



Draft

Mekong River Commission

Basin Development Plan Programme, Phase 2

Assessment of basin-wide development scenarios

Technical Note 6

Economic Assessment

(Work in Progress)

February 2010

Note to the reader

This series of technical notes is prepared to serve facilitation and discussion on the assessment of basin-wide development scenarios of the Mekong Basin by stakeholders in the basin countries. The assessment process is continuing and feedback on the initial findings is requested.



Mekong River Commission

Basin Development Plan Programme, Phase 2

Assessment of basin-wide development scenarios

List of Technical Notes

Technical Note 1: *Synthesis of initial findings from assessments*

Technical Note 2: *Hydrological assessment*

Technical Note 3: *Geomorphological assessment*

Technical Note 4: *Environmental assessment*

Technical Note 5: *Social assessment*

Technical Note 6: *Economic assessment*

Technical Note 7: *Power benefits assessment*

Technical Note 8: *Agriculture impacts assessment*

Note: Technical note on Fisheries Assessment is being prepared. Only power point presentation is available

Preliminary Findings of Economic Assessment

Table of Contents

1	Introduction	2
2	Preliminary Findings	3
	2.1 <i>Definite Future Scenario</i>	3
	2.2 <i>Foreseeable Future Scenarios (20 Year Plan): With and Without Mainstream Dams</i>	4
	2.3 <i>Flood Management in the Mekong Delta</i>	6
3	OVERALL SUMMARY TABLES	7
4	SUMMARY TABLES BY DEVELOPMENT SCENARIO	11

1 Introduction

This report provides a synopsis of the preliminary findings of the economic assessment which forms part of the Economic, Environmental and Social Impact Assessment of Basin-wide Water Resources Development Scenarios. The main purpose of the economic assessment is to estimate the benefits and costs of the various BDP development scenarios in order to determine whether the proposed investments will be able to generate adequate net economic benefits in the future. The economic analyses was undertaken on an incremental basis by contrasting the annual net economic benefits in the “future with” and “future without” development situations projected over a 50 year period. In order to evaluate their contribution to economic growth, net present values (NPVs) of the incremental benefits were then estimated for each development scenario.

The equitable distribution of economic benefits from the development of water resources is a key objective of the LMB development strategy. A distributional analysis was therefore undertaken in order to determine the likely allocation of the incremental net economic benefits between the four LMB countries. In addition, employment created by the scenario interventions (e.g. hydropower, irrigation and flood management) was estimated for each LMB country as well as the overall basin economy.

Based on these preliminary findings, key issues and constraints relating to the economic development of water resources within each country, as well as the LMB as a whole, were identified.

2 Preliminary Findings

2.1 Definite Future Scenario

The findings of the economic assessment of the definite future scenario are as follows:

- ❑ US\$8.2 billion is being invested in hydropower and the overall economic rate of return is estimated at 18% (excluding indirect benefits and losses);
- ❑ Direct economic net benefits of developing 6,000 MW of hydropower in LMB (existing and under construction) will be substantial (i.e. NPV: US\$8.2 billion);
- ❑ Direct benefits from reservoir fisheries are notable i.e. NPV: 0.43 billion;
- ❑ Indirect benefits (from both UMB and LMB dams) of reducing flooding in LMB, mitigating saline intrusion in Mekong Delta, and increasing water depth for navigation (in dry season) are, in total, significant (i.e. NPV: US\$0.52 billion);
- ❑ Indirect losses from the anticipated decline in capture fisheries are also significant (NPV: US\$0.39 billion) but will be offset by an expansion of reservoir fisheries and the further development of aquaculture;
- ❑ Economic losses from wetlands (excluding the value of capture fisheries) are likely to be relatively small, and the economic impact on riverbank erosion is either neutral or slightly positive over next 20 years but there may be a negative impact in the longer term which will require additional investment in protection measures at locations with high value assets (e.g. urban centres), particularly in the upper reaches of LMB;
- ❑ Significant employment opportunities are generated during the construction of the hydropower plants and jobs will also be created by annual O&M activities. The development of reservoir fisheries will also provide sustainable livelihood opportunities for rural communities, and a small rise in navigation and tourism jobs is expected;
- ❑ Inequitable distribution of the economic benefits from hydropower is a major concern. There are substantial benefits to Lao PDR (60% of overall NPV) and Thailand (31%) as the main producers, but the benefits gained by Cambodia are negligible. Cambodia also experiences the highest economic losses from a decline in capture fisheries resulting in a negative economic impact overall. This issue needs to be addressed to ensure that benefit sharing mechanisms are established prior to the construction of future hydropower plants.

2.2 Foreseeable Future Scenarios (20 Year Plan): With and Without Mainstream Dams

The main findings of the economic assessment of the foreseeable future scenarios are as follows:

- ❑ US\$57.4 billion will be invested in hydropower if all mainstream and tributary dams are constructed but, if lower mainstream dams are excluded, the investment falls to US\$30.8 billion and, without all mainstream dams, this investment declines further to US\$19.2 billion;
- ❑ Although the economic viability of the different hydropower dams varies widely (from 4% to 48%), overall economic rate of return is estimated at 17.2% excluding indirect benefits and losses. In aggregate, the economic rate of return is slightly higher for tributary dams *vis a vis* mainstream dams (18.1% compared to 16.5%);
- ❑ Direct economic net benefits of developing 27,505 MW of hydropower (all dams) will be very substantial (i.e. NPV US\$26.4 billion). If the lower mainstream dams are excluded, the NPV falls to US\$18.6 billion and, without all mainstream dams, the NPV declines further to US\$14.8 billion. Both the mainstream and tributary dams will therefore make a major contribution to economic growth in the LMB economy;
- ❑ Direct economic benefits from reservoir fisheries and significant in all foreseeable future scenarios, e.g. NPV: US\$0.46 billion for reservoir fisheries when all hydropower dams are constructed. The development of aquaculture with LMB will also make a notable contribution to economic development (NPV: US\$0.68 billion overall) as well as the household incomes of rural communities;
- ❑ US\$8.7 billion will be invested if all irrigation projects in the 20 year plan (2.0 million hectares of irrigation) are developed, of which 75% will be invested in Thailand. However, the economic net benefits are small (overall NPV: 0.09 billion) and this is mainly due to the negative NPV for Thailand which offsets the positive NPVs for Lao PDR, Cambodia and Vietnam. Based on average investment cost of around US\$4,400 per hectare (low by international standards for new irrigation schemes), the overall economic rate of return is estimated at 10.2%, and ranges from 8.8% in Thailand to 17.3% in Lao PDR.
- ❑ The main reason for the negative NPV for irrigation in NE Thailand is the limited scope for dry season cropping without storage reservoirs. The cropping intensity in the 20 year plan for irrigation development in NE Thailand is only 133% and this restricts the potential benefits from the irrigation infrastructure to providing only supplementary irrigation in the wet season plus some dry season cropping (about 30% of the cultivated area);
- ❑ For all foreseeable future scenarios, indirect economic benefits of reducing flooding in LMB, mitigating saline intrusion in Mekong Delta, and increasing water depth for navigation (in dry season) are, in total, significant (i.e. NPV: US\$0.44 billion);

