at Khone Phapheng Falls

   Mean annual Q – 10,310
   Min observed flow – 1,068
   Max observed flow – 42,447

53. Spillway design –

   - No spillway

   - open flow

   - gated spillway,
     dimensions

54. Max spillway design discharge and return period used

55. Estimated sediment load per year (million cu.m/year)
56. Mechanisms proposed for clearing sediment, how often might these be used? Sand flushing gates

57. Dimensions of bottom outlets,

58. Design discharge for bottom outlet (cu.m/sec)

59. Sediment flushing outlets - dimensions and design discharge

### 4.9.2 PURPOSE

60. Proposed market for electricity,
   - national (%) 10%
   - export (%) to which country? 90% Thailand

61. Multipurpose uses considered (if any) None

62. Details of irrigation, if being considered (Cu.m/s or area irrigated) None

### 4.9.3 RESERVOIR

Headpond type capable of being lowered to pass floods and bedload

63. Full Supply level of reservoir (masl) 74.5

64. Low Supply level of reservoir (masl) 72.0

65. Area inundated at FSL 290 ha

66. Active volume of the reservoir (million cu.m) 115 MCM

67. Dead storage volume of reservoir (million cu.m)

68. Draw down (m) 2.5 m

69. Expected daily fluctuations in level of reservoir (m)

70. Length of reservoir (km) 5 km

### 4.9.4 CONSTRUCTION

**Area of construction site** 12.8 ha

**Embankments** 4.5 ha

71. Duration of construction

72. Access roads required – length (km) 5.7 km on Don Sahong Barge depots
73. Transmission line required – length (km) 20.68 km for 230 kva line to Ban Hat substation

74. Expected size of construction workforce,
   - skill types required
   - policy for local employment

75. Dimensions of navigation locks (if any) No navigation facility

76. Type and dimensions of fish passes (if any) Modifications to side channels and small fish pass to be constructed and trialed during construction

### 4.9.5 IMPACTS

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total area affected</td>
<td>290.7 ha</td>
</tr>
<tr>
<td>Total area of reservoir</td>
<td>265.2 ha</td>
</tr>
<tr>
<td>Mekong river and tributaries</td>
<td>92.6 ha</td>
</tr>
<tr>
<td>Island area flooded at 75 masl</td>
<td>94.8 ha (right bank) + 77.8 ha (left bank)</td>
</tr>
</tbody>
</table>

77. Total area of agricultural land inundated (ha) 30.4 ha
   - irrigated area inundated (ha)
   - rainfed agriculture (ha)
   - “slash and burn” (ha)
   - Main crop types

78. Total Area of forest (ha) 172.7
   - types of forest cover inundated

79. Number of communities, households and people to be resettled
   - Communities 3 villages on 2 islands, 1 village on mainland
   - households 14
   - people 66

80. Infrastructure inundated in reservoir –
   - Paved roads (km)
   - Government buildings,
   - Hospitals,
   - Schools,
   - Temples etc.

81. Tourism and cultural sites lying in the inundation zone
   - Caves, waterfalls, historic sites Near Khone Phapheng Falls – possible impact upon flow of water over main falls
   - Cultural sites

### 4.9.6 COSTS

82. Estimated cost of the dam (Million $)

---

*ICEM – International Centre for Environmental Management*
83. Estimated environmental and social costs (million $)

### 4.9.7 MAPS AND IMAGES

**Google earth Image**

![Google earth Image of Don Sahong dam site](image)

**Map 1-108**

![Map showing Don Sahong dam site](image)
Dam site looking downstream

Hou Sahong looking upstream from dam site
Hou Sahong – drilling rig for dam survey

Top end of Hou Sahong
Hou Xang Peuk – channel to be modified for improving fish passage
4.10 THAKHO HPP