- ❑ If all mainstream and tributary dams are constructed, there will be substantial decline in capture fisheries resulting in significant net economic losses (NPV: -US\$1.48 billion). 64% of these losses will occur in Cambodia and 33% in Vietnam. However, these losses will be partially offset by an expansion of reservoir fisheries and the further development of aquaculture. For the development scenarios without lower mainstream dams, the overall net capture fisheries losses are much smaller (NPV: 0.35 billion). This clearly shows that the economic losses related to the decline in capture fisheries are closely associated with the development of the lower mainstream dams, i.e. 76% of the US\$1.48 billion losses directly relate to lower mainstream dams;
- ❑ Without all mainstream dams, the impact on net fisheries losses is estimated at NPV: 0.24 billion, so the overall impact of tributary dams on capture fisheries is less significant. However, it should also be noted that, without mainstream dams, the fisheries losses experienced by Cambodia and Vietnam are offset by gains in Lao PDR and Thailand due to the expansion of capture fisheries within the wetland areas designated for irrigation development;
- ❑ For all foreseeable future scenarios, economic losses in wetland areas (excluding capture fisheries) are likely to be very small, and the economic impact on riverbank erosion is negligible and maybe slightly positive if mainstream dams are constructed;
- ❑ Significant employment opportunities will be generated during the construction of hydropower plants and jobs will also be created by annual O&M activities. The development reservoir fisheries and further expansion of aquaculture will also provide a substantial number of additional livelihood opportunities for rural communities. Employment in navigation and tourism is not expected to be significantly affected.
- ❑ Risks and uncertainties with respect to changes in key variables related to the development of hydropower (such as investment costs, oil/gas prices and regional growth in demand for electricity) will affect the financial and economic viability of hydropower development and consequently the rate of development over the next 20 years. It should also be noted that, while hydropower generates substantial economic benefits, the selection and scheduling of HEP project will depend on financial viability of individual project from the perspective of the private developer. Preliminary financial analysis (based on return on equity over 20 years) indicates that, under the present financial conditions, many of hydropower projects would not be implemented. For example, the Stung Treng mainstream dam in Cambodia is both financially and economically unviable and should therefore be excluded from the 20 year plan;
- ❑ Inequitable distribution of economic benefits is a major concern. When all dams are constructed, substantial benefits go to Lao PDR (68% of overall NPV) as the main producer. Vietnam (14%) and Thailand (8%) also benefit as the main consumers. Cambodia (11%) also benefits as both a producer and consumer. A similar pattern emerges for the other foreseeable future scenarios.

- ❑ For Cambodia and Vietnam, the economic benefits from hydropower are partially offset by the high economic losses due to a decline in capture fisheries (primarily resulting from the construction of the lower mainstream dams). This issue needs to be addressed to ensure that the significant negative impacts of dam construction are offset by the accelerated development of rural economy to provide alternative livelihood opportunities in agriculture, aquaculture and rural industries. In addition, benefit sharing mechanisms and compensatory arrangements should be established prior to the development of future hydropower plants.

2.3 Flood Management in the Mekong Delta

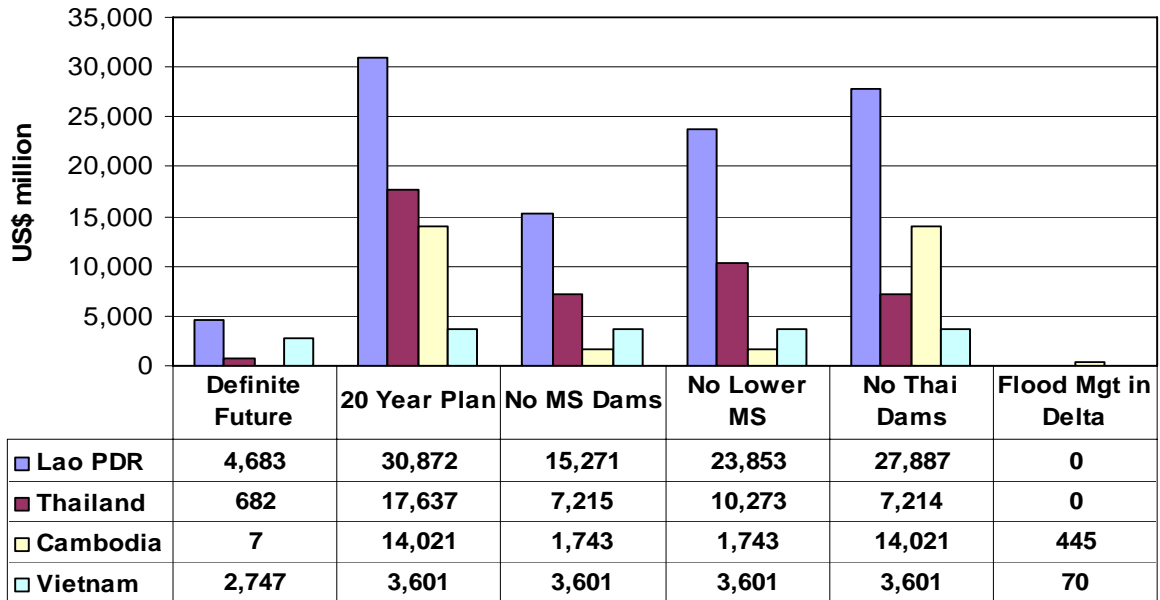
- ❑ US\$0.52 billion will be required for flood protection, drainage and irrigation development in the Mekong Delta over the next 20 years, of which US\$0.45 billion will be invested in Cambodia and US\$0.07 billion in Vietnam;
- ❑ Projects in Cambodia (e.g. West Basak and East Mekong) are estimated to generate an economic rate of return of 16%, while the overall economic rate of return for the Vietnamese projects (e.g. Long Xuyen Quadrangle and Plain of Reeds) is estimated at 10%. It is evident from the analysis that flood protection investment cannot be economically justified without an integrated agricultural development programme, including irrigation and drainage systems, to increase cropping intensity and crop yields;
- ❑ Total area benefiting from flood protection, drainage and irrigation interventions is estimated at 2.12 million hectares (0.88 million hectares in Cambodia and 1.24 million hectares in Vietnam);
- ❑ Direct economic net benefits of developing the infrastructure will be relatively small (i.e. NPV US\$0.22 billion) and are mainly generated by the Cambodian projects;
- ❑ Indirect losses associated with a reduction in flooding benefits (e.g. enhanced soil fertility) and loss of capture fisheries are fairly significant and have been incorporated into the overall economic analysis;
- ❑ Economic losses in wetland areas are likely to be small, but the impact on saline intrusion is unknown;
- ❑ The successful implementation of the proposed flood protection, drainage and irrigation projects will depend on very close co-operation between Cambodia and Vietnam. The construction of flood protection in Cambodia will have an adverse impact on water levels in Vietnam. Similarly, flood protection in Vietnam has negative consequences for Cambodia. The implementation of plans which have been jointly prepared and agreed by the two countries is therefore essential to the development of flood management intervention in the Mekong Delta.

3 OVERALL SUMMARY TABLES

Table 1: Comparison of Key Economic Indicators by Development Scenario and Country

Key Economic Indicators	Unit	Definite Future Scenario	Foreseeable Future 20-Year Plan Scenario	20-Year Plan Scenario without Mainstream Dams	20-Year Plan Scenario without Mainstream Dams in Middle and Lower LMB	20-Year Plan Scenario without Thai Mainstream Dams	Mekong Delta Flood Management Scenario
		3000	4000	5000	6000	6001	7000
Lao PDR							
NPV benefits and losses	US\$ million	5,327	18,549	9,497	13,102	15,178	
Jobs created	person year	12,360	251,892	239,812	247,352	247,772	
Investment cost	US\$ million	4,683	30,872	15,271	23,853	27,887	
Thailand							
NPV benefits and losses	US\$ million	870	2,010	929	1,645	1,614	
Jobs created	person year	0	446,801	446,801	446,801	447,401	
Investment cost	US\$ million	682	17,637	7,215	10,273	7,214	
Cambodia							
NPV benefits and losses	US\$ million	-58	2,012	1,197	1,158	1,974	254
Jobs created	person year	0	164,096	143,816	143,816	164,096	48,832
Investment cost	US\$ million	7	14,021	1,743	1,743	14,021	445
Vietnam							
NPV benefits and losses	US\$ million	2,601	3,925	4,213	3,626	3,854	-30
Jobs created	person year	2,840	170,046	170,046	170,046	170,046	7,102
Investment cost	US\$ million	2,747	3,601	3,601	3,601	3,601	70
Total LMB							
NPV benefits and losses	US\$ million	8,740	26,496	15,836	19,531	22,620	224
Jobs created	person year	15,200	1,032,836	1,000,476	1,008,016	1,029,316	55,934
Investment cost	US\$ million	8,119	66,131	27,830	39,470	52,723	515