Source: Thakho IEE, prepared for CNR August 2009

### 4.10.1 OVERVIEW OF PROJECT

1. **Name of Dam**
   - Thakho Diversion HPP

2. **Location of preferred site option –**
   - 722 km upstream of delta
   - Intake
     - Latitude: 13°57’50.9"N
     - Longitude: 105°59’15.3”E
   - Power house
     - Latitude: 13°57’6.6"N
     - Longitude: 105°59’20.2”E

3. **Dam statistics –**
   - No dam

4. **Please provide dam lay out if available**
   - Intake structure located 300 m upstream of Khone Phapheng Falls – 12 sluices 7.5 m wide – total width 100m
   - Headrace channel – 1,700 m x 70 m width
   - Power house located 500 m below Khone Phapheng Falls

5. **Rated head (metres)**
   - 15.5 m

6. **Plant discharge (cu.m/sec)**
   - 380 cu.m/sec

7. **Number of Units**
   - 2 x 25 MW

8. **Installed capacity (MW)**
   - 50 MW

9. **Firm and secondary energy generated annually (gigawatt hours)**
   - Mean - 360 GWh/yr

10. **Mode of operation –**
    - Continuous generation or peak load
    - Continuous
    - If peak load, hours of operation per day

11. **Environmental flow discharges, Q (cu.m/sec) for whole Mekong at Khone Phapheng Falls**
    - Mean annual Q – 10,310
    - Min observed flow – 1,068
    - Max observed flow – 42,447

12. **Spillway design –**
    - No spillway
    - Open flow
    - Gated spillway,
13. Max spillway design discharge and return period used

14. Estimated sediment load per year (million cu.m/year) Not applicable

15. Mechanisms proposed for clearing sediment, how often might these be used?

16. Dimensions of bottom outlets, No bottom outlets

17. Design discharge for bottom outlet (cu.m/sec)

18. Sediment flushing outlets - dimensions and design discharge

4.10.2 PURPOSE

19. Proposed market for electricity, national (%) 100%
   export (%) to which country? 0%

20. Multipurpose uses considered (if any) possible irrigation and water supply from channel under consideration

21. Details of irrigation, if being considered (Cu.m/s or area irrigated)

4.10.3 RESERVOIR

22. Full Supply level of reservoir (masl) 71.7 masl (normal Mekong level at intake)

23. Low Supply level of reservoir (masl) 68.7 masl (min.operating level of Mekong)

24. Area inundated at FSL (sq. km) 30 ha of land affected by intake, headrace channel, and power house out of 1,500 ha in the immediate locality

25. Active volume of the reservoir (million cu.m) n/a

26. Dead storage volume of reservoir (million cu.m) n/a

27. Draw down (m) n/a

28. Expected daily fluctuations in level of reservoir (m) n/a

29. Length of reservoir (km) n/a

4.10.4 CONSTRUCTION
Area of construction site

30. Duration of construction

31. Access roads required – length (km) 2km Access road from Route 13

32. Transmission line required – length (km) 155 kva - 2 km to road then along road 20 km to Ban Hat sub-station

33. Expected size of construction workforce,
   - skill types required
   - policy for local employment

34. Dimensions of navigation locks (if any) No Navigation

35. Type and dimensions of fish passes (if any) Not required

4.10.5 IMPACTS

<table>
<thead>
<tr>
<th>Total area of reservoir</th>
<th>No reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total land area affected</td>
<td>30.3 ha</td>
</tr>
<tr>
<td>Cultivated land</td>
<td>13.5 ha</td>
</tr>
<tr>
<td>Secondary forest</td>
<td>16.4 ha</td>
</tr>
</tbody>
</table>

36. Total area of agricultural land inundated (ha) 13.5 ha
   - irrigated area inundated (ha)
   - rainfed agriculture (ha)
   - “slash and burn” (ha)
   - Main crop types

37. Total Area of forest (ha) 16.4 ha
   - types of forest cover inundated secondary forest, dry dipterocarp and mixed deciduous

38. Number of communities, households and people to be resettled
   - Communities 0
   - households 0
   - people 0

39. Infrastructure inundated in reservoir –
   - Paved roads (km)
   - Government buildings,
   - Hospitals,
   - Schools,
   - Temples etc.

40. Tourism and cultural sites lying in the inundation zone
   - Caves, waterfalls, historic sites Water is diverted around Khone
Phapheng Falls. Minimum dry season (c. 800 cu.m/sec) flows ensured over falls under operational rules

- Cultural sites

### 4.10.6 COSTS

41. Estimated cost of the dam (Million $) $109 Million

42. Estimated environmental and social costs (million $) c. 2% of total investment costs

### 4.10.7 MAPS AND IMAGES

Google earth Image with layout
View of Intake site looking downstream towards Khone Phapheng Falls

Khone Phapheng Falls

Location of Tailrace looking out to main channel of Mekong
4.11 STUNG TRENG

Source: MRC database
Note: very little detailed information is available on the Stung Treng HPP because there has been no feedback from Russian developers on the feasibility study

4.11.1 OVERVIEW OF PROJECT

<table>
<thead>
<tr>
<th>Name of Dam</th>
<th>Stung Treng HPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of preferred site option –</td>
<td>about 8 km upstream of Stung Treng</td>
</tr>
<tr>
<td>Latitude</td>
<td>13°34’31.13”N</td>
</tr>
<tr>
<td>Longitude</td>
<td>105°59’0.41”E</td>
</tr>
<tr>
<td>(NB: location given in MRC database is incorrect)</td>
<td></td>
</tr>
<tr>
<td>Dam statistics –</td>
<td></td>
</tr>
<tr>
<td>Height,</td>
<td>22 m</td>
</tr>
<tr>
<td>Length,</td>
<td>10,844 m</td>
</tr>
<tr>
<td>Type of dam construction</td>
<td>Gravity, earth fill</td>
</tr>
<tr>
<td>Please provide dam lay out if available</td>
<td>N/A</td>
</tr>
<tr>
<td>Rated head (metres)</td>
<td>15.2 m</td>
</tr>
<tr>
<td>Plant discharge (cu.m/sec)</td>
<td>18,493</td>
</tr>
<tr>
<td>Number of Units</td>
<td>10 x 98 MW</td>
</tr>
<tr>
<td>Installed capacity (MW)</td>
<td>978 MW</td>
</tr>
<tr>
<td>Peaking capability</td>
<td>591 MW</td>
</tr>
<tr>
<td>Firm and secondary energy generated annually (gigawatt hours)</td>
<td>Mean - 4,870 GWh/yr</td>
</tr>
<tr>
<td></td>
<td>Firm – 2,937 GWh/yr</td>
</tr>
<tr>
<td>Mode of operation –</td>
<td>Continuous</td>
</tr>
<tr>
<td></td>
<td>if peak load, hours of operation per day</td>
</tr>
<tr>
<td>Environmental flow discharges, Q (cu.m/sec)</td>
<td>Nominal flow – 8,000</td>
</tr>
<tr>
<td></td>
<td>Mean annual Q – 13,714</td>
</tr>
<tr>
<td></td>
<td>Max flood – 79,100</td>
</tr>
<tr>
<td>Spillway design –</td>
<td>N/a</td>
</tr>
<tr>
<td>open flow</td>
<td></td>
</tr>
<tr>
<td>gated spillway,</td>
<td></td>
</tr>
<tr>
<td>dimensions</td>
<td></td>
</tr>
<tr>
<td>Max spillway design discharge and return period used</td>
<td>73,500 cu.m/sec</td>
</tr>
</tbody>
</table>
54. Estimated sediment load per year (million cu.m/year)  N/a
55. Mechanisms proposed for clearing sediment, how often might these be used?
56. Dimensions of bottom outlets,  N/a
57. Design discharge for bottom outlet (cu.m/sec)
58. Sediment flushing outlets - dimensions and design discharge