Investment Costs by Country and Development Scenario



NPV of Net Economic Benefits by Country and Development Scenario

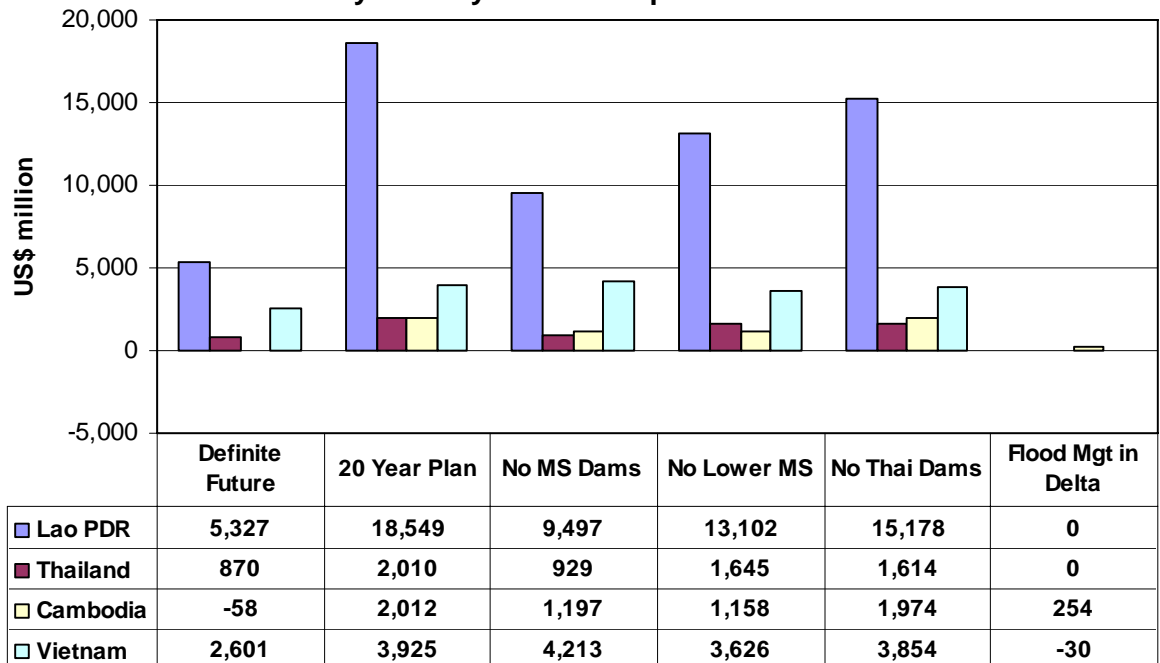
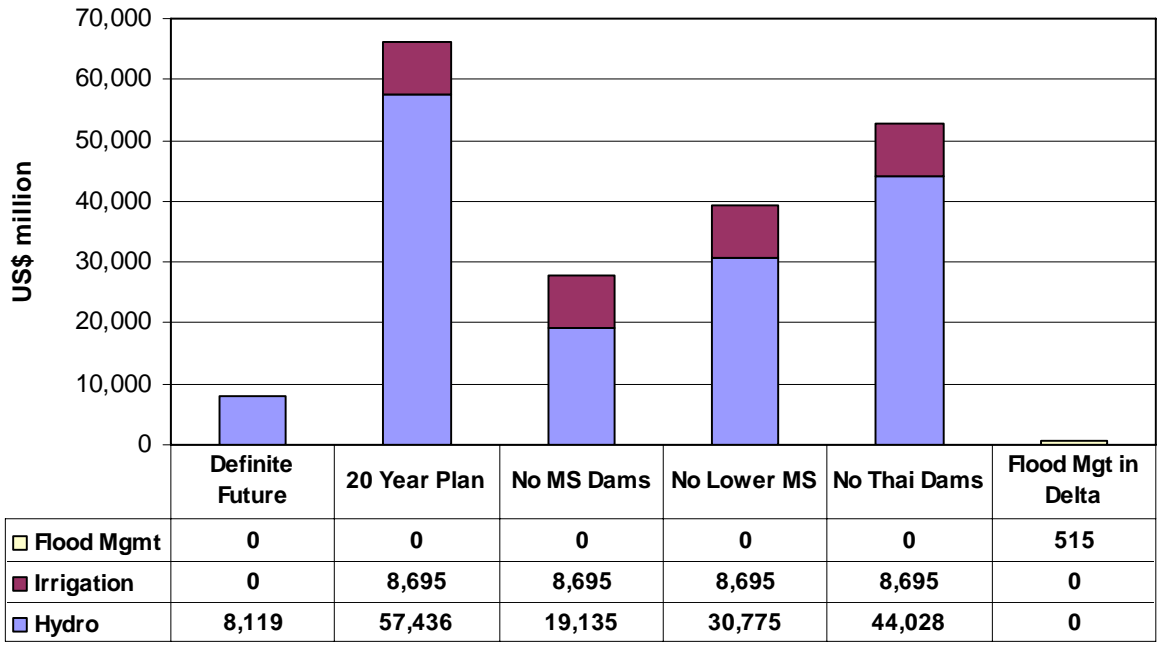


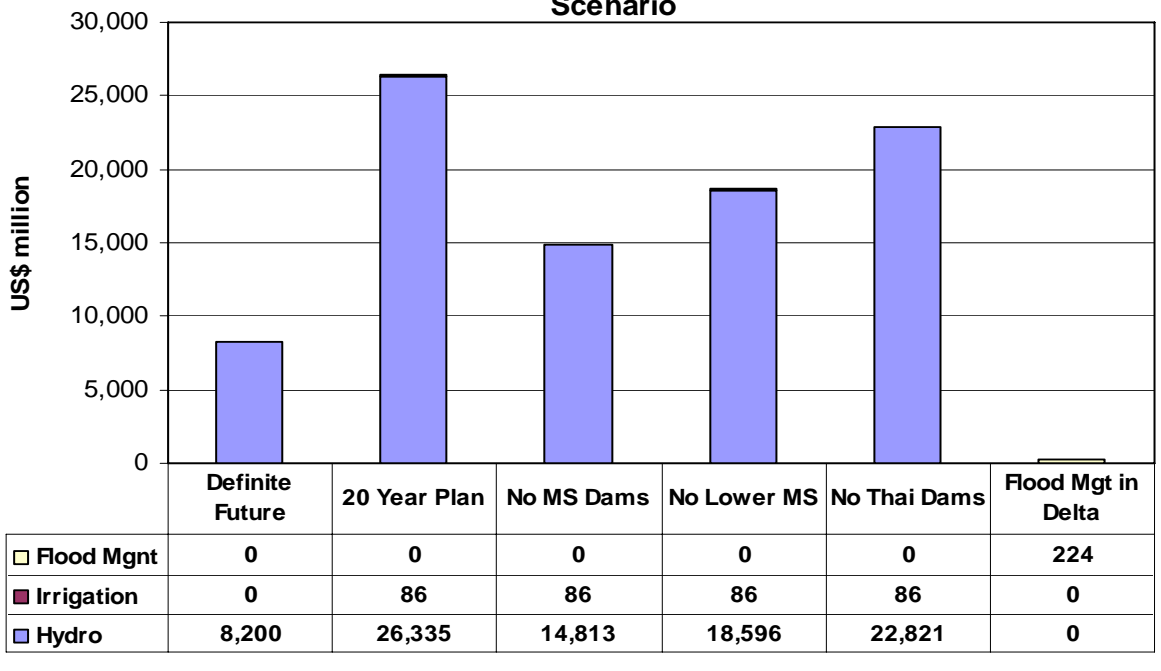
Table 2: Comparison of Key Economic Indicators by Development Scenario and Sector