### 4.11.2 PURPOSE

59. Proposed market for electricity,
   - national (%)  10%
   - export (%) to which country?  90% Vietnam

60. Multipurpose uses considered (if any)  Navigation
    Irrigation
    Flood control

61. Details of irrigation, if being considered (Cu.m/s or area irrigated) N/a

### 4.11.3 RESERVOIR

62. Full Supply level of reservoir (masl)  55 masl
63. Low Supply level of reservoir (masl)  50 masl
64. Area inundated at FSL (sq. km)  211 sq km
65. Active volume of the reservoir (million.cu.m)  70 MCM
66. Dead storage volume of reservoir (million.cu.m)
67. Draw down (m)  5 m
68. Expected daily fluctuations in level of reservoir (m)  2 m
69. Length of reservoir (km)  50 km

### 4.11.4 CONSTRUCTION

**Area of construction site**

70. Duration of construction

71. Access roads required – length (km)

72. Transmission line required – length (km)  To Vietnam – route not determined yet
73. Expected size of construction workforce,
   - skill types required
   - policy for local employment

74. Dimensions of navigation locks (if any)  
    N/a

75. Type and dimensions of fish passes (if any)  
    N/a

4.11.5 IMPACTS

Total area of reservoir  
211 sq km

76. Total area of agricultural land inundated (ha)  
   - irrigated area inundated (ha)
   - rainfed agriculture (ha)
   - “slash and burn” (ha)
   - Main crop types
   
   N/a

77. Total Area of forest (ha)  
   - types of forest cover inundated  
     riverine forest
   
   N/a

78. Number of communities, households and people to be resettled  
   - Communities  
     21 villages
   - households  
     2,059 households
   - people  
     10,617 persons

   Note these figures are taken from estimates of people living in the Stung Treng Ramsar site

79. Infrastructure inundated in reservoir –  
   - Paved roads (km)
   - Government buildings,
   - Hospitals,
   - Schools,
   - Temples etc.

80. Tourism and cultural sites lying in the inundation zone  
   - Caves, waterfalls, historic sites  
     The whole reservoir area lies within the Stung Treng Ramsar site
     It has high biodiversity and high tourism potential

   - Cultural sites

4.11.6 COSTS

81. Estimated cost of the dam (Million $)  
    N/a

82. Estimated environmental and social costs (million $)
4.11.7 MAPS AND IMAGES

Google earth Image
Map of the Stung Treng Ramsar Site

Stung Treng Ramsar Site
Lower Mekong, Cambodia

Permanent river
Temporary river
Pond or lake
Ramsar Site boundary
Human settlements
Roads
Country border

Elevation
High: 40m
Low: 1m

Scale: 1:150,000

IUCN
OPG

Directed by Anna Pelle for the Downstream Initiative-funded project “Strengthening policy and institutional capacity regarding transboundary river management and institutional

ancellation” led by IUCN and UNEP in 2005.

Compiled by ICEM, in cooperation with the Mekong River Commission (2010). The information contained in this document is intended to provide general information only and is not complete or exhaustive.

The information contained in this document is intended to provide general information only and is not complete or exhaustive.

Thailand
Lao PDR
Viet Nam
Cambodia
Lok

International Centre for Environmental Management

81
Reservoir areas of Sambor and Stung Treng HPPs
4.12 SAMBOR

Source: Sambor Prefeasibility study by China Southern Grid Co Ltd. Cambodia
MRC database figures shown in red where different.

4.12.1 OVERVIEW OF PROJECT

5. Name of Dam: SAMBOR, Cambodia

6. Location of preferred site option –
   - Latitude: Dam site II – 12° 47’ N (12 36.5’N)
   - Longitude: 105° 57’ E (106 1.0’E)
(Taken from Google earth picture of location from Chinese developers)

83. Dam statistics –
   - Height: 56 m (35m)
   - Length: 18,002 m (30,664 m)
   - Type of dam construction: Concrete gravity dam and earth rock fill dam