Key Economic Indicators	Unit	20-Year Plan					
		Definite Future Scenario	Foreseeable Future 20-Year Plan Scenario	20-Year Plan Scenario without Mainstream Dams	Scenario without Mainstream Dams in Middle and Lower LMB	20-Year Plan Scenario without Thai Mainstream Dams	Mekong Delta Flood Management Scenario
		3000	4000	5000	6000	6001	7000
Hydropower							
HEP capacity	MW	6,032	27,505	11,241	18,719	24,556	
HEP production	GWh	27,548	119,472	51,541	83,947	117,460	
Investment costs	US\$ million	8,119	57,436	19,135	30,775	44,028	
NPV benefits/costs	US\$ million	8,200	26,335	14,813	18,596	22,821	
Jobs created	person year	0	0	0	0	0	
Irrigated Agriculture							
Incremental irrigated area	hectare		1,990,893	1,990,893	1,990,893	1,990,893	
Incremental crop production	tons/annum		8,008,184	8,008,184	8,008,184	8,008,184	
Investment costs	US\$ million		8,695	8,695	8,695	8,695	
NPV benefits/costs	US\$ million		86	86	86	86	
Jobs created	person year		497,188	497,188	497,188	497,188	
Flood Management							
Incremental area protected	hectare						2,115,026
Investment costs	US\$ million						515
NPV benefits/costs	US\$ million						224
Jobs created	person year						55,934
Reservoir Fisheries							
Incremental fish production	tons/annum	39,348	106,062	40,015	100,034	96,014	
NPV fish production	US\$ million	429	456	428	451	445	
Jobs created	person year	15,200	72,060	39,700	47,240	68,540	
Aquaculture							
Incremental fish production	tons/annum		710,406	710,406	710,406	710,406	
NPV fish production	US\$ million		679	679	679	679	
Jobs created	person year		463,588	463,588	463,588	463,588	
Capture Fisheries							
Fish catch losses	tons/annum	-69,235	-445,466	-137,573	-97,456	-445,308	
NPV fish catch losses	US\$ million	-392	-1,480	-239	-350	-1,480	
Wetlands							
Wetland area lost	hectare	-38,638	-51,502	--	--	--	
NPV wetland area lost	US\$ million	-21	-17	-	-	-	
Flood Mitigation							
Reduction in flood area	hectare	200,728	237,020	++	++	++	
NPV flood damage mitigation	US\$ million	455	367	++	++	++	
Saline Intrusion							
Change in saline area	hectare	0	+	+	+	+	
NPV change in saline area	US\$ million	5	5	5	5	5	
Riverbank erosion							
Area lost to bank erosion	hectare	N	N	N	N	N	
NPV area lost to erosion	US\$ million	N	N	N	N	N	
Navigation							
Increase IWT cargo	tons/annum	+	+	+	+	+	
NPV increase IWT cargo	US\$ million	64	64	64	64	64	
Total LMB							
NPV benefits and losses	US\$ million	8,740	26,496	15,836	19,531	22,620	224
Jobs created	person year	15,200	1,032,836	1,000,476	1,008,016	1,029,316	55,934
Investment cost	US\$ million	8,119	66,131	27,830	39,470	52,723	515

Investment Costs by Sector and Development Scenario



NPV of Net Economic Benefits by Sector and Development Scenario



4 SUMMARY TABLES BY DEVELOPMENT SCENARIO

Definite Future Scenario

Table A1: Direct Net Economic Benefits of Definite Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
HEP capacity	MW	3,502	309	1	2,220	6,032
HEP production	GWh	16,435	532	3	10,578	27,548
Net present value	US\$ million	5,072	572	7	2,549	8,200
Reservoir Fisheries						
Fish production	tons/annum	9,432	8,545	10,629	10,742	39,348
Net present value	US\$ million	105	94	117	114	429

Table A2: Indirect Net Economic Impact of Definite Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
POSITIVE IMPACTS						
Flood Damage Mitigated						
Reduction in flood area	hectare	62,591	68,625	53,574	15,938	200,728
Net present value	US\$ million	175	169	51	60	455
Saline Area Mitigated						
Net reduction in saline area	hectare					
Incremental crop production	tons/annum					
Net present value	US\$ million			0	5	5
Navigation Enhanced						
Increase in IWT cargo	tons/annum	N	++	N	N	+
Net present value	US\$ million		64			64
NEGATIVE IMPACTS						
Capture Fish Reduced						
Fish catch losses	tons/annum	-3,939	-3,574	-37,780	-23,942	-69,235
Net present value	US\$ million	-23	-24	-220	-126	-392
Wetland Area Reduced						
Wetland area lost	hectare	-5,350	-9,388	-23,621	-279	-38,638
Net present value	US\$ million	-3	-5	-13	0	-21
Riverbank Erosion						
Area lost to bank erosion	hectare	-	N	N	N	N
Net present value	US\$ million	-	N	N	N	N

Definite Future Scenario (cont'd)

Table A3: Main Economic Benefits and Losses in Definite Future Scenario by Sector and Country

Economic Benefit/Loss	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Net Economic Benefits						
NPV hydropower (LMB only)	US\$ million	5,072	572	7	2,549	8,200
NPV reservoir fisheries	US\$ million	105	94	117	114	429
NPV flood damage mitigation	US\$ million	175	169	51	60	455
NPV saline area mitigation	US\$ million	0	0	0	5	5
NPV navigation improvement	US\$ million	0	64	0	0	64
sub-total		5,352	899	175	2,728	9,153
Net Economic Losses						
NPV capture fish catch losses	US\$ million	-23	-24	-220	-126	-392
NPV wetland area lost	US\$ million	-3	-5	-13	0	-21
NPV area lost to bank erosion	US\$ million	-	N	N	N	0
sub-total		-26	-29	-233	-127	-414
Overall Net Benefits/Losses	US\$ million	5,327	870	-58	2,601	8,740

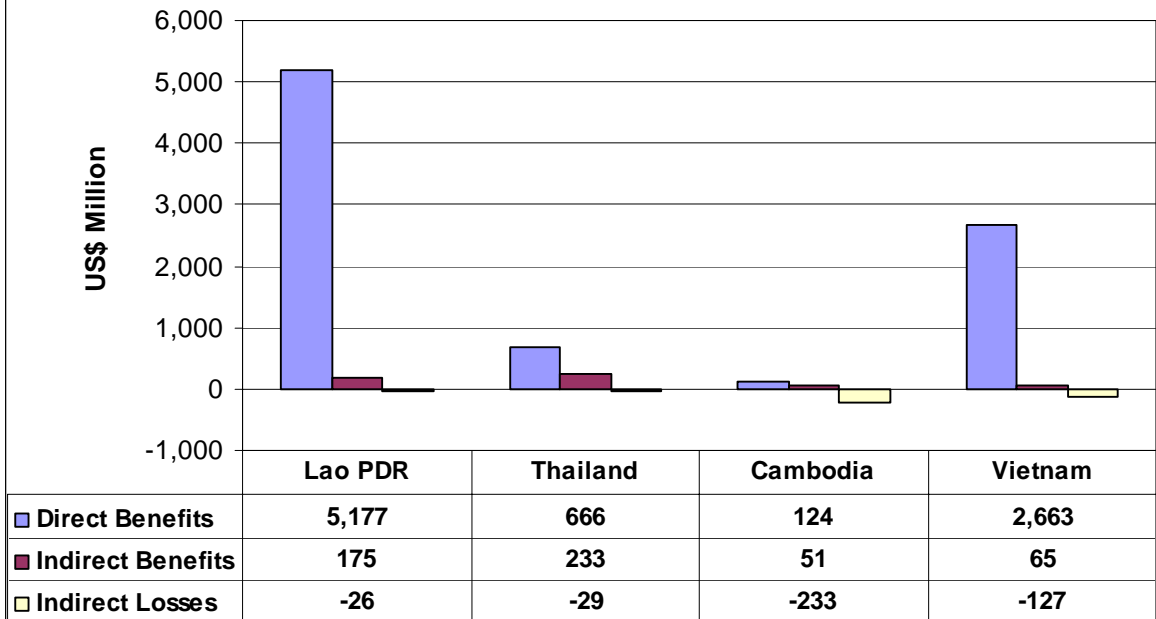
Table A4: Employment Created in Definite Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Construction jobs per annum	person year					0
O&M jobs	person year					0
sub-total		0	0	0	0	0
Fisheries						
Reservoir fisheries jobs	person year	12,360	0	0	2,840	15,200
Other Sectors						
Navigation	trend	N	++	N	N	+
Tourism	trend	+	+	N	N	+
Total Jobs Created	person year	12,360	0	0	2,840	15,200

Table A5: Development Costs and Economic Viability of Definite Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Investment costs	US\$ million	4,683	682	7	2,747	8,119
Annual O&M costs	US\$ million	31	5	0	18	54
Economic rate of return	%	18.1%	6.0%	20.3%	18.1%	18.0%