84. Please provide dam lay out if available

85. Rated head (metres): 16.5 (22.9 – 9.5 m max and min) (32.9)

86. Plant discharge (cu.m/sec): 441.7 x 40 = 17,668 (19,163)

87. Number of Units: 40

88. Installed capacity (MW): 65MW x 40 = 2,600 (3,300)

89. Firm and secondary energy generated annually (gigawatt hours)
   - Average annual energy: 11,740 Gw.h (14,870)

90. Mode of operation –
   - continuous generation or peak load
   - if peak load, hours of operation per day Annual average 4515 hours = 12.37 hrs.day

91. Environmental flow discharges (cu.m/sec): Continuous

92. Spillway design –
   - open flow
   - gated spillway,

93. Max spillway design discharge and return period used
   - Peak inflow (149,300 cu.m/sec)
   - (161,000 cu.m/sec)

94. Estimated sediment load per year (million cu.m/year)

95. Mechanisms proposed for clearing sediment, how often might these be used?
96. Dimensions of bottom outlets,

97. Design discharge for bottom outlet (cu.m/sec)
   - Sediment flushing outlets – 37 release sluices
   - dimensions and design discharge 15m x 20 m elevation, 159 cu.m/sec = 5,883 cu.m/sec

4.12.2 PURPOSE

98. Proposed market for electricity,
   - 7.1 national (%) 30%
   - 8.1 export (%) to which country? 70% to Vietnam

99. Multipurpose uses considered (if any) Power, flood control and Navigation

100. Details of irrigation, if being considered (Cu.m/s or area irrigated)

4.12.3 RESERVOIR

101. Full Supply level of reservoir (masl) 40 (40)

102. Low Supply level of reservoir (masl) 39 (38)

103. Area inundated at FSL (sq. km) 620

104. Active volume of the reservoir (million.cu.m) 465 (2,000)

105. Storage Coefficient 0.108%

106. Dead storage volume of reservoir (million.cu.m) 3,794

107. Draw down (m) 1 m

108. Expected daily fluctuations in level of reservoir (m) small daily regulation, generating all the time,

109. Length of reservoir (km)

4.12.4 CONSTRUCTION

110. Duration of construction 87 months

111. Access roads required – length (km)

112. Transmission line required – length (km) 3 x 260 km, 500 kv to HCMC

113. Expected size of construction workforce, Av 2700, max 3000
   - skill types required
   - policy for local employment
114. Dimensions of navigation locks (if any) 100 tonnes – 481 m long, 8m wide from 40masl – 16 masl

115. Type and dimensions of fish passes (if any) 3,397.8 m
   o Dolphin breeding farm included

### 4.12.5 IMPACTS

116. Total area of agricultural land inundated (ha) 3,369 ha
   o irrigated area inundated (ha)
   o rainfed agriculture (ha)
   o “slash and burn” (ha)
   o Main crop types

117. Total Area of forest (ha)
   o types of forest cover inundated 13,143 ha

118. Number of communities, households and people to be resettled
   o communities
   o households
   o people 19,034

(5,120)

119. Infrastructure inundated in reservoir –
   o House area 24,351 sq m
   o Paved roads (km)
   o Government buildings,
   o Hospitals,
   o Schools,
   o Temples etc.

120. Tourism and cultural sites lying in the inundation zone
   o Caves, waterfalls, historic sites
   o Cultural sites

### 4.12.6 COSTS

121. Estimated cost of the dam (Million $) 4,947 M$
   o Transmission line 312.9 M$

122. Estimated environmental and social costs (million $)
   o Social including resettlement 80.33 M$ but note that this was based on 10,000 people for resettlement, so will probably be double this
   o Environmental 21.24 M$

   o Cost/KW 1,685 $/KW
   o Cost/kwh 0.373 – 0.398 $/KWh
Online tariff: 7.23 – 7.97 cents/kwh
IRR: 13.0%
Loan agreement: 25 years

4.12.7 MAPS AND FIGURES
Dam location on Google Earth
Reservoir areas of Sambor and Stung Treng HPPs