Definite Future Scenario: NPV of Benefits and Losses



Foreseeable Future 20 Year Plan Scenarios

With mainstream dams

Table B1.1: Direct Net Economic Benefits of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
HEP capacity	MW	18,449	1,784	4,760	2,512	27,505
HEP production	GWh	83,598	2,008	22,051	11,815	119,472
Net present value	US\$ million	17,892	2,027	2,780	3,636	26,335
Irrigated Agriculture						
Incremental irrigated area	hectare	284,820	1,306,673	274,243	125,157	1,990,893
Incremental crop production	tons/annum	1,944,321	4,806,714	615,539	641,610	8,008,184
Net present value	US\$ million	322	-348	4	108	86
Aquaculture						
Incremental aquaculture area	hectare	49,331	62,134	45,472	65,585	222,522
Incremental fish production	tons/annum	125,794	158,442	115,954	310,217	710,406
Net present value	US\$ million	94	107	53	426	679
Reservoir Fisheries						
Incremental fish production	tons/annum	35,148	31,000	2,192	37,722	106,062
Net present value	US\$ million	141	124	41	150	456

Table B1.2: Indirect Net Economic Impact of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
POSITIVE IMPACTS						
Flood Damage Mitigated						
Reduction in flood area	hectare	66,339	75,973	72,049	22,659	237,020
Net present value	US\$ million	126	125	49	67	367
Saline Area Mitigated						
Net reduction in saline area	hectare				+	+
Incremental crop production	tons/annum				+	+
Net present value	US\$ million			0	5	5
Navigation Enhanced						
Increase in IWT cargo	tons/vessel	N	++	N	N	+
Net present value	US\$ million		64			64
NEGATIVE IMPACTS						
Capture Fish Reduced						
Fish catch gains/losses	tons/annum	-891	-22,722	-274,584	-147,269	-445,466
Net present value	US\$ million	-24	-87	-903	-467	-1,480
Wetland Area Reduced						
Wetland area lost	hectare	-5,794	-10,804	-34,412	-492	-51,502
Net present value	US\$ million	-2	-3	-12	0	-17
Riverbank Erosion						
Area lost to bank erosion	hectare	-	N	N	N	N
Net present value	US\$ million	-	N	N	N	N

Foreseeable Future 20 Year Plan Scenarios *With mainstream dams (cont'd)*

Table B1.3: Main Economic Benefits and Losses in Foreseeable Future Scenario by Sector and Country

Economic Benefit/Loss	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Net Economic Benefits						
NPV hydropower	US\$ million	17,892	2,027	2,780	3,636	26,335
NPV irrigated agriculture	US\$ million	322	-348	4	108	86
NPV aquaculture	US\$ million	94	107	53	426	679
NPV reservoir fisheries	US\$ million	141	124	41	150	456
NPV flood damage mitigation	US\$ million	126	125	49	67	367
NPV saline area mitigation	US\$ million	0	0	0	5	5
NPV navigation improvement	US\$ million	0	64	0	0	64
sub-total		18,574	2,100	2,926	4,392	27,993
Net Economic Losses						
NPV capture fish catch losses	US\$ million	-24	-87	-903	-467	-1,480
NPV wetland area lost	US\$ million	-2	-3	-12	0	-17
NPV area lost to bank erosion	US\$ million	-	N	N	N	0
sub-total		-25	-90	-915	-467	-1,497
Overall Net Benefits/Losses	US\$ million	18,549	2,010	2,012	3,925	26,496

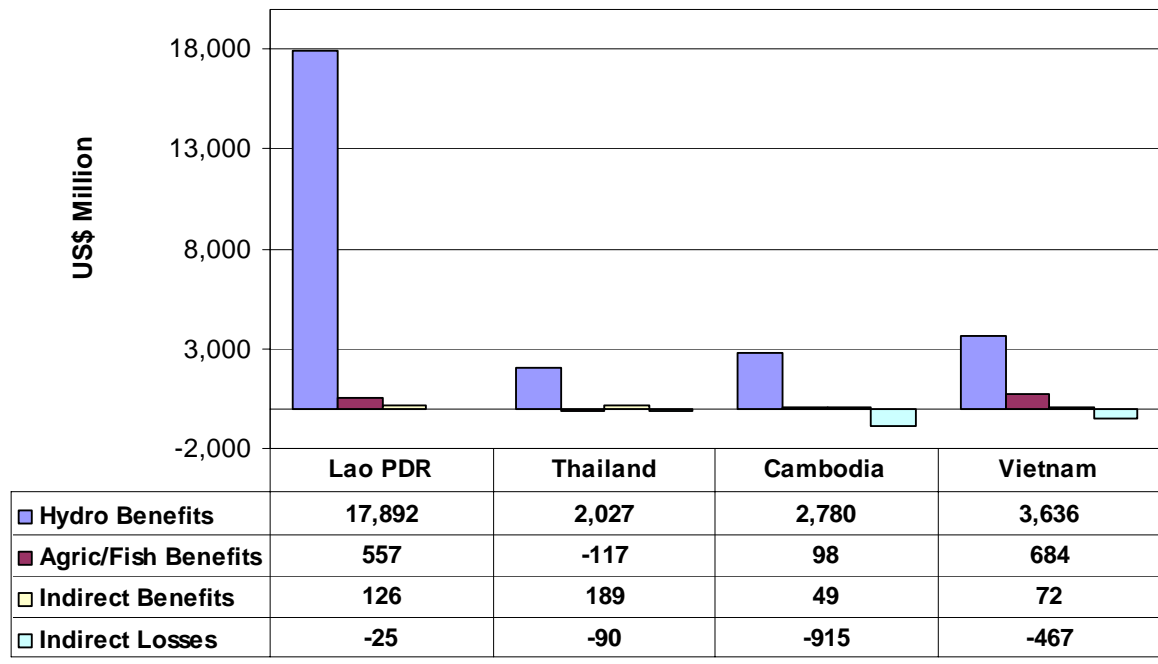
Table B1.4: Employment Created in Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Construction jobs per annum	person year					0
O&M jobs (after 20 years)	person year					0
sub-total		0	0	0	0	0
Irrigated Agriculture						
Construction jobs per annum	person year	24,693	131,987	23,507	10,159	190,346
O&M jobs (after 20 years)	person year	12,397	65,994	11,753	5,079	95,223
Crop production jobs (after 20 years)	person year	71,689	119,374	6,243	14,313	211,619
sub-total		108,779	317,355	41,503	29,551	497,188
Fisheries						
Aquaculture jobs	person year	102,773	129,446	94,733	136,635	463,588
Reservoir fisheries jobs	person year	40,340	0	27,860	3,860	72,060
sub-total		143,113	129,446	122,593	140,495	535,648
Other Sectors						
Navigation	trend	N	++	N	N	+
Tourism	trend	+	+	N	N	+
Total Jobs Created	person year	251,892	446,801	164,096	170,046	1,032,836

Table B1.5: Development Costs and Economic Viability of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Investment costs	US\$ million	29,862	11,104	13,245	3,225	57,436
Annual O&M costs	US\$ million	236	73	78	21	408
Economic rate of return	%	17.6%	21.0%	10.4%	18.2%	17.2%
Irrigated Agriculture						
Investment costs	US\$ million	1,010	6,533	776	376	8,695
Annual O&M costs	US\$ million	26	163	19	9	217
Economic rate of return	%	17.3%	8.7%	10.1%	16.5%	10.2%
Total Investment Cost	US\$ million	30,872	17,637	14,021	3,601	66,131

**20 Year Plan Scenario (All Dams):
Net Present Value of Economic Benefits and Loses**



Foreseeable Future 20 Year Plan Scenarios

Without mainstream dams

Table B2.1: Direct Net Economic Benefits of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
HEP capacity	MW	7,939	309	481	2,512	11,241
HEP production	GWh	36,879	532	2,315	11,815	51,541
Net present value	US\$ million	8,930	992	1,255	3,636	14,813
Irrigated Agriculture						
Incremental irrigated area	hectare	284,820	1,306,673	274,243	125,157	1,990,893
Incremental crop production	tons/annum	1,944,321	4,806,714	615,539	641,610	8,008,184
Net present value	US\$ million	322	-348	4	108	86
Aquaculture						
Incremental pond area	hectare	49,331	62,134	45,472	65,585	222,522
Incremental fish production	tons/annum	125,794	158,442	115,954	310,217	710,406
Net present value	US\$ million	94	107	53	426	679
Reservoir Fisheries						
Incremental fish production	tons/annum	13,973	11,772	161	14,109	40,015
Net present value	US\$ million	129	113	50	136	428

Table B2.2: Indirect Net Economic Impact of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
POSITIVE IMPACTS						
Flood Damage Mitigated						
Reduction in flood area	hectare	++	++	++	++	++
Net present value	US\$ million	++	++	++	++	++
Saline Area Mitigated						
Net reduction in saline area	hectare				+	+
Incremental crop production	tons/annum				+	+
Net present value	US\$ million			0	5	5
Navigation Enhanced						
Increase in IWT cargo	tons/annum	N	++	N	N	+
Net present value	US\$ million		64			64
NEGATIVE IMPACTS						
Capture Fish Reduced						
Fish catch gains/losses	tons/annum	-6,161	-13,007	-111,108	-7,298	-137,573
Net present value	US\$ million	23	1	-165	-98	-239
Wetland Area Reduced						
Wetland area lost	hectare	--	--	--	--	--
Net present value	US\$ million	-	-	-	-	-
Riverbank Erosion						
Area lost to bank erosion	hectare	-	N	N	N	N
Net present value	US\$ million	-	N	N	N	N

Foreseeable Future 20 Year Plan Scenarios *Without mainstream dams (cont'd)*

Table B2.3: Main Economic Benefits and Losses in Foreseeable Future Scenario by Sector and Country

Economic Benefit/Loss	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Net Economic Benefits						
NPV hydropower	US\$ million	8,930	992	1,255	3,636	14,813
NPV irrigated agriculture	US\$ million	322	-348	4	108	86
NPV aquaculture	US\$ million	94	107	53	426	679
NPV reservoir fisheries	US\$ million	129	113	50	136	428
NPV flood damage mitigation	US\$ million	++	++	++	++	0
NPV saline area mitigation	US\$ million	0	0	0	5	5
NPV navigation improvement	US\$ million	0	64	0	0	64
sub-total		9,474	928	1,362	4,311	16,075
Net Economic Losses						
NPV capture fish catch losses	US\$ million	23	1	-165	-98	-239
NPV wetland area lost	US\$ million	-	-	-	-	0
NPV area lost to bank erosion	US\$ million	-	N	N	N	0
sub-total		23	1	-165	-98	-239
Overall Net Benefits/Losses	US\$ million	9,497	929	1,197	4,213	15,836

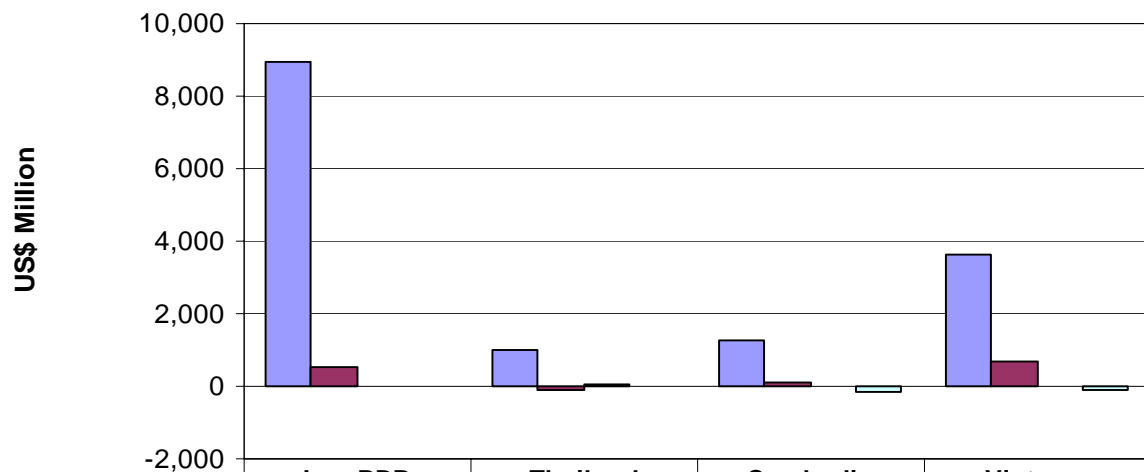
Table B2.4: Employment Created in Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Construction jobs per annum	person year					0
O&M jobs	person year					0
sub-total		0	0	0	0	0
Irrigated Agriculture						
Construction jobs per annum	person year	24,693	131,987	23,507	10,159	190,346
O&M jobs	person year	12,397	65,994	11,753	5,079	95,223
Crop production jobs	person year	71,689	119,374	6,243	14,313	211,619
sub-total		108,779	317,355	41,503	29,551	497,188
Fisheries						
Aquaculture jobs	person year	102,773	129,446	94,733	136,635	463,588
Reservoir fisheries jobs	person year	28,260	0	7,580	3,860	39,700
sub-total		131,033	129,446	102,313	140,495	503,288
Other Sectors						
Navigation		N	++	N	N	+
Tourism		+	+	N	N	+
Total Jobs Created	person year	239,812	446,801	143,816	170,046	1,000,476

Table B2.5: Development Costs and Economic Viability of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Investment costs	US\$ million	14,261	682	967	3,225	19,135
Annual O&M costs	US\$ million	95	5	6	21	73
Economic rate of return	%	18.0%	6.0%	19.1%	19.4%	18.1%
Irrigated Agriculture						
Investment costs	US\$ million	1,010	6,533	776	376	8,695
Annual O&M costs	US\$ million	26	163	19	9	217
Economic rate of return	%	17.3%	8.7%	10.1%	16.5%	10.2%
Total Investment Cost	US\$ million	15,271	7,215	1,743	3,601	27,830

**20 Year Plan Without Mainstream Dams:
Net Present Value of Benefits and Losses**



	Lao PDR	Thailand	Cambodia	Vietnam
■ Hydro Benefits	8,930	992	1,255	3,636
■ Agric/Fish Benefits	544	-128	107	670
■ Indirect Benefits	0	64	0	5
■ Indirect Losses	23	1	-165	-98

Foreseeable Future 20 Year Plan Scenarios *Without lower mainstream dams*

Table B3.1: Direct Net Economic Benefits of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
HEP capacity	MW	14,878	849	481	2,512	18,719
HEP production	GWh	66,626	3,191	2,315	11,815	83,947
Net present value	US\$ million	12,555	1,723	1,255	3,063	18,596
Irrigated Agriculture						
Incremental irrigated area	hectare	284,820	1,306,673	274,243	125,157	1,990,893
Incremental crop production	tons/annum	1,944,321	4,806,714	615,539	641,610	8,008,184
Net present value	US\$ million	322	-348	4	108	86
Aquaculture						
Incremental pond area	hectare	49,331	62,134	45,472	65,585	222,522
Incremental fish production	tons/annum	125,794	158,442	115,954	310,217	710,406
Net present value	US\$ million	94	107	53	426	679
Reservoir Fisheries						
Incremental fish production	tons/annum	29,002	25,426	14,600	31,006	100,034
Net present value	US\$ million	135	119	54	143	451

Table B3.2: Indirect Net Economic Impact of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
POSITIVE IMPACTS						
Flood Damage Mitigated						
Reduction in flood area	hectare	++	++	++	++	++
Net present value	US\$ million	++	++	++	++	++
Saline Area Mitigated						
Net reduction in saline area	hectare				+	+
Incremental crop production	tons/annum				+	+
Net present value	US\$ million			0	5	5
Navigation Enhanced						
Increase in IWT cargo	tons/annum	N	++	N	N	+
Net present value	US\$ million		64			64
NEGATIVE IMPACTS						
Capture Fish Reduced						
Fish catch gains/losses	tons/annum	5,425	-1,397	-62,086	-39,398	-97,456
Net present value	US\$ million	-4	-19	-208	-119	-350
Wetland Area Reduced						
Wetland area lost	hectare	--	--	--	--	--
Net present value	US\$ million	-	-	-	-	-
Riverbank Erosion						
Area lost to bank erosion	hectare	-	N	N	N	N
Net present value	US\$ million	-	N	N	N	N

Foreseeable Future 20 Year Scenario *Without lower mainstream dams (cont'd)*

Table B3.3: Main Economic Benefits and Losses in Foreseeable Future Scenario by Sector and Country

Economic Benefit/Loss	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Net Economic Benefits						
NPV hydropower	US\$ million	12,555	1,723	1,255	3,063	18,596
NPV irrigated agriculture		322	-348	4	108	86
NPV aquaculture		94	107	53	426	679
NPV reservoir fisheries	US\$ million	135	119	54	143	451
NPV flood damage mitigation	US\$ million	++	++	++	++	0
NPV saline area mitigation	US\$ million	0	0	0	5	5
NPV navigation improvement	US\$ million	0	64	0	0	64
sub-total		13,106	1,665	1,366	3,745	19,881
Net Economic Losses						
NPV capture fish catch losses	US\$ million	-4	-19	-208	-119	-350
NPV wetland area lost	US\$ million	-	-	-	-	0
NPV area lost to bank erosion	US\$ million	-	N	N	N	0
sub-total		-4	-19	-208	-119	-350
Overall Net Benefits/Losses	US\$ million	13,102	1,645	1,158	3,626	19,531

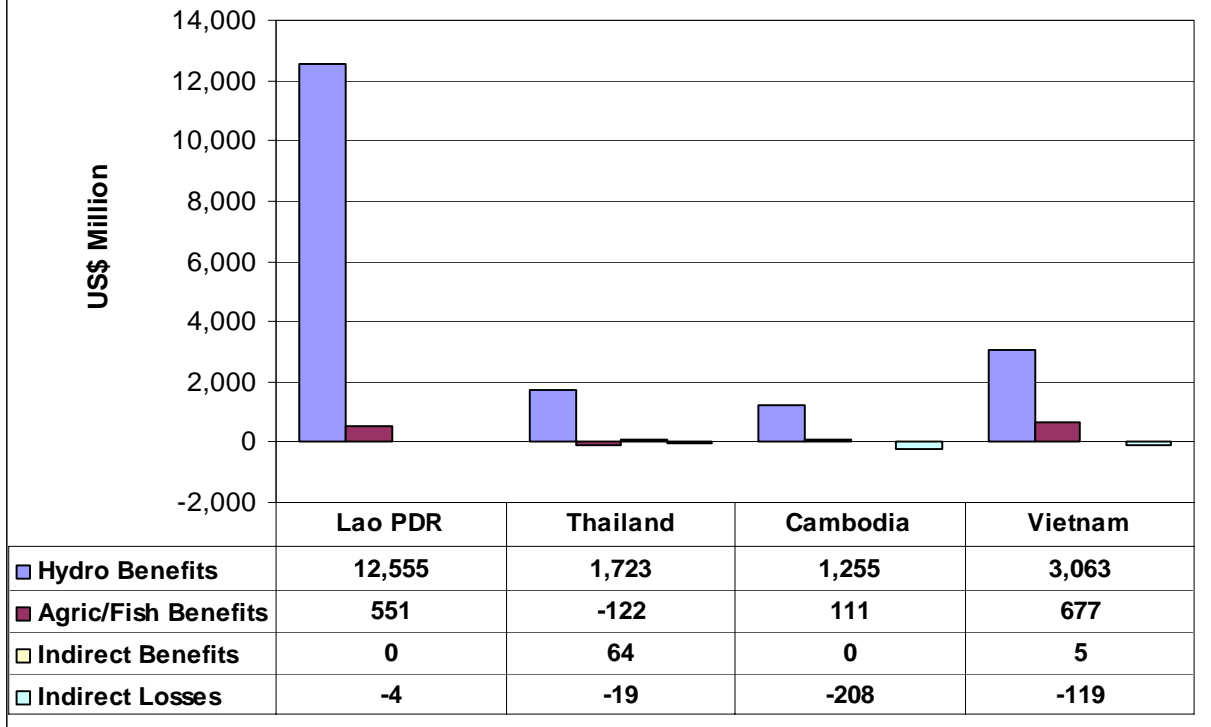
Table B3.4: Employment Created in Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Construction jobs per annum	person year					0
O&M jobs	person year					0
sub-total		0	0	0	0	0
Irrigated Agriculture						
Construction jobs per annum	person year	24,693	131,987	23,507	10,159	190,346
O&M jobs	person year	12,397	65,994	11,753	5,079	95,223
Crop production jobs	person year	71,689	119,374	6,243	14,313	211,619
sub-total		108,779	317,355	41,503	29,551	497,188
Fisheries						
Aquaculture jobs	person year	102,773	129,446	94,733	136,635	463,588
Reservoir fisheries jobs	person year	35,800	0	7,580	3,860	47,240
sub-total		138,573	129,446	102,313	140,495	510,828
Other Sectors						
Navigation		N	++	N	N	+
Tourism		+	+	N	N	+
Total Jobs Created	person year	247,352	446,801	143,816	170,046	1,008,016

Table B3.5: Development Costs and Economic Viability of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Investment costs	US\$ million	22,843	3,740	967	3,225	30,775
Annual O&M costs	US\$ million	159	25	6	21	211
Economic rate of return	%	14.4%	13.0%	19.1%	19.4%	17.0%
Irrigated Agriculture						
Investment costs	US\$ million	1,010	6,533	776	376	8,695
Annual O&M costs	US\$ million	26	163	19	9	217
Economic rate of return	%	17.3%	8.7%	10.1%	16.5%	10.2%
Total Investment Cost	US\$ million	23,853	10,273	1,743	3,601	39,470

**20 Year Plan Scenario Without Lower Mainstream Dams:
Net Present Value of Economic Benefits and Losses**



Foreseeable Future 20 Year Plan Scenarios *Without Thai mainstream dams*

Table B4.1: Direct Net Economic Benefits of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
HEP capacity	MW	16,974	309	4,761	2,512	24,556
HEP production	GWh	83,058	532	22,055	11,815	117,460
Net present value	US\$ million	14,648	1,757	2,780	3,636	22,821
Irrigated Agriculture						
Incremental irrigated area	hectare	284,820	1,306,673	274,243	125,157	1,990,893
Incremental crop production	tons/annum	1,944,321	4,806,714	615,539	641,610	8,008,184
Net present value	US\$ million	322	-348	4	108	86
Aquaculture						
Incremental pond area	hectare	49,331	62,134	45,472	65,585	222,522
Incremental fish production	tons/annum	125,794	158,442	115,954	310,217	710,406
Net present value	US\$ million	94	107	53	426	679
Reservoir Fisheries						
Incremental fish production	tons/annum	32,195	28,200	1,271	34,348	96,014
Net present value	US\$ million	138	121	40	146	445

Table B4.2: Indirect Net Economic Impact of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
POSITIVE IMPACTS						
Flood Damage Mitigated						
Reduction in flood area	hectare	++	++	++	++	++
Net present value	US\$ million	++	++	++	++	++
Saline Area Mitigated						
Net reduction in saline area	hectare				+	+
Incremental crop production	tons/annum				+	+
Net present value	US\$ million			0	5	5
Navigation Enhanced						
Increase in IWT cargo	tons/annum	N	++	N	N	+
Net present value	US\$ million		64			64
NEGATIVE IMPACTS						
Capture Fish Reduced						
Fish catch losses	tons/annum	-891	-22,722	-274,506	-147,189	-445,308
Net present value	US\$ million	-24	-87	-903	-467	-1,480
Wetland Area Reduced						
Wetland area lost	hectare	--	--	--	--	--
Net present value	US\$ million	-	-	-	-	-
Riverbank Erosion						
Area lost to bank erosion	hectare	-	N	N	N	N
Net present value	US\$ million	-	N	N	N	N

Foreseeable Future 20 Year Plan Scenario *Without Thai mainstream dams (cont'd)*

Table B4.3: Main Economic Benefits and Losses in Foreseeable Future Scenario by Sector and Country

Economic Benefit/Loss	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Net Economic Benefits						
NPV hydropower	US\$ million	14648	1757	2780	3636	22,821
NPV irrigated agriculture		322	-348	4	108	86
NPV aquaculture		94	107	53	426	679
NPV reservoir fisheries	US\$ million	138	121	40	146	445
NPV flood damage mitigation	US\$ million	++	++	++	++	0
NPV saline area mitigation	US\$ million	0	0	0	5	5
NPV navigation improvement	US\$ million	0	64	0	0	64
sub-total		15202	1701	2877	4321	24100
Net Economic Losses						
NPV capture fish catch losses	US\$ million	-24	-87	-903	-467	-1,480
NPV wetland area lost	US\$ million	-	-	-	-	0
NPV area lost to bank erosion	US\$ million	-	N	N	N	0
sub-total		-24	-87	-903	-467	-1,480
Overall Net Benefits/Losses	US\$ million	15,178	1,614	1,974	3,854	22,620

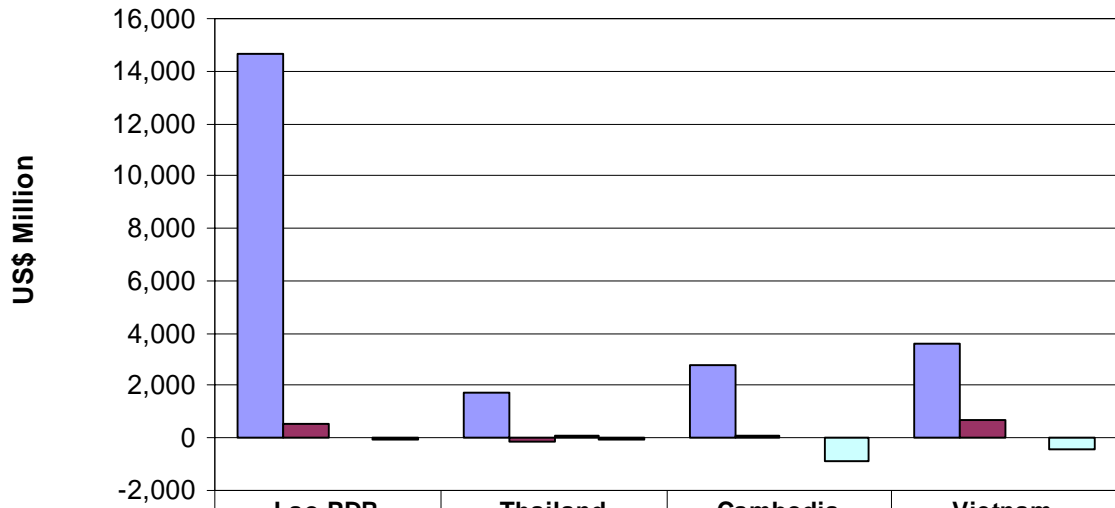
Table B4.4: Employment Created in Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Construction jobs per annum	person year					0
O&M jobs	person year					0
sub-total		0	0	0	0	0
Irrigated Agriculture						
Construction jobs per annum	person year	24,693	131,987	23,507	10,159	190,346
O&M jobs	person year	12,397	65,994	11,753	5,079	95,223
Crop production jobs	person year	71,689	119,374	6,243	14,313	211,619
sub-total		108,779	317,355	41,503	29,551	497,188
Fisheries						
Aquaculture jobs	person year	102,773	129,446	94,733	136,635	463,588
Reservoir fisheries jobs	person year	36220	600	27860	3860	68,540
sub-total		138,993	130,046	122,593	140,495	532,128
Other Sectors						
Navigation		N	++	N	N	+
Tourism		+	+	N	N	+
Total Jobs Created	person year	247,772	447,401	164,096	170,046	1,029,316

Table B4.5: Development Costs and Economic Viability of Foreseeable Future Scenario by Sector and Country

Sector	Unit	Lao PDR	Thailand	Cambodia	Vietnam	Total LMB
Hydropower						
Investment costs	US\$ million	26,877	681	13,245	3,225	44,028
Annual O&M costs	US\$ million	178	5	78	21	282
Economic rate of return	%	16.2%	6.0%	10.4%	18.2%	17.2%
Irrigated Agriculture						
Investment costs	US\$ million	1,010	6,533	776	376	8,695
Annual O&M costs	US\$ million	26	163	19	9	217
Economic rate of return	%	17.3%	8.7%	10.1%	16.5%	10.2%
Total Investment Cost	US\$ million	27,887	7,214	14,021	3,601	52,723

**20 Year Plan Scenario Without Thai Dams:
Net Present Value of Economic Benefits and Losses**



	Lao PDR	Thailand	Cambodia	Vietnam
Hydro Benefits	14,648	1,757	2,780	3,636
Agric/Fish Benefits	554	-120	97	680
Indirect Benefits	0	64	0	5
Indirect Losses	-24	-87	-903	-467

Mekong Delta Flood Management Scenario

Table C1: Direct Net Economic Benefits of Mekong Delta Flood Mgt by Sector and Country

Sector	Unit	Cambodia	Vietnam	Total LMB
Cambodia Development Scenario				
Incremental area with interventions 1/	hectare	875,071		875,071
Net present value	US\$ million	262	-39	224
Vietnam Development Scenario				
Incremental area with interventions	hectare		1,239,955	1,239,955
Net present value	US\$ million	-8.7	8.8	0.1
Joint Development Scenario				
Incremental area with interventions	hectare	875,071	1,239,955	2,115,026
Net present value	US\$ million	254	-30	224

1/ Partial or full flood protection with irrigation development

Table C2: Indirect Net Economic Impact of Mekong Delta Flood Mgt by Sector and Country

Sector	Unit	Cambodia	Vietnam	Total LMB
NEGATIVE IMPACTS				
<i>Flood Benefits Reduced</i>				
<i>Capture Fish Reduced</i>		-	-	-
<i>Wetland Area Reduced</i>				
Wetland area lost	hectare			0
Net present value	US\$ million			0
<i>Saline Area Increased</i>				
Increase in saline area	hectare			0
Net present value	US\$ million			0

Table C3: Economic Benefits and Losses in Mekong Delta Flood Mgt Scenario by Sector and Country

Economic Benefit/Loss	Unit	Cambodia	Vietnam	Total LMB
Net Economic Benefits				
Cambodia scenario	US\$ million	262	-39	224
Vietnam scenario	US\$ million	-9	9	0
sub-total		254	-30	224
Net Economic Losses				
NPV flood benefit reduction	US\$ million	-	-	-
NPV capture fish catch losses	US\$ million	--	--	--
NPV wetland area lost	US\$ million	0	0	0
NPV saline area increase	US\$ million	0	0	0
sub-total		0	0	0
Overall Net Benefits/Losses	US\$ million	254	-30	224

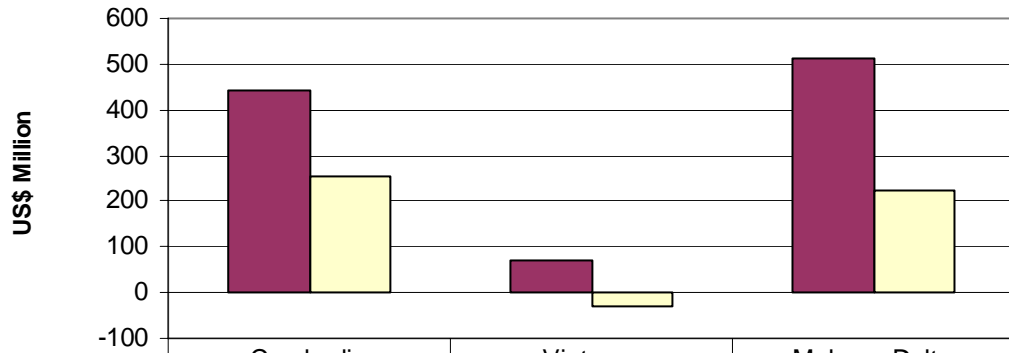
Table C4: Employment Created in Mekong Delta Flood Mgt Scenario by Sector and Country

Sector	Unit	Cambodia	Vietnam	Total LMB
Flood Protection and Irrigation Dev't				
Construction jobs per annum	person year	26,942	3,788	30,730
O&M jobs (after 10 years)	person year	6,735	947	7,682
sub-total		33,677	4,735	38,412
Irrigated Agriculture				
Crop production jobs (after 10 years)	person year	15,155	2,367	17,522
Fisheries				
Aquaculture jobs	person year			0
Total Jobs Created	person year	48,832	7,102	55,934

Table C5: Development Costs and Economic Viability of Mekong Delta Flood Mgt by Country

Sector	Unit	Cambodia	Vietnam	Total LMB
Flood Protection and Irrigation				
Investment costs	US\$ million	445	70	515
Annual O&M costs	US\$ million	11	2	13
Economic rate of return	%	16%	10%	15%

Flood Management in Mekong Delta: Investment Costs and Net Benefits



	Cambodia	Vietnam	Mekong Delta
■ Investment Cost	445	70	515
□ NPV Benefits	254	-30	